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THE SEMIOTIC CONCEPT OF CODE

A study in concept formation

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Contents

INTRODUCTION

The present monograph is about one of the most popular yet least studied concepts in the humanities and social sciences. For several decades, the semiotic concept of code has occupied a prominent position in the study of communication and symbolic thought in semiotics and related disciplines. There is a simple reason for this. The concept seems to be suitable for capturing both a cluster of necessary conditions of signification and the internal configuration and/or logical properties of any set of signs functioning as a whole in communication. A quick look at some informal definitions suffices to give an indication of the remarkable flexibility of the concept. Leeds-Hurwitz (1993, 51) points out that "[t]echnically, semioticians term a group or set of signs a code…. Yet the concept of code implies more than 'groupness'; it also includes rules for the organization of individual signs". Thus, it can be properly defined as a "set of signs and rules for their use". In a similar vein, O'Sullivan et al. (1994, 43) define code as "a system of signs governed by rules agreed (explicitly or implicitly) between the members of the using culture". For Johansen and Larsen (2002, 7), codes in general can be defined as "rules governing the selection and combination of elements". Two basic types of code can be discerned. On the one hand, there are codes that connect "a set of elements into a well-defined but not necessarily closed system"; on the other hand, there are codes "connecting at least two such systems" and, thus, "can be viewed as a kind of translation from one structure into a different one" (Johansen and Larsen 2002, 11). Semiotic codes fall under the latter type and they are typically said to provide "the set[s] or system[s] of rules and correspondences which link signs to meanings" (Coupland and Jaworski 2001, 170-171). There is an obvious conventional aspect in such correspondences; however, "[c]odes are not simply 'conventions' of communication but rather procedural *systems* of related conventions which operate in certain domains" (Chandler 2007, 148; emphasis in the original). Specifically, semiotic codes "are 'organizational systems or grids' for the recurring elements that go into the constitution of anything that humans make, including signs, rituals, spectacles, behaviours, and representations of all kinds" (Danesi 2002, 42). In other words, “[c]odes consist of interacting elements, forming a cohesive whole, which can be deployed to represent types of phenomena in specific ways” (Sebeok and Danesi 2000, 3).

The partially overlapping definitions quoted above bring into relief a constellation of fundamental notions entrenched in modern scientific thought. The semiotic concept of code brings together the notions of system, structure, whole, interdependence, rule, convention, model, transformation, equivalence, correspondence, and set of hierarchical relations. In the countless applications of the concept during a period of more than half a century, no single formula of conceptual synthesis has come to prevail. Rather, from the very beginning various patterns of conceptual blending have been observed, each reflecting a different emphasis. In general, most applications of the concept can be grouped in two major categories. The first category comprises uses that focus on codes as systems. Here, the notions of structure, whole, and interdependence figure prominently. The second category comprises the concept’s applications in connection with rules governing the correlation between ordered sets of elements or the transformation from one system of units to another. In such cases, there is an emphasis on the notions of equivalence, convention, transformation, and correspondence. These categories are not mutually exclusive, but they do constitute two distinct poles around which different uses of the concept have clustered. In light of such diversity in emphasis and shades of meaning, it would not be an exaggeration to speak of a protean concept. In precisely this respect, we notice a striking similarity with the development of the various concepts of system that have dominated both the natural and social sciences in the twentieth century (Blauberg et al. 1977, 126-148). We might even argue that the protean character of the semiotic concept of code was indeed inherited from the ‘great family’ of system concepts. This ‘genealogical’ hypothesis, however, would not suffice to account for those aspects of the concept that relate to the notions of convention and rule. The semiotic concept of code could indeed be analyzed as a variant system concept, but we still need to broaden the horizon of our investigation beyond a systems-theoretical perspective if we want to understand how the concept acquired its distinctive character. In particular, we need to examine the conditions of the emergence of the concept and follow the path of its early development until its consolidation in semiotics.

As implied in the opening sentence of this introduction, there are very few accounts of the semiotic concept of code. Although these accounts provide useful information about the typical applications of the concept, they pay little attention to the question of its origins. Some remarks made by Guiraud (1963) in connection with the comparison between natural languages and cryptographic or commercial codes suggest an early concern about the use of "code" as a linguistic term. This issue was taken up by Mounin (1970), who offered a more detailed discussion on the introduction of "code" in postwar linguistics. Mounin was not interested in engaging in some sort of conceptual analysis, but he did seek to elucidate the implications of an evolving conception of language in terms of codes. Mounin's (1970, 78-79) survey of key linguistic writings available at the time led him to the conclusion that "code" was introduced in linguistics from 'American sources' under the influence of information theory, and it served as a synonym for "*langue*" or "linguistic system". Thus, fundamental linguistic dichotomies, such as *langue* and *parole* or paradigmatic and syntagmatic relations, came to be restated in terms of codes and messages. The new words began to gain currency among linguists on both sides of the Atlantic, and by the early 1960s the first concerns were raised about the theoretical implications of such a terminological innovation. However, it took more than a decade for the first account of the semiotic concept of code to appear, in Eco's collection of essays titled *Semiotics and the philosophy of language*. The temporal distance that separated the two texts was especially important. Mounin wrote at a time when "code" still enjoyed an increasing popularity in the study of both verbal and non-verbal communication. When Eco presented his account, the semiotic concept of code, which had evolved in an intellectual milieu heavily influenced by structuralism, was reaching a critical point in its development, epitomized as follows.

> It would be sufficient to assume that the concept of encyclopedia improves and better articulates the 'old' concept of code, so that it would be advisable to get rid of such an outdated category. However, if it is wise to try new coinages when a concept becomes more elaborate and more comprehensive, it is always imprudent to dispose of the old ones without exploring, along with their history, the reasons for which they enjoyed consensus and popularity, as well as their perhaps still undiscovered fruitfulness. (Eco 1984, 164-165)

Eco sought precisely to provide an exploration of the history and the prospects of the concept, drawing on his own elaboration presented several years earlier in *A theory of semiotics*. The major part of his analysis was devoted to the logical properties of codes along the axis of the contrast between equivalence and inference. This kind of analysis enabled Eco to expand his scope beyond linguistic and other semiotic codes and accommodate further types, such as cryptographic and legal codes or even the famous 'genetic code', thus implying that there is a general, comprehensive concept of code above the specifically semiotic concept. As regards the emergence of the latter, Eco spoke of a "landslide effect" caused by two seminal books: Shannon and Weaver's *The mathematical theory of communication*, and Jakobson and Halle's *Fundamentals of language*.

> After these two scientific events, the code wave crested, and the landslide effect of the new category did not allow enough time to make subtle formal distinctions….
>
> Even though a suspicion of indulgent metaphorization was authorized, it was impossible to avoid the question as to whether this code boom represented a sort of epistemological trend, something similar to the common 'formative will' that, in the domain of arts, Panofsky called Kunstwollen…. Cultures know such kinds of terminological pollution: a given term, extrapolated from a precise disciplinary framework, quickly becomes a password, a shibboleth, and, not only for cliquish reasons, comes to designate a cultural atmosphere, an era. (Eco 1984, 166)

The books singled out by Eco and the figures discussed in his account (Jakobson, Lévi-Strauss, Shannon, and Barthes) suggest that structuralism and information theory were considered as the major shaping forces behind the 'code boom'.

A somewhat similar view was expressed by Thibault in his entry for the *Encyclopedia of semiotics*. Thibault did not address directly the issue of the origins of the concept, but rather presented an account based on the contrast between two models exemplifying distinct conceptions of code. The first model derived from information theory and cybernetics and was said to refer "to the communication of messages in a purely mechanistic (nonhuman) system" in which code is taken as "a context-free set of rules for the encoding, transmission, and decoding of information" (Thibault 1998, 125). The second model was predicated on the conception of code as a meaning-making potential and was associated with the work of thinkers such as Saussure, Hjelmslev, Bateson, and

Halliday (Thibault 1998, 126-127). A more nuanced and informative account was offered by Nöth (1990, 206-220). Again, information theory was acknowledged as a major source of influence, but Nöth (1990, 206) further remarked that the "semiotic concept of code has inherited a fundamental ambiguity from its presemiotic usage". Concretely, two basic presemiotic senses were discerned, each associated with a different domain of social practices. In Law, "codes are known as sets of rules prescribing forms of social behavior…. From a semantic point of view, codes of social institution are autonomous semiotic systems…. they generate a system of social signs and meanings which do not exist except by this very social convention". In secret communication, by contrast, codes "are only secondary sign systems. They are instructions for translating a message of a given, primary code into a secret message. The secret code is then a correlational device for substituting the signs or sign elements of the primary code, usually a natural language, into a secret code" (ibid.). As the semiotic definitions quoted earlier indicate, these two senses carried over to the linguistic and semiotic applications of the word. Thus, at this point Nöth suggested a certain connection between the history of the word and the protean character of the semiotic concept of code, without delving however into the nature of this connection. As regards the development of the concept, Nöth pointed to the work of prominent structuralists like Jakobson, Lévi-Strauss, and Prieto, but he mainly focused on Eco's key contribution.

The accounts offered by Eco, Thibault, and Nöth suggest a straightforward answer to the question of the emergence of the semiotic concept of code. Under the growing transdisciplinary influence of information theory in the 1950s, structural linguistics adopted the technical terms "code" and "message" as synonyms for "*langue*" (or "linguistic system") and "*parole*" (or "speech act"). Initially, the two terms were used in a rather metaphorical sense, but eventually they came to acquire a permanent place in linguistic terminology thus giving rise to some concerns about the relation between codes proper and natural languages. In the meantime, "code" and "message" migrated to the evolving discipline of semiotics under the combined influence of structuralism, information theory, and cybernetics, where they were used in connection with the study of a wide array of semiotic phenomena pertaining to both verbal and non-verbal communication. In that way, a distinct concept of code emerged in semiotics and related disciplines, which retained its position after the demise of structuralism. In other words, the three accounts outlined above suggest that the semiotic concept of code emerged out of a terminological appropriation of a technical term from information theory that progressively became the standard term for the notions of linguistic system and semiotic system. This is indeed the accepted view about the origins of the concept that will concern us here, a view that so far has remained largely uncontested. A notable exception is a paper read by Fehr in 1999, at the Eighth International Conference on the History of the Language Sciences. Fehr (2003, 366) argued that the structuralist concept of code could not have been introduced in postwar linguistics from information theory or cryptography. “Code” in the latter fields denotes exclusively a method of correlation or substitution between different sets of units. In structural linguistics, by contrast, the same term has been used in a variety of senses that can hardly derive from such a technical notion of correlation. Thus, according to Fehr the key issue at stake here is not the migration of a term from information theory to linguistics but the relation and the exchanges between the two disciplines in the early postwar period. It is precisely this interdisciplinary relation, he argued, that provides the proper framework for an account of the conceptualization of language in terms of codes.

There seems to be strong evidence in the structuralist literature in favor of the standard view of the origins of the concept of code in linguistics. Jakobson’s early postwar linguistic writings, in particular, have justifiably attracted much attention. Jakobson was the main responsible for the introduction of information-theoretical terms in linguistics, and he exerted a major influence on the shaping of semiotics during the 1960s. His phonological writings of the 1950s and the impact they had both within and outside linguistics seem to corroborate the standard view: the concept of code originated in a terminological appropriation. At this point, several crucial questions can be raised. In the first place, how did the migration of a technical term give rise to a linguistic concept? Was the new term adopted simply as a fashionable alternative label for a well-established concept (as the standard view implies)? If that is so, can we speak in this case of a genuine concept formation? If, on the contrary, “code” was introduced as the proper term for a new linguistic concept, how can we account for this conceptual genesis in terms of terminological shifts? Moreover, how did a semiotic concept emerge out of the linguistic concept of code? Can we speak in this case, too, of another concept formation that originated in a terminological innovation? For what concept was “code” introduced in semiotics? The accounts offered by Eco, Thibault, and Nöth were not intended, of course, to address such questions. The available evidence suggested a fairly simple and obvious answer to the question of the origins of the concept of code in linguistics and semiotics, an answer that came to be generally accepted without ever being submitted to a critical examination. Within the framework of the standard view, however, the crucial questions mentioned above could hardly be raised. From the three accounts discussed here, we can only deduce that at a given historical juncture the word “code” underwent a series of semantic shifts, as a result of which it acquired several new uses in telecommunication, linguistics and semiotics. Those shifts are only a small, albeit crucial, part of a long history whose roots can be traced back to the semantic development of the Latin word “*codex*”. In linguistics, “code” was purportedly used as an alternative term for Saussure’s concept of *langue*. However, we cannot preclude the possibility of an underlying conceptual shift, even if a minimal one inevitably caused by the terminological appropriation itself. The history of the word alone cannot tell us whether there was indeed a genuine concept formation behind the semantic shifts in question. In order to elucidate this issue, we should engage in an in-depth analysis of the early linguistic and semiotic uses of the word and shed light on the conceptual systems, theoretical premises, and epistemological assumptions that sustained those uses. In other words, we should distinguish between word and concept.

A particularly useful illustration of this methodological distinction is offered in Koselleck’s project of the history of concepts known as *Begriffsgeschichte*. Koselleck discussed in detail this distinction in an essay about the relation between *Begriffsgeschichte* and social history. The aim of the essay was to delineate the former as a distinct historical discipline and specify its position among the historical sciences, especially in relation to social history. This text provided the proper context for a discussion about the nature of concepts and their relation to words, insofar as the distinction between the two was taken by Koselleck as securing the methodological autonomy of *Begriffsgeschichte*. Koselleck’s interest lay in the history of social and political concepts. *Begriffsgeschichte* was defined, in the first place, as “a specialized method for source criticism, taking note as it does of the utilization of terminology relevant to social and political elements, and directing itself in particular to the analysis of central expressions having social or political content" (Koselleck [1972]2004, 81). Apparently, that was only a minimal definition.

> *Begriffsgeschichte* is, however, capable of doing more than this would indicate. More precisely, its methodology lays claim to an autonomous sphere which exists in a state of mutually engendered tension with social history. From the historiographic point of view, specialization in *Begriffsgeschichte* had no little influence on the posing of questions within social history. First, it began as a critique of a careless transfer to the past of modern, context-determined expressions of constitutional argument; and second, it directed itself to criticizing the practice in the history of ideas of treating ideas as constants, assuming different historical forms but of themselves fundamentally unchanging. Both elements prompted a greater precision in method, such that in the history of a concept it became possible to survey the contemporary space of experience and horizon of expectation, and also to investigate the political and social functions of concepts, together with their specific modality of usage, such that (in short) a synchronic analysis also took account of situation and conjuncture. (ibid.)

The synchronic analysis referred to represents the initial phase of the investigation. In the second phase, concepts "are detached from their situational context, and their meanings ordered first according to the sequence of time and then secondly with respect to each other… Only at this level is historical-philological method superseded, and only here does *Begriffsgeschichte* shed its subordinate relation to social history" (Koselleck [1972]2004, 82).

In the long passage quoted above, the reference to the critique of the history of ideas (*Ideengeschichte*) invites the question: what is a concept for *Begriffsgeschichte*? Moreover, how is its relation to a word conceived of? We should recall that Koselleck was interested in social and political concepts, and the answer that *Begriffsgeschichte* can give to these two questions is ultimately determined by its specific focus. Evidently, "not every word is a social and political concept. Social and political concepts possess a substantial claim to generality and always have many meanings" (Koselleck [1972]2004, 84-85). Social and political concepts form part of the discursive practices specific to that particular subset of social relations called "political relations", thus entering the struggle for the well-being of society as a whole[1]. In this respect, it is not difficult to see why Koselleck takes the claim to generality as a constitutive factor of such concepts. It is not at first sight clear, however, why polysemy is regarded as a constitutive factor, too. One reason may lie in the polemical function of these concepts. Ideological struggles require versatile weapons, and polysemy can confer adaptability when concepts need to perform multiple tasks in shifting contexts. Another reason may lie in the nature itself of social and political concepts.

> In use a word can become unambiguous. By contrast, a concept must remain ambiguous in order to be a concept. The concept is connected to a word, but is at the same time more than a word: a word becomes a concept only when the entirety of meaning and experience within a sociopolitical context within which and for which a word is used can be condensed into one word.
>
> Concepts are thus the concentrate of several substantial meanings. The signification of a word can be thought separately from that which is signified. Signifier and signified coincide in the concept insofar as the diversity of historical reality and historical experience enter a word such that they can receive their meaning only in this one word, or can be grasped only by this word…. A concept bundles up the variety of historical experience together with a collection of theoretical and practical references into a relation that is given and can be experienced only through the concept. (Koselleck [1972]2004, 85)

From this passage, we can tell that the problem of the relation between word and concept lies at the heart of Koselleck's conception of concepts. The key to understanding his approach to that problem is his thesis about the inherent and indissoluble ambiguity of concepts.

A social or political concept is intrinsically ambiguous because it constitutes a unity of a diversified totality of meaning and experience[2]. It is precisely this idea of a concept uniting "within itself a plenitude of meaning" (ibid.) that allows for elucidating how "the diversity of historical reality and historical experience [can] enter a word". A concept can be said to "bundle up" a "variety of experience" in the sense that it forms an integral part of a heterogeneous *ensemble* of practices, norms, values, beliefs, expectations, plans,

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[1] From a socio-ontological point of view, political relations are, according to Kondylis (1999, 207), the subset of social relations that have as their object all social relations.

[2] This aspect of Koselleck's conception bespeaks a strong Hegelian influence. For an account of the philosophical roots of Koselleck's concept of concept, see Palti (2011).

objects, devices, and structures (both institutional and material). As such, it "is not simply indicative of the relations which it covers; it is also a factor within them. Each concept establishes a particular horizon for potential experience and conceivable theory, and in this way sets a limit. The history of concepts is therefore able to provide knowledge which is not accessible from empirical study (*Sachanalyse*)" (Koselleck [1972]2004, 86). Thus, *Begriffsgeschichte* finds a particular place among the historical sciences insofar as it "breaks free of the naive circular movement from word to thing and back" and directs its attention to the sustained tension "between concept and materiality" (ibid.). It is "a methodologically independent part of sociohistorical research" (Koselleck [1972]2004, 89), whose methodological autonomy is precisely secured by the distinction between word and concept.

Notwithstanding the suggestive methodological insights offered by *Begriffsgeschichte*, the crucial question is whether Koselleck's conception of concepts is in any way pertinent to a study on concept formation in the humanities and social sciences. Can we say that concepts in these fields, too, "possess a substantial claim to generality" and are intrinsically ambiguous? Are we justified to approach such concepts in terms of a unity between meaning and experience? Evidently, scientific concepts differ in significant respects from sociopolitical concepts. Scientific concepts develop within a particular social institution, the scientific establishment, as part of a cluster of specific types of practice. Ideally, they are defined as rigorously as possible within a definite framework of procedures, which are intended to ensure that ambiguity is kept to a minimum. Scientific concepts are constructs devised for observing, categorizing, analyzing, explaining, and predicting natural and social phenomena; they are not devised for political action and ideological struggle. Thus, they are evaluated according to their efficiency and usefulness in the research process and the construction of scientific theories and models. In light of these remarks, one could easily conclude that Koselleck's methodological insights seem least pertinent here, since scientific concepts are not inherently ambiguous, do not possess a claim to generality, and do not concentrate within themselves a plenitude of meaning and experience. This, in turn, could undermine any attempt to introduce a methodological distinction between word and concept in a study such as the one presented in this monograph, insofar as such a distinction would be taken to derive from the methodological principles of *Begriffsgeschichte*. However, such a conclusion would be rather hasty.

Strictly speaking, the present study will not attempt to provide a consistent application of the method of *Begriffsgeschichte* to the investigation of scientific concepts, although the method employed here may partly overlap with the one employed in the history of social and political concepts. *Begriffsgeschichte* is rather invoked in connection with the insights it can offer into the nature of concepts and the methodological tools it has devised for their historical study. The decision to distinguish between word and concept in the investigation of the emergence and consolidation of the semiotic concept of code derives from the fundamental assumption that in various kinds of concepts the semantic development of the word and the specific process of concept formation follow distinct paths intersecting at certain historical junctures. As these paths intersect, part of the history of the word enters the formation process of the concept, while the latter adds a new branch in the semantic development of the word. In order to specify the implications of this phenomenon for the development of a concept, the methodological distinction between word and concept can prove valuable, especially in cases such as that of the semiotic concept of code. As regards the contrast between sociopolitical and scientific concepts, it should be noted that the preceding remarks reveal only part of the whole picture. Scientific definitions exhibit varying degrees of rigor and it is not uncommon to come across ambiguous concepts, especially in the humanities and social sciences, where fundamental concepts often become a contested ground and get entangled in long-standing debates about ontological, epistemological, and methodological issues. Under such conditions, scientific concepts can be appropriated for polemical purposes, especially when the associated theoretical debates are inextricably intertwined with sociopolitical interests and ideological struggles. The interpenetration of science and sociopolitical activity can affect the ways in which scientific concepts are formed and the roles they assume in scientific practices. Thus, scientific concepts can concentrate within themselves –even if indirectly– historical experiences and social significations. Yet, they are primarily characterized by a different kind of unity.

Scientific concepts give unity to a large number of heterogeneous elements involved in their diverse applications. Depending on the field of study and the type of concept, these elements may involve a great variety of acts relating to the collection and analysis of data, the use or construction of models, the revision of frameworks, the analysis of other concepts, the evaluation of results obtained from experiments, the assessment of arguments and counter-arguments, the analysis of theories, the elaboration of premises etc. They may also involve the use of scientific instruments and other devices, the procedures and rules that should be followed in the conduct of research, and many other individual acts that make up the complex fabric of scientific practices. Moreover, these elements are intertwined with various sorts of beliefs, assumptions, views, scientific conceptions, ethical principles, and ideological positions. Thus, scientific concepts, too, can be said to give unity to a plenitude of meaning and experience, albeit in connection with different spheres of social activity compared to social and political concepts. Furthermore, they can be said to possess a claim to generality in their own, distinctive way. A scientific concept represents its object detached from its particular manifestations, 'purged' from its contingent properties. It subsumes a great variety of perceptions, dependencies, and interactions under a unified phenomenon. In that way, it claims to apprehend in a single form an entire field of reality. Concepts such as culture, social class, language, or ritual illustrate in a striking manner the distinct claim to generality of scientific concepts. We can conclude, therefore, that Koselleck's remarks about the nature of social and political concepts may have a broader significance for other types, such as the concepts developed and employed in the humanities and social sciences. It may be erroneous to take ambiguity as a *stricto sensu* constitutive factor of scientific concepts, but we have good reasons to argue that the other two factors mentioned by Koselleck are *mutatis mutandis* pertinent. Above all, it can be shown that a scientific concept is a unity of meanings and experiences that extend far beyond what the word sense covers. For this reason, the methodological distinction between word and concept becomes necessary for an analysis that aspires to shed light on the emergence and development of a concept in a given field of scientific practices.

The concept formation analyzed in this study is a complex process that involves two distinct but closely connected concepts. Although they both form part of the same conceptual development, they are distinguished on the basis of the disciplines from which they emerged and the respective fields of application. The linguistic concept of code emerged in Jakobson's structural phonology. Jakobson can be said to have devised the conceptual matrix for a general, semiotic concept of code. However, the latter did not arise from a straightforward extension of Jakobson's concept but followed a sinuous developmental path that passed through Lévi-Strauss's structural anthropology. The aim of this study is to disentangle the main threads of this complicate concept formation in order to elucidate the origins of the semiotic concept of code and account for its consolidation in semiotics and related disciplines. To this end, the investigation will be divided in two main parts following the methodological distinction between word and concept. Chapters 1-4 will be devoted to the presemiotic senses of "code" taking as a point of departure the senses of the Latin word "*codex*" that carried over to its descendant cognates. In this part, I will seek to specify the conditions in which these presemiotic senses originated, focusing mainly on the pertinent aspects of sociopolitical, economic, material, and intellectual history behind each usage and semantic shift. In focusing on the social and cultural background of these usages, I expect to identify the long-term structures and the enduring social practices that made possible the persistence of the presemiotic senses through time. This, in turn, will allow for addressing in more specific terms the issue raised by Nöth (1990, 206) in his remark about the "fundamental ambiguity" that the semiotic concept of code inherited from the word's presemiotic usages. The first part will conclude with a chapter on the quantification of information, which will examine the major technological and theoretical advances that culminated in Shannon's general theory of communication. The quantification of information is the crucial link between the semantic development of "code" up to the first half of the twentieth century and the emergence of the semiotic concept of code in an intellectual climate suffused with the enthusiasm engendered by the breakthrough of communication engineering.

The second part of the investigation will focus on the formation process of the linguistic and semiotic concepts of code. Chapter 6 will examine the conditions of the migration of "code" from information theory to psychology and phonetics in the 1950s, where it was employed as a purely technical term. Chapter 7 will shift the attention to the parallel adoption of the word in structural linguistics, where Jakobson introduced it as a synonym for Saussure's "*langue*". The analysis in this chapter will move from the 'surface level' of Jakobson's uses of "code" to the foundations of his theoretical edifice, in order to specify whether there was indeed a genuine concept formation behind Jakobson's terminological innovations. It will be shown that "code" did not enter structural linguistics simply as a new name for Saussure's concept of *langue* but it came to designate a different concept of linguistic system, constructed by Jakobson through a sustained and thorough critique of Saussure's conception of language as a scientific object. Jakobson provided a general conceptual scheme of language as a multilayered multifunctional system that seemed extensible to forms of non-verbal communication. However, the matrix for a general concept of semiotic system did not emerge directly from structural linguistics but it was carved out by Lévi-Strauss in his attempt to provide an anthropological theory of symbolic thought. Chapter 8 will engage in a detailed analysis of the theoretical premises of Lévi-Strauss's project seeking to lay bare the conceptual substratum sustaining the application of "code" in structural anthropology. It will be shown that beneath the seemingly trivial uses of the word lies a general semiotic concept, which forms an indispensable part of Lévi-Strauss's conception of symbolic activity. The anthropological theory of Lévi-Strauss provided a major thread in the development of the semiotic concept of code. Two further threads, that ran parallel to Lévi-Strauss's seminal research in the 1960s, will be discussed in Chapter 9. The work of Sebeok and Prieto is indicative of a nascent tendency toward the construction of a general framework for a semiotic theory of codes. A similar tendency can be discerned outside semiotics, e.g. in the work of Basil Bernstein, which gave rise to a sociological theory of education based on a sociolinguistic concept of code. This period saw a wide diffusion of the term "code" in the humanities and social sciences accompanied by several conceptual crystallizations. In semiotics, the concept of code entered a new phase in its development, which culminated in Eco's general theory of codes. The analysis in the second part of this chapter will examine this critical phase against the backdrop of Eco's attempt to pave the way for a transition from code semiotics to interpretive semiotics, a transition that revealed at the same time the limits of the concept's potential.

In what follows I intend to offer a primarily historical rather than systematic exposition of the semiotic concept of code. The reason for this decision is twofold. First, a systematic exposition of a scientific or philosophical concept or problem generally depends in crucial respects on an adequate historical exposition. In the case studied in this monograph, such an historical exposition is still missing. Secondly, the misconceptions surrounding the emergence and early development of the semiotic concept of code may undermine in advance any attempt to provide a full-fledged systematic exposition. For unless we specify the conditions of the concept's emergence, especially in relation to the word's semantic history, we run the risk of losing sight of the major theoretical debates that lie at the heart of the concept's early development. It is, therefore, necessary to provide first an historical exposition elucidating the critical early stages of the concept formation under consideration, in the hope of paving the way for an adequate systematic exposition.

CHAPTER 1

The Development of Writing and Manuscripts

According to Eco (1984, 165), the word “code” had “to do with communication or signification since its most remote origins”. More precisely, however, the long history of the word is inextricably intertwined with the development of writing. Thus, the latter is the proper point of departure for the reconstruction of the historical facts, social practices, political, cultural and economic institutions, and technological innovations that shaped the semantic history of “code”. Ancient people considered writing to be a gift of the gods. From India to the Middle East and from the southeastern Mediterranean to Scandinavia, myths and legends recount the divine origin of writing (Coulmas 1989, 5). This universal tendency toward supernatural explanations is indicative of the ways in which the first writing systems must have been received in ancient cultures. The perceived complexity of those systems, their exclusive use by social elites, and the things one could do with a few weird marks must have awed those people who saw their lives being progressively transformed by the advent of writing.

Archaeological evidence points to several independent ancient origins of writing (Daniels 1996, 2). The Sumerian cuneiform script is probably the oldest among the ancient writing systems. The first known written texts come from the Mesopotamian city of Uruk and date from the late fourth millennium B.C.E. They mainly contained numbers and pictographic signs (Michalowski 1996, 33-34). By the mid-third millennium B.C.E. the Sumerian script was adapted to the Semitic dialects of Mesopotamia. The earliest cuneiform texts in the Akkadian dialect family appeared around 2350 (Cooper 1996, 37). In ancient Egypt, writing appeared around 3150 B.C.E. Although a ‘stimulus diffusion’ from Sumer through trade cannot be precluded, the Egyptian hieroglyphic script probably originated independently of the Sumerian cuneiform system (Martin 1994, 15-16, Ritner 1996, 73). In the Indus Valley, writing emerged around 2500 B.C.E. during the Mature Harappa phase of the Indus civilization. In this case, too, there was possibly some early

Mesopotamian influence through trade routes, but, like the Egyptian hieroglyphic script, the Indus writing system is assumed to be of independent origin (Parpola 1996, 165).

The same seems to be the case with respect to the early Chinese scripts, since there is no evidence or indication of foreign influence. In ancient China, the emergence of writing coincided with the rise of the first civilization in the lower basin of the Yellow River (Martin 1994, 19). The earliest inscribed objects (ox scapulae and turtle plastrons) date from about 1200 B.C.E. and they contain royal divinations. The modern Chinese characters derive from the script of that period (also known as Shang script). Despite the striking difference in form, “the basic structural principles that underlie the Shang writing system are fundamentally the same as for later stages of the Chinese script, including the modern script” (Boltz 1996, 191). Writing seems to have emerged independently in Mesoamerica, too. Until the late 1990s, it was held that the earliest known scripts (Zapotec, Epi-Olmec and Mayan) dated from 500 to 150 B.C.E. and appeared in Oaxaca, the Pacific Coast of Guatemala and the Gulf Coast (Macri 1996, 172-174). However, a block incised with a previously unknown script that was found in Veracruz, Mexico in 1999, suggests the existence of a much earlier writing system, which dates from about 900 B.C.E. and is associated with the Olmec civilization (del Carmen Rodríguez Martínez, et al. 2006).

So far, no definite answer has been given to the question of the character of the origins of writing. Did the early writing systems emerge independently or was their invention actually the result of a ‘stimulus diffusion’ from Mesopotamia? The former explanation largely prevailed in the twentieth century, whereas today the latter explanation has gained wide acceptance (Robinson 2009, 22). While the possibility of a unilineal development cannot be excluded, according to the existing evidence it is very likely that some of the earliest writing systems emerged independently. There are still several lacunae in the historiography of writing due to insufficient evidence and difficulties in deciphering certain scripts. There is still a debate, for instance, with regard to the emergence of West Semitic scripts (O'Connor 1996, 90). At any rate, the available research has shown that for historical reasons the evolution of writing exhibits a geographical and temporal asymmetry.

The earliest clay tablets from Mesopotamia (*ca* 3000 B.C.E.), Crete and mainland Greece (*ca* 1500 B.C.E.) were accounting records. In Egypt, the earliest evidence for writing was found on ivory or bone tags used for the identification of goods. Similar findings from China, India and Mesoamerica are rare, but this could be due to the use of perishable writing materials (Robinson 2009, 8). Such evidence led several scholars to assume that writing first served accounting purposes[3]. This of course does not preclude other early functions, even in the case of Sumer where we lack evidence that would support such a hypothesis (Martin 1994, 27). In fact, evidence from other sources of writing points to different early uses. In China, the earliest known system was almost exclusively used for inscribing royal oracles on shells and bones. However, the possibility of purposes other than divination cannot be ruled out, despite the lack of relevant evidence or direct indications (Coulmas 1989, 91-93). In Mesoamerica, on the other hand, writing was from the outset associated with the need for recording astronomical observations (Macri 1996, 172). The available data from different parts of the world may not converge to a single early use, but they do suggest a set of practices necessary for the administration of considerably complex societies. This is perhaps less obvious in the cases of China and Mesoamerica, but we should not forget that both divination and astrology were especially important forms of predicting practices in the ancient world. Measurement, accounting records, the protection of property, the regulation of economic exchanges, the ratification of contracts, and the prediction of the future were all vital for societies that had already reached the stage of surplus production and developed a dense system of hierarchical social relations. All vital needs could thenceforth be met in new, highly sophisticated ways thanks to writing. The attested earliest uses point precisely to this fundamental social function. This is further corroborated by the available archeological findings.

Writing appeared in societies based on intensive agriculture and rigorous hierarchy. Its parallel emergence in different parts of the world was part of a long sequence of technological and social developments that shaped humanity throughout the centuries. The gradual evolution and geographical diffusion of the early writing systems and the continuous expansion of their application had a profound, multiple impact ranging from

[3] See e.g. Daniels (2001, 45), and Coulmas (1996, 49).

the organization of society to human cognition. Certainly, it would not be an exaggeration to argue that modern society would be unthinkable without writing (Coulmas 1989, 9). However, in order to assess the historical significance of writing, we need to go beyond such trivial remarks. The overvaluation of writing presupposes an abstraction from both the material and technological conditions of its development and the concomitant mental evolution of human beings. Only by virtue of such a double abstraction it is possible to view a communication medium in itself as a principal factor of social development. Writing is a genuine product of a certain type of society, which built on the far-reaching consequences of the Neolithic revolution. It emerged in societies that had entered the stage of surplus production based on an advanced system of labor division and a rigorous social hierarchy. In those societies, writing provided a sophisticated tool for the administration of production and the control of people.

Soon writing expanded beyond administration and economy, transforming substantially every field of its application (e.g. literature, religion etc.). The evolution of writing comprises three closely interrelated strands: the development of new scripts through differentiation, the continuous expansion of writing to an increasing number of new social practices, and the progressive geographical expansion of writing systems. Writing did not evolve through a univocal linear transition from one process to another. Rather, it followed a complex pattern as regards both the interaction of its evolutionary strands and its interdependence with the development of different social formations. This interdependence was intensified as writing expanded in geographical and social terms and it became intertwined with manifold social transformations. Throughout this multilayered and internally diversified process, an element remained invariant, which is the distinctive trait of writing. In every field of social practices in which it was introduced, writing served primarily as a means of systematization, being itself a product of successive systematizations of different order. Writing emerged in societies characterized by an increasing systematization of their economy and administration, and it was employed for the purpose of expanding and enhancing various systematization techniques in several key fields, such as Law or language learning. The cumulative effect of its increasingly diversified and intensified use was also reflected in the development of human cognition. In brief, writing soon became an agent of change insofar as it was entangled in a relation of mutual dependence and transformation with society, a relation that grew ever more complex throughout the centuries and brought about several irreversible consequences.

Research on the evolution of writing systems has reasonably focused mainly on morphological changes. However, developments in writing materials deserve also attention. Since the earliest times, a wide variety of materials, such as wood, stone, gold, clay, shells, reeds, or animal skins, has been used for both writing surfaces and writing tools. The stage of economic and technological development of the societies that began to use writing determined the production methods of writing materials. The advent of metallurgy increased significantly the range of materials that could be used as writing surfaces and tools. In Mesopotamia, clay was for centuries the dominant material for writing surfaces. The Mesopotamians impressed or incised with a stylus the signs of their cuneiform script on damp clay tablets, which were then left to dry or in rare cases were baked (Taylor 2011, 13-16). In Egypt, writing was associated with papyrus since the fourth millennium B.C.E. (Martin 1994, 15). Papyrus was also used widely in southeastern Mediterranean until the Hellenistic period. In China, bamboo, wooden strips, and silk were the basic materials for writing surfaces.

The increasing use of early scripts in more complex social practices required a series of changes at different levels. The transition from the logographic to the syllabic and phonemic systems was crucial for the evolution of writing as a means of communication and systematization, for it allowed for representing a much larger number of linguistic signs with a limited set of characters. Changes in the production and use of writing materials were equally important. An integral part of these changes was the development of the manuscript format. A major thrust in the evolution of writing was provided by the problems caused by the diffusion of its use to new spheres of social activity. Among the early challenges associated with the introduction of writing, two practical problems proved crucial for the development of the new medium. Available evidence suggests that early on there was a need for protecting documents from damage and securing their confidentiality. A finding from Külpete (present-day Turkey), which is kept at the British Museum (BM 113573), is particularly revealing. It is an Old Assyrian letter (*ca* 1.920–1.740 B.C.E.) written in a clay tablet, which was protected by a clay envelope (Lewy 1939, 121). The practice of covering administrative texts and letters with clay envelopes dates from the early Ur III period (*ca* 2.230–2.000 B.C.E.)[4] and it represents perhaps the first attempt to address the problem of secrecy in written communication. The search for more sophisticated solutions to this problem, based on writing itself rather than writing materials, led to the invention of the first cryptographic methods, early examples of which are attested in Babylonian documents written in cuneiform script[5].

The finding from Külpete foregrounds another interesting early challenge. The clay tablet and its envelope were accompanied by a smaller tablet, used to provide additional space for concluding the letter. Increasing the available surface for writing and finding the appropriate materials for writing surfaces and tools were two of the major early problems that literate societies had to face. As the system of social practices relying on writing grew steadily, there was a need for larger and more complex documents, which in turn called for a more efficient use of writing surfaces. Reducing the size of characters and constructing larger 'sheets' proved insufficient and caused several practical problems. Thus, early on it became clear that the solution lay in binding together several individual sheets into a composite written object: the manuscript. This solution proved vital for the subsequent development and diffusion of writing. The quest for sophisticated binding techniques together with the advances in the production of writing materials paved the way for the mass use of writing.

In terms of their shape, all known forms of manuscript can be subdivided into two basic types. The first type comprises manuscripts made of a single, rectangular item pliable enough to be rolled up into a cylinder. The second type comprises manuscripts made of two or more rectangular items bound together on one side so that they can rotate freely around the binding axis. Both types appeared very early in different parts of the world. In ancient China, manuscripts were made of bamboo or wood. They consisted of strips bound together like the pages of modern books. Bamboo was used for classical and religious texts, whereas wood for official documents and private letters (Tsien 1985, 29-32). Evidence from oracle-bone scripts show that the use of such manuscripts dates back to the

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[4] For a description of the enveloping technique, see Taylor (2011, 19-21).
[5] See Pearce (1982).

fourteen century B.C.E. (Liu 2016, 4). Bamboo or wooden strips were also used for rolls since the sixth century B.C.E. (Edgren 2007, 97). During the same period, silk rolls began to appear, which together with paper rolls eventually replaced manuscripts made of bamboo and wood (Tsien 1985, 228). In ancient India, roll was the basic manuscript format. Early Indian manuscripts were principally made of birch bark and the text was written in ink with a stylus. The same technique was also applied to the palm leaf manuscript, which did not have the form of a roll but consisted of multiple strips strung together so that they formed a stack (Wujastyk 2014, 166).

In the ancient Near East, early attempts to devise usable manuscript formats date back to the Ur III period. The Sumerians used wooden or ivory boards consisting of two or more sheets covered with a mixture of wax and orpiment (Taylor 2011, 25). There is evidence suggesting the use of such boards by the Assyrians, the Babylonians, and the Hittites (Symington 1991, Wiseman 1955). In Pharaonic Egypt, wooden boards were probably used for taking notes or for drafts of drawings and school-exercises. However, manuscripts consisting of multiple boards bound together were commonly used much later, in the Graeco-Roman period (Eyre 2013, 31). For centuries, the dominant manuscript format in ancient Egypt was the roll. In ancient Greece, wood was one of the earliest writing materials[6]. Plutarch relates that when he visited Athens, in the Prytaneion there were still remains of the *axones* (revolving wooden beams) used for displaying Solon's laws[7]. There is no conclusive evidence as regards the use of manuscripts with multiple sheets. Yet, if Homer's reference to a folded tablet, which Proetus used to send a message to the king of Lycia[8], was not an anachronism, then this manuscript format might have been used by Greeks long before Solon's era[9]. At any rate, the available evidence from archeological

[6] Excavations on Minoan sites have brought to light only clay tablets. There is, however, evidence that wooden board might have been used for official documents. See Olivier (1986, 387).
[7] Plutarch, *Solon* 25. Plutarch seems to suppose that "*kyrbeis*" was another name for *axones*. On the relation between *kyrbeis* and *axones*, see Robertson (1986).
[8] Homer, *Iliad* 6.169.
[9] Among the important findings from the shipwreck at Ulu Burun (present-day Turkey) dating back to the fourteenth century B.C.E., there is a wooden diptych consisting of two small leaves, joined with a three-piece ivory hinge. According to the archeologists, this finding suggests that Homer's reference to a folded tablet was not an anachronism. On the excavations at Ulu Burun, see Bass et al. (1989). On the wooden diptych, see Payton (1991). This finding seems to support the hypothesis that the use of writing boards was introduced to ancient Greece from the Near East, perhaps from the Hittites. On this hypothesis, see Roberts and Skeat (1983, 11), and Burkert (1992, 30).

research suggests that by the classical period wooden boards were established as a standard medium (Thompson 1912, 13-14). Findings from Herculaneum and Pompeii indicate that such boards were also used by Romans (Kilgour 1998, 51). The use of writing boards consisting of multiple sheets dates back at least to the fifth century B.C.E. (Roberts and Skeat 1983, 11-12). In ancient Rome, such boards were generally used whenever there was a need to protect the document from damage. Texts written in wooden boards included letters, legal documents, and official certificates. There were several names for this type of manuscript. In ancient Greek, a board was called "*πίναξ*", "*πινακίς*", "*δελτίον*", "*δέλτος*", "*πυκτίον*", or "*γραμματεῖον*". In Latin, it was called "*tabella*", "*cera*", or "*tabula*". Writing boards of two leaves were called "*δίθυροι*" or "*δίπτυχα*" in Greek, "*diptycha*" or "*duplices*" in Latin. When the boards consisted of many leaves, they were called "*πολύπτυχα*" and "*polyptycha*" or "*multiplices*", respectively (Thompson 1912, 14-15). In Latin, a *polyptych* was also called "*caudex*" (later: *"codex*"). The word originally meant the trunk or stem of a tree and subsequently it came to denote the manuscripts made of several wooden boards. Later, this sense was extended to polyptychs made of other materials[10]. This usage must be very old. In the time of Cato the Elder, "*codex*" was synonymous for "*tabula*" (Roberts and Skeat 1983, 12-13).

Polyptychs were introduced rather belatedly to ancient Egypt, where papyrus rolls dominated the manuscript market for centuries. The papyrus plant and the form of the roll were integral part of the Egyptian writing tradition. It is reasonable to assume that the specific manuscript format prevailed because it was found to be particularly suitable for the pliable papyrus leaves. The same format was used for manuscripts made of animal skin. The use of skin as a writing material in ancient Egypt must be very old. It has been argued that it dates back to the time of Cheops; however, the evidence is scant (Thompson 1912, 27). Extant Egyptian leather rolls are rare, and that has led to the conclusion that their role in Egyptian manuscript market must have been rather insignificant. Yet, it cannot be precluded that "rarity of leather as a writing material may… be a distortion of the archaeological record" (Eyre 2013, 32). In ancient Greece and Rome, leather rolls must have preceded papyrus rolls. It is unclear when papyrus was introduced in ancient Greece,

[10] *Oxford Latin Dictionary,* s.v.

but it is assumed that it must have come into general use by the middle of the seventh century B.C.E. (Turner 1968, 2). In Rome, it is assumed that the introduction of papyrus must have taken place around the end of first century B.C.E. (Mioni 1973, 18). Papyrus and parchment were the two dominant writing materials in classical antiquity. Both established roll as a major manuscript format. There is no firm evidence about the introduction of parchment in the Graeco-Roman world. The traditional account[11], which attributes the 'invention' of parchment to the king of Pergamum Eumenes II (ruled 197–159 B.C.E.), is obviously untenable, for parchment and leather were widely used in Western Asia much earlier. The reason for the increase in the production and export of parchment must be sought in a shortage of papyrus supplies around the second half of the second century B.C.E. due to a war between the Seleucids and the Ptolemies. Apparently, "what actually happened was that the Pergamene authorities were forced to fall back on parchment when Egyptian supplies of papyrus were interrupted during the invasions of Egypt by Antiochus Epiphanes (170-168 B.C.E.). It was during the same period that Pergamene scholars introduced the new material to Rome, where no doubt the shortage of papyrus was no less keenly felt" (Roberts and Skeat 1983, 6). Papyrus soon regained its dominant position after the end of the war, yet parchment would eventually come to prevail in the next centuries for reasons that had to do with its physical properties and its production. Parchment "is immensely strong, remains flexible indefinitely under normal conditions, does not deteriorate with age, and possesses a smooth even surface"; more importantly, it "could be produced wherever the skins of suitable animals were available in sufficient quantity" (Roberts and Skeat 1983, 8).

The diffusion of the use of parchment benefitted the roll, but it also contributed significantly to the development of the format of the polyptych. The Romans were the first who sought to replace wood with a lighter and more pliable material for polyptychs. For that purpose, they opted for parchment (Roberts and Skeat 1983, 15). Horace informs us that by his time parchment notebooks (*membranae*) were used for drafts of literary texts[12]. A more concrete reference to the *codex* as a format for literary texts is to be found in some

[11] Pliny, *Naturalis historia* 13.21.
[12] Horace, *Satirae* 2.3, 1–2; Horace, *Ars poetica* 386–390.

verses of Martial[13]. The transition from wooden tablets to parchment notebooks seems to imply that the emergence of *codex* was a result of the predominance of parchment. However, there are indications that run counter to such a straightforward evolutionary scheme. The surviving manuscripts from Egypt suggest a more complex process that cannot be accounted for exclusively in terms of the practical advantages of the *codex* over the roll and of parchment over papyrus[14]. For the period between the second and the fourth century C.E., papyrus *codices* significantly outnumbered parchment *codices* (Kilgour 1998, 55). In this case, a high number of papyrus *codices* is not surprising, but the extremely low number of early parchment *codices* is still striking, especially if one takes into account the indications of parchment trade in second-century Egypt (Turner 1977, 37-38). At any rate, the evidence shows that the new format was not exclusively associated with the use of parchment. It is reasonable to assume that *codex* went through an initial stage with early variants of both papyrus and parchment before it was established as a form of parchment manuscript.

The preponderance of *codex* is generally attributed to certain "superiorities… over the roll: the obvious savings of money in using both sides of the papyrus, the increased speed in production, and the greater ease in retrieving information from text" (Kilgour 1998, 54)[15]. However, both the extent of this superiority and its role in establishing *codex* as the dominant manuscript format have been questioned[16]. The advantages of *codex* are indubitable. Yet, it took long for the new medium to prevail over the roll, and usually this is mainly attributed to "a reluctance to accept change" (Kilgour 1998, 56). However, early on Christians adopted *codex* as the principal medium for the dissemination of their sacred texts (Roberts and Skeat 1983, 38-40), and the spread of Christian religion was crucial for the diffusion of the new manuscript format. Besides the obvious advantages referred to earlier, *codex* might have also attracted the early Christians because it could differentiate them from both the Jewish and the pagan traditions (Roberts and Skeat 1983, 60).

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[13] Martial, *Epigrammata* 1.2, 14.007, 14.184, 14.184, 14.188, and 14.192. In these verses, Martial speaks of *membranae*, not *codices*.
[14] On the issue of the representativeness of such evidence, see Roberts and Skeat (1983, 35).
[15] See also Casson (2001, 129).
[16] See Roberts and Skeat (1983, 45-52), Skeat (1982), and Skeat (1990).

The preceding discussion suggests that the emergence and subsequent diffusion of *codex* presents several puzzling aspects. Given the available evidence, it would be difficult to support the hypothesis of a single decisive factor or region behind this development. The seemingly straightforward transition from the wooden polyptych to the parchment *codex* may be part of a more complex process. It is interesting to note that even the widely accepted thesis[17] of the genetic relationship between the polyptych and the *codex* is not immune to objections[18]. The objections raised and the recent re-consideration of the proposed theories[19] suggest that the question of the origins of the *codex* is still open. Yet, its historical contour is sufficiently clear. As the ancient Near Eastern and Mediterranean societies expanded the use of writing, as their centralized administration, their cultural life, their political and legal institutions relied increasingly on texts, the manuscript acquired a special significance – both practical and symbolic. *Codex* formed part of a long manuscript tradition in a world that witnessed intense warfare activity, extended trade networks, major sociopolitical transformations and great intellectual achievements. That was, roughly, the context in which the word "*codex*" acquired the sense of manuscript format.

[17] See e.g. Roberts and Skeat (1983, 1), Kilgour (1998, 52), Casson (2001, 125).
[18] Szirmai (1990) questions the existence of a direct genetic relationship between the polyptych and *codex*, arguing that the binding techniques in the two formats differ substantially. As regards the relationship between *codex* and the Roman parchment notebooks, Szirmai reminds that besides some references there is no relevant evidence. The binding of *codex* was far more complex, and the only (slight) indications of an older format with equally complex binding are some representations on Hittite steles from the seventh century B.C.E. An early reference to the potential significance of these steles for the study of the history of *codex* is offered in Van Regemorter (1958).
[19] See Harnett (2017).

CHAPTER 2

Law Collections

In the context outlined in the previous chapter, the Latin word "*codex*" acquired the additional sense of law collection, which was retained in the descendant cognates and it was later expanded to any set of rules or principles covering a specific sphere of social activity. This second sense was established through the association of "*codex*", as a manuscript format, with the systematization of Roman law and the publication of collections with imperial enactments. As such, it presupposes a long series of developments in the use of writing in ancient legal practices. The origins of these developments lie in ancient Mesopotamia. Law does not necessary entail the use of writing. Many cultures have relied on oral law for centuries. However, the increasing use of writing in legal practices had a deep impact not only on the practices themselves but also on the perceptions of social beings about the law and its binding force.

The earliest legal systems appeared in the ancient Near East. They emerged in various sociocultural and linguistic environments, but all evolved under the strong influence of the Mesopotamian law[20]. Early on, the Mesopotamians used writing in their legal practices. Until the first millennium B.C.E., their cuneiform script served as the principal vehicle for the transmission of Mesopotamian law to other cultures. The vast majority of the extant ancient legal documents comes from this region (Westbrook 2003, 5). Among them, there are the extant "law codes", as they are usually called today[21], which offer valuable information about the origins of law collections. Most of them come from Mesopotamia and cover a period of nearly fourteen centuries, starting with the Laws of Ur-Nammu (ca 2.100 B.C.E.), the Laws of Lipit-Ishtar (ca 1.900 B.C.E.) and the famous Laws of Hammurabi (ca 1.750 B.C.E.). There are also the Hittite Laws from Anatolia and some fragments of law collections that have been identified in the Old Testament. The

[20] There are strong reservations about Egypt, which will be discussed later.
[21] Some scholars do not agree with the use of the term "law code" for such collections. See e.g. (Claassens 2010).

Mesopotamian collections were all written in cuneiform script (Westbrook 2003, 8-9). Some of them had a similar structure. They included a prologue and an epilogue, which provided the political framework of the publication of laws and portrayed the king as the guardian of justice who drew his authority from the gods (Roth 1997, 2). Common features were also identified in the form and the content of a larger and more diversified set of collections. Typically, the texts were usually formulated in a casuistic form. A hypothetical *protasis* described a particular case and an *apodosis* set forth the legal consequence. Several such cases recur in various collections; they often appear in variants or they are followed by different legal consequences. The shared features identified in a wide array of records from different periods and regions may be indicative of a common tradition of Mesopotamian origin throughout the ancient Near East (Westbrook 2003, 17). The typical form of the law collections may also provide some hints about the possible uses of those legal documents and the intellectual tradition from which they emerged. A series of casuistic laws could not constitute a comprehensive law code, in the modern sense of the word. The accumulation of particular cases alone does not suffice for the construction of a genuine collection of general laws. In this sense, the early collections under consideration were inevitably restricted in scope. It would be too easy to take this feature as a defect, but in that case we would possibly miss the crucial connection between the casuistic form of these collections and the role of early written law in the ancient Near East.

The use of writing in ancient legal acts could not have an immediate impact on law. The first societies that wrote down their laws had a long oral tradition that could not become obsolete in just a few centuries. In the ancient Near East, writing was used extensively for many different legal acts. Yet, until at least the early first millennium B.C.E., legal documents did not have an independent role. Rather, they performed a complementary function. Ceremonial acts played a far more important role in the validation of legal acts (Westbrook 2003, 12-13). Symbolic gestures had a special significance for this procedure, not only in private law but also in the context of diplomatic relations (Charpin 2010, 47). Not surprisingly, then, in such legal traditions legal documents were not treated as autonomous texts (Westbrook 2003, 20). This, however, raises the question of the function and the binding force of the great Mesopotamian law collections. Several hypotheses have been proposed as regards the function of the collections. First, it has been assumed that such texts recorded existing practices and, thus, provided precedents for the courts. It has also been suggested that they were actually scientific treatises produced in scribal schools. Lastly, others argued that they rather served as royal apologia together with other administrative documents (Roth 1997, 4).

The extant legal documents do not support the hypothesis that the early law collections were used like the modern law codes. That is, they did not provide systematically arranged bodies of general laws for the administration of justice. There is no evidence as regards the citation of such collections in courts (Westbrook 2015b, 186). The scant references to stelae with laws in some documents do not suggest the application of the inscribed rules on specific cases (Roth 1997, 5-7). Thus, these collections might serve different purposes. The casuistic character of the laws contained in the early monumental collections provides some particularly useful hints. Among the thousands clay tablets discovered in the regions that once belonged to the Mesopotamian kingdoms there are many lists of words. Initially, they may have been used in the training of scribes. Later, they were significantly expanded and were used for recording and organizing the objects of the diverse fields of natural and social life. Some of these inventories were really impressive. An ‘encyclopedia’ from the first half of the second millennium B.C.E. contained almost ten thousand “entries” arranged in a specific way. These lists bespeak “an enormous and constant intellectual effort, typical of the state of mind of the ancient Mesopotamians, as an attempt to *understand* the universe by classifying and organizing its contents, itemized by common traits and by specific differences” (Bottéro 1992, 30; emphasis in the original). Among such inventories, there were also ‘dictionaries’ of legal terms and phrases (Westbrook 2003, 10). The Mesopotamian method of classification was very sophisticated, but it never extended beyond the realm of perceptible elements to attain a high level of abstraction (Bottéro 1992, 31). It lacked definitions of abstract concepts and classification in categories and sub-categories (Westbrook 2003, 20). This is more clearly seen in the so-called treatises or manuals of the Mesopotamian scholars.

The treatises dealt with key topics of lexicography, grammar, divination, mathematics, jurisprudence and medicine. Such texts were actually long series of conditional clauses arranged in specific ways. A standard medical treatise, for example, comprised a more or less exhaustive series of conditional clauses, which provided the diagnosis for each type of symptom (Bottéro 1992, 169-176). In such works, which served both practical and didactic purposes, the Mesopotamians discerned constant relations between types of case, but they never postulated any abstract principles. Despite the fact that no ‘general laws’ could be deduced from the long series of hypotheses that made up a treatise, such works were nonetheless useful manuals of instruction (Bottéro 1992, 177-178). In light of the available evidence on this scholarly activity, it has been suggested that the extant Mesopotamian law collections, such as the so-called Code of Hammurabi, were in fact law treatises rather than pieces of imperial legislation, in the strict sense of the term (Bottéro 1992, 167, Westbrook 2003, 18). Of course, other uses cannot be precluded. Such collections might well serve the practical needs of judges, providing them with the guidelines for judging unanticipated cases (Charpin 2010, 77). Moreover, they could also serve political purposes (Finkelstein 1961, 101-103).

It appears, then, that the practice of writing law in the ancient Near East constitutes a multilayered phenomenon with transcultural implications. However, there is no evidence of Mesopotamian influence on Egypt. No ‘law codes’ have survived from the third and the second millennia BCE. In legal documents from the Middle and the New Kingdoms there are only references to some law collections (Jasnow 2003a, 93, 2003b, 255-256, 2003c, 289-290) . The so-called Law Code of Hermopolis West[22] is much later (third century BCE) and it was rather a ‘handbook’ for the Egyptian judges (Manning 2003, 819). The Code of Hermopolis probably contains part of an older collection of Egyptian laws (late sixth century BCE), which was compiled during the Persian domination under Darius I (Johnson 1994, 157-158). Some features of this text suggest the possibility of a legal scholarly tradition like the one established in Mesopotamia (Westbrook 2003, 10-11), but there is no further evidence for or against the hypothesis of a Near Eastern influence on Egypt.

The question of such an influence on Ancient Greece is much more complicated. It is true that at least from the Late Bronze Age there were close contacts between Greece and

[22] On the Law Code of Hermopolis West, see Mattha and Hughes (1975).

the Near East and that the latter exerted a cultural influence on the former[23]. It would seem reasonable, then, to assume that there was a similar Near Eastern influence in legal practices. Indeed, in various sources there are indications that important written Greek laws, such as the so-called Gortyn Code or the laws of Solon, fit in part into traditional thematic and structural Near Eastern patterns (Westbrook 2015a, 67-68). Yet, on the basis of these indications alone we cannot determine whether the Greeks took the idea of writing law from the Near East. But even if they did, it is more important to consider the sociopolitical setting in which this idea was transplanted.

Most of the extant early Greek laws were inscribed on stone or other durable materials. They date from the mid-eighth to the mid-fifth century B.C.E. and many of them are from Crete (Dreros, Gortyn, Lyttos, Eleutherna)[24]. No inscribed laws survive from Archaic Athens. Draco's homicide law (621-0 B.C.E.) and Solon's famous laws (594 B.C.E.) were re-inscribed in 409-8 B.C.E. The quantity of the surviving legal inscriptions is impressive, yet we do not know what portion of all archaic legislation it represents. Interestingly, it does constitute the majority of public inscriptions for the period between 650 and 500 B.C.E. (Gagarin 2008, 93) Most of these legal inscriptions contain laws that did not form part of some large-scale legislation but independently regulated in a very detailed way specific issues (Hölkeskamp 1993, 90-91). A notable exception is a relatively late set of laws, the so-called Gortyn Code. Although it has a degree of organization "unparalleled in Near-Eastern laws" (Gagarin 2008, 162), it cannot be taken as a fully systematic and comprehensive collection (Davies 1996, 37). Generally, the term "code" can be applied in the case of Ancient Greek law only in a loose manner (Gagarin 2008, 75), since codification presupposes a "different sort of approach" to law and entails a process that is "intentionally started with the explicit objective of creating a 'code'" (Hölkeskamp 2005, 284). But it seems that the Greeks lacked such an approach to law and it is at least questionable if there was a pan-Hellenic movement toward a comprehensive codification, as it is sometimes assumed (Hölkeskamp 1992, 51-60). Yet, in Archaic Greece a new

[23] For a detailed account, see Burkert (1992).
[24] See Van Effenterre and Ruzé (1994).

attitude toward law started gradually to emerge along with a series of crucial social and political transformations.

Early written Greek law appeared in the milieu of the archaic *polis*, in a dynamic sociopolitical setting with tensions, periods of internal instability, economic and demographic growth, territorial expansion and intense interaction between communities (Hölkeskamp 1992, 67). Many laws were written in times of political crisis and their inscription on durable materials was probably a means for reinforcing their authority (R. Thomas 2005, 56). In classical Greece, written law was thought to be closely connected with democracy and equal justice[25]. Yet "there is little reason to think that [it] is in itself inherently democratic or egalitarian" (Thomas 1995, 60), and many early laws were actually written in oligarchies. This, though, does not explain why written law emerged in Archaic Greece *poleis* in the first place. The reaction of the lower classes against the oppression and the arbitrary interpretation of law by the ruling elites is usually taken as a major factor that led to the practice or writing law[26]. On the other hand, it has also been suggested that this practice "does not really appear as a concession to the many, but rather as a reaction of the few aiming at preserving their political influence as completely as possible" (Eder 2005, 240). At any rate, it seems reasonable to assume that "the writing down of law was probably undertaken in a variety of ways by different city-states for rather varied purposes" (Thomas 2005, 42).

Irrespective of the diverse purposes and the particular implications in different Greek *poleis*, the practice of writing law had some important overall effects. It gradually led to the creation of a separate class of rules with special authority and stability that were publicly available (Gagarin 2005, 92). More importantly, "the act of writing down laws in archaic Greece created for the first time depersonalized, authoritative rules" (Gagarin 2008, 108). No law codes, in the strict sense of the word, were compiled in ancient Greece, but the collections that survive exhibit a considerable, albeit varying, degree of organization and contain specific laws, many of which "detail procedures to follow in the case of misdemeanor rather than set out what one might call 'commandments' or

[25] See e.g. Euripides, *Suppliants* 429-34.
[26] See e.g. Hölkeskamp (1992).

'prohibitions'"(Thomas 2005, 284). Early on, Greek written law had a predominantly practical character and a crucial political significance. As regards specifically the practice of compiling law collections, the Greeks apparently attained a high level of systematization. However, codification, in the modern sense, requires an altogether different approach to law (Hölkeskamp 2005, 284), which was unknown to archaic societies. Early steps toward such an approach can be traced back to the transition from the archaic to the classical period, when a new conception of law emerged through the sociopolitical transformations and the evolving legal practices of the Greek poleis. Yet, it was not Greece but ancient Rome that furnished the specific conditions that would favor the emergence of codification.

The circumstances surrounding the beginnings of the practice of writing law in Rome resemble those in archaic Greece. The Twelve Tables (451-540 B.C.E.), the earliest Roman collection of laws, were inscribed in one of the most turbulent periods of Roman history, marked both by frequent wars with Rome's neighbors and by "a long series of bitter struggles between the patrician aristocracy and the plebeians: the Conflict of the Orders" (Raaflaub 2005, 4). The accumulation of power and wealth by the patricians brought about demands for political and economic reforms. The Twelve Tables came as a response to a major political and social crisis. According to tradition, an embassy of Romans was sent to Greece, in order to write down the laws of Solon and be acquainted with the laws of other Greek communities (*Liv.*, 3.31-32; cf. Dionysius of Halicarnassus, *Roman Antiquities* 10.55.5). Among the scholars there is still some disagreement about the credibility of this story. Yet it is generally believed that some Greek elements must have been introduced into the Twelve Tables, although there is no conclusive evidence (Schiller 1978, 156-157). Irrespective of the nature and the extent of such an early Greek influence, writing law entered a different path during the Republic (509 – 27 B.C.E.) and acquired a distinctively Roman character.

The Law of the Twelve Tables (*Lex duodecim tabularum*), one of the most important pieces of legislation of the archaic period of Roman law and jurisprudence[27], is an integral

[27] For a periodization of Roman law, see Jolowicz and Nicholas (1972, 5-7); for Roman jurisprudence, see Schulz (1946).

part of a long process of political and social transformations. The fall of monarchy in the late sixth century B.C.E. was followed by a series of major constitutional and social changes that affected directly the relation between the patricians and the plebeians[28]. Key aspects of these changes are reflected in two important laws of this period. *Lex Canuleia* (445 B.C.E.) overturned a ban on intermarriage between the patricians and the plebeians[29] and *Lex Licinia Sextia* (367 B.C.E.) permitted the admission of plebeians to one of the two consulships. The reforms of the latter law benefitted mostly the leaders of the plebeians and had a profound impact on both the political structure of the Roman state and the cohesion of the plebeian movement (Cornel 1989, 340-341). The radical sociopolitical transformations during the Republic were indissolubly intertwined with important developments in Roman law and jurisprudence.

Archaic Roman law has its remote origins in the long process of political and cultural fusion between the neighboring clans (*gentes*) that eventually formed the city-state of Rome. The customs and rituals that regulated the social practices of the different *gentes* underwent a gradual assimilation, which yielded a common set of norms (*mores maiorum*) for the new community (Mousourakis 2007, 22; Colognesi 2014, 32-33). These customary norms formed the basis of the early legal edifice of Rome, a system characterized by extreme formalism and a close connection with religion. Both features are exemplified in the function of the college of pontiffs (*pontifices*), the most important priestly body. As State priests (*sacerdotes publici*), the pontiffs were, above all, concerned with the application and the development of sacral law. Their role, however, extended well beyond that task. For them priesthood was actually an honorary position and usually many pontiffs were previously or simultaneously magistrates. From that social position, they had a keen interest in private law as well, especially in the law of the family and inheritance, which was very important for the family cult (*sacra privata*), i.e. for the sacrifices and religious rites performed by individuals on behalf of families or clans (Schulz 1946, 7-8). In the archaic period of Roman law, a case could be brought to court only on specific days (*dies fasti*) of the year. The litigants had to follow a strict legal procedure (*legis actio*), which

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[28] For a detailed account, see Drummond (1989).
[29] The ban on intermarriage between the orders was imposed by the Law of the Twelve Tables (Table XI). See Warmington (1938, 504-505).

was actually a ritual involving certain words and gestures (Mousourakis 2007, 32-33). The knowledge of the appropriate days for litigation and the necessary formulae for the initiation of legal action were traditionally entrusted to the pontiffs. These were the guardians both of the secular law (*ius*) and the divine law (*fas*), and they retained the privilege of the interpretation of *ius* until the second century B.C.E. (Mousourakis 2007, 20). Hence, they were frequently consulted (by magistrates or citizens) to give their legal advice (*responsum*) on procedural matters about cases pertaining either to sacral or private law. *Responsa* could be given with respect to both contemplated and performed acts (Schulz 1946, 16-21). This juristic activity was very important for the development of Roman jurisprudence. As such, it also played a key role in the emergence of the practice of codification.

The enactment of the Law of the Twelve Tables was followed by a "long gestation period" (Colognesi 2014, 63) of more than a century. The application of the rules of the Twelve Tables in a shifting social and economic environment necessitated adaptations, which were effected through the pontifical interpretive activity (*interpretatio*). This was one of the most important juristic activities of the pontiffs, by means of which new formulae and legal institutions were created (Schiller 1978, 162). During this period, the production of juristic texts (in sacral, public and private law) was restricted exclusively to records of formulae, *responsa*, instructions etc. for the archives of the pontiffs, the magistrates and the State. None of these records was intended for publication (Schulz 1946, 33-36). According to tradition, however, by the end of the fourth century B.C.E. Gnaeus Flavius published a collection of formulae (*ius Flavianum*) that could be taken as a "slight indication of the gradual development of lay jurisprudence" (Schulz 1946, 10). A more comprehensive collection (*ius Aelianum*) –which probably contained the new formulae that had emerged in the meantime– was published a century later by Sextus Aelius Paetus. This jurist is also said to have published the *Tripertita*, a work much broader in scope than the usual early collections of formulae, which contained the provisions of the Law of the Twelve Tables together with their interpretation and the respective procedural formulae (Schiller 1978, 166).

Sextus Aelius Paetus stood on the threshold of a new period of Roman jurisprudence[30], which covers the second half of the late Republic (ca 201-27 B.C.E.) and partly overlaps with the formative (Jolowicz and Nicholas 1972, 5) or pre-classical (Guarino 1990, 40) period of Roman law. This was not an age of radical break with the past. Public law was still in the hands of magistrates and senators, whereas the pontiffs retained their key position in sacral and private law. Yet, in these two branches lay jurists from the nobility of Rome (*iuris consulti*) began to appear (Schulz 1946, 40-41). These jurists steadily grew in number, especially in private law, and eventually replaced the pontiffs (Mousourakis 2007, 60). What characterized the last two centuries B.C.E. was an effort of preserving the legal tradition without allowing, however, the law to become petrified (Schulz 1946, 60-61). During the late Republic, Roman law actually underwent a considerable development, mainly through the *responsa* of the jurists and the Edicts issued by the magistrates (*edicta magistratuum*)[31]. A similar (and perhaps more intense) interplay between continuity and change occurred in jurisprudence. In the late Republic, Roman civilization "was faced with the necessity of determining its relations with Hellenism" (Schulz 1946, 38). In this context, various Greek philosophical movements exerted a significant influence on the intellectual life of Rome, including Roman jurisprudence. Scholars have expressed differing views as regards the precise character and the extent of such an influence on Roman jurists[32]. Yet, there seems to be no reason to deny the impact of this cultural contact on the development of Roman juristic thought. A particularly interesting aspect of this impact concerns the use of the dialectical method.

Prominent Roman jurists must have acquired knowledge of dialectic through philosophical circles, although there were probably other sources as well (Schulz 1946, 63). The application of the dialectical method allowed them to divide their material into genera and species and discover the principles that govern the individual phenomena pertaining to the same groups. It also enabled them to envisage "problems which have not actually occurred in practice" (Schulz 1946, 68). Of course, mastering the new technique

[30] In Schulz's (1946, 38) periodization it is referred to as the "Hellenistic period". For a critical remark on the very distinction between a Hellenistic and a classical period of jurisprudence, see Schiller (1947).
[31] By means of these edicts, higher magistrates notified the citizens about their orders and intentions. See Jolowicz and Nicholas (1972, 97-98).
[32] See Schiller (1978, 291-297, 569-577).

of organizing legal facts according to genera required time, and it would be rather unlikely for Roman jurists to have attained a high level of systematization at such an early stage. However, by the first century B.C.E. these attempts yielded some results. According to Pomponius[33], Quintus Mucius Scaevola the pontifex compiled a compendium of civil law, arranged in eighteen books. Given the inadequate surviving evidence, a full reconstruction of the work is not feasible. It is generally held, though, that Q. Mucius's compendium was the first systematic treatise on the *ius civile*, organized according to a scheme based on distinctions between genera and species (Schiller 1978, 313). On the character and the origins of this scheme, some scholars have raised doubts[34]. At any rate, this work marked a decisive turn in the history of Roman jurisprudence and exerted a considerable influence on the next generations of jurists. It seems that there was no other systematic exposition of civil law during the Republic apart from Q. Mucius's compendium. Servius Sulpicius Rufus was another prominent jurist who employed the dialectical method, but he wrote no systematic work (Schulz 1946, 96). He was, though, a prolific writer, if Pomponius's account is credible[35], and he left many multi-volume works[36]. His collections of *responsa* are especially interesting, for they extended beyond actual cases and dealt with theoretical questions as well. It appears that Cato the Elder's *Commentarii iuris civilis* shared a similar interest in theoretical issues (Schulz 1946, 91-92). Numerous other collections of *responsa* were compiled during this period, which, together with a few commentaries and other collections of formulae, formed the major part of the literature of private law. Many of these works (especially the collections of *responsa*) were not intended for publication but were kept in archives. There were also some works on sacral and public law, but only scant fragments have survived. Finally, it should be noted that in public law, statutory laws (*leges*, *senatus consulta*, *edicta magistratuum*) represented a significant part of the respective textual production (Schultz 1946, 87-96).Thus, by the end of the Republic there was an adequate mass of "raw" textual material for further elaboration. There was also an evolving method of systematization. These two elements, together with a nascent interest

[33] Pomponius, *Libro singulari enchiridii* D. 1.2.41.
[34] See e.g. Kreller (1948).
[35] Pomponius, *Libro singulari enchiridii* D. 1.2.43.
[36] For a brief discussion, see Schiller (1978, 315-317).

in theoretical issues, would eventually prove crucial for the emergence of the practice of codification.

With the reign of Augustus (27 B.C.E. – 14 C.E.), a new era began for Rome, which coincided with the transition to the classical period of Roman jurisprudence. In both this and other aspects of social and political life, there was no sudden break with the past. The turbulence of the late Republic paved the way for a gradual but profound transformation during the Principate, which evolved through an intricate interplay between the old and the new (Alföldy 1988, 94-105). The changes that shaped the classical law and jurisprudence were an integral part of this multi-level transformative process. Some of these changes were of special importance both for the juristic activities in general and for the practice of codification in particular. A major historical factor with a decisive impact on the direction that the jurisprudence took in the Empire was the sustained attempt of the central administration to gain total control of the development of law and the administration of justice. The centralization achieved in the late Empire was not the work of a single emperor, but rather the outcome of a long series of converging imperial policies implemented under the pressure of the challenges following the expansion of Rome. During this extended period of reforms and innovations, new administrative institutions were established, some of which had a direct influence on jurisprudence. The imperial council (*consilium principis*) is a case in point.

Republican magistrates often sought advice on particular matters from experts in various fields. Such advisory boards were known as "*consilia magistratuum*" (Berger 1953, 408).The same practice continued through the Principate, with an imperial council (*consilium principis*) acquiring gradually a more formal character (Loewenstein 1973, 291). Legal experts played, of course, a significant role in this council. As before, offering legal advice (*respondere*) was one of the most important juristic activities. Augustus tried to attract leading legal experts by granting a group of prominent (senatorial) jurists the right to give *responsa* on his authority (*responsa ex auctoritate principis*)[37]. Although these opinions were not binding for magistrates and judges, they had in practice such authority

[37] The information on this issue is insufficient and controversial. For further, see Jolowicz and Nicholas (1972, 359-360).

that by the second century C.E. the *ius respondendi* was recognized as a source of law (*ius publice respondendi*) (Loewenstein 1973, 299-300). This is indicative of the major role played by the jurist of the Principate in the development of law during the classical period. Despite its undeniable significance, *respondere* was only part of a multi-faceted contribution that included active involvement in public life, advisory services offered to judges and magistrates as well as participation in the imperial council (Jolowicz and Nicholas 1972, 374-375). The manifold activities of the jurists gave them the opportunity of a regular involvement (direct or indirect) with administrative tasks. In Augustan times, however, no firm connection with the central administration was established. Even the right to give *responsa ex auctoritate principis* was not formally associated with any official position. The licensed jurists remained private citizens just like the non-licensed ones, who continued to give *responsa* in the republican fashion (*propria auctoritate*). Under Augustus's successors, the practice of giving *responsa* on imperial authority started to diminish in significance and it was finally abandoned after the reorganization of the imperial council by Hadrian (Schulz 1946, 113)[38]. The growing tendency toward centralization necessitated a new relationship between the jurisconsults and the State, a relationship that entailed a permanent position and a salary.

Republican jurisprudence was aristocratic in character. This means, among other things, that the jurists received no money for their services (Schulz 1946, 23-24). In the Principate, the situation gradually changed. It appears that, under the reign of Vespasian (69 – 79 C.E.), some jurists started to get a remuneration for their services to the imperial administration. During this period, the "old conception of the statesman-jurist assumes a new shape, more suited to the times" (Schulz 1946, 103). Under Hadrian, the imperial council was reorganized and the participation of leading experts in it assumed a regular character. Irrespective of its real scope, Hadrian's reform resulted in "the creation of a professional nucleus within the *consilium*" (Crook 1955, 59). Yet, the position of salaried officials was firmly established in the times of Antoninus Pius (Loewenstein 1973, 362). A group of professional jurists in the imperial council was vital for a State faced with an ever-increasing number of judicial affairs. Of equal importance was the need for the

[38] On the character and scope of this reorganization, see Crook (1955, 56-65).

complete control of the law-making process by the emperor. Hadrian's reform of the juristic function of the *consilium* aimed to secure a regular assistance from legal experts, but it may also have been motivated by the need to handle the issue of conflicting *responsa* (Crook 1955, 57-58). A more direct measure toward the centralization of the development of law was the stabilization of the form of the *edictum magistratuum*[39].

The edicts of magistrates with jurisdictional duties, such as the praetors, were an important source of law in the Republic. Officially, the praetors were not legislators. However, within the limits set by civil law, they had a considerable freedom in specifying the ways in which they would carry out their duties. Through this procedure, they often introduced innovations that eventually had a significant influence on the law. Thus, together with the *ius civile* arose the *ius honorarium* (Jolowicz and Nicholas 1972, 97-98). The form of the praetorian and aedilicial edicts was settled, on Hadrian's orders, by the prominent jurist Salvius Iulianus and was approved by the Senate. Thenceforth, magistrates would carry out their jurisdictional duties within a stereotyped framework. A uniform framework was also established for the edicts of the governors of the provinces (Schulz 1946, 127). Magisterial edicts would continue to be published annually and the distinction between *ius civile* and *ius honorarium* would be retained, but "as a source of new law the edict apparently cease[d] to count" (Jolowicz and Nicholas 1972, 357). During this period, the development of law is increasingly carried out through senatorial decrees (*senatus consulta*) and imperial constitutions (*constitutiones principum*) such as the *edicta*, *decreta*, *mandata*, *epistulae* or *rescripta* (Jolowicz and Nicholas 1972, 363-371). The fixed form of the edict may have halted the praetorian innovations, but there was still room for interpretation. Indeed, a significant part of the classical juristic activity was precisely devoted to this task, as evidenced by the post-Hadrian juristic literature (Crook 1955, 64).

Gaius's *Institutiones* is the only one classical work that has survived in a more or less complete form. Information about other classical texts derives from extensive post-classical abridgments and quotations, which, despite their fragmentary character, suffice to give a clear indication of the abundance and the diversity of the juristic literature during

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[39] In the relevant literature, this is usually referred to as the "codification of the Edict". See e.g. Schulz (1946, 112) and Schiller (1978, 432).

this period (Schulz 1946, 141). Collections of *responsa*, which flourished in the Republic, retained their significance, although they were now subsumed (together with collections of *quaestiones*, *disputationes* etc.) under a broader category of works dealing with difficult problems of a varying degree of abstraction (Schulz 1946, 223-224). There were also textbooks (*institutiones*, *enchiridia*) and similar introductory texts (*regulae*, *definitiones*, *sententiae*), works on the *ius civile*, treatises on the law in general (*digesta*), comments on the edict and other commentaries, as well as various monographs (Jolowicz and Nicholas 1972, 376-377). Of these, the commentaries on the edict were of special importance for the development of Roman jurisprudence (Schulz 1946, 183). As regards the edicts of praetors and aediles, the longest commentary was written by Pomponius and consisted of one hundred fifty book-rolls (*libri*). It could be regarded as a supplement to the stabilization of the edict by Salvius Iulianus. By the third century C.E., however, it was already outdated due to the developments that took place under the Severan dynasty (Schulz 1946, 192-193). Based on Pomponius's work, Ulpian composed his famous *Ad Edictum* in eighty-three books, which enjoyed wide diffusion during the post-classical period. With this work, Ulpian can be said to have successfully completed Pomponius's endeavor to standardize the interpretation of the Edict (Schulz 1946, 196-198). Edictal commentaries were also written by other prominent jurists, such as Paul and Gaius. The sheer amount of effort invested in edictal interpretation reflects the far-reaching impact of the stabilization of the Edict in the times of Hadrian. As evidenced from the arrangement of topics not only in edictal commentaries but also in other juristic works, the Edict assumed the status of model as regards the structure of various commentaries and collections (Schulz 1946, 189-190). This holds also for the general treatises (*digesta*), which combined the order of the edict with a traditional arrangement of statutes. Salvius Iulianus's *Digesta*, his major work and one of the greatest products of Roman jurisprudence, is a case in point. It comprised ninety books of *responsa* together with a small portion of lemmatic commentary on the edict. One part of the work (the first fifty-eight books) followed the edictal order and another was structured according to a traditional arrangement of statutes (Schiller 1978, 338). From Celsus and Iulianus onwards, this was the standard order of that important type of juristic literature (Schulz 1946, 226). Thus, by the accession of Diocletian in 284 C.E., there was a large amount of different types of juristic works largely organized in a uniform way. The establishing of a common framework for the arrangement of topics bears undoubtedly the mark of prominent jurists of the classical period, yet it was essentially the outcome of long-term parallel developments in Roman law and jurisprudence. Juristic interpretation was also oriented toward the direction of standardization under the influence of the major edictal commentaries of the time. It appears, then, that Roman jurisprudence was following an evolutionary pattern, which corresponded increasingly to the major transformations of the Dominate.

In the late third century C.E., a new political system emerged in Rome; Diocletian (284-305) set its foundations and Constantine I (325-337) perfected it. It was an absolute monarchy, with the emperor as "the apex of the pyramid of a hierarchically stratified, centralized bureaucratic establishment which serves no one else than the emperor, who himself may, or may not, pretend to be guided by the *utilitas publica*" (Loewenstein 1973, 403). Not surprisingly, in such a political system the ultimate source of law is the emperor alone. As already mentioned, during the Principate the emperor's enactments played an increasingly significant role as a source of law. In the Dominate, imperial constitutions eventually superseded all other sources. Their form still varied, but thenceforth all imperial rules were officially recognized as *leges generales* (Jolowicz and Nicholas 1972, 460). The rise of absolute monarchy marks the predominance of statutes over juristic law. The time of innovation had passed, and this was reflected in the uncreative character of the post-classical juristic literature (Jolowicz and Nicholas 1972, 455). Under the new social and political conditions, priority was given not to reformatory legislation but to the elimination of any uncertainty that would give rise to juristic controversies. The prevailing tendency was now "to throw the whole law into statutory form and thus to stabilize it" (Schulz 1946, 286). It appears that an effective means of carrying out this project was the compilation of large collections of constitutions. The earliest such collections were the *Codices Gregorianus* and *Hermogenianus*.

Both compilations were produced under the reign of Diocletian and are said to be "private" (Schiller 1978, 55), "unofficial" (Jolowicz and Nicholas 1972, 463) or "semiofficial" (Schulz 1946, 315) collections[40]. It is true that neither of them was published by an imperial act, but this does not preclude an involvement of the central administration. Indeed, data from the analysis of their content, as well as some evidence about the possible positions of the compilers in the administration, suggest that both works were probably part of an imperial project (Corcoran 2000, 26-29). *Codex Gregorianus* was compiled approximately in 292 C.E. and contained imperial rescripts (replies to queries of officials or petitions of citizens) from the reign of Hadrian up to 291 C.E. It was divided into books and titles and was compiled by Gregorius, who was perhaps an imperial official. *Codex Hermogenianus* was a much shorter, single-volume collection divided in titles only. It was compiled approximately in 295 C.E. and contained rescripts from the years 293 and 294 C.E. Its compiler, Hermogenianus, was a *magister libellorum*[41] to Diocletian. Both collections were republished with additions (Corcoran 2000, 28-29, 37-38). They were arranged according to the classical *Digesta* (Schulz 1946, 309); hence, they also incorporated the order of the Edict. In the pre-Diocletian era, the practice of collecting imperial constitutions was not unusual. With these two Diocletianic compilations, however, the collection and promulgation of imperial enactments reached an unprecedented level (Corcoran 2004, 57). This was the prelude to the first large-scale official compilation under Theodosius II, emperor in the East.

The famous *Codex Theodosianus*, which was published on February 15, 438 C.E. and came into force on January1, 439 (Jolowicz and Nicholas 1972, 465)[42], was actually part of an ambitious project of two large collections. The first one would include imperial constitutions (even obsolete ones) from 312 to 438 C.E. This would be a supplement to the two Diocletianic compilations. The three *codices*, together with extracts from juristic works, would form a second, comprehensive volume (Turpin 1987, 620, Matthews 2000, 10). However, the initial plan failed and eventually only the first of the two collections was produced (the *Codex Theodosianus*). As regards its form, the new work followed the

[40] On the issue of the "unofficial" character of these *codices*, see Turpin (1987, 624).
[41] The *magister libellorum* was the head of the bureau of the imperial chancery that dealt with the petitions to the emperor.
[42] In the West, it was presented to the senate of Rome in December 438 by Anicius Acilius Glabrio Faustus, who had brought with him a copy from Constantinople. For a detailed account of the senatorial meeting, at which the *Codex Theodosianus* was accepted in the West, see Matthews (2000, 31-54).

pattern of the Diocletianic collections and adopted mainly the arrangement of the *Digesta*. It was divided into books, which were subdivided into titles ordered according to subject matter. Under each title, the constitutions were ordered chronologically (Jolowicz and Nicholas 1972). In terms of content, the Theodosian compilation differed significantly from its 'model'. Private *rescripta*, the type of imperial constitutions that formed the bulk of the two Diocletianic *codices*, were excluded from the *Codex Theodosianus*, which focused on *leges generales* (Turpin 1985, 342, Jolowicz and Nicholas 1972, 464). Apparently, the works of Gregorius and Hermogenianus served primarily as a model of systematization. However, they had presumably an additional function. It has been suggested that the (programmatically stated[43]) connection with the previous *codices* enabled Theodosius to endow "his undertaking with the authority of the precedent, without committing himself as to how accurate that precedent might be" (Matthews 2000, 63). In that way, the imperial project was placed in the context of a wider tradition. The precise position of the project in that tradition can be deduced from its purpose, as stated in the first Novel (new law) of the emperor (15 February 438), which gave authority to the *Codex* in the East:

> Wherefore, We have cleared away the cloud of volumes on which have been wasted away the lives of many persons who explain nothing; We confirm this compendious body of knowledge of the divine imperial constitutions from the times of the sainted Constantine, and after the kalends of next January, to no man is granted the right to cite an imperial law in court and in daily legal practice or to compose the instruments of litigation, except, of course, from these books that have come to be under Our name and are kept in the sacred imperial bureaus. However, their own immortality has not been taken away from any of the previous Emperors, the name of no lawgiver has perished; rather, their laws have been changed by the clarification of Our jurisconsults for the sake of lucidity, and they are joined with Us in an august fellowship. The consummate glory of the founders of the laws, therefore, remains and will forever remain, and to Our account has passed nothing except the light of brevity. *(Novellae Theodosii* 1.3)

[43] *Codex Theodosianus* 1.1.5: "We decree that, after the pattern of the Gregorian and Hermogenian Codes, a collection shall be made of all theconstitutions that were issued by the renowned Constantine,by the sainted Emperors after him, and by Us andwhich rest upon the force of edicts or sacred imperial lawof general force".

Brevity and simplicity: these were the virtues extolled of a work, which was intended to dispel any ambiguities by offering an authoritative compilation of imperial constitutions. The compilers had orders to make abridgements and interpolations, and to distribute parts of individual constitutions under different headings, in order to produce a compilation that would present the law in a clear and accessible form[44]. Behind the "cloud of volumes", referred to in the passage above, there was a specific problem. During the Principate, the *rescripta* given by the emperor to officials or private citizens evolved gradually into a significant source of law. From the second century C.E., the private rescripts (*subscriptiones*) played a key role in the development of private law, especially since it became a common practice for litigants (and judges) to address a petition to the emperor asking for his decision on a particular matter (Mousourakis 2007, 108, Jolowicz and Nicholas 1972, 369-370). Normally, imperial constitutions of this type applied only to individual cases. However, under certain circumstances, they could acquire the status of precedent and thus be applied to analogous cases in the future (Matthews 2000, 13). The citations of rescripts in juristic writings of the second and third centuries C.E. provide a telling indication of the tendency to regard these imperial enactments as having a potentially general applicability (Harries 2004, 29). It is, thus, no coincidence that a 'desire' for compiling private collections of imperial rescripts is noted during this period (Corcoran 2000, 31). The proliferation of rescripts implied a routine procedure carried out by special secretariats in the imperial chancery (Jones 1964, 367-368). Insofar as this administrative mechanism was not immune to the defects of bureaucracy and the corruption that beset the judicial system of the empire[45], the abuse of rescripts was almost inevitable. Gradually, it became ever more difficult to control the procedure of issuing rescripts and granting privileges to litigants (Turpin 1987, 627). The lack of control led to the issuing of rescripts that were contrary to the law (Jolowicz and Nicholas 1972, 461), and this caused problems to the conduct of lawsuits. The works of Gregorianus and Hermogenianus signal an early attempt to tackle with these problems by means of authoritative collections of *rescripta* (Corcoran 2000, 41). Constantine I tried to settle the issue with an edict of 315 C.E., which denied validity to rescripts that were contrary to

[44] See *Codex Theodosianus* 1.1.6.
[45] On judicial corruption, see Jones (1964, 502-504).

law[46]. In 398 C.E., a law of Arcadius and Honorius limited the binding force of rescripts (given in response to requests by judges) to the individual cases for which they were issued[47]. After that, "rescripts never recovered the general force they had earlier possessed" (Honoré 1998, 88). Theodosius II took a further step by opting not for another collection of rescripts but for an authoritative compilation of *leges generales*. A compilation that would present the law in a systematic and accessible form and thus would facilitate the judges in the administration of justice (Turpin 1987, 627-628).

The promulgation of the *Codex Theodosianus* did not result in an abatement of the imperial legislative activity. The new compilation was far from comprehensive and even in the areas covered by its constitutions the need for clarification surfaced again. Moreover, there was also the need for keeping the law up-to-date. Both needs were met by new individual constitutions (*Novellae*). Already a few weeks after the completion of the *Codex*, the first *Novellae* of Theodosius II were issued (Harries 2004, 62). Many more Novels were issued in subsequent years by Theodosius II in the East, Valentinian III in the West, and their successors. Since there was no provision for regular revisions of the *Codex*, the new enactments were compiled in separate collections that had the general form of the *Codices* (Liebs 2000, 246-247). It would take almost a century for a new major compilation of imperial constitutions to appear. In the meantime, law books based on Roman sources were issued by Germanic kings for the Romans that still lived in their territories. The three surviving collections (*Edictum Theoderici*, *Lex Romana Burgundionum* and *Lex Romana Visigothorum*) consisted of extracts from the three Roman *codices* (*Gregorianus*, *Hermogenianus* and *Theodosianus*), some juristic works (mainly Paul's *Sententiae* and Gaius's *Institutiones*), and the post-Theodosian Novels (Jolowicz and Nicholas 1972, 466-468). It was through such law books that the *Codex Theodosianus* continued to exert its influence in the West. In the eastern part of the empire, however, it

[46] *Codex Theodosianus* 1.2.2: "Rescripts that are contrary to law shall not be valid, in whatsoever manner they may have been impetrated. For the judges must rather follow what the public laws prescribe". See also *Codex Theodosianus* 1.2.3.
[47] *Codex Theodosianus* 1.2.11: "Rescripts which have been issued or which will in the future be issued in reply to references of cases to the Emperor shall assist only those lawsuits for which they shall be proved to have been issued".

was superseded by another imperial compilation that was bound to be a landmark of Roman jurisprudence.

Nearly a century after the promulgation of the *Codex Theodosianus*, Justinian I assessed the state of the imperial legislation in a way reminiscent of the view of Theodosius II on the same matter: the enactments of the previous emperors were in "urgent need of correction"[48], they should be purged of faults and discrepancies and be presented in a straightforward manner[49]. The emperor responded to this challenge with a very ambitious project, which eventually yielded a compilation of imperial constitutions (*Codex Iustinianus*), a collection of excerpts from juristic writings (*Digesta*) and a textbook of law (*Institutiones*). The *Codex* was published in 529 C.E. and contained imperial constitutions from the three *Codices* and from Eastern collections of enactments issued after 438 C.E. It also included individual constitutions from the imperial archives. The arrangement of the material was modeled on the *Codices Gregorianus* and *Theodosianus* (Schulz 1946, 317-318). After the promulgation of this *Novus Codex*, Justinian I issued a long series of constitutions with the aim of revising various areas of law. Fifty of them seem to have been published in a separate collection known as the *Quinquaginta Decisiones* (Jolowicz and Nicholas 1972, 479-480). The intense legislative activity of this period led inevitably to a revised edition, which was published on November 16 as *Codex repetitae praelectionis*. It contained constitutions on ecclesiastical, private, administrative and criminal law, distributed in twelve books. Again, the 'standard' arrangement was used, based mainly on the *Codex Gregorianus*. This is the only edition of the *Codex* surviving today (Jolowicz and Nicholas 1972, 493-495). During the period between the two editions, the emperor ordered the preparation of another collection that would bring together excerpts from the writings of the jurists that had been grated the *ius respondendi*. More than thirty authors were used, but the greatest part of the material derived from the works of Gaius, Papinian, Ulpian, Modestinus and Paul. The collection was divided into fifty books, each of which was subdivided into titles according to the subject matter. The arrangement was modeled mainly on the *Codex Iustinianus* (Jolowicz and Nicholas 1972, 481-482). The *Digesta* was

[48] *Constitutio Haec* 1.
[49] *Constitutio Deo auctore* 1-2.

produced rather for educational purposes (Liebs 2000, 250); yet, a constitution of December 16, 533 C.E. gave this work the force of law[50]. The same constitution gave the force of law to the *Institutiones*, a compilation intended as an introductory textbook for the schools of law. The work was published on December 533 C.E. as *Imperatoris Iustiniani Institutiones* and it replaced Gaius's *Institutiones*, which served as its main source. Other sources included Gaius's *Res cottidianae* and the Institutes of Marcian, Florentius and Ulpian. It was divided in four books and it followed the arrangement of Gaius's *Institutiones* (Jolowicz and Nicholas 1972, 492-493). Apart from excerpts from the works of classical jurists, it also contained excerpts from imperial constitutions from the *Codex Iustinianus* of 529 C.E. and the *Quinquaginta Decisiones* (Schulz 1946, 304-305).

By the year 534 C.E., the ambitious project of Justinian I was completed. The eastern empire had a comprehensive corpus of legal collections designed to meet both practical and educational needs. The imperial legislative activity, however, continued uninterrupted throughout the subsequent decades. Like its predecessor, the *Codex Iustinianus* was followed by a series of *Novellae constitutiones*, many of which were issued by Justinian I. Most of them were written in Greek and they mainly concerned matters pertaining to public or ecclesiastical law. There were also constitutions on specific areas of private law. These enactments were compiled only in unofficial collections. The oldest one (*Epitome Iuliani*) was written in Latin and dates probably from the time of Justinian I. It contains one hundred and twenty-four constitutions. Another collection written in Latin was the *Authenticum*, with one hundred and thirty-four enactments issued during the period 535-556 C.E. The *Collectio Graeca* is the largest one, with one hundred and sixty-eight constitutions issued by Justinian I, Justinian II (565-578 C.E.) and Tiberius II (578-582 C.E.) (Jolowicz and Nicholas 1972, 496-498). The two collections in Latin were originally compiled for the teaching of the *Novellae* to the Latin-speaking students of law (Stolte 2015, 359). Both enjoyed a wide circulation during the Middle Ages (Radding and Ciaralli 2007, 35-36) and, thus, played a significant role as a source of Roman Law in the West. Equally important, in this respect, were the aforementioned law books (especially the *Lex Romana Visigothorum* or *Breviarium Alaricianum*) issued in the Germanic kingdoms

[50] See *Constitutio Tanta* 23.

(Vinogradoff 1909, 7). Interestingly, these compilations were influenced by the pre-Justinianic legislation, notably the *Codex Theodosianus*. In the East, on the contrary, the Roman legal tradition was represented by the Justinianic corpus.

Byzantine law was firmly rooted in the Roman legal system. Nonetheless, it did not evolve under the exclusive influence of its rich Roman heritage. The relation between the two legal systems could perhaps be described more accurately in terms of a complex interplay between continuity and change. Continuity figures prominently in the imperially sanctioned Byzantine collections, which invariably drew on the Justinianic corpus (Stolte 2015, 360-361). The most important of them are the *Ecloga*, the *Eisagoge*, the *Prochiron*, and the *Basilika*. The *Ecloga* was promulgated in 741 C.E. by the emperors Leo III and Constantine V. It was a collection of excerpts from the Justinianic law and enjoyed considerable popularity (Chitwood 2017, 23-24). The other three collections date from the ninth century C.E. and were part of the so-called purging of the ancient laws (*anakatharsis tōn palaiōn nomōn*), a large-scale project of legal reform carried out during the Macedonian dynasty (Pieler 1989, Chitwood 2017, 16-44). The *Prochiron* was probably published during the 870s. It was rather a manual of law, based primarily on the *Institutiones* of Justinian I and to a lesser extent on the *Ecloga*. It also contained some new constitutions (Vasiliev 1952, 339-340, Chitwood 2017, 25-27). The *Eisagoge* was another important recapitulation of the older constitutions. It was promulgated in the 880s and was given the force of law (Chitwood 2017, 31). The 'purging' of the Justinianic legislation culminated in the *Basilika*[51], published by Leo VI on 888. The collection consisted of sixty books, subdivided into titles and chapters. The proem of the work established the affinity of the project with the Justinianic corpus, but at the same time it contrasted the two endeavors by highlighting the faults of the Justinianic collections that needed remedy. What was deemed contradictory or superfluous was excluded, and the rest was arranged according to the subject matter. This collection was officially sanctioned from the start, but it was not until 1166 that it acquired exclusive legal force (Chitwood 2017, 32-35).

[51] This is the name of the collection from the eleventh century C.E. onwards. Following Schminck (1986, 27-33), Chitwood (2017, 32-33) uses the term "sixty books" to distinguish the early collection from the one that was promulgated together with various excerpts from juristic works (*scholia*) in the eleventh century under the name "*Basilika*" (imperial [laws]). On the *scholia* to this collection, see Pringsheim (1963).

The *Basilika* exemplified in the most characteristic way the sustained efforts to 'purge' and reorganize the Justinianic law in order to adapt it to the needs of the Middle Byzantine administration. These efforts resulted in a large-scale Hellenization of Roman law, through which the Byzantine emperors of the Macedonian dynasty appropriated the Roman legal legacy in an attempt to reaffirm the 'Roman identity' of the empire (Chitwood 2017, 21-22). In this multi-faceted project, the practice of codification played a key role. An increasing reliance on law collections, as a form of systematization and promulgation of enactments, is also noted in canonical law from the sixth century C.E. onwards. The concurrent appearance of many thematic collections with similar form and content, both in the East and the West, indicates a sort of a 'systematic movement' in the Mediterranean world during this period (Wagschal 2015, 226). Undoubtedly, practical purposes (e.g. the need to cope with a growing mass of canonical corpora) must have played a key role in the emergence of this phenomenon. However, one cannot preclude other types of purpose. It seems equally undeniable that the secular codifications (especially the Justinianic ones) must have exerted a strong influence as regards the structure of the collections. Yet, other types of literature might have also served as a model of thematic arrangement (Wagschal 2015, 227-230). At any rate, the parallel evolution of secular and canonical codifications suggests a wider process in the historical development of the use of writing in Roman and Byzantine law.

The reign of Justinian I represents in various respects a landmark in Roman legal history. It marks the end of antiquity and of Roman jurisprudence (Schulz 1946, 2, Mousourakis 2007, 191). It was also at that time that Roman law acquired its final form (Jolowicz and Nicholas 1972, 7, Schiller 1978, 111). For the present discussion on the history of law collections in the Mediterranean world and the Near East, this period has a special significance. The long evolutionary process of the systematization of ancient law culminated in the great Justinianic corpus. At that particular historical juncture, the main characteristics of the practice of codification (in the modern sense of the term) were consolidated. The collections of the Justinianic corpus, together with the *Codex Theodosianus*, provided both the model and the impetus for subsequent compilations of secular and canonical law. Thenceforth, the legislative activity would become increasingly intertwined with the process of codification, and the *codex* would acquire the status of the standard form of law collections. The emergence of codification, as a sophisticated form of the systemization law, is a complex historical phenomenon. Although far from exhaustive, the preceding exposition highlighted some of the key factors involved in this process and touched on some interesting aspects of their interconnections. The Mesopotamian and the ancient Greek law collections probably played a role in preparing the ground for the Twelve Tables. As we saw, however, codification, as it emerged in the Roman Empire under the Dominate, required much more than a mere expansion of an old technique.

The practice of codification signals a key turn in the semantic development of "*codex*". The word gradually acquired a second sense, which has been retained throughout the centuries in its descendant cognates. The new sense is intrinsically associated with the previous one. As such, it presupposes the history of the material form of the Roman manuscript. At the same time, it necessarily presupposes the history of Roman jurisprudence, too. Unless these two developments are taken into account in their interconnection, it cannot be explained how the Latin word "*codex*" came to denote law collections. As already mentioned in the opening section of this chapter, writing boards were one of the earliest manuscript formats in Rome. They were widely used both for public and private documents of various sorts. The archaic period of Roman law and jurisprudence is not characterized by lengthy administrative and legal texts. Thus, the writing board was a reasonable option for such texts, since in this case its limited capacity did not pose any practical problems. More importantly, it provided a sufficiently durable medium for texts that had to be publicly displayed or be kept in private or official archives, and thus required extra protection. As its name implies, *Lex duodecim tabularum* was undoubtedly inscribed on such boards. However, scholars have expressed differing views about the material used and the issue of the public display of the boards (Schiller 1978, 146-147). Important documents of Roman magistrates were also written on boards. A whitened board (*album* or *tabula dealbata*) was the standard medium for the annals of the pontifex maximus and the edict of the praetor (Crake 1940, 375-378, Schiller 1978, 433-434). Wooden boards were used for private documents as well. Wills were traditionally written on *tabulae*, and the word was so strongly associated with this particular type of legal document that it was used by classical jurists as a synonym for the text of the will[52].

Toward the end of the Republic, the juristic literature started to grow in number and diversity. This period witnessed the first systematic treatise on civil law by Quintus Mucius Scaevola and numerous extensive collections of *responsa*. All these were lengthy works. Q. Mucius's compendium comprised eighteen books, but this was only a small fraction of the body of works written by Servius Sulpicius Rufus, which almost reached one hundred eighty books[53]. The word used for such books was "*libri*", and that is a clear indication of the format of these manuscripts. Until late, "*liber*" denoted the book in the form of roll (of linen, papyrus or parchment). Because lengthy works had to be divided into multiple rolls, the word came to denote also the subdivisions of a text[54]. By the first century B.C.E., the papyrus roll was the dominant medium for a variety of genres (Winsbury 2009, 15). The introduction of papyrus, and later of parchment, in Rome offered a practical solution to the prolific writers of the classical period of Roman jurisprudence. Thus, the roll became the standard format of the masterpieces of the classical jurists. Roman law continued to evolve through successive transformations of varying degrees, in which the development of Roman jurisprudence played a decisive role. The proliferation and diversification of the juristic literature were in part a specific aspect of a wider sociocultural phenomenon of the time. But they also constituted the material, tangible expression of the developments that took place in Roman jurisprudence, as regards especially the evolution of the systematization of law. The direction that these developments took under the Dominate, with the increasing centralization of the legislative activity and the administration of justice, eventually favored a different manuscript format that would also prevail in other sections of social life.

The parallel transition from papyrus to parchment and from roll to *codex* was not a straightforward process. As explained in the concluding paragraphs of the previous chapter, Christianity played a pivotal role in the final prevalence of the *codex* over the roll.

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52 See e.g. *Digesta Iustiniani* 37.1.6., 37.4.1.
53 See Pomponius, *Libro singulari enchiridii* D. 1.2.43.
54 *A dictionary of Greek and Roman antiquities*, s.v.

Roman law and jurisprudence, however, provided further impetus for the use of the new manuscript format. At the turn of the fourth century C.E., Roman jurists were engaged in significant editorial activity, which produced the most characteristic types of post-classical juristic literature: the anthology and the epitome (Jolowicz and Nicholas 1972, 455). A similar trend occurred during this period in other literary genres with various epitomes and commentaries (Reynolds and Wilson 1991, 31-33). *Codex* became the standard format of such documents, and that facilitated considerably the spread of its use in pagan literature. Its association with the publication of imperial enactments was equally important. The first two collections of imperial rescripts, compiled under the reign of Diocletian by Gregorius and Hermogenianus, respectively, were published in parchment *codices* and were named after their format. Thenceforth, the *codex* would be the standard form of secular and canonical law collections in the East and the West. Undeniably, such collections bestowed prestige on the new format. Moreover, through this association the word "*codex*" acquired a derivative sense, that of "law book" or "law collection", which subsequently passed to the descendant cognates and it was later extended to the more general sense of a system of rules, principles or prescriptions[55]. From the Middle Ages onwards the word "*codex*" was primarily used as a general term for "book". This use was retained even after the advent of printing. For a long time, both printed books and manuscripts were called "*codices*". Later, the word was used only for manuscripts, and in that specific sense it is used today in palaeography as a technical term (Rizzo 1973, 69-70). As a word denoting law collection, it was especially used with reference to the *codices Theodosianus* and *Iustinianus*. The semantic development of the word practically ended with the consolidation of these two senses. But the development of the descendant cognates exhibited a remarkable accretion of senses, which was intensified particularly during the twentieth century.

[55] *Oxford English Dictionary*, s.v.; *Littré*, s.v.

CHAPTER 3

Cryptography and Telecommunication

Cryptography is intrinsically associated with writing, not merely in the trivial sense that it involves the concealment of something written, but, more importantly, because it is necessitated by the very nature of written communication. In contrast to speech, writing allowed for an extensive diffusion of messages across space and time until the advent of sophisticated electronic media. At the same time, it offered greater opportunities for message interception, especially in the case of distant communication. Hence, from the earliest times attempts were made to devise methods of protecting written messages from interception. Irrespective of the writing material used, the sender who needs to protect a message has two basic options. Either to conceal the presence of the message or use external means to secure that it will be read only by the intended recipient(s). A typical, and perhaps the earliest known, example of a method that falls under the latter case is the use of clay envelopes, referred to in the beginning of this chapter, for protecting letters or administrative documents. If the sender chooses to conceal the presence of the message, two further options are available: either to leave the text unaltered but somehow conceal its existence, or render it unintelligible and make sure that the recipient will be able to perform the reverse procedure that will disclose the initial message. In the terminology of cryptology, the first class of methods is known as "steganography" and the second as "cryptography" (Kahn 1967, xiii). Archaeological evidence suggests that some of the earliest cryptographic methods date at least from the first millennium B.C.E. They were applied in Akkadian texts written in cuneiform script, and they involved substitutions with numerals. Interestingly, two different methods were applied, one at the level of syllabic signs and another at the level of logograms[56]. In other words, the substitutions performed involved either meaningless or meaningful units. These are actually the two options available for cryptographic substitution in many writing systems. In modern terms,

[56] For a detailed account, see Pearce (1982).

substitutions at the level of meaningless units are performed with the use of ciphers, whereas for meaningful units (words or phrases) the lists used are known as “codes” (Menezes et al. 1997, 240). Although in everyday usage the word “code” is often used both for ciphers and word lists, as a technical term it refers specifically to a distinct method of cryptographic substitution.

It is unclear how exactly “code” came to acquire this technical sense. From the eighteenth century onwards, the word was widely used as a synonym for “law collection”. Accordingly, it came to denote compilations of different types of rules, principles, prescriptions etc. In that way, it became a convenient synonym for “collection” or “list” in general, and it was probably in this sense that it began to be used in cryptography since the nineteenth century[57]. However, lists of words and phrases assigned with unique symbols began to appear centuries earlier. A primitive form can be traced back to the Akkadian logograms referred to above. Yet, such lists were not intended exclusively for purposes of secrecy (Pearce 1982, 113-114). The scant evidence on protocryptography[58] or ancient cryptography suggests no significant use of word lists among different civilizations[59]. From the late Middle Ages onwards, however, substitution at the level of meaningful units acquired an increasingly important role in the practices of secret writing in the West. The emergence of the cryptographic sense of the word “code” has its deepest roots precisely in those early stages and especially in the military and political institutions and practices that shaped the history of secret communications in early modern Europe.

The history of Western cryptology is indissolubly intertwined with that of European diplomacy. This oft-repeated thesis suggests more than a close connection with politics. Secret writing has always been used for political purposes, but throughout human history its role remained limited in this respect. The transition from late medieval to early modern Europe provided the conditions for a new role of secret writing. Secrecy became an essential component of the new diplomacy that began to appear in the Italian peninsula during that period. Notwithstanding the influences from other fields (e.g. occultism or the

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[57] *Oxford Concise Dictionary of English Etymology*, s.v.
[58] “Protocryptography” refers to uses of substitution methods for purposes other than that of secrecy. See Kahn (1967, 76).
[59] See Kahn (1967, 71-105).

Renaissance science), cryptology evolved precisely through its instrumental relation with the new diplomacy. As such, it was marked by the profound sociopolitical and cultural transformations that shaped early modern Europe.

From the late Middle Ages onwards, the Italian peninsula was gradually transformed into a diversified territory in institutional and constitutional terms. The various republics and principalities together with the Papal States and the southern kingdoms eventually formed a dynamic system of political powers with distinctive characteristics. The emergence of secular polities had a profound impact on the nature of the struggle for power. The Italian secular states could not rely on the traditional religious sanction of authority. This posed serious challenges to the ruling elites that strove for legitimacy and political survival. Internal and external conflicts were intensified as the states were increasingly engaged in an ongoing quest for more power, mainly through wars with neighboring rivals. Constant warfare became an essential aspect of a political arena marked by prolonged tensions, shifting alliances, conspiracies and continuous alertness. Under the conditions of such a fragile equilibrium, diplomatic practices provided a valuable means for countering the dangers of war and for satisfying the increasing need for information (Mattingly 1988, 49-52). The emergence of modern diplomacy was the result of a series of multi-level adaptations to a shifting political climate. It was the outcome of a long process of transformative integration of existing practices into a flexible political activity. Through a constant interplay between continuity and change, Italian diplomacy became "capable of elaborating innovative languages of power and resistance, and of providing a common arena in which they could be used by political actors of different quality and weight" (Lazzarini 2015, 6). Negotiation, information gathering, and representation were the main functions through which the dynamics of this flexible activity unfolded. Information gathering assumed progressively a key role. A particular need for information is revealed in diplomatic letters from the second half of the fourteenth century. This early concern eventually led to the development of a whole set of practices and procedures not only for the gathering but also for the control and manipulation of information. The systematic concealment and distortion of facts attested during this period bespeaks an attitude oriented toward the possible uses of information as a new, efficient weapon. An integral part of the manipulation of information was the interception of diplomatic couriers. Interception became a standard practice and thus posed a serious threat to the security of documents. Since interception could not be totally prevented, the encryption of documents appeared as a useful means for minimizing the risk of information leakage (Lazzarini 2015, 71-74). Of course, the increased use of cryptographic techniques in diplomatic communication did not deter interception but rather sparked a keen interest in cryptanalysis, which in turn provided the impetus for the development of advanced methods of encryption. Thus, secret writing became an essential component of Italian diplomacy and the need for security took a form yet unknown. The ever-intensified quest for the control and manipulation of information called for a more or less unified field of cryptographic and cryptanalytic practices, which would be adapted to the specific characteristics of the emerging political and diplomatic arena. Modern cryptology originated in this crucial gestation period and its subsequent development remained inextricably intertwined with that of Italian diplomacy, as the latter spread north of the Alps to become a "standardized and recognizable European language of political interaction" (Lazzarini 2015, 6).

The new cryptology initially relied on earlier practices and techniques. Both ciphers and codes were irregularly used, in a primitive form, for various purposes throughout the Middle Ages. The ciphers of that period entailed very simple (and even partial) substitutions. Similarly, the first codes were short lists of abbreviated names. Evidence from the archives of Venice reveals that by the first half of the thirteenth century there was already a slight interest in political cryptology. During the second half of the next century, the substitution systems available were improved and they began to be used regularly. Until the late 1460s, monoalphabetic substitution was the only known method of encipherment. From the early 15th century onwards, cipher alphabets began to include homophones for vowels, but it took almost another century for the use of homophones for consonants. Lists of abbreviated names soon evolved into secret codes. The earliest extant example is a little list from the late 1330s or the early 1340s. Since then, such lists grew steadily in size and number and began to include frequently used words and phrases. At the turn of the 15th century, a mixed system appeared which is known today as "nomenclator". It combined a cipher alphabet with a list of coded names and words. The nomenclator was the dominant system in Western cryptography for more than four centuries (until the 1850s) and it retained its position even after the advent of polyalphabetic substitution in the sixteenth century (Kahn 1967, 106-109).

Polyalphabetic substitution appeared at a crucial juncture in the history of European cryptology. The evolving practices of secret writing were already an indispensable part of the European diplomacy, and this was reflected in both the appointment of the first full-time cipher secretaries and the spread of ciphers and codes to the colonies in the New World. At the same time, a growing theoretical interest is attested in various parts of the European continent. Prominent polymaths began to publish treatises on cryptography and cryptanalysis, in which major innovations were introduced. Among them, polyalphabetic substitution was perhaps the most important one, as it offered an unparalleled level of security. Yet, it did not gain wide currency among the professionals of the field, for whom speed and accuracy were of paramount importance. The use of multiple cipher alphabets for the encipherment of a text can be time-consuming and entails a considerable degree of error. Nomenclators offered a much more practical solution in terms of speed and accuracy, even though they were more vulnerable to the attacks of the cryptanalysts (Kahn 1967, 150). Thus, they continued to be the preferred method despite the advent of more secure systems. The limited and delayed impact of such innovations on the practice of cryptology is indicative of a certain tension that characterized the development of secret writing in the early modern era. The theory and the practice of cryptology evolved at different pace. The authors of treatises on cryptographic and cryptanalytic techniques were usually unware of the ways in which real cryptology was practiced. Of course, they did recognize the importance of secret writing for the new political arena that had emerged in the West, but they tended to regard cryptology rather as a source of intellectual challenges and, thus, they paid less attention to the practical needs of the professionals (Kahn 1967, 156). With a hindsight, we can say that some of them were indeed ahead of their time.

The dominance of the nomenclator for more than four hundred years is indicative of the character of the practice of political cryptology of the period, of its priorities, needs, and constraints. It is also indicative of the means by which diplomatic and military communications took place. The far-reaching inventions in communications technology during the nineteenth century had a profound impact on the practice of secret writing, as a result of which ciphers eventually prevailed over the nomenclator. Concretely, the advent of telegraphy rendered the nomenclator obsolete and called for advanced systems of encryption. The electric telegraph was a powerful means of telecommunication for governments and other organizations. Its use, however, was expensive. Thus, reducing transmission costs became early on a major concern, which had a direct and profound impact on the form of the telegraphic message. A new, extremely concise style of writing was developed for the construction of short messages. To the same end, numerous lists of coded words and phrases began to appear (Nickles 2003, 173-174). These commercial codes, as they were called, proved so cost-efficient that government ministries adopted their form to construct genuine secret codes, in order to replace the old nomenclator. However, both codes and nomenclators were soon found to be insufficient for the rapidly increasing need for security in diplomatic and military communications. Thus, by the nineteenth century, cryptology began to rely heavily on ciphers, and this led to a new phase of innovations in the methods of encipherment and decipherment (Kahn 1967, 190-192).

The close connection between commercial and secret codes probably accounts for the introduction of "code" in telegraphy as a technical term for the lists of names, words and phrases that facilitated the reduction of transmission costs. It is worth noting that key terms of cryptology were also used for the same purpose, even in conjunction with the word "code". The titles of several compilations of this period, such as *Bloomer's commercial cryptograph: a telegraph code and double-index holocryptic cipher*, *The United States telegraphic cipher* or *The standard telegraphic cipher code for the cotton trade*, are indicative of the perceived structural similarity between the methods of cryptographic substitution and the methods applied for the condensation of the telegraphic messages. Both types of method were seen as relying essentially on the same principle of transforming a message by altering its signs in a pre-arranged pattern. Thus, although encipherment operates at a different level of substitution from that of the telegraphic wordlists, the latter were sometimes called "ciphers" or even "cipher codes". This terminological ambivalence was resolved when "cipher" was finally confined to its traditional, cryptographic sense, and "code" was adopted as a general term for wordlists, even for those that were used for the purposes of secrecy and rendered the nomenclator obsolete. In that way, "code" entered two new important fields: telecommunication and cryptology. This was decisive for its semantic development. For the first time, the word was directly associated with practices that concern a fundamental aspect of the communication process itself: the production and transmission of signals. On the basis of this association, a new sense emerged that encapsulated the idea of signal transformation. Given that signal or stimuli transformation underlies all processes of perception and communication among living beings, this new sense of the word could allow for further uses in connection with various communicational phenomena. The first crucial step toward that direction was made in communication engineering and information theory, where "code" entered as a term of telegraphy and evolved into a technical term of telecommunications in general.

Telegraphy marks the beginning of a new era in the history of telecommunication. Until the eighteenth century, there was no substantial progress in the means of distant communication. For many centuries, the exchange of information between remote communicators was confined to the limited range of signal transmission and the poor repertoire of transmittable messages afforded by the rudimentary means available at the time (e.g. flags, drums, beacon fires etc.). However, the transition toward industrial capitalism provided the critical gestation period for an unprecedented transformation of telecommunication. The first signs of change came from devices that operated on the same principle as the most efficient means of the past – that is, they relied on the transmission of optical signals. The British shutter system and the French semaphore system of the late eighteenth century entailed extensive networks of stations with mechanical devices supported by a powerful, new instrument: the telescope. The idea of such networks was not, of course, new. There are numerous reports of chains of beacon fires in the ancient world (Burns 2004, 3-10). The semaphore system, however, was faster and more accurate. Not surprisingly, then, it eventually prevailed in Europe and the United States until the mid-nineteenth century (Beauchamp 2001, 3-18). In the meantime, various experiments were being conducted in order to explore, for the first time in human history, the possibility of a transmission channel other than the air. All those efforts focused on electricity, the puzzling phenomenon that began to attract increasingly the attention of experimenters since the seventeenth century. The second half of the eighteenth century witnessed a considerable advance in the scientific understanding of the phenomenon and there was a keen interest in its potential applications. A number of discoveries and inventions at the turn of the nineteenth century provided both the impetus and the necessary means for electrical experiments in signal transmission. The idea of an electric telegraph was expressed publicly for the first time in February 1753, in an anonymous letter to *Scots Magazine*, but it took about twenty years for the first attempts to be made in Geneva (Burns 2004, 58-60). Soon afterwards, a long series of experiments followed on both sides of the Atlantic, starting with electrostatic devices. The parallel advance in the study of electricity allowed further experiments, first with electrochemical and then with electromagnetic devices.

Despite the undeniable progress made until the 1840s, it was difficult for the electric telegraph to gain wide acceptance and displace the mechanical devices that were still in use. The semaphore system proved very reliable, especially in wartime, and new devices of doubtful efficiency, such as the electrostatic and electrochemical telegraphs, were seen with mistrust. Even worse, in the first decades of the nineteenth century telecommunication systems in general "tended to lapse into disuse in peacetime and new ideas remained under-developed" (Burns 2004, 71). The response of the British Admiralty to the requests of Francis Ronalds, a pioneer of electric telegraphy, epitomizes the typical attitude of the time toward the new inventions in distant communication. Ronalds tried to persuade the British government for the importance of his electrostatic telegraph, but on August 5, 1816 he received the following reply by the Secretary to the Admiralty:

> Mr. Barrow presents his compliments to Mr. Ronalds, and acquaints him, with reference to his note of the 3rd inst, that telegraphs of any kind are now wholly unnecessary, and that no other than the one now in use will be adopted. (Quoted from Fahie (1884, 136))

This "technological inertia" (Wenzlhuemer 2013, 66-71), however, did not last for long. The accelerating expansion of machine-driven production in the nineteenth century and the concomitant transformation of all industry were accompanied by an increasing need for speed. Fast mass production required fast transfer of raw materials and products, which could not be achieved by means of animal-hauled vehicles. Soon, it became evident that mechanical transport was imperative for the rising industrial capitalism. The first crucial leap in the technology of transport occurred with the invention of the locomotive in the early 1800s. The locomotive unleashed the great potential of the railway, which until that time was confined to the service of mining. In 1825, the first passenger train appeared in Britain. In a few decades, an extensive long-distance network already spread in Europe, the United States and other parts of the world and it was still expanding (Hobsbawm 1977, 70-72). The railway became the dominant land transport system and had a deep impact on various facets of social and economic life. The steamship played a similar role in maritime transport. Above all, both inventions were instrumental in the growth of global trade and the consolidation of an ever-denser network of economic exchange and interdependence worldwide (Hobsbawm 1977, 64-68).

The impact of an emerging network of rapid circulation of goods and people on information exchange is unavoidable. Actually, in this case fast communication is as imperative as fast transport. The first signs of change in distant communication appeared before the great expansion of the telegraph. Undoubtedly, the advances in land and maritime transport played a decisive role, although they were not the only factors the affected the conventional mail speed. The steamer had a direct impact on overseas communications. It also contributed to the initial improvement of overland communications in Europe through the first coastal steamship services in the early nineteenth century. From the 1850s onwards, the worldwide expansion of the railway provided a further strong impetus for the reduction of overland dispatch times (Kaukiainen 2001, 9-16). Thus, the initial response to the pressing need for speed in communications was to exploit the new means of transport for improving the conventional systems of overseas and overland mail. Despite the considerable increase in speed achieved through such efforts, the communication technology of the time was obviously reaching its limits and eventually would prove inadequate for a world in constant acceleration. An early challenge to traditional communications came from the new transport technology, which in the first place made possible the improvement of conventional mail.

Railway operation presents special problems. Among them, the most complex one is perhaps the co-ordination of traffic. Single-track lines entail a high risk of collision. Double tracking is an obvious solution, but it is a costly alternative and does not eliminate the possibility of accident (Field 1992, 406). Safe rail transport requires an additional element: a communication system that can transmit signals faster than the maximum speed of the train. Already in the early 1860s, however, trains were the fastest means of transport. Therefore, the signaling system required should incorporate a far more advanced technology than that of the traditional methods of optical signaling. More importantly, it should not rely on the existing means of transport for the transmission of messages. Notwithstanding its early drawbacks, the electromagnetic telegraph provided the only viable option as a reliable and cost-efficient railway signaling system. The first applications were made in Britain in the late 1830s. Soon, they were followed by a series of improvements and adaptations, and in a few decades telegraph lines spread along the side of railway tracks in various parts of Europe and the United States (Beauchamp 2001, 34-39). This was actually a process of mutual development. The telegraph provided a reliable signaling system for the efficient co-ordination of rail traffic. It also allowed for significant capital-savings in the railway sector (Field 1992, 406-408). At the same time, it took advantage of the expanding railway networks to reach new markets and enjoy increased demand for telegraph services. Telegraphy had a positive impact on shipping, too (Lew and Cater 2006, 149-151).

The railway was indeed vital for the early development of the telegraph. It provided a field for experimentation as a response to a specific practical need, and acted simultaneously as a major ‘vehicle’ for the expansion of the use of the new device. Yet, the need for efficient railway co-ordination did not suffice for the diffusion of the innovative communication system. First, rival signaling systems appeared for the control of railway tracks and threatened its position in the railway (Winston 1998, 26-27). Secondly, its use as a railway signaling system was so specialized that could hardly ensure a promising prospect of further applications outside the transport sector. A wider social diffusion was made possible thanks to the stock market and the press, both of which began to explore hesitatingly the potential of the telegraph in the early days of the railway. Already by the late 1840s, New York newspapers were using both domestic and European telegraphic news dispatches. Initially, the dispatches were collected and distributed by news brokers. Soon, this function was taken up by the emerging news agencies, such as the New York Association Press (Schwarzlose 1974, 597-600). In Europe, too, news agencies evolved progressively into large-scale users of the telegraph. Once adopted, the new communication technology became a key factor in the emergence of the first news monopolies. The extensive telegraph networks in Britain, France and Germany provided the necessary infrastructure for the initial development of the three major European agencies (Reuters, Agence Havas, Wolff Telegraphisches Bureau). The continuous expansion of the networks enabled news agencies on both sides of the Atlantic to penetrate remote parts of the world. With the construction of submarine cables, from the 1850s onwards, a growing web of connections began to spread throughout the planet. This paved the way for the increasing integration of different regions into a global media environment controlled by a small number of Western organizations. Telegraph infrastructures ensured the uninterrupted fast flow of information that is necessary for mass production and dissemination of news. News agencies played a decisive role in the creation of a new commodity and became themselves "the wholesalers of news for banks, merchants, government circles and newspapers" (Rantanen 1997, 609). The commodification of news and the rise of the first monopolies were integral part of a far-reaching, multi-faceted transformation of the world under the development of industrial capitalism. An equally important aspect of this process was the integration of financial markets, which also relied heavily on information flows.

Financial markets were among the earliest users of the telegraph. Fast and reliable exchange of information is crucial for inter-market transactions. Delays in communication typically give rise to uncertainty and considerable price fluctuations. It is not surprising, then, that shortly after the first telegraph lines were strung, market participants sought to exploit the new medium in financial exchanges. The positive impact of the telegraph was immediate. Time delays in the exchange of price information and the execution of purchase and sale orders were substantially reduced. For the first time, continuous interaction between distant markets became possible and that had a direct effect on the decrease of inter-market price differences. This unprecedented acceleration in information flows created extremely favorable conditions for the integration of financial markets, both nationwide and worldwide. In the second half of the nineteenth century, Britain witnessed, on the one hand, a "multi-centred but integrated securities market with London the dominant component among numerous thriving local centres", and, on the other hand, a "rapid and reliable communication […] between London and major foreign stock exchanges" (Michie 1997, 310). In the United States, major stock and foreign exchange markets were immediately affected by domestic telegraph services, despite the adverse effects of other factors (such as transaction costs). Communication between foreign financial markets was also significantly enhanced as soon as the early overseas telegraph lines were established. The impact of the first trans-Atlantic cable on the interaction between the bond markets of New York and London is a case in point (Garbade and Silber 1978, 823-828).

The implications of rapid communication for market integration were not limited to the exchange of assets. In general, telegraphy played a crucial role in the creation of both large national markets and extensive international trade networks. At the same time, it provided the necessary communication system for the vertical integration of large manufacturing companies into distribution. Thus, it allowed for the emergence of the first multifunctional firms (Yates 1986, 151-155). Numerous other advantages derived for large-scale operations as the competitive growing firms began to exploit the new medium in their pursuit for market domination. The telegraph proved a powerful tool for market penetration in both remote parts of the world and relatively isolated sub-national regions. In a few decades, the interaction between market and firm underwent a profound change. Market monitoring, long-distance transactions and co-ordination of nationwide or worldwide trade of goods were some of the key functions that could now be performed with increasing efficiency. Analogous advantages were obtained in business operations, especially as regards the co-ordination of internal communications and the supervision of distant units of large firms (Du Boff 1984, 573-579).

A crucial common feature of the diverse uses of the telegraph in the world of business and finance was its centralizing effect. The dominant market forces quickly realized that the nineteenth century innovations in distant communication could play a decisive role in monopolization. Thus, from its early days telegraphy entered into a process of co-evolution with the emerging monopolies in the leading capitalist countries and soon became itself a thriving industry. The initial interdependence between electrical transmission systems and economy was strengthened and it produced multiple ramifications as the transformation of telecommunications deepened with the advent of the telephone, the radio and the television. By the early twentieth century, the successive advances in telecommunication technology had already exerted a major impact on the ways in which people throughout the world experienced space and time in their communication exchanges. The astonishing acceleration of information flows altered radically the practical significance of physical distance in diverse spheres of social activity. This effect was intensified by the parallel advances in transport technology. News and goods, people and ideas travelled faster than ever before, and the world seemed to be constantly shrinking. Yet, the networks of transport and communication expanded unevenly. The emerging global web of interconnections exhibited significant variance in density and many regions were left poorly connected. Outside the web, information flows remained slow and depended on the available means of transport. Even worse, as the acceleration of communications widened “the gap between the places accessible to the new technology and the rest, it intensified the relative backwardness of those parts of the world where horse, ox, mule, human bearer or boat still set the speed of transport” (Hobsbawm 1977, 77). Telecommunication networks had, then, two opposing effects. On the one hand, they provided the threads of a developing web of international exchanges and interaction. On the other hand, they divided the planet into zones with information flows of differing speed. In an accelerating world, “time had become one crucial factor of inclusion or exclusion” (Wenzlhuemer 2013, 47).

The telegraph introduced a new way of signal transmission that altered radically the character of distant communication. Electricity made possible the dissociation of information exchange from overseas and overland transport and, thus, allowed for signaling systems that were not subject to the physical restrictions imposed on the motion of vehicles. A new, promising path opened for the burgeoning industries of the early twentieth century world powers, a path full of unprecedented challenges for scientists, government agencies, managers and entrepreneurs. Communication engineering emerged as a response to the need for a scientific discipline dedicated specifically to the increasingly complex problems of the new media. It offered the ground for the consolidation of a prospectively unified framework that would enable various agents to co-ordinate efforts in an incessant struggle for technological supremacy and economic domination in telecommunications. From this struggle emerged the first scientific conception of information, articulated in purely mathematical terms. It encapsulated a statistical approach to communication that addressed the issue of signal transmission at an extremely high level of abstraction, thus allowing for the construction of a theory of general applicability. Information turned into a measurable quantity and soon it was felt that it could be a valuable tool outside electrical engineering. Psychology, communication science, and linguistics were among the first disciplines that seized the opportunity to recast their fundamental problems in information-theoretical terms, selectively re-interpreting the basic concepts of the mathematical approach to communication according to their particular needs.

The emergence of a scientific conception of information has a special significance for the present study. Communication engineering provided a new field for the application of “code” as a technical term. In its new role, the word was not confined to specific means or practices (e.g. telegraphy or cryptology), but denoted in general the transformative element in the process of signal transmission. The transdisciplinary diffusion of the mathematical approach to communication brought “code” first to communication science and then to linguistics, where it formed part of new linguistic models. It, thus, began to deviate from its role as a technical term and oscillate toward the notion of language. This initial instability was a particular manifest of an underlying gestation process, which eventually led to the emergence of a new semiotic concept. In order to understand this process, it is necessary to start with the mathematical approach to communication and delve into its impact on the study of language.

CHAPTER 4

The Quantification of Information

The history of the scientific concept of information has many, intricately interrelated aspects, each of which comprises multiple layers. Even an account strictly confined to a single scientist or institution cannot avoid coming across issues that transcend the boundaries of certain disciplines and embrace wider relations between science and society. Of course, it is an altogether different matter how such a narrowly focused account would treat these general issues. Geoghegan's (2008) critical survey shows that the literature on the history of information and control systems progressively attained an increasing awareness of the multiple dimensions of its object of study. Within this development, the emergence of the scientific concept of information could no more be conceived of as the endpoint in a single line of intellectual achievements but rather as a particular facet of wider historical processes. This approach finds strong support from research in the history of science.

The nineteenth century is, in many respects, a critical turning point in the history of humanity. The preceding discussion on the telegraph highlighted characteristic aspects of a general phenomenon that had a decisive impact on the course of world history: the growing interdependence between science and technology and their interpenetration with social and economic life. In all major sectors of industry, technological inventions provided the impetus for the rise of monopolies. The consolidation of the latter, however, needed science as an organized institution with a solid structure and an effective division of labor. Industry played a key role in the shaping of science as an institution by offering an expanding and diversified field for experimentation and practical applications and by securing the material means for scientific research. War was equally important in this respect, as it intensified the involvement of governments in scientific research. Industry and government agencies became an integral part of science as institution and this altered radically the status of scientists, in that they "ceased to be professional men in the old sense" and became "employees or executives of government departments or large firms"

(Bernal 1965, 708). War had, no doubt, a much broader impact on science. It brought together scientists and engineers from diverse disciplines to collaborate in projects with strict and demanding requirements. War accelerated, in a dramatic way, the application of scientific discoveries and demonstrated the potential of science as a tool for political power. Above all, it showed that science and technology were even more necessary for both life and death. Before the end of the first half of the twentieth century, it was increasingly felt that in principle any problem of human life could be formulated in scientific terms and find its solution in science. It is precisely within this intellectual and cultural climate that communication came to be seen as an engineering problem.

Electrical engineering has a big share in the evolution of science as a factor of social transformation. By the late nineteenth century, it became clear that this transformation rested in significant respects on two fundamental conditions: the "availability of power in adequate quantities" and the "precise and increasingly automatic control of all industrial operations, whether mechanical or chemical" (Bernal 1965, 713). Implicit in these conditions is a third one that concerns the rapid and reliable transmission of signals. The first condition entails the construction and efficient operation of extensive power networks, which in turn require advanced methods of power production and distribution and sophisticated systems of control and communication. On the other hand, uninterrupted power supply in adequate quantities is a prerequisite for control and communication systems. The inherent link between power supply, automatic control of industrial operations, and electrical signaling ramified progressively into a maze of reciprocal dependencies, as electrical engineering assumed an ever more important role in the ongoing process of industrialization. As a result, communication engineering grew in complexity, and technological progress often necessitated intense interaction with other subfields of electrical engineering. Thus, several developments in telecommunications have a rather heterogeneous historical background, which may comprise diverse organizations, research projects, scientific theories and technological innovations. This phenomenon is perhaps best exemplified in the construction of a mathematical approach to communication.

The emergence of a scientific conception of information was a process that unfolded in a multidisciplinary space, which comprised certain developments in mathematics, physics, control and communication engineering, neurophysiology and psychology (Aspray 1985, 117-118). Research in control and communication played a pivotal role in this process and it is particularly relevant for the present study, since it relates to those figures whose pioneering work exerted a major influence on communication scientists and linguists. In 1948, Claude E. Shannon published, in two articles, his famous mathematical theory of communication, in which information was treated as a measurable quantity. Behind the precise definitions formulated in those articles, there is a long history of theoretical contributions and technological innovations in control and communication. The 'material dimension' in that history is so important that it would be misleading to view Shannon's theory only as the culmination of prior intellectual achievements. The quantification of information was a complex process in which various devices and networks played a vital role. Initially, the theoretical and practical work done for the design and operation of equipment and systems was motivated by particular technical problems. Progressively, the experience accumulated from the increasing use of advanced media in diverse industrial and social settings enabled some communications engineers to arrive at a more general description of the characteristics and the limitations of electrical signaling. This embryonic tendency toward a general account of electrical communication found its counterpart in the 'unifying view' expressed by AT&T's vice president Frank B. Jewett in 1935. In his address at the annual meeting of the National Academy of Sciences of the United States, Jewett attacked the then prevailing view of electrical communication in terms of distinct media, such as the telegraph, the radio or the television. The different media, he argued, "are merely variants of a common applied science"; it is the specific manipulation or 'modulation' of the electric current that "determines whether we are concerned with telephony, telegraphy, telephotography or television" (Jewett 1935, 172). In other words, all signals were made of the same 'material'. What differentiated them from each other was the particular method of manipulation applied for rendering them suitable for transmission. In that way, Jewett tried to delineate a unified market in which "AT&T, with its natural monopoly, would emerge as the unified communications company: a builder of transmission, a carrier of long-distance signals, and a switcher of information" (Mindell

2002, 136). One of the key steps toward the consolidation of a unified market of telecommunications was the quantification of information, which would deepen the commodification of information. However, a universally applicable quantification presupposed a universally applicable theory of communication. It appears, then, that two strong and mutually supporting forces drove the development of a mathematical approach to communication: the scientific-technological progress, on the one hand, and the expansion of communications monopolies, on the other. Each one presupposed and, at the same time, reinforced the other throughout the various stages of this process, with the interaction between them gradually getting stronger and more intricate. The present exposition will highlight some crucial transition points in this development, focusing particularly on the United States, in an attempt to reveal the basic ideas that underlie the scientific conception of information.

As soon as telegraphy was established as an indispensable factor in the ongoing industrialization of the world during the second half of the nineteenth century, the demand for telegraph services began to increase rapidly. To meet this challenge, telegraph companies needed denser and more extensive networks. They needed to cover ever-larger geographical areas and increase the number of lines per region. However, network expansion, in terms of both distance and density, had a limit and, above all, entailed high costs of infrastructure construction and maintenance. Thus, it would prove unprofitable unless the problem of the efficient utilization of telegraph lines was also taken into consideration. The two key parameters in this problem were the speed of transmission and the capacity of the line. The former refers to the number of words transmitted per minute and the latter to the number of messages transmitted on a single wire. Increasing both would lead to more efficient utilization, provided that the quality of the electric signal would remain unaffected.

Early attempts to improve transmission speed focused on eliminating the unavoidable time delays caused by the operators at the different telegraph stations, through which a message might pass to reach its destination. To this end, various recording or printing machines were devised for the automatic reception and decoding of the transmitted message. Successive technical improvements led to a significant increase in the speed of transmission at the turn of the twentieth century (Beauchamp 2001, 85-90). As regards the problem of line capacity, the solutions sought relied on the principle of multiplexing, which refers to the development of communication systems capable of transmitting multiple messages on a single line. The first multiplex systems appeared after 1850. In 1853, Julius W. Gintl devised in Vienna a method for transmitting two messages (one in each direction) on a single wire. Based on that method, Joseph B. Stearns developed in the late 1860s the first duplex telegraph system for commercial use by the Franklin Telegraph Company in Boston. A few years later, Thomas A. Edison developed for Western Union a quadruplex system that allowed four signals to be transmitted simultaneously on a single wire, two in each direction (Beauchamp 2001, 82, Hochfelder 2012, 142). Meanwhile, in France Émile Baudot presented a novel method of multiplex transmission that relied on the utilization of the time during which the line remained idle. The idea was to enable different operators to use the same line by transmitting signals consecutively at specific time intervals. To this end, Baudot designed a system with multiple sectors, each allocated to a different operator. A rotating device (distributor) allowed each operator to use the circuit for transmitting a letter at a given length of time before passing to the next operator. A similar, synchronized device at the other end of the line made possible the correct reception of the messages. Baudot's telegraph system represents the earliest application of the principle of time-division multiplex to telecommunications (Beauchamp 2001, 394). After World War II, this principle assumed a new role in digital telephony.

Before the end of the nineteenth century, inventors such as Alexander Graham Bell, Thomas A. Edison, Elisha Gray, François van Rysselberghe and Ernest Mercadier continued to experiment with multiplex systems in order to increase the number of signals that could be transmitted simultaneously on the same line. Their pioneering work led to different forms of the so-called harmonic telegraph systems, which operated on alternating current (in contrast to the earlier, direct current systems) and comprised vibrating reeds tuned to different frequencies. Each transmitting reed generated a separate frequency, which could be selected by the corresponding receiving reed at the other end of the line. The different frequencies generated functioned as 'carriers' for the multiple telegraph signals transmitted simultaneously on the same line. The use of a 'carrier current' allowed for a more efficient utilization of the frequency band of the line. Several signals could be transmitted through the same medium if they were superposed (or ‘impressed’) on different carrier frequencies, provided that the latter were placed in sections of the frequency spectrum with a sufficient distance between them so as to avoid mutual interference. At the receiving end, the carrier frequencies were separated by the receiving reeds and the transmitted messages were accordingly retrieved (Colpitts and Blackwell 1921, 205-208). The harmonic telegraph systems introduced a new transmission method: the frequency-division multiplex. Initially, the method relied on mechanical resonance and was thus of limited capabilities. In the 1890s, however, it entered a new phase of development with the appearance of the first systems that could use electrical resonance. In its advanced form, frequency-division multiplex would demonstrate its potential in the two major inventions of the last third of the nineteenth century: the telephone and the radio.

Early telephony posed serious challenges to engineers as regards both the efficient utilization of the line and the expansion of the network. The use of wires for signal transmission entails power losses, which result in weaker signals at the receiving end of the line. A loss of that sort, known as attenuation, is affected by several factors such as weather conditions, the length of the line and the range of signal frequencies. Attenuation increases with frequency and distance. Thus, in telephony, which operates at much higher frequencies than telegraphy, attenuation problems pose severe limitations to long-distance signaling. To overcome these limitations and meet the increasing demand for inter-city communications, telephone companies in Europe and the United States experimented with various improvements. Early attempts to enhance the quality of telephone signals focused on the efficiency of microphone transmitters, receivers and the battery systems that supplied the network with power (Hugill 1999, 61-64). Although significant, by themselves such improvements could not allow for reliable nationwide networks. Thus, research began to focus increasingly on the transmission line itself. An increase in the diameter of the copper conductors could reduce attenuation, but this approach was soon abandoned as it resulted in heavier and more expensive wires (Mindell 2002, 107). A more promising solution, however, seemed to lie in theoretical work on the propagation of signals. In a series of papers published in *The Electrician* between January 1885 and December 1887, Oliver Heaviside presented a comprehensive account of electromagnetic induction based on Maxwell’s theory of electromagnetic radiation. Among other things, he addressed the problem of long-distance telephone signaling. In his preliminary remarks on that matter, Heaviside ([1887] 1894, 121-122) stressed the importance of induction for signal transmission and suggested two methods for reducing attenuation, one of which was to increase the inductance of the line. Several experiments were conducted during the following years by various scientists in an attempt to design and test a suitable device for this purpose. An extremely useful idea was expressed in 1893 by Silvanus P. Thompson at the International Electrical Congress in Chicago. Discussing the problem of signaling retardation in submarine telephone cables due to uniformly distributed electrostatic capacitance, Thompson suggested that the 'remedy' applied should also be 'distributed'. Thus, instead of "devices placed at the ends of the cable, means must be sought for applying compensating devices *distributively* along the length of the cable, either at intervals or continuously" (Thompson 1894, 145; emphasis in the original). This could be done either by self-induction coils or by mutual induction coils. Four years after the International Electrical Congress in Chicago, George A. Campbell joined AT&T and began working on this idea, seeking to specify the characteristics of the suitable loading coil for a long-distance telephone system. By 1899, Campbell had devised his coil and demonstrated its applicability. The same year, Michael I. Pupin from Columbia University published a study in which he presented his work on the mathematical theory of electrical wave propagation, with a special emphasis on the 'physical aspect' of the theory in connection with long-distance signaling. In this context, Pupin discussed also the use of cables with loading coils placed at predetermined intervals, an issue which he took up again a year later in a more detailed exposition[60]. Eventually, it was Pupin, not Campbell, who was granted the first two patents on loading coils in 1900. AT&T immediately bought the patents for a large sum of money and shortly after began commercial installation. The system spread rapidly, first throughout the United States and a few years later in Europe (Huurdeman 2003, 318-319).

Loading coils improved long-distance transmission and enabled telephone networks to expand. Their capabilities, however, were limited. As passive elements[61], they "simply

[60] See Pupin (1899, 1900).
[61] On the concept of passive circuit elements, see Choma, Jr. (2006).

facilitated the propagation of the wave down the line but added no additional energy" (Mindell 2002, 109). Thus, attenuation and distortion continued to pose obstacles to the projects of communications monopolies for even bigger networks, such as the transcontinental line that would connect New York with San Francisco. Projects like that required devices that could amplify the electric current and allow for a much more elaborate manipulation of the transmitted signals. That became possible with the invention of vacuum tubes. In 1904, John A. Fleming invented the thermionic valve, a sealed glass container with a wire filament (cathode) and a metal plate (anode) in it. When heated, the filament emitted electrons that were attracted by the (positively charged) plate. In that way, a unidirectional flow of electrons was generated inside the tube. The device was used for converting alternating current into direct current. It was also useful for detecting telegraph or voice signals impressed on radio carrier waves. Two years later, Robert von Lieben in Vienna and Lee de Forest in New York devised a version of thermionic tube with a third electrode (a 'grid'), which acted as a 'gate' and thus could control the flow of electrons (Bray 2002, 56-57). The new version had amplifying capabilities, which remained undiscovered until 1912. It would take another year and a lot of research by Bell System engineers until a reliable electronic amplifier was devised and tested successfully on commercial circuits. In 1914, the vacuum tube was used in AT&T's grand project: the construction of the transcontinental line, which opened in 1915 (Fagen 1975, 256-262). Initially, electronic amplifiers were used in conjunction with loading coils on the same line, but gradually the latter were removed.

Amplification marked a decisive turn in the history of telephony. With inductive loading, the network remained a passive infrastructure for the transmission of electrical signals. Amplifiers, on the other hand, added energy to the system and, in a sense, they turned the network into a machine. This allowed for uncoupling the message signal from "its physical embodiment. Electricity in the wires was no longer the conversation itself but simply a carrier" (Mindell 2002, 112). This was the second crucial dissociation in the development of telecommunications. The first one occurred with the advent of the telegraph, when the exchange of information was detached from overseas and overland transport. The second split, which occurred at the turn of the twentieth century, concerned the electrical signal itself and provided far more possibilities for the manipulation of messages. Here, too, the crucial step was made with the vacuum tube. The early devices of von Lieben and de Forest attracted almost immediately the interest of brilliant engineers, who devoted much effort to investigating the phenomenon of thermionic emission. The theoretical and experimental work done since the mid-1910s disclosed the great capabilities of the vacuum tube and enabled engineers to design tube types for different purposes (Nebeker 2009, 40-41). A key contribution to wire and wireless communications was the design of vacuum tubes as modulators and demodulators.

Modulation is the complex process by which a low-frequency message signal is impressed on a high-frequency carrier wave. The inverse process of retrieving the original message signal is called demodulation (Colpitts and Blackwell 1921, 222, 226). As the message (or modulating) signal is impressed on the carrier wave, a parameter of the latter varies in accordance with the variations of the respective parameter of the former. In amplitude modulation, for instance, the amplitude of the carrier wave varies in accordance with the amplitude variations of the modulating wave (Fig. 4.1).

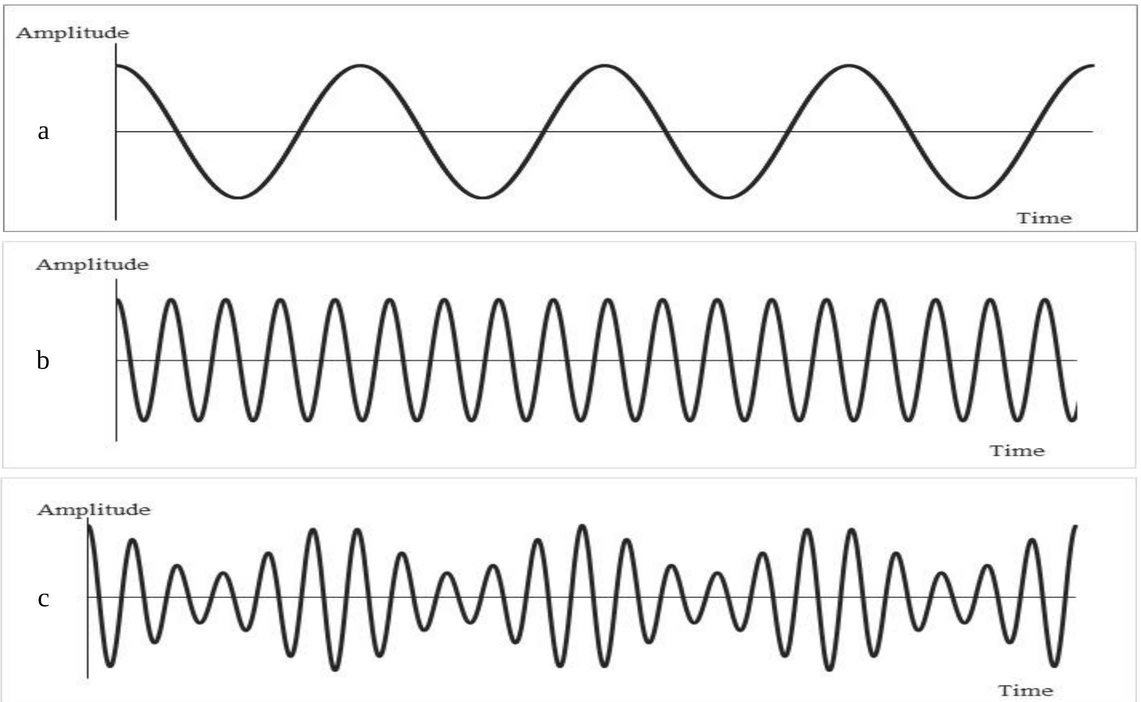

Figure 4.1 Amplitude modulation: (a) signal message; (b) carrier wave; (c) modulated signal.

In frequency modulation, the amplitude variations of the modulating wave affect the frequency of the carrier wave (Fig. 4.2). In amplitude and frequency modulation, both the message signal and the carrier signal are continuous waves. In pulse modulation, pulses of energy (as in telegraphy) are used as carriers instead. In this case, the pulses may vary in amplitude, in duration or in position in accordance with the amplitude variations of the modulating signal.

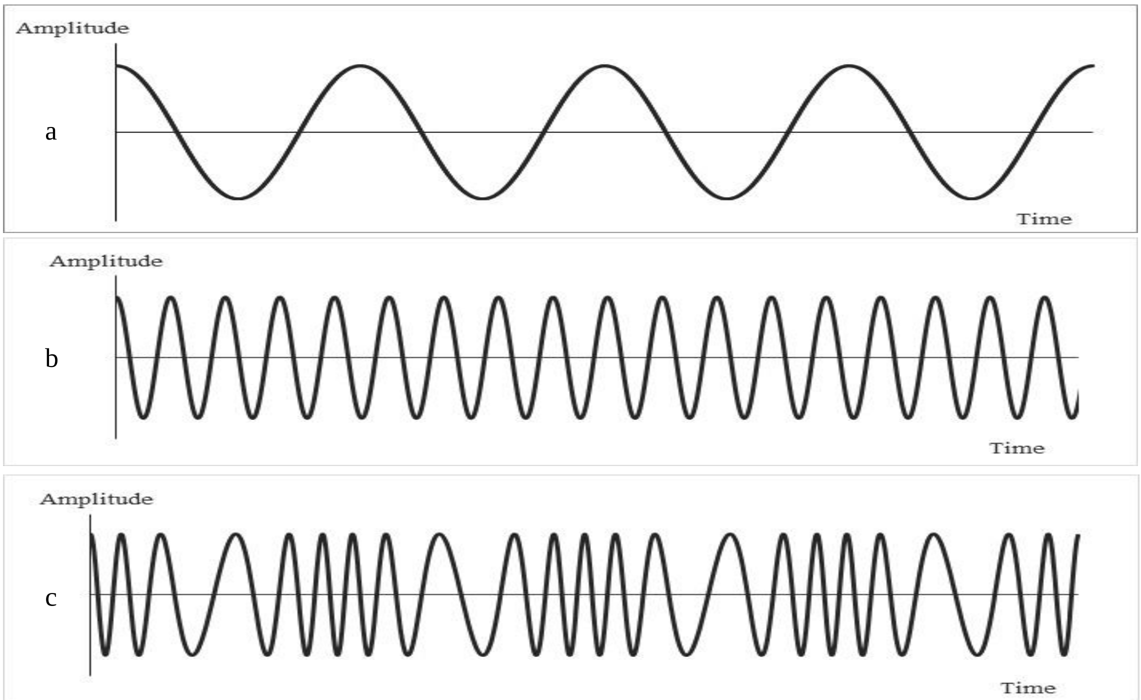

Figure 4.2 Frequency modulation: (a) signal message; (b) carrier wave; (c) modulated signal.

Pulse modulation may also be used for converting analog signals (such as the cosinusoidal waves depicted above) into digital ones. Analog to digital conversion requires a specific sampling procedure designed to represent the (continuous) modulating wave by a long series of instantaneous samples. The samples are taken at regular intervals, at a rate at least twice the maximum frequency of the message signal[62]. Accordingly, they must be transformed into a series of pulses. This can be done if each sample is assigned a single value. However, the amplitude of the initial modulating wave may take an infinite number of values, as it varies continuously with time. Thus, the total amplitude range is first

[62] For voice signals, which range approximately between 300Hz and 3.4 kHz, the standard sampling rate is 8 kHz, that is, 8000 samples per second or 1 sample per 0.000125 seconds.

divided in a limited number of steps (quanta). Then, each sample is assigned a specific value. Once the ‘quantizing’ procedure is performed, the samples can be transformed into pulses by means of a binary code[63]. These are the main steps in the so-called pulse-code modulation (PCM). The method was invented in the late 1930s by Alec H. Reeves, but it had a wide commercial use long after the end of World War II (Huurdeman 2003, 327-331).

Modulation by means of electronic tubes represented a real breakthrough. It became an indispensable element in wireless communications[64]. In telephony, it allowed for a considerably efficient utilization of the line at a frequency range much higher than the voice-frequency band. The vacuum tube technology provided not only reliable modulators and demodulators but also stable oscillators for the generation of high frequency carrier waves. The rapid progress both in electronic devices and in infrastructure materials made possible the development of the so-called carrier telephone systems, which incorporated advanced methods of multiplexing. The first experiments were conducted in Germany and the United States before 1915. In 1918, AT&T presented the first commercial systems, the four-channel *Type A* and the three-channel *Type B*. In less than ten years, the distance covered by carrier systems lines had grown exponentially and in 1924 a new system, the *Type C*, appeared. At about the same time, advanced multiplex systems were developed in telegraphy. In the rest of the world, the new wire communications technology spread at varying pace, with Norway, Russia, Australia and Malaysia being among the first countries where carrier telephone systems were installed (Huurdeman 2003, 324-326). Thus, by the late 1930s, communications engineers had found novel ways to tackle the twin problems of long-distance signaling and efficient utilization of the transmission medium. The methods and systems devised during this period brought telecommunications to a new stage of development and paved the way for the sophisticated media technology of the second half of the twentieth century. More importantly, they also introduced a new way of

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[63] For a detailed account of the basic types of modulation, see AT&T Co. (1953, 252-264).
[64] For an accessible outline of the early modulation techniques in radio, see Bussey (1990, 13-20) and Huurdeman (2003, 269-281).

thinking about communication, which began to take a more concrete shape as the interdependence between theoretical and practical research increased.

Signal manipulation in radio and telephony was far more challenging than in telegraphy. Long-distance transmission and multiplexing required an in-depth theoretical understanding of the electromagnetic phenomena involved in the operation of advanced wire and wireless systems. Thus, a growing body of theoretical work began to accumulate during the first decades of the twentieth century. Heaviside's (1894) early theoretical contributions in telegraphy and telephony paved the way for Campbell's (1903) and Pupin's (1899, 1900) work on loading coils. In the following years, the increasing interest in the vacuum tube provided the impetus for the theoretical investigation of thermionic emission and the experimental exploration of the capabilities of the new device. Langmuir's (1913, 1915, 1920) early theoretical studies on thermionic phenomena and van der Bijl's exposition of the theory and applications of the vacuum tube had a crucial impact on communication engineering. Once the modulating capabilities of tubes were discovered, the need arose for a deeper understanding of modulation and a re-examination of transmission theory. In both research fields, Carson's contribution was instrumental. In 1915, Carson presented an analysis of modulated waves, in which he revealed the existence of two extra frequency bands ('sidebands') in the modulation output besides those of the message signal and the carrier wave. He, then, demonstrated that the original message could be retrieved from one of the sidebands alone. The other sideband could be filtered out and the carrier could be suppressed (Fagen 1975, 280-281). Based on this analysis, he devised a 'single-sideband' modulation method, for which he was granted a patent in 1923[65].

In the following years, Carson made valuable contributions in wire and wireless communications with his work on the analysis of modulation and the mathematical elaboration of the theory of transmission[66]. At about the same time, Campbell added another key link in the chain of successive achievements at the turn of the twentieth

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[65] John R. Carson, "Method and Means for Signaling with High-Frequency Waves". US patent 1,449,382, filed December 1, 1915, and issued March 27, 1923.

[66] See e.g. Carson (1919a, 1919b, 1922, 1926).

century. The transition from mechanical to electrical resonance in the 1890s was a step forward in the development of the early multiplex systems. However, the electrical circuits that were used for separating frequency bands were not sufficiently reliable. Thus, new selective devices were needed that could meet the requirements of the evolving multiplex systems. While working on loading coils, Campbell noticed a phenomenon characteristic of periodically loaded lines. When transmission frequency exceeded a limit (determined by the distance between the coils), attenuation increased rapidly. It seemed that at this point the line was filtering out a specific range of high frequencies. Campbell sought to exploit this property of loaded lines in order to devise a new type of selective circuit. In 1909, he invented the electric wave filter, and by 1910 he had designed three basic types: low-pass, high-pass and band-pass filters[67] (Brittain 1970, 43, n.21, 56, Espenschied 1966, 162, Fagen 1975, 279-280). Following his laboratory work, Campbell made a significant contribution to the diverse theoretical studies of this period by publishing in 1922 an introductory exposition of the physical theory of the new device[68]. Campbell's studies led to yet another breakthrough in the early twentieth century communications technology and his wave filter proved to be "as essential as the electron tube to the successful development of carrier transmission" (Fagen 1975, 280).

From the first multiplex telegraph systems onwards, engineers realized that frequency manipulation was the key to the problem of the efficient utilization of a transmission medium. Ongoing research on modulation and frequency selection was vital for the evolving radio and telephone systems. The advances in communications technology during this period provided the ground for further developments in telegraphy, as a response to the increasing demand for printing-telegraph services. In the United States, the acquisition of Western Union Telegraph Company by the AT&T in 1910 and the subsequent change in the telegraph business policy of the Bell System provided the impetus for further research on telegraph technology (Fagen 1975, 742-3). The projects launched thereafter focused mainly on the design of teletypewriter machines for the development of a multiplex printing-telegraph system, which would operate at a much

[67] A low-pass filter excludes frequencies above a selected threshold. A high-pass filter excludes frequencies below a selected threshold. A band-pass filter limits the transmitted frequencies to a particular range.
[68] Campbell (1922).

higher transmission rate than that of the conventional Morse sets. To this end, a systematic investigation of telegraph signaling was required. This, in turn, entailed theoretical research on the parameters of telegraph speed and on the nature and sources of signal distortion. In both fields, the contribution of the AT&T engineer Harry Nyquist was invaluable. In 1924, Nyquist published a study in which he sought to determine the best wave shape of signals and the more suitable code for attaining maximum transmission speed in various telegraph systems (including radio and carrier systems). In order to be able to compare between different codes and waveforms, Nyquist introduced two key terms: the "signal element" and the "line speed". If time is divided into "short intervals of approximately equal duration, such that each is characterized by a definite, not necessarily constant, voltage impressed at the sending end", then a signal element can be defined as that "part of the signal which occupies one such unit of time" (Nyquist 1924, 325). The line speed, on the other hand, "equals the number of signal elements per second divided by two" (ibid.). Practically, the time unit used in this case equals the time interval that corresponds to a dot in conventional telegraph systems[69]. With the signal elements thus defined, Nyquist carried out a comparative analysis of three basic waveforms at the level of both the signal element and the complex wave, including a consideration of the relative interference of the examined types of waveform (Nyquist 1924, 326-329).

For the comparison between different codes, Nyquist devised a formula for the speed of transmission of 'intelligence', meaning by that the "the number of characters, representing different letters, figures, etc., which can be transmitted in a given length of time assuming that the circuit transmits a given number of signal elements per unit time" (Nyquist 1924, 333). At this stage, the study sought to establish a relation between the speed of intelligence transmission and the number of values that a code used in order to represent the electric current. In particular, Nyquist wanted to know if an increase in the number of current values would lead to an increase in the speed of transmission. Assuming that the telegraph circuit under consideration has a given line speed, the code used has m current values, and the characters are of uniform duration n (n is the number of signal

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[69] This is evident from the example that Nyquist (1924, 325) gives: "the letter *a* in ordinary land telegraphy will be said to be made up of five signal elements, the first constituting a dot, the second a space and the next three a dash".

elements per character), then the total number of characters that can be encoded equals m^n. Since both m and n are constant, m^n will be a constant, too. Starting from this simple equation (rewritten in logarithmic form[70]), Nyquist arrived at the following formula for the speed W of intelligence transmission: $W = Klogm$, where K is another constant[71] (Nyquist 1924, 342-343). In that way, Nyquist devised a common measure of transmission speed for various types of telegraph systems. It is worth noting that in this study, the transmission of information is for the first time expressed in the form of a logarithmic rule (Kay 2000, 95).

The segmentation of signals into discrete elements on the basis of a division of time into short intervals was an important step in the theoretical analysis of telegraph signaling. It allowed for determining the speed of a line and for defining the transmission rate of information as a function of the number of current values used for encoding. The concept of signal element had also a special significance for the theoretical analysis of distortion. Ideally, the length of a signal element is confined to the time unit to which it is ascribed. Yet, distortion causes signal elements to extend to adjacent time units, thereby producing overlapping between different wave segments (Nyquist 1928, 619). Thus, such deviations could provide a measure of distortion. For example, when analyzed at the receiving end of the telegraph line, the changes in the length of ‘marks’ (dots and dashes) and spaces that make up the transmitted signals can reveal different kinds of distortion that require different treatment (Nyquist, Shanck and Cory 1927). Nyquist’s work on transmission theory and distortion analysis was mainly focused on telegraphy, but it did encompass all available telegraph systems in the early twentieth century. In that sense, it was a crucial step toward a general transmission theory, albeit confined to digital signals. The next step was taken by Bell Laboratories researcher Ralph V. Hartley.

In his famous 1928 article “Transmission of information”, Hartley sought to devise a quantitative measure for comparing between different communications systems. To this end, he took up again the familiar issue of frequency, but with a different objective in mind. Hartley opened the discussion as follows:

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[70] That is, $c = n\log m$.
[71] $K = s/c$, s being the line speed and $c = n\log m$.

> While the frequency relations involved in electrical communication are interesting in themselves, I should hardly be justified in discussing them on this occasion unless we could deduce from them something of fairly general practical application to the engineering of communication systems. What I hope to accomplish in this direction is to set up a quantitative measure whereby the capacities of various systems to transmit information may be compared. (Hartley 1928, 535)

As already mentioned, problems of frequency manipulation were one of the main driving forces behind the development of telecommunications from the late nineteenth century onwards. A major part of the work done for the efficient utilization of lines involved theoretical and experimental research on the frequency ranges used for signal transmission. However, that research was predominantly focused on the particular problems of specific communications systems (e.g. carrier telephony or radiotelephony systems). Hartley thought that the notion of frequency range could also be useful for a general treatment of communication irrespective of the transmission medium used. He thus characterized all communications systems (radio, telephony, television etc.) with the generic term "line" and sought to express the specific capacity of each system in terms of a relation between the frequency range of operation of the system and the total amount of transmittable information (Hartley 1928, 555). Yet, while a frequency band could be expressed in quantitative terms, no measure existed for information. So Hartley began his analysis with a section devoted to the "Measurement of information".

From the standpoint of the communications engineer, the essence of communication is encapsulated in two fundamental notions: selection and exclusion. Information exchange among the members of a group of communicators relies on a finite set of symbols. The use of the symbols and the meanings assigned to them are specified by social conventions. The rules (syntactical, semantic etc.) that make up these conventions define a set of acceptable combinations of symbols, which are determined by social and historical factors. In most cases, the number of acceptable combinations for a given series of symbols corresponds to a limited subset of all possible combinations. This subset may vary with time and group of communicators. For example, changes in the lexicon or morphology of a language may affect the number of acceptable combinations of its symbols. The total number of combinations, however, remains constant for a given set. Seen from the viewpoint of its physical aspect, communication proceeds with a series of successive selections of symbols concatenated in acceptable sequences. Every selection instantly excludes all other symbols that could have been chosen instead. Similarly, every sequence formed (e.g. a word in a sentence) excludes all other sequences that could have taken its place. Progressively, the chain of selections opens a clear ‘path’ amidst the mass of excluded alternatives and the information conveyed is said to become more precise. Given the relation of dependence that appears to hold between information precision and the alternative sequences of symbols, “it would seem reasonable to hope to find in the number of these sequences the desired quantitative measure of information” (Hartley 1928, 536).

Whereas communication always utilizes only the historically varying set of acceptable, meaningful sequences determined by the respective social conventions, a uniform quantitative measure of information cannot be determined by factors that do not relate directly to the physical properties of communication media. It needs to have a firm basis; otherwise, its reliability will be severely undermined. Only the total number of possible combinations of a given set of symbols can provide such a basis, as it depends only on the symbols themselves *qua* members of a set. Thus, “in estimating the capacity of the physical system to transmit information we should ignore the question of interpretation [and] make each selection perfectly arbitrary” (Hartley 1928, 538). That, of course, excludes from the discussion any consideration of meaningfulness. A symbol sequence is treated merely as the outcome of successive selections from a finite set of elements, irrespective of whether that sequence has a meaning for anyone at a particular point in time. With respect to the capacity of a medium, what matters is the total number of possible combinations. That was the point of departure for Nyquist in his attempt to devise a formula for the speed of intelligence transmission. For Hartley, it was the number that could provide the guiding thread for a quantitative measure of information.

Following Hartley, in a telegraph system we can distinguish between primary and secondary symbols. The primary symbols are the current values used for encoding various characters (letter, numbers etc.). The latter are the secondary symbols. For a system with s_1 current values, the total number of possible sequences formed by n selections equals s_1^n.

In the Baudot system[72], for example, where there are two current values (s_1=2) and each character is a sequence formed by five selections (n=5), the total number of possible sequences equals 2^5=32. The same formula holds for the characters s_2 used for constructing words or other expressions by making n selections. Thus, for each encoding of a single character there are, generally, s_1^n alternatives and for each sequence of characters there are s_2^n alternatives – with s_1 and s_2 being constant while n increasing throughout the transmission process. If the number of possible alternatives itself was taken as the quantitative measure sought, then each successive selection would result in an exponential increase of the amount of information. The performance of actual communication systems, however, indicates that there is no such exponential increase in practice. Hartley, therefore, concluded that the key to information measurement was to take information as proportional not to the number of possible alternatives but to the number of selections. Elaborating on this idea, which could be expressed by the simple equation $H = Kn$, where H is the amount of information, K is a constant that depends on the number of available symbols, and n is the number of selections, he arrived at the following formula: $H = \log s^n$. The choice of the logarithmic base determines the unit that will be used for information measurement (Hartley 1928, 539-541). By defining appropriately the primary and secondary symbols for different media, such as the telephone or the television, Hartley showed that the formula was applicable both to discrete and continuous channels. Thus, he had found a uniform way of measuring information, which allowed for devising a quantitative measure for comparing between the capacities of different media. The measure arrived at was expressed it terms of a relation between the amount of information and the frequency range characteristic of a line. Concretely, Hartley (1928, 554) found out that for a system with a specific frequency range, "the total amount of information which may be transmitted […] is proportional to the product of the frequency-range which [the system] transmits by the time during which it is available for the transmission".

With the theoretical work of Carson, Langmuir, van der Bijl, Campbell, Nyquist and Hartley, a general transmission theory began to evolve, attaining an ever-higher degree of

[72] See Beauchamp (2001, 394-396). If, for the shake of convenience, we represent the two current values of the Baudot code with the numbers 0 and 1, then the letters of the English alphabet are encoded as follows: A=10000, B=00110, C=10110 etc.

abstraction. While the point of departure in such studies was typically some problem pertaining to specific communications systems, the insights arrived at were usually of broader significance. Nyquist's analysis encompassed the category of discrete signals and Hartley's classical paper extended to the entire range of discrete and continuous signals. Hartley added two fundamental elements: the quantitative measures of information and channel capacity. Thus, although a general theory of communication was still lacking, the crucial step had been taken and a more global perspective on transmission problems was gaining currency among communications engineers. It was against the backdrop of these developments and the prospects of further advances that Jewett spoke of a "common applied science" in his 1935 address before the National Academy of Sciences in Washington. Despite the enormous progress made during the first third of the twentieth century, it would take several years of further experimentation and many wartime projects in order to arrive at a general theory of signal transmission, traditionally associated with the name of the American engineer and mathematician Claude E. Shannon.

As pointed out in the opening paragraphs of this chapter, the history of the scientific concept of information has many interrelated aspects, some of which are not confined to the field of communication engineering. Among them, those pertaining to the development of control engineering and cybernetics are of special significance. A detailed account of the technological advances in control systems and their impact on the conceptualization of information lies outside the scope of the present exposition[73]. In what follows, specific reference will be made only to some American wartime projects on fire control systems that relate to the work of Shannon. Cybernetics will be touched upon later in this chapter, with reference to Wiener's conception of information. Key aspects of the transdisciplinary impact of cybernetics will be discussed in the next chapter.

By the end of the 1930s, telecommunications had reached an advanced stage of development in both technological and economic terms. Communication practices became more diversified as sophisticated media assumed an increasingly important role in everyday life. At the same time, the scientific knowledge accumulated during the preceding decades cast a fresh light on the material aspect of communication processes. A

[73] See Mindell (2002) for a history of control systems in the United States during the period 1916-1948.

new perception of communication began to emerge, gradually permeating different spheres of social activity. As a result, the question "What is communication?" acquired a new meaning. For the communications engineer, this question concerned specifically the process of signal transmission in any system whatsoever, and called for integrating all previous theoretical insights and 'translating' them in a general scheme. Early on, Shannon took up this great challenge and addressed the fundamental problem of signal transmission from a mathematical point of view. While working as a PhD student on a project of developing "an algebra especially suited to the problems of the dynamics of Mendelian populations" (Shannon 1940, 1), Shannon had already began to consider the issue of a general communication theory. In a letter to Vannevar Bush[74] written on February 16, 1939, Shannon outlined a conception of signal transmission in terms of successive transformations. His scheme comprised three mathematical functions of time ($f_1(t)$, $F(t)$, and $f_2(t)$) and two operators (T and R) in linear arrangement. $f_1(t)$ represented the "intelligence to be transmitted", $F(t)$ denoted what was "actually transmitted" and $f_2(t)$ was a third function at the receiving end. The operator T was responsible for the transition from $f_1(t)$ to $F(t)$. During that stage, the first function was transformed into the second one due to modulation, distortion or other processes. At the receiving end, R operated on $F(t)$ in order to produce a third function $f_2(t)$, "which should be as closely similar to $f_1(t)$ as possible" (Shannon 1939, 455). Shannon acknowledged that there was a lot of work to be done, e.g., for formulating a precise mathematical definition of distortion or for providing the proofs of certain theorems he had envisaged, but it was clear that this scheme contained the seeds of the mathematical theory of communication he sought to devise.

Whatever happens during the transmission of a signal is an operation that unfolds in time. This is, perhaps, the most abstract way in which the events taking place in signal transmission could be characterized. By representing transmission as a series of transformations between time functions, Shannon unraveled the essence of all signaling irrespective of the medium and the type of signal employed. Furthermore, he was able to render in a uniform way all elements involved into measurable quantities. After completing

[74] Vannevar Bush was vice-president of MIT since 1932. On January 1, 1939, he left the vice-presidency for the position of the president of the Carnegie Institution of Washington, D.C.

his PhD, Shannon spent the summer of 1940 at Bell Laboratories. There, he had the opportunity to see how algebra was applied to relay and switching circuits, a topic to which he had devoted his Master's thesis in 1937[75]. Following Bush's recommendation, Shannon moved to Princeton University in the fall of 1940 for a postdoctoral fellowship under the mathematician Hermann Weyl. A few months later, on June 12, President Franklin Roosevelt approved Bush's proposal for establishing an organization that would coordinate and implement scientific projects for warfare purposes. On June 27, the National Defense Research Committee (NDRC) was established. It consisted of four divisions, each of which comprised a number of sections for handling particular problems. Division D was responsible for research on radars and detection, fire control systems, instruments, and heat radiation. The section D-2 was responsible for fire control systems and was headed by the mathematician Warren Weaver, director of the Division of Natural Sciences of the Rockefeller Foundation (Mindell 2002, 188). In November 1940, Weaver convinced Shannon to give up his fellowship at Princeton and sign a contract[76] for the Project 7.5-7 of D-2 on the "Mathematical studies relating to fire control". Shannon's task was to analyze gun directors in order to improve their ability to track moving targets (Mindell 2002, 289). His work under the contract in question yielded five studies (Hazen 1946, 59-60). In the fall of 1941, Shannon joined the mathematics department at Bell Laboratories and continued to work for various projects. One of them was the so-called Project X (or Sisgaly). The project concerned the development of a speech encryption system for a radiotelephone line that would allow the secure communication between Franklin Roosevelt and Winston Churchill. Another project involved theoretical work on cryptography (Kline 2015, 30-32).

Wartime projects were instrumental in the development of Shannon's mathematical theory of communication. Working in parallel on fire control and cryptography was a stimulating experience and enabled Shannon to draw analogies between different types of systems. For example, under his first war contract ("Mathematical studies relating to fire control"), Shannon ([1942] 1993) provided a mathematical theory of mechanical

[75] See Shannon (1940a).
[76] Contract NDCrc-105.

computing circuits based on an analogy with electrical circuits. Between cryptography and communication, the analogy was much stronger. In 1945, Shannon wrote at the Bell Laboratories a classified report titled “A mathematical theory of cryptography”[77]. In that report, the mathematical description of secrecy systems gives the impression that his famous theory of communication sprang precisely from his theoretical work on cryptography. Commenting on the development of the two theories, Shannon explained in an interview:

> That cryptography report is a funny thing because it contains a lot of information theory that I had worked out before, during the five years between 1940 and 1945. Much of that work I did at home […] I started with Hartley’s paper and worked at least two or three years on the problems of information and communications. That would be around 1943 or 1944; and then I started thinking about cryptography and secrecy systems. There is this close connection; they are very similar things, in one case trying to conceal information, and in the other case trying to transmit it. (Price 1984, 124)

Thus, the wartime work on cryptography did not actually provide the matrix out of which emerged the communication theory expounded in Shannon’s famous 1948 paper, despite the fact that “part of that [paper] was taken verbatim from the cryptography report, which had not been published at that time” (ibid.). Nonetheless, the case of secrecy systems did shed a different light on the problem of communication Shannon had been working on it since the early 1940s. Cryptography laid bare what was for Shannon the essence of communication, from the engineer’s point of view: transformation.

As already mentioned, by 1939 Shannon was convinced that an adequate mathematical description of communication could be formulated in terms of a series of transformations between mathematical functions. Both his theory of cryptography and his theory of communication emanated from this seminal idea. The generalized scheme for secrecy systems presented at the 1945 report comprised two information sources and two transformative operations (Shannon 1945, 25-26; see also Fig. 6). Both sources were regarded as stochastic (that is, statistical) processes generating discrete sequences of symbols. The first source generates the message to be transmitted. In this case, the message

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[77] A declassified version of that report was published in 1949 in the Bell System Technical Journal. See Shannon (1949).

source represents a natural language, such as English or Russian. But it has to be stressed that a mathematical theory of cryptography is interested only in the statistical properties of a language, such as the relative frequencies of different letters and combinations of letters or the probabilities of occurrence of various words in a message. Semantic considerations are largely irrelevant in this respect, and "[t]he 'meaning' of a message has significance only in its influence upon these probabilities" (Shannon 1945, 11). The second source of symbol sequences provides a key for enciphering the message. That is the first transformative operation, performed by the encipherer at the transmitting end of the system. At the receiving end, the decipherer performs the inverse operation in order to retrieve the original message with the help of the appropriate key (sent in advance to the destination of the message). Thus, the output of the transformation that takes place at the transmitting end could be expressed with the formula

$$E = f(M, K)$$

where E is the enciphered message, M is the original message and K is the key used. Since a secrecy system allows not for a single transformation but for a whole family of such operations, the same formula could be written as

$$E = T_iM$$

T_i being now a member of a family of operations T_1, T_2, …, T_m rather than an independent variable. At the receiving end, the operation performed must be the inverse of enciphering, if the message is to be retrieved. Hence, it can be expressed as

$$M = T_i^{-1}E$$

In other words, a "secrecy system is a family of uniquely reversible transformations T_i of a message space Ω_M into a cryptogram space Ω_E, the parameter i belonging to a probability space Ω_K" (Shannon 1945, 26).

The conceptualization of language as a stochastic process and the definition quoted above suffice to demonstrate the cardinal position that probability theory occupied in Shannon's distinctive approach to cryptography. The same conclusion can be drawn if we examine some of the fundamental quantities introduced in that report. The major threat for secret communications is the interception of the encrypted message and its decipherment by a cryptanalyst. Therefore, it is vital for a secrecy system to ensure that the risk of a successful cryptanalytic attack is minimized. The critical role of that threat for the design of secrecy systems is reflected in Shannon's model. Between the transmitting end and the receiving end, there is a point of intersection representing the interception of the cryptogram by an enemy cryptanalyst. Thus, the scheme comprises an intended and an unintended recipient. Whereas the former has the enciphering key and can therefore retrieve easily the original message, the latter has to retrieve the key itself from the intercepted cryptogram, in order to gain access to the message transmitted secretly. Shannon addressed the problem of the cryptanalyst in probability-theoretical terms. The message and the key source in a secrecy system can generate two distinct sets of symbol sequences (i.e. messages and keys, respectively), each of which has a certain set of probabilities associated with it. These are the *a priori* probabilities of the sets of sequences that the system can generate, and are known not only to the cryptographer but also to the cryptanalyst. As far as the latter is concerned, these probabilities constitute his or her "a priori knowledge of the situation" (Shannon 1945, 2). After intercepting an enciphered message, the cryptanalyst can calculate the *a posteriori* probabilities associated with the possible messages and keys, out of which the intercepted cryptogram might have been generated. The "calculation of these a posteriori probabilities is the generalized problem of cryptanalysis" (Shannon 1945, 3), and indicates the cryptanalyst's knowledge of the situation after the interception of the transmitted cryptogram.

In that way, Shannon expressed the cryptanalyst's knowledge (hence also the cryptanalyst's uncertainty) in terms of probabilities and was, thus, able to specify mathematically how immune a secrecy system could be to cryptanalytic attacks. If the set of *a posteriori* probabilities is identical with the set of *a priori* probabilities, it can be said that the cryptanalyst has gained no further knowledge. In other words, the cryptanalyst is as uncertain as before the interception about the key that was used and the message that was enciphered. In that case, there is "perfect secrecy" (Shannon 1945, 56). However, an increase in the material intercepted affects the *a posteriori* probabilities. As more letters are intercepted, the probabilities of a subset of possible messages (or keys) increase, while those associated with the remaining possible sequences decrease, until the probability of one single message (or key) is approximately 1 and all the rest become nearly 0. In that case, a unique solution to the intercepted cryptogram has been obtained. This relationship between the amount of intercepted material and the *a posteriori* probabilities suggests an aspect of the cryptanalyst's uncertainty that is amenable to measurement. Devising a quantitative measure of uncertainty would be extremely useful for a mathematical theory of cryptography, for it would allow for specifying theoretically the 'degree of secrecy' of a system. To this end, Shannon turned to the generic formula,

$$\mathrm{H} = -\sum_{i=1}^{n} p_i \log p_i$$

which has been used for measures of randomness in disciplines such as statistical mechanics. Shannon suggested that this formula could be used for devising a measure of uncertainty about the occurrence of an event with probability p_i out of a set of possible events with probabilities p_1, p_2, …, p_n. This measure was intended to show "how 'uncertain' we are of the outcome" or "[h]ow much 'choice' is involved in the selection of the event by the chance element that operates with those probabilities" (Shannon 1945, 7). At this point, Shannon drew a connection between uncertainty and information by suggesting that "H measures in a certain sense how much 'information is generated' when the choice is made" (Shannon 1945, 9), or it can measure "the total amount of information generated" (Shannon 1945, 10), when

$$\mathrm{H} = -\mathrm{N}\sum_{i=1}^{n} p_i \log p_i$$

where N is the number of N independent choices made. The same type of formula was used for introducing a new quantity, called "equivocation", intended to measure how far a cryptanalyst is from arriving at a single solution in his or her attempt to retrieve the original message and the key used from an intercepted cryptogram E. The equivocation in message for a given E is

$$Q(M) = -\sum_{M} P_E(M) \log P_E(M)$$

where M is the number of all possible messages and $P_E(M)$ is the probability of M under the condition that E is intercepted. Similarly, the equivocation in key is

$$Q(K) = -\sum_{M} P_E(K) \log P_E(K)$$

Analogous formulas were constructed for the equivocation in message and in key of a secrecy system as a whole (Shannon 1945, 62-63). Other important quantities introduced in Shannon's mathematical theory of cryptography were also represented by logarithmic formulas. For instance, two of the most important parameters of a language as a stochastic process, the "information rate" and the "maximum rate", were defined in logarithmic terms. The former "measures the average amount of choice per letter or text that is produced", whereas the latter equals "the logarithm of the number of different letters in the language" (Shannon 1945, 19). Using these two parameters, Shannon defined the parameter $D = R_o - R$, which represented the redundancy of a language. The redundancy was taken as one of the key parameters in cryptography and "measures, in a sense, how much a text in the language can be reduced in length without losing any information" (Shannon 1945, 2).

The basic idea in Shannon's 1945 technical memorandum was that cryptography could be adequately described in abstract mathematical terms if it was treated as a function of a particular type of communication system. Yet, at that time no full-fledged theory of signal transmission existed. Therefore, Shannon had to rely on his previous efforts and elaborate further on the idea of representing signal transmission as a set of mathematical transformations. Thus, his early work on a general theory of communication passed through an intermediate stage of development in a particular field, that of secrecy systems. This stage yielded a general theory of cryptography, in which the conceptual backbone of a general transmission theory was laid bare through the treatment of the main problems of cryptography and cryptanalysis. Three years later, Shannon presented a comprehensive mathematical theory of communication, articulated in twenty-three theorems for discrete, continuous and mixed types of channel. All fundamental notions introduced in the 1945 report were now transposed to an extremely general level and the structure of the communication process was adjusted accordingly. The "amount of information" was, of course, the core concept in that theory, but Shannon (1948, 393) preferred now to call it "entropy", as the same logarithmic formula was used for entropy in statistical mechanics[78].

The most obvious difference between the models presented in 1945 and 1948 had to do with the element of secrecy. A general scheme of signal transmission need not include the possibility of encryption as an essential element, since the threat of interception by an unintended recipient of the message becomes in most cases irrelevant. Nevertheless, there is a part in Shannon's general theory of communication where a core aspect of secrecy systems surfaces again, in its universal form. In cryptography, the original message is deliberately altered by a specific procedure, so that it be transmitted in a form unintelligible to all recipients, intended and unintended, and be retrieved only by those who possess the encryption key. When there is no need for secrecy, the message to be transmitted does not have to be transformed, yet it does undergo alterations caused by distortion and noise. Thus, even in the case of an ordinary message exchange, the received signal is expected to differ from the sent message. It may not always be totally unintelligible like an enciphered message, but at any rate it will not be the same as the message generated by the transmitter. Shannon split the problem of unintended signal alteration in two distinct cases. The effect of distortion is characterized by regularity, in the sense that a given transmitted signal always corresponds to the same altered signal at the receiving end. If there is an inverse operation to this effect, then in principle distortion can be corrected. In the case of noise, there is a degree of randomness. Hence noise, too, can be taken as a stochastic process. Thus, "[i]f a noisy channel is fed by a source there are two statistical processes at work: the source and the noise" (Shannon 1948, 406). It seems, then, that there is a structural similarity between the noisy channel of a typical signaling system and the transmission channel of a secrecy system, which also comprises two sources (a message source and a key source). Between the two cases there is, of course, a substantial difference. In a secrecy system, the original message is easily retrieved with the proper encryption key (assuming that the effects of distortion and noise are negligible). In a noisy channel, on the contrary, "it is not in general possible to reconstruct the original message or the transmitted signal with *certainty* by any operation on the received signal" (Shannon 1948, 407; empasis in

[78] See e.g. Feynman (1972, 6).

the original). Notwithstanding this difference, the structural similarity referred to above allowed Shannon to extend his distinctive mathematical approach from cryptography to the general problem of noisy channels. It is, therefore, no surprise that in his analysis of noise Shannon invoked the notions of equivocation and *a posteriori* probabilities adjusted accordingly (Shannon 1948, 407-408). The case of noisy channels shows how revealing can be the structure of secrecy systems for the process of communication in general, when an abstract mathematical approach is employed.

Shannon defined the “fundamental problem of communication” as “that of reproducing at one point either exactly or approximately a message selected at another point”, making clear once more that the “semantic aspects of communication are irrelevant to the engineering problem” (Shannon 1948, 379). Abstracting from the physical properties and the particular characteristics of the various communication systems, Shannon devised a general model of communication that comprised the basic elements involved in any instance of signal transmission. The model was schematically represented in a linear diagram showing the elements arranged according to the succession of the main operations performed in a typical transmission. The elements were connected together through a chain of inputs and outputs. (Shannon 1948, 381). The sequence of events started with an information source generating a message, which was subsequently fed to a transmitter. There, the first set of transformations was performed producing a suitable signal for the transmission channel. A second source (noise) might affect the transmitted signal as it traveled toward the receiver, where a second set of transformations was performed for reconstructing the message from the received signal. Once reconstructed, the message reached its destination. At first sight, it is perhaps difficult for someone totally unfamiliar with communication engineering to realize that this simple diagram encapsulated a whole mathematical theory of signal transmission. After stating the fundamental problem of communication and presenting the main elements of a typical transmission system, Shannon proceeded with unfolding one by one the multiple layers hidden in his model by employing his mathematical approach to the main problems in both discrete and continuous channels.

In his letter to Vannevar Bush back in 1939, Shannon had expressed a seminal idea: communication can be described mathematically as a set of transformations between time functions. In less than ten years, he developed a mathematical theory of cryptography and a general theory of communication out of that seminal idea, building in his unique way on the theoretical work of his predecessors and benefiting immensely from his participation in cutting-edge projects on both control and communications systems technology. His approach to the theoretical description of the engineering problem of communication consisted in treating signal transmission in statistical terms. In that way, he was able to give a precise definition of concepts such as information or noise, applicable to all types of channel. The generic formula for measuring randomness ($\mathrm{H} = -\sum p_i \log p_i$) became the standard mathematical expression for the scientific conception of information[79]. As applied to communication engineering, that formula could be said to connote the whole series of technological advances and theoretical developments that made possible the quantification of information. The preceding discussion highlighted some critical turns in that history, focusing in particular on the intricate interplay between experimental and theoretical work.

In October 1948, the second part of Shannon's influential paper appeared in *The Bell System Technical Journal*. In that same month, Norbert Wiener, a mathematician at the Massachusetts Institute of Technology, published his *Cybernetics: or control and communication in the animal and the machine*, which soon became very popular both within and outside the fields of control and communication engineering. During the war, Wiener worked for the same section of NDRC that let Shannon a contract in 1940. Both contracts began on December 1, 1940. Wiener undertook a two-year project[80] on a "General Mathematical Theory of Prediction and Applications". The project's objective was to develop a network for an antiaircraft fire control system that would allow for predicting the path of enemy airplanes. Initially, Wiener and his assistant Julian Bigelow

[79] The formula $\mathrm{H} = -\sum p_i \log p_i$ is used in the case of discrete channels. For continuous channels, the analogous formula is: $H = -\int_{-\infty}^{\infty} p(x) \log p(x)\, dx$, where *p(x)*, is the density distribution function of a continuous distribution. The formula $H = -\int_{-\infty}^{\infty} p(x) \log p(x)\, dx$ is actually the continuous analogue of the weighted sum. For the use of this formula in the case of continuous channels, see Shannon (1948, 628).

[80] Project 6, contract NDCrc-83.

used an electrical network as a model, which eventually proved to be unstable. Thus, they turned to statistics for an alternative approach with time series analysis and feedback control as its main components. The new model relied on a statistical analysis designed to yield predictions about the future performance of a time function based on its past performance. Under a new contract with the D-2section, Wiener prepared a document with his theoretical results, which was published in a limited number of copies as a classified report[81] titled *Extrapolation, Interpolation, and Smoothing of Stationary Time Series with Engineering Applications* (Mindell 2002, 278-279). A declassified version of that report was first published in 1949. In it, Wiener spoke several times of "information". Yet, the term was not strictly associated with the overall alternatives in a given transmission, but was mainly used in connection with the statistical information provided by the "auto-correlation and cross-correlation coefficients" of time series (Wiener 1964, 81). However, a statistical conception of information similar to that formulated by Shannon in 1948 was already prefigured in Wiener's approach:

> …the statistical theory of time series does not consider the individual time series by itself, but a distribution or *ensemble* of time series. Thus the mathematical operations to which a time series is subjected are judged, not by their effect in a particular case, but by their average effect… No apparatus for conveying information is useful unless it is designed to operate, not on a particular message, but on a set of messages, and its effectiveness is to be judged by the way in which it performs on the average on messages of this set. "On the average" means that we have a way of estimating which messages are frequent and which rare or, in other words, that we have a *measure* or probability of possible messages. (Wiener 1964, 4; emphasis in the original)

One of the core elements in any statistical conception of information is precisely the idea expressed in the above passage. As Weaver (1949a, 12) aptly pointed out about Shannon's communication theory, "[t]he concept of information applies not to the individual messages, as the concept of meaning would, but rather to the situation as a whole".

In January 1943, D-2's Project 6 on a "General Mathematical Theory of Prediction and Applications" ended because no concrete results were produced and the NDRC let no more

[81] NDRC Report to the Services 370.

contracts to Wiener. Despite his unfortunate experience with the NDRC, Wiener pursued further his work on prediction and feedback control in an attempt to draw a connection with the study of the behavior of living organisms, focusing in particular on the behavior of humans. The first step toward that direction was made in the spring of 1942, when Wiener began investigating the neurophysiological implications of his research on feedback with the physiologists Arturo Rosenblueth and Walter Cannon (Mindell 2002, 282). A few months later, Wiener, Bigelow and Rosenblueth published an influential paper under the title "Behavior, purpose and teleology". In that paper, the authors sought to define the three concepts stated in the title in a way that would allow for constructing a "uniform behavioristic analysis… applicable to both machines and living organisms, regardless of the complexity of the behavior" (Rosenblueth, Wiener and Bigelow 1943, 22). In the following years, Wiener continued to collaborate closely with Rosenblueth. During the years 1945 and 1946, he had the opportunity to visit Mexico twice and participate in Rosenblueth's research at the Instituto Nacional de Cardiología. In 1947, they managed to get a five-year grant from the Rockefeller Foundation for a joint project between the Massachusetts Institute of Technology and the Instituto Nacional de Cardiología (Wiener 1948, 24-41). Wiener's collaboration with Rosenblueth during the 1940s focused on the investigation of neurophysiological and biological problems from an interdisciplinary perspective heavily influenced by the recent achievements in control and communication engineering. This was a critical period for the development of the unified field expounded in Wiener's *Cybernetics*, the famous book published simultaneously with the second part of Shannon's mathematical theory of communication.

Cybernetics was introduced as "the entire field of control and communication theory, whether in the machine or in the animal" (Wiener 1948, 19), intended to serve as a unified framework for a wide array of disciplines ranging from control and communication engineering, biology and neurophysiology to psychology and anthropology. At the heart of this framework, there were two key concepts: feedback and information. Wiener developed an alternative scientific conception of information independently of Shannon. However, the fundamental idea behind both approaches was essentially the same. As pointed out earlier, Shannon's point of departure was his conception of signal transmission as a set of successive transformations of time functions. Wiener, too, viewed signal transmission in terms of time functions. Message and noise were both treated as sequences of events unfolding in time and as such they could be subjected to time series analysis. On the basis of this premise, Wiener (1948, 74-112) developed a statistical approach to the analysis of signals in the presence of noise. It is interesting to note that, as regards the measure of the amount of information, Wiener (1948, 76) arrived at the same formula that Shannon used in the case of continuous channels but with opposite sign: $\int_{-\infty}^{\infty} f(x) \log f(x)\, dx$. The change in sign implies that Shannon took information as a measure of uncertainty or disorder like entropy, whereas Wiener saw it as negative entropy, that is, as a measure of order or predictability. Yet, Shannon avoided making a direct connection between the statistical concept of information and the concept of entropy in physics. On the contrary, Wiener drew explicitly a parallel between the two:

> The notion of the amount of information attaches itself very naturally to a classical notion in statistical mechanics: that of *entropy*. Just as the amount of information in a system is a measure of its degree of organization, so the entropy of a system is a measure of its degree of disorganization; and the one is simply the negative of the other. This point of view leads us to a number of considerations concerning the second law of thermodynamics, and to a study of the possibility of the so-called Maxwell demons. Such questions arise independently in the study of enzymes and other catalysts, and their study is essential for the proper understanding of such fundamental phenomena of living matter as metabolism and reproduction. The third fundamental phenomenon of life, that of irritability, belongs to the domain of communication theory. (Wiener 1948, 18; emphasis in the original)

The way Wiener portrayed the relation between the statistical concept of information and the physical concept of entropy is indicative of the purported breadth of the unified framework he expounded in his *Cybernetics*. Shannon developed his mathematical theory of communication as a general framework for the engineering problems in signal transmission, and devoted a considerable part of his seminal 1948 paper to an in-depth analysis of coding. Wiener viewed communication from a much broader perspective. He treated signal transmission and feedback control as two fundamental functions in both electromechanical operations and biological processes, and sought to lay the foundations of an interdisciplinary field whose object would transcend the dichotomy between animate and inanimate entities and would study both from the perspective of control and communication processes. The statistical approaches to signal transmission developed by Shannon and Wiener arrived at the same quantitative measure for information from different paths. Both had a tremendous transdisciplinary impact during the following decades and sparked a widespread interest in further developing the scientific conceptualization of information.

It should be noted, however, that this conceptualization did not originate in the works of Shannon or Wiener. The first steps toward a quantitative treatment of information were made by the famous statistician Ronald A. Fisher. A few years before Hartley's attempt to devise a measure of information for signal transmission, Fisher (1922, 1925) sought to find a way to calculate the "amount of information" provided by a sample in a scientific experiment. Fisher's approach to information measurement reached a wider scientific audience through his influential book *The Design of Experiments*, which was published in 1935[82]. Thus, information as a measurable quantity was first introduced in classical statistics in connection with scientific experimentation. Shortly after, it appeared in the pioneering studies referred to earlier in signal transmission theory. To these studies, we should add the early work of the physicist Dennis Gabor on the "theory of communication". Gabor wanted to devise a method of signal representation, which would combine the standard descriptions of a waveform as a time function and a frequency function. In other words, he wanted to use time and frequency as the co-ordinates of a two-dimensional model of signal analysis. But this was a rather challenging task. The definition of both time and frequency involves a certain degree of uncertainty. Moreover, between the two uncertainties (Δt and Δf, respectively) there is a reciprocal relation, which means that "t and f cannot be simultaneously defined in an exact way". At this point, Gabor could not fail to notice the analogy with Heisenberg's uncertainty principle, which states that it is not possible to define exactly the position and the momentum of a particle at the same time[83]. In the case of signal analysis, the particular relation between Δt and Δf called for a representation method based on a specific type of diagram, called "information diagram", which allowed for depicting the independent data that an instrument could obtain from a

[82] See Fisher (1935).
[83] For more on Heisenberg's uncertainty principle, see Beiser (2003, 108-114).

given signal. The data were represented by small rectangles with dimensions Δt and Δf. The smallest possible rectangles corresponded to a kind of elementary signals. Each such rectangle was taken as representing a single datum or "one elementary quantum of information" called "logon". All other (complex) signals could be expanded into a set of elementary signals thereby being represented by a number of logons (Gabor 1946, 435). Gabor arrived at his logon by considering the fundamental engineering problem of communication from the broad perspective of waveform analysis. In that way, he devised a measure of information with a general applicability. Gabor himself was particularly interested in the application of the concept of information to the theory of light[84].

Reciprocally related uncertainties were also the point of departure for the British physicist Donald MacKay, who sought to integrate the information measures devised by Fisher, Gabor and Shannon into a wider framework. Like Fisher, MacKay approached the problem of information measurement from the point of view of scientific experimentation. During his wartime research on radars for the British Admiralty, MacKay was faced with the problem of the physical limits to accurate measurement. An especially interesting aspect of this problem had to do with a reciprocal uncertainty relation similar to that studied by Gabor at about the same time. MacKay (1969, 1) noticed that the physical limits to accuracy "seemed to be related in a complementary way, so that one of them could be widened only at the expense of a narrowing of another". He was thereby led to conclude that the "art of physical measurement seemed to be ultimately a matter of compromise, of choosing between reciprocally related uncertainties" (ibid.). In this case, too, the analogy with the problem of the limits to accurate measurement in quantum mechanics was obvious, and MacKay drew on Heisenberg's principle in his attempt to find some sort of invariance amidst the various reciprocal uncertainties. In quantum mechanics, the relation between the uncertainty Δx in the position of a particle and the uncertainty Δp in its momentum is given by the mathematical expression $\Delta x \Delta p \geq \frac{\mathrm{h}}{4\pi}$, where h is Planck's constant. Obviously with that relation in mind, MacKay calculated an analogous product for different pairs of uncertainty limits and obtained two kinds of invariants, each taken as

[84] See e.g. Gabor (1961).

representing “an irreducible limiting factor of experimentation” called “quantum of information” (MacKay 1969, 2). The difference between the two kinds of invariants stemmed from the fact that they were obtained from two different groups of limits. The limits of the first group were calculated *a priori*, that is, they were independent of the measurement performed. The limits of the second group, however, were calculated a posteriori and as such depended on the actual measurement. Thus, it seemed that a ‘quantization of information’ in scientific experimentation should take into account two distinct levels. On the one hand, there was the level of measurement design and concerned the logical categories (or dimensions) used for grouping the observed phenomena. On the other hand, there was the level of the observed world and concerned the number of events (or the ‘weight of evidence’) represented in the measurement. For these levels, two different types of information unit were accordingly defined. The structural units corresponded to the level of the logical categories of measurement, and the metrical units corresponded to the weight of evidence. MacKay argued that Gabor’s measure of information belonged to the first type, whereas Fisher’s measure of information could be subsumed under the second type. Following Gabor, MacKay (1969, 4-5) termed “logons” the structural units; the metrical units were termed “metrons”.

Logons and metrons seemed suitable for measuring information in scientific experiments, but there remained a vast space of human activity that involved an astonishing variety of other kinds of communication processes. For MacKay, there was a fundamental difference between the two fields. Both physical observation and communication involve the use of some sort of representations. However, in communication “the representation produced is (or purports to be) a *replica* of a representation already present to… the sender”, whereas in scientific observation “the goal is the making of a *new* representation” (MacKay [1951] 1969, 42-43; emphasis in the original). In information-theoretical terms, communication comprises “any situation in which what is observed is thought of as specifying one out of an ensemble of preconceived possibilities” (MacKay [1951] 1969, 43). In such cases, information measurement does not have to do with logical categories or observed events but with the choices made from a fixed set of possibilities. Thus, besides its structural and metrical aspects, ‘information content’ appeared to have also a “selective” aspect, as MacKay called it, for which an appropriate measure was that devised by Shannon. Through this synthesis, MacKay tried to show that the approaches of Fisher, Gabor and Shannon were in fact complementary. They did not offer rival measures of information, but each concerned specifically one of the main aspects of 'information content'. MacKay understood information theory quite differently from Shannon. He considered it a nascent interdisciplinary field whose subject matter "could be said to be the making of representations" (MacKay [1951] 1969, 42) and, as such, it extended beyond the confines of control and communication engineering. MacKay's papers during the 1950s were, in fact, part of an ongoing debate on both sides of the Atlantic over the potential applications of the statistical approach to signal transmission and reception in an array of disciplines that ranged from physics and neurophysiology to psychology and linguistics. That debate reflected developments that left an indelible mark on the character and orientation of postwar science. For the present study, the issue of information theory is of special importance, because it is intimately connected with the introduction of the term "code" into postwar linguistics. In order to understand exactly how that word acquired a place in the terminology of linguistics and came later to designate a new concept, we need to examine more closely the influence of the statistical study of information on the theory of language.

CHAPTER 5

The Pursuit of a Unified Theory of Control and Communication

Shannon’s mathematical theory of signal transmission and Wiener’s cybernetic vision soon reached a varied scientific audience. The statistical approach to information measurement seemed to offer a much promising instrument for the construction of general models applicable to both inanimate structures and living organisms. For some social scientists, in particular, this statistical approach was expected to bring a mathematical rigor to the study of society and culture. Early on in the West, information theory and cybernetics were seen as providing a space for interdisciplinary research that would transcend the traditional divide between the natural and social sciences. Suddenly, an uncharted territory appeared which invited explorers from both sides of the divide to work together on opening new pathways. The alluring prospect of devising a uniform description of physical, biological, psychological and social phenomena in terms of information, control, and communication motivated prominent natural and social scientists to engage in regular exchanges on an unusually broad and diversified range of topics. Such ambitious interdisciplinary collaborations, however, were not without precedence. In various countries, the World War II mobilized both natural and social scientists, some of which inevitably worked together on common projects. In the United States, various research programs of the NDRC gave social scientists the opportunity to collaborate with physicists, mathematicians and engineers. For instance, research on fire control systems funded by D-2 and Division 7[85] involved many studies on applied psychology, since the responses of human operators and their interaction with machines were of vital importance for the efficiency of fire control systems[86].

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[85] In June 1941, the Office of Scientific Research Development (OSRD) was established. It incorporated the NDRC together with other committees. As a result, the latter was reorganized and its original four divisions were replaced by seventeen new ones. Division 7 was the successor of D-2 and was responsible for fire control. For more, see Mindell (2002, 197-200).

[86] See Hazen (1947) for a summary of these studies.

Interdisciplinary collaborations of that kind for the purposes of national defense were also promoted by independent organizations, such as the Josiah Macy, Jr. Foundation. The Macy Foundation was established in April 1933 in New York as an organization devoted to promoting "human welfare by means of assistance to scientific medicine and improved health care" (Macy Foundation 1955, 2), focusing in particular on psychosomatic and psychosocial problems. To this end, various conferences were arranged for small groups of scientists from diverse disciplines. Progressively, the early sessions gave rise to some core groups, the members of which held regular meetings (usually once a year) on a specific topic of common interest. Each conference was also attended by a limited number of guests. These meetings evolved into an interdisciplinary network that relied on a more direct mode of communication. Rather than restricting themselves to research results that were published with the usual delay in academic journals, the scientists that attended the Macy conferences had the opportunity to share ideas and exchange experiences about projects still in progress. This mode of communication seemed suitable for research that required pioneering work in different disciplines. It was also very helpful for research conducted under extraordinary conditions, such as those prevailing during wartime. In the early 1940s, the Macy Foundation contributed to the large-scale research conducted for the purposes of national defense by arranging conferences on relevant topics. The groups on shock, bone and wound healing, adrenal cortex, and liver injury emerged from meetings held in those years (Macy Foundation 1955, 15-16). Another important group had also its origins in a meeting that took place in the midst of war.

In May 1942, Frank Fremont-Smith, the medical director of the Macy Foundation, arranged a two-day conference on "Cerebral Inhibition" for a limited number of invitees from various disciplines. Representatives of anthropology, physiology, electrical engineering, psychiatry, neurology and medicine gathered to discuss about "the physiological mechanisms underlying the phenomena of conditioned reflexes and hypnosis as related to the problem of cerebral inhibition" (Macy Foundation 1955, 20). Among the conferees were the social scientist Lawrence K. Frank, executive vice-president and executive secretary of the Macy Foundation from 1938 to 1941, the anthropologists Gregory Bateson and Margaret Mead, the neurophysiologist Warren McCulloch, the physician and physiologist Arturo Rosenblueth and the psychiatrist

Lawrence S. Kubie. The contributions of McCulloch and Rosenblueth made a distinct impression on the conferees. McCulloch presented his research with the mathematician Walter Pitts on the application of propositional logic to the description of neural activity (Kline 2015, 40). This pioneering work was published in 1943[87] and it paved the way for modeling the behavior of neural nets in analogy with the logical operations performed by digital machines. On his part, Rosenblueth outlined his recent discussions with Wiener and Bigelow on the neurophysiological implications of the research that the latter two conducted on negative feedback and prediction for fire control systems. The main purpose of those exchanges was "to identify in a behaviorist spirit some of those aspects of what organisms do that can be analyzed in terms of what certain analogous machines do" (Heims 1991, 15). Yet, their approach departed from classical behaviorism in that it concerned purposeful behavior and was based on a notion of circular rather than linear causality.

The prospect of a unified mathematical model of machines and living organisms seemed exciting, especially to the representatives of the social sciences who were interested in its potential applications to social behavior. After the war, the Macy Foundation organized a core interdisciplinary group that would explore further the ideas presented at the 1942 meeting, especially the approach proposed by Rosenblueth. In March 1946, the first meeting on "Circular Causal and Feedback Mechanisms in Biological and Social Systems" took place in New York City. It was followed by a series of nine conferences that took place between 1946 and 1953. The members of the core group represented various disciplines, such as electrical engineering, mathematics, psychology, physiology, sociology and anthropology (Macy Foundation 1955, 20-21). Among them were Norbert Wiener, Julian Bigelow, Warren McCulloch, Walter Pitts, Arturo Rosenblueth, Gregory Bateson, Margaret Mead, as well as the mathematician John von Neumann, the philosopher Filmer S.C. Northrop, the neurophysiologist Rafael Lorente de Nó and the sociologist Paul Lazarsfeld. Prominent guests were also invited, such as Claude Shannon, Donald MacKay, Ivor A. Richards, Yehoshua Bar-Hillel, Charles W. Morris, Clyde Kluckhohn and Roman Jakobson. The core group on cybernetics was "the most widely

[87] See McCulloch and Pitts (1943).

diverse of the Foundation's conference groups, with, therefore, the most challenging problems of communication to solve" (Macy Foundation 1955, 21). The Macy conferences on circular causal and feedback mechanisms were not the only interdisciplinary meetings held at the United States from the early 1940s onwards. They were not isolated intellectual events but formed part of a large-scale reshaping process of science, in which World War II acted as a catalyst. Both the astonishing advances in control and communication engineering and their far-reaching impact on a broad range of disciplines can be seen as key aspects of that large-scale process that determined the character of science throughout the twentieth century.

The Macy conferences on cybernetics played a pivotal role in postwar intellectual exchanges in the West by promoting a specific interdisciplinary link based on the assumption that the problems of the physical, biological and social sciences could be treated in a uniform way if they were recast in terms of control and communication processes. The distinguished scientists who participated in those conferences experimented with the idea of such a uniform approach and, in doing so, they contributed significantly to the dissemination of the statistical conceptions of information and communication. However, this evolving interdisciplinary field, which came to be known as "cybernetics", was not the only 'channel' through which the aforementioned statistical conceptions reached a broader scientific audience. During the formative years of cybernetics, communication theorists began to explore more systematically the potential of Shannon's mathematical theory of communication. Soon, it was felt that Shannon's statistical approach to information measurement could be expanded and become applicable to fields other than that of communication engineering. The very prospect of such an expansion gave rise to a critical question: what was information theory? Originally, the term was mainly associated with the work of Shannon. However, in view of the early, tentative appropriations of his theory by scientists working in diverse disciplines, "information theory" came increasingly to be taken as denoting an interdisciplinary field whose boundaries remained to be specified. Thus, throughout the 1950s an ongoing debate about the scope of information theory ran parallel to the exploration of Shannon's seminal work. The intellectual effort invested in these twin purposes was principally channeled through major academic and professional settings, usually in the form of personal exchanges at interdisciplinary meetings. The published material that related directly or indirectly to those meetings was an equally important vehicle for further intellectual exchanges. Two key settings for the development of information theory were provided by the London Symposia on Information Theory and the Professional Group on Information Theory (PGIT) of the Institute of Radio Engineers (IRE).

The first London Symposium on Information Theory was held in September 1950 at the Royal Society. It was followed by three additional meetings in 1952, 1955 and 1960[88]. The PGIT was established in May 1951[89]. It published its own transactions and organized annual symposia. Both organizations played a crucial role in promoting information theory and were actively involved in the debate about its boundaries. In the first place, the first London symposium was intended to present the work of Shannon to a European audience. The initial plan changed, however, and a few months before September the organizers decided to cover a broad range of topics. Shannon contributed to the meeting with three lectures. The first one consisted of an exposition of the fundamentals of his mathematical theory of communication. The second one was devoted to the problem of coding; and the last one presented an overview of his statistical conception of information[90]. Gabor read a paper on “Communication theory and physics”. Building on his previous work on signal representation, he attempted to connect the mathematical formalism of the statistical theory of communication with the physical reality of signals. Gabor (1953b, 48) explained the necessity of making that connection as follows: “communication is the transmission of physical effects from one system to another, hence communication theory should be considered as a branch of physics. Thus it is necessary to embody in its foundations such fundamental physical data as the quantum of action, and the discreteness of electric charges”. Another physicist, MacKay, introduced an enlarged conception of information, which covered the problems of both communication engineering and scientific experimentation[91]. As explained in the preceding chapter, this conception was based on the

[88] Continuing the tradition of these historical meetings, the Kings College, London, organized the fifth London Symposium on Information Theory, which was held on May 30 and 31, 2019.
[89] In 1963, the Institute of Radio Engineers was merged into the Institute of Electrical and Electronics Engineers (IEEE) and the PGIT was renamed IEEE Information Theory Group. Its current name is IEEE Information Theory Society.
[90] See Shannon (1953a-c).
[91] See MacKay (1953b).

distinction between three types of information content (structural, metrical, and selective), to which corresponded different units of measurement (logon, metron, and bit, respectively). Further potential applications of information theory to other disciplines were also discussed. The study of the functions and behavior of human organism had a considerable share in the topics covered. Almost one third of the papers read at the symposium was about applications of information theory to psychology and neurophysiology.

In addition, some contributions served a different purpose. Rather than exploring certain possibilities of expansion toward specific fields, these papers concerned information theory itself as a distinct discipline and its place in science. In his opening speech at the symposium, Gabor (1953a, 2) spoke of the "new science of information theory" that connected "several fields of research, old and new, each with its own techniques". The mathematical theory of communication, as applied to the problems of communication engineering, occupied a central position in this evolving web of fields. However, it did not, and was not designed to, address a wide range of problems to which the scientific concept of information could be fruitfully applied. Thus, at the heart of the scientific study of information, a fundamental distinction seemed to suggest itself:

> [In] communication theory… information is supposed to be pre-existent in some mind, or at least foreseen… But the concept of Information has wider technical applications than in the field of communication engineering. Science in general is a system of collecting and connecting information about nature, a part of which is not even statistically predictable. Communication theory, though largely independent in origin, thus fits logically into a larger physico-philosophical framework, which has been given the general title of "Information Theory". It has already made some progress, and has made contact with formal logic and the mathematical theory of representation on the one hand, with epistemology on other. (Gabor 1953a, 4)

This use of the term "information theory", which became standard among British scientists, was in stark contrast to the use prevalent on the other side of the Atlantic. For most researchers in the United States, the term referred to the communication theories of Shannon and Wiener. Naturally, the discrepancy produced confusion, which made the task of defining the boundaries of the new field even more difficult. To this, we should add the lack of standard terminology. Acknowledging the problem, the organizing committee of the first symposium asked MacKay to make a glossary. Given that there was no consensus whatsoever about the basic terms of the ‘new science’, MacKay (1953a, 9) contented himself with “an attempt to collect and collate as many as possible of the terms which are in current use, and to define tentatively the ways in which they are related and the senses in which they may be interpreted without conflict”. That tentative glossary, however, did not gain wide acceptance in the following years (Kline 2015, 107). A second glossary was prepared by the neurologist John Bates, which contained physiological terms[92]. This small group of contributions with a more general purpose also included a historical sketch by the British engineer Colin Cherry[93]. In that paper, Cherry tried to give a comprehensive overview of an emerging interdisciplinary approach based on the statistical conception of information. He outlined the major developments in communication engineering, focusing in particular on the work of Shannon and his predecessors. In connection with these developments, he summarized the main points of Gabor’s work on signal representation. He discussed the parallel advances in research on control systems and computing machines, highlighting their relevance for the recent and prospective neurophysiological studies. Finally, he addressed the problem of information measurement in scientific experimentation.

It is worth noting that among the exploratory papers read at the first London Symposium on Information theory, there was a contribution by the British phonetician Dennis Fry on the relation between communication theory and linguistics. Early on, issues pertaining to language and speech appeared as topics at interdisciplinary meetings on information theory and cybernetics. In 1948, the first day of the Fifth Macy Conference on Cybernetics (April 29-30, May 1) was devoted to language. Among the guests were the linguists Roman Jakobson and John Lotz, the anthropologist Dorothy Lee, the neuropsychiatrist Eilhard von Domarus, and the semiotician Charles Morris. In the following years, there was a growing interest in topics such as the statistical aspects of language, the mechanisms of speech perception or the phonological description of natural languages. The exploration of

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[92] See Bates (1953a). For his contribution to the meeting, see Bates (1953b).
[93] See Cherry (1953).

linguistic applications of the statistical approach to communication had just begun, and it was precisely at that juncture that Fry talked about linguistic theory at the first London symposium. In his paper, Fry sought to redescribe the process of speech perception in information-theoretical terms. To this end, he portrayed the communication between two interlocutors along the lines of Shannon's model of a general communication system:

> At the opposite ends of the chain we have the mental activity of the speaker and the listener, which we may call for convenience… conceptual thinking. The ultimate aim of the speech communication is that the conceptual thinking of the listener should proceed along lines which are at least similar to those of the speaker. Intervening between the thinking of the speaker and of the listener we have a communication chain which is composed of a large number of links, and at each link we have a transformation which constitutes an operation of communication. The whole process may be divided into three main sections: the encoding of the message in the speaker, the transmission of the coded message through the medium of communication, and the decoding of the message by the listener. (Fry 1953, 120)

This is undoubtedly one of the earliest adaptations of Shannon's model for the description of the 'speech chain'. It is also one of the earliest uses of the technical term "code" for the purposes of linguistic theory. It is interesting to note that Fry's tentative model of speech retains Shannon's seminal idea of communication as a series of transformations. This notwithstanding, the two schemes differ in one essential respect: in Fry, all the elements in Shannon's model except for the message are reinterpreted in cognitive and neuropsychological terms. The information source is now the speaker, the listener being the destination. The former is at the same time the transmitter, the latter being the receiver. The cognitive and neurophysiological operations underlying speech production correspond to the encoding transformations in Shannon's model, while the respective operations underlying speech perception constitute the decoding transformations. Accordingly, the main purpose of the chain of transformations foreseen in each scheme is different. For Shannon (1948, 379) "[t]he fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point". In Fry (1953, 120), "[t]he ultimate aim of the speech communication is that the conceptual thinking of the listener should proceed along lines which are at least similar to those of the speaker". Thus, in this case there is a complete reinterpretation of Shannon's communication model in cognitive and neuropsychological terms. Fry's scheme has a special significance for the present study, for it exemplifies in a striking manner the general character of all subsequent linguistic models based on Shannon's formal representation of a typical communication system.

Within that broad framework, the production and reception of speech could be analyzed as a series of interrelated transformations taking place at successive stages. At the symposium, Fry suggested a rough way in which the analysis of speech perception, or 'decoding', might proceed. The basic idea was to divide the entire process of speech perception into stages, each of which takes as its input the output of the previous stage. For the set of operations performed at the higher levels of the central nervous system, Fry proposed an analysis in terms of a series of "scanning processes" performed at four successive stages. Each stage corresponded to a different linguistic category. The initial input is the set of "sensation patterns" produced by the impulses of the acoustic nerve. By virtue of the scanning process performed at this stage, the phonemes that make up the received message are identified. In turn, the phonemes are 'fed' as input into the second stage, at which the corresponding morphemes are identified. The scanning processes at the next two stages proceed from morphemes to words, and from words to sentences, respectively. Once the sentences are identified, "the message is assimilated to the conceptual thinking of the listener who is then aware of the 'meaning' of the message" (Fry 1953, 121). At each stage, the analyst can discern a different communication channel together with the corresponding transformative operation. Hence, at each stage a different kind of code can be discerned and, thus, that part of the process of speech perception can be portrayed as a chain of codes operating on a flow of signals. The term "code" should be understood here strictly in its technical, information-theoretical sense. It denotes any kind of transformative operation that can take place in the 'speech chain'. The type of analysis outlined by Fry entails a considerable degree of flexibility. Insofar as the stages or levels of the operations involved in speech perception are determined according to certain linguistic categories, it is possible to adapt the structure of the analysis to the categories pertaining to a given family of natural languages. Once the structure of analysis is determined, the analyst can proceed to "discover the number of codes used, the units in each code, possibly something about the probabilities associated with any given unit and lastly, a good deal about the constraints which operate on the units at each level" (Fry 1953, 122).

Fry was one of the first researchers who realized the significance of the mathematical theory of communication for experimental phonetics. At the 1950 symposium, he tried to show that Shannon's theory could enable the phonetician to arrive at a novel linguistic model of speech. Two years later, Fry and Denes described a machine for speech recognition at the second London symposium[94], which was rather limited in scope focusing mainly on communication engineering problems. A second paper on mechanical speech recognition was presented at the third symposium in September 1955[95], a meeting with an impressively broad scope. With two hundred and fifty participants from thirteen countries representing more than twelve disciplines from the natural and social sciences, the third London symposium sparked a debate over the boundaries of information theory[96]. For the chair of the PGIT Louis de Rosa, this debate was directly connected with the orientation that the Group should adopt. Thus, just two months after the third London symposium, de Rosa wrote an editorial for the December issue of the Group's transactions inviting members to express their views on the matter:

> The expansion of the applications of Information Theory to fields other than radio and wired communications has been so rapid that oftentimes the bounds within which the Professional Group interests lie are questioned. Should an attempt be made to extend our interests to such fields as management, biology, psychology, and linguistic theory, or should the concentration be strictly in the direction of communication by radio or wire? (de Rosa 1955, 2)

The next two issues of the Group's transactions published the response of the two leading figures in the field, Shannon and Wiener. In his famous editorial titled "The bandwagon", Shannon (1956, 3) expressed his reservations claiming that information theory had "become something of a scientific bandwagon" and, as a result, it had "perhaps been ballooned to an importance beyond its actual accomplishments". He thus urged "workers in other fields [to] realize that the basic results of the subject are aimed in… a direction

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[94] See Fry and Denes (1953).
[95] See Fry and Denes (1956).
[96] For a detailed report on the third London symposium, see Blachman (1956).

that is not necessarily relevant to such fields as psychology, economics, and other social sciences". While not denying that the concepts of information theory could be profitably applied to the social sciences, Shannon finally reminded that "the establishing of such applications is not a trivial matter of translating words to a new domain, but rather the slow tedious process of hypothesis and experimental verification".

In the following issue of the PGIT transactions (June 1956), Wiener approached the issue raised by de Rosa from a broader perspective. The case of information theory could be seen as an instance of the more general problem of the overspecialization of postwar science and the concomitant obstacles posed to the cross-fertilization of ideas among the various disciplines. Wiener, thus, argued for an 'open' attitude toward the prospective interdisciplinary applications of the statistical theory of communication, but on one crucial condition:

> I am pleading in this editorial that Information Theory go back of its slogans and return to the point of view from which it originated: that of the general statistical concept of communication. A message is to be conceived as a sequence of occurrences distributed in time to be considered not exclusively by itself, but as one of an ensemble of similar sequences. As such it comes under the theory of time series which is an important branch of statistical theory with a rapidly developing technique and set of concepts of its own. This theory is closely allied to the ideas of Willard Gibbs in statistical mechanics. What I am urging is a return to the concepts of this theory in its entirety rather than the exaltation of one particular concept of this group, the concept of the measure of information into the single dominant idea of all. (Wiener 1956, 48)

Like Shannon, Wiener did not preclude the possibility of profitable applications of information theory outside the fields of control and communication engineering. But he did insist on the necessity of a thorough understanding of its concepts and methods as a pre-requisite of a substantial contribution to disciplines other than those for which it was designed in the first place. In other words, if researchers in diverse disciplines wished to obtain genuine insights in their own fields by using the statistical theory of communication, they had to approach their particular objects of study from the perspective of the theory of time series. In that way, they would be led to perform a double experimentation, as it were. On the one hand, they would subject the statistical method taken from control and communication engineering to a new field of study; on the other hand, they would subject their particular problem or phenomenon to a novel, statistical method. Under that essential condition, information theory could indeed be shown to have a transdisciplinary potential.

It is difficult to estimate the precise impact of those editorials on the scientific community. At any rate, it seems that the discussion that de Rosa sought to initiate with respect to the boundaries of information theory did not proceed much further. By the mid-1950s, the new, statistical ideas about communication had already covered a considerable part of their irregular course through the natural and the social sciences, and much of their initial force had crystallized into novel approaches with varying prospects. Among the diverse physical, biological and social phenomena that came to be seen from a statistical point of view, language and speech occupied a special position. As noted above, language and speech topics were introduced quite early at the interdisciplinary meetings on cybernetics and information theory. It is indicative that a few months before the first London symposium, the Acoustical Society of America, the Carnegie Project on Scientific Aids to Learning at M.I.T., and the Psycho-Acoustic Laboratory at Harvard University organized a conference on speech communication at M.I.T. Among the participants were Norbert Wiener, the electrical engineer Robert Fano, the linguists Martin Joos and John Lotz, the German phoneticians Paul Menzerath and Werner Meyer-Eppler, the biophysicist Walter Rosenblith, and the psychologist George Miller. The majority of the twenty-four papers read at the meeting dealt with topics that related to the physical and neurophysiological aspects of speech. That line of research was pursued further during the following years and led into important technological innovations. The aforementioned machine for speech recognition described by Fry and Denes was a notable example.

The investigation of language and speech from the point of view of information theory involved research that cut across the divide between the natural and the social sciences. Besides acoustics and neurophysiology, disciplines such as linguistics or psychology had a significant share in the applications of information-theoretical ideas to the study of verbal communication. In psychology, such applications appeared quite early. The first half of the 1950s saw an increasing number of important studies that applied the statistical method of information measurement to experiments of various types[97]. These studies formed part of a wider stream of intellectual activity in the social sciences, which produced a series of foundational works in the mid-1950s. These "were works that started long, productive lines of research, that received thousands of citations… and that introduced terms – information, system, stress, organization, process– into the broader culture beyond academia" (Crowther-Heyck 2015, 82). The pioneering work in experimental psychology during that period exerted a far-reaching impact on the development of the field. The psychologists that endeavored to explore the potential of the mathematical theory of communication soon faced the challenge of reintroducing mind as a legitimate object of study in a discipline dominated by the doctrine of behaviorism. From within that behavioristic discipline, a novel approach to the study of mind began to evolve that eventually led to the rise of a new field of study, known as cognitive science. Information theory and the nascent computer science were two major sources of influence of the new approach to mind, which rested on a structural analogy between the human brain and the computer[98]. One key aspect of that critical turn in the history of psychology concerned the application of the statistical conception of communication to the analysis of verbal behavior. A detailed survey of this aspect lies outside the scope of this book. For the purpose of the present chapter, the discussion will be confined to the seminal work of the psychologist George Miller. There are two main reasons for this choice. First, Miller "literally embodies much of the history of cognitive psychology and cognitive science"; thus, a survey of his groundbreaking studies during the 1950s can give an insight into the main ideas behind the new approach to language and cognition. Secondly, Miller was perhaps the first scholar who popularized the technical term "code". In a series of influential works published in the first half of the 1950s, Miller used "code", "encoding", "decoding" and "recoding" as descriptive terms for a variety of processes pertaining to cognition and verbal behavior. In that way, he paved the way for establishing these words as legitimate technical terms in the scientific study of language in its diverse aspects (physical, neurophysiological, psychological etc.). This terminological appropriation

[97] See e.g. Aborn and Rubenstein (1952), Frick and Miller (1951), Garner and Hake (1951), Hick (1951).
[98] For more on the significance of this analogy for the development of experimental psychology, see Crowther-Heyck (1999). This study is used as a guide for the discussion that follows.

played a crucial role in the emergence of the semiotic concept of code, for it allowed for a 'critical mass' of scientific uses to be formed, which was absolutely necessary for the concept formation analyzed in this book.

In Shannon's seminal work published in 1948, Miller saw a powerful instrument for reforming experimental psychology as a behavioristic discipline. The first step toward that direction was made in 1949 with the article "Statistical behavioristics and sequences of responses", co-authored with Frederick Frick. The article concerned an issue of special significance for the experimental psychologist: the predictability of the subject's responses in a psychological experiment. The authors sought to develop a quantitative measure of predictability based on the average uncertainty U_s of a given series of responses. Miller and Frick (1949, 320) used Shannon's logarithmic formula in order to measure "the uncertainty with which a response can be predicted when only the preceding s-1 responses are known". The "uncertainty per response" U_s is calculated on the assumption that the various alternative responses are non-equiprobable. The corresponding calculation for equiprobable alternatives yields the maximum uncertainty U_{max}. Accordingly, the ratio of U_s to U_{max} yields the relative uncertainty U. An index of predictability (or "index of behavioral stereotypy", as the authors called it) can be obtained when the relative uncertainty is subtracted from 1. In that way, it is possible to calculate the predictability of the subject's responses using Shannon's logarithmic formula for information measurement. A distinctive characteristic of Miller and Frick's approach is that it focuses on response sequences rather than isolated responses. Thus, it allows for predicting the frequencies of the diverse "courses of action" that such sequences determine (Miller and Frick 1949, 313-314).

It is interesting to note that in this early paper[99], the statistical conception of information was introduced in connection with scientific experimentation. As mentioned in the previous chapter, MacKay showed a similar concern for the measurement of information in scientific experiments. However, whereas the latter focused on the observation of physical phenomena, Miller was interested in the observation of experimental subjects and

[99] Kline (2015, 139) argues that Miller and Frick's 1949 article "is generally recognized as the first application of information theory to psychology".

the correlation between stimuli and responses. In information-theoretical terms, this correlation could be seen as the result of a transformation performed within a communication system, in which the subject of the experiment would be the communication channel. The stimuli and the responses could be taken as the input and the output information, respectively, whereas the correlation between them would be the amount of information transmitted by the system. By establishing these analogies, the experimenter would be able to use the statistical tools of the mathematical theory of communication in order to manipulate the amount of input information and determine the impact of this intervention on the correlation between stimuli and responses by measuring the amount of transmitted information (Miller 1956, 82).

The 1949 article was soon followed by a series of papers outlining various applications of information theory to the study of cognition and language[100]. Besides such short studies, Miller published in 1951 his influential *Language and communication*, in which he sought "to summarize for students of psychology the results of scientific studies of language and communication" (Miller 1951, 1). In that book, which was instrumental in popularizing information theory in the social sciences, Miller actually tried to bring together the scientific study of language and the statistical theory of communication. To this end, he sketched a purely formal approach, in which speech was taken strictly as vocal behavior and linguistic signs were treated as stimuli of arbitrary nature. The arbitrariness of verbal stimuli meant that the relation between a linguistic sign and its *representatum* was not a causal but a conventional one. Speech as vocal behavior is considered to be intrinsically variable and, as such, it "is neither completely predictable nor completely unpredictable; it is in an intermediate position where it is possible only to say that, *on the average*, certain things will happen. Statistics is the language of averages, and so is the proper language for a science of communication" (Miller 1951, 8; emphasis in the original). In that way, an object of study amenable to statistical description was delineated, and that allowed for introducing the concepts and the methodology of information theory to the study of language. For the purposes of Miller's exposition, the communication model of Shannon became the "idealized communication system" that represented the basic structure and the

[100] See e.g. Miller (1950), Miller and Selfridge (1950), and Miller et al. (1951).

main functions of all communication processes irrespective of whether they are mediated by mechanical devices or not. An interesting implication of the generalization of Shannon's scheme was that the components and functions, which originally referred to electromechanical devices and operations, could thenceforth be taken as representing organs of the human body and neurophysiological processes. In the case of verbal behavior, for example, the speaker is the source of information and the listener is the destination. Accordingly, the transmitter "is the human speech machinery [that] operates upon the information and changes it into a pattern of sound waves [and the] ear is a receiver that operates upon the acoustic waves to convert them into nervous activity" (Miller 1951, 7). The expansive reinterpretation of the operations associated with the transmitter and the receiver brought about a significant terminological shift. The terms "encoding" and "decoding", which Shannon's mathematical theory used to denote the respective operations, entered the study of verbal behavior and acquired a new meaning as technical terms.

The terminological shift discussed here in connection with Miller's psycholinguistic application of information theory had a direct impact on the semantic development of the word "code". As a technical term in communication engineering, "code" had the general sense of transformational algorithm, which also encompassed the codes used for the purposes of secrecy. Such a transformational element is materially indispensable for communication systems. It is also logically indispensable for a statistical theory that relies on a conception of communication as a chain of transformations. In Shannon's communication model, the element of code forms part of the mechanisms responsible for the manipulation of signals at both ends of the transmission chain. As such, it does not appear as a separate component in the representation of a typical communication system but it is rather implied in the transmitter and the receiver. The partial appropriation of the statistical theory of communication for the purposes of the scientific study of language brought gradually code into the fore, highlighting it as a distinct element in the communication process. This crucial shift may be said to have been initiated in Miller's influential textbook published in 1951 and it culminated five years later in Jakobson's model of the functions of language, which will be discussed in detail in chapter 7. In the introduction of *Language and communication*, Miller devoted a short section to the typical structure of the “idealized communication system”, which derived from Shannon’s linear model. Miller did not add the element of code as a sixth component, but in discussing the operations of the transmitter and the receiver, he remarked:

> We usually think of codes in terms of secrets and international intrigue, but here we shall speak of codes in a much more general sense. Any system of symbols that, by prior agreement between the source and destination, is used to represent and convey information will be called a code. Thus, in the sense we use the word here, the French language is one code and the German language another. Spoken English is the code that will interest us primarily, but similar considerations apply for all codes. (Miller 1951, 7)

Taken out of context, this oft-quoted definition might seem to assimilate code with language. However, in the behavioristic approach expounded in this book, “meaningful aspects of verbal behavior are… ignored, and the symbols are seen as simple patterns of muscular twitches, or agitations of the air molecules, or patterns of squiggles on the page” (Miller 1951, 2). Thus, it would be erroneous to assume that here “code” is proposed as a fully equivalent term for language. Rather, it is used as a technical term denoting any pattern of stimuli that can be used for the purposes of communication. In 1957, Colin Cherry offered a similar and equally influential definition in his widely read book titled *On human communication*, where “code” was used in the sense of “an agreed transformation, usually one to one and reversible, by which messages may be converted from one set of signs to another” (Cherry 1957, 7). Here, the word “sign” must also be understood in a technical sense.

In both cases, code was defined in connection with two interrelated necessary conditions of signal transmission. The first condition concerned the existence of a minimum set of conventions or a shared orientation, however rudimentary, with respect to the use of certain physical events as signals in a communication process. Miller referred to a “prior agreement between the source and destination” and Cherry spoke of an “agreed transformation”. An agreement of this kind is indeed imperative in order to decode properly the transmitted signals and retrieve the original message. The second condition invoked in these definitions concerned the transformational operations that lie at the heart of all signal exchange. Cherry referred explicitly to the conversion of messages “from one set of signs to another”, thus highlighting the crucial role of codes in signal transformation.

Miller, on the other hand, pointed to this role in a rather indirect way, insofar as he spoke of a "system of symbols" used to "represent and convey information". Yet, from the point of view of an approach that treats communication as a chain of transformations, both the representation and the transmission of information entail a series of mappings between different kinds of elements. Thus, transformation is the key notion for Miller, too, although code in this case is defined as a "system of symbols" rather than an "agreed transformation".

With a hindsight, we could say that the early definitions discussed above seemed to foreshadow the typical semiotic definition of code offered much later. Miller's definition contained the key notion of sign system, whereas Cherry used another key notion for the study of signs: the transformational rule. We should remember, however, that both Miller and Cherry restricted the scope of their definitions to the non-semantic aspects of communication. They were not concerned with signs in the full sense of the word but rather with signals. Nevertheless, it could be said that their definitions did provide the building blocks for a general definition of "code" as a term for a distinct semiotic concept. For the moment, "code" remained a technical term of information theory, but the range of phenomena to which it could be applied was significantly expanded. It thus entered the study of language by two complementary routes: experimental psychology and structural linguistics. George Miller was perhaps the first who introduced the term in the study of verbal behavior and provided an early definition. Roman Jakobson, on the other hand, was the one who established "code" as a linguistic term and used it as a word for a new concept.

CHAPTER 6

Code as a Linguistic Term

George Miller played a decisive role in the dissemination of the statistical conception of communication across the social sciences. With his exploratory research, his explanatory papers and the influential textbook he published in 1951, he exerted a major influence on psychologists and other social scientists as regards the application of the tools of the mathematical theory of communication to the study of language and cognition. Miller was perhaps one of the first scientists outside the field of electrical engineering who read Shannon's famous paper, as originally published in 1948 in *The Bell System Technical Journal*, and offered, in the article he co-authored with Frick in 1949, one of the earliest expositions of Shannon's measure of information for a non-engineering audience. A few months after Miller and Frick delivered their article to the *Psychological Review* for publication[101], Weaver published the first popularizing account of the mathematical theory of communication in *Scientific American*[102]. An expanded version of that text appeared a little later together with Shannon's 1948 paper in a single volume titled *The mathematical theory of communication*. The book was intended to make Shannon's theory known to a wider audience, especially in the social sciences, and Weaver's account served primarily the purpose of providing an accessible introduction to those not familiar with mathematics and communication engineering. However, the simplified exposition offered in that introduction was intertwined with a particular interpretation, according to which the scope of the theory extended beyond the non-semantic aspects of communication.

Weaver (1949b, 97-100) acknowledged that Shannon's theory was specifically designed to account for the material aspects of communication and that the key notion of information should not be confused with the meaning of individual messages. Yet, he firmly believed that "the mathematical theory is exceedingly general in its scope,

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[101] The manuscript was received by the journal on May 13, 1949.
[102] See Weaver (1949a).

fundamental in the problems it treats, and of classic simplicity and power in the results it reaches" (Weaver 1949b, 114). Thus, it seemed that the challenge for the social scientist was not to devise a general theory of communication taking Shannon's statistical theory as a point of departure, but rather to 'extract' the former from the latter, making the necessary modifications. Weaver's exposition accompanying the republished paper of Shannon was actually devoted to providing the rough guidelines for uncovering the general communication theory contained therein. A broad definition of communication and a distinction between three interrelated levels (a material, a semantic, and a pragmatic one) formed the backbone of this exposition.

It would be interesting to dwell a little on the exact wording that Weaver used in order to define communication and introduce its distinct levels. In the opening paragraph of the exposition, it is stated that the term "communication" is used

> in a very broad sense to include all of the procedures by which one mind may affect another. This, of course, involves not only written and oral speech, but also music, the pictorial arts, the theatre, the ballet, and in fact all human behavior. In some connections it may be desirable to use a still broader definition of communication, namely, one which would include the procedures by means of which one mechanism… affects another mechanism (Weaver 1949b, 95).

Insofar as Shannon's communication model applies to any kind of signal exchange, irrespective of whether it is performed by machines, human beings, or both, it seems at first sight reasonable for Weaver to adopt an equally general conception of communication in his exposition. However, the "very broad sense" referred to above means something more than an expansive understanding of communication. It implies a crucial shift in focus, indicative of the particular way in which Weaver interpreted the mathematical theory of communication. Shannon conceived of communication as a series of transformations (amenable to mathematical description) and excluded all semantic considerations from his analysis. He thus set a boundary, which Weaver so easily crossed by subsuming under the category of communication "all the procedures by which one mind may affect another". This reference to mind has a special significance, in that it foreshadows an interpretation of Shannon's theory predominantly psychological in character.

The wording that Weaver used in order to introduce the different levels of communication is equally revealing:

> Relative to the broad subject of communication, there seem to be problems at three levels. Thus it seems reasonable to ask, serially:
>
> LEVEL A. How accurately can the symbols of communication be transmitted? (The technical problem.)
>
> LEVEL B. How precisely do the transmitted symbols convey the desired meaning? (The semantic problem.)
>
> LEVEL C. How effectively does the received meaning affect conduct in the desired way? (The effectiveness problem.) (Weaver 1949b, 95-96)

It is evident that the definitions of the semantic and the effectiveness problems are modeled on the definition of the technical problem as derived from Shannon. Concretely, the semantic problem is said to concern "the identity, or satisfactorily close approximation, in the interpretation of meaning by the receiver, as compared with the intended meaning of the sender" (Weaver 1949b, 96). Similarly, the effectiveness problem concerns "the success with which the meaning conveyed to the receiver leads to the desired conduct on his part" (Weaver 1949b, 97). At this point, it is worth quoting again what Shannon exactly wrote in connection with engineering problem of communication:

> The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently the messages have *meaning*; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem. (Shannon 1948, 379; emphasis in the original)

It is surely no coincidence that Shannon's definition in terms of an exact or approximate reproduction is directly followed by his famous statement about the exclusion of the semantic aspects of communication from his theory. In ordinary language, people usually talk about how accurately the words they utter or hear convey certain meanings, but such accuracy cannot be defined in quantitative terms and is definitely of a different order compared with the accuracy with which a signal may be reproduced at the receiving end of a communication system. In defining the semantic and the effectiveness problems along the lines of the definition of the technical problem, Weaver once again crossed easily the boundary drawn by Shannon. In that way, he suggested an analogy between the three levels, which nevertheless had to be demonstrated than simply postulated.

The definitions and assumptions presented in the opening section of Weaver's account provided the background for the simplified exposition of Shannon's theory in the following section. The concluding section was supposed "to review the situation, and see to what extent and in what terms the original section was justified… in indicating that the interrelation of the three levels is so considerable that one's final conclusion may be that the separation into the three levels is really artificial and undesirable". Unfortunately, Weaver did not actually address the issue of this interrelation. He did not specify "to what extent and in what terms" the mathematical theory of Shannon could be applied to the semantic and pragmatic aspects of communication, nor did he elucidate how the three levels of communication related to each other. Weaver's argument seemed to amount merely to a reiteration of an undeniable fact: "This is a theory so general that one does not need to say what kinds of symbols are being considered – whether written letters or words, or musical notes, or spoken words, or symphonic music, or pictures. The theory is deep enough so that the relationships it reveals indiscriminately apply to all these and to other forms of communication" (Weaver 1949b, 114). It is true that Shannon devised a uniform mathematical description of signal transmission. This fact, however, does not necessarily entail that with some minor modifications or additions an analogous uniform description of a wide variety of meaning-assigning processes can be obtained. The transition from the technical to the semantic and pragmatic levels is not as straightforward as Weaver seemed to imply in his account[103], and it is arguably questionable whether a full statistical description of meaning can be devised by strict analogy to Shannon's description of signal transmission. At any rate, Weaver offered no genuine insights as regards the interrelation between the three levels of communication and failed to indicate a promising path, along

[103] See e.g. Weaver (1949b, 115; emphasis in the original): "Thus when one moves to levels B and C, it may prove to be essential to take account of the statistical characteristics of the destination. One can imagine… another box labeled 'Semantic Receiver' interposed between the engineering receiver… and the destination. This semantic receiver subjects the message to a second decoding, the demand on this one being that it must match the statistical *semantic* characteristics of the message to the statistical semantic capacities of the… receivers".

which the transition from the first level of analysis to the next two could proceed. In light of these shortcomings, Weaver's (1949b, 116) concluding remark, that "one is now, perhaps for the first time, ready for a real theory of meaning", was unjustified.

Despite its highly speculative character, Weaver's exposition exerted a pervasive influence across the social sciences. For decades, it was an essential reading for students of language and communication approaching the work of Shannon for the first time (Ritchie 1986). It reached a wide scientific audience as a text inseparable from Shannon's 1948 paper, and played a decisive role in shaping a guiding perspective for the reception of the mathematical theory of communication among social scientists. More importantly, it inspired prominent scholars, such as Roman Jakobson and Claude Lévi-Strauss, who were instrumental in applying cybernetic ideas and information-theoretical tools to the study of language and culture. In this complex, multilayered process of dissemination and appropriation of concepts, methods and perspectives, Jakobson was undoubtedly a leading figure. When he arrived in New York in June 1941, he had already a record of significant contributions to the study of language and literature. Among his multifarious research interests, the construction of a general theory of language as a semiotic system stood out as an enduring concern throughout his career. In order to accomplish this task, Jakobson embarked on a long-standing "quest to uncover the function and structure of sound in language" (Waugh 2002, 1). His groundbreaking research in phonology unfolded in four major stages, starting in the 1920s and 1930s with his work on the structural patterns of phonological systems in collaboration with Nikolai S. Trubetzkoy. The second stage began in the late 1930s, with Jakobson gradually developing "the notion of binary distinctive features as the minimal building blocks of language" (Waugh 2002, 2). The next stage (1950s and 1960s) was dedicated to the "acoustic definitions" of these minimal units and to the idea of "a small set of features which underlies the phonological systems of all the languages of the world" (ibid.). In the final stage (1970s), a special focus was placed on the "importance of functional concerns in the analysis of sound" (ibid.).

Jakobson's first decade in the United States marked the transition from the second to the third stage of his work on the 'sound shape of language' and, at the same time, it coincided with his initiation into cybernetics and information theory. He was perhaps one of the first few representatives of the social sciences who had contacts with some of the founding members of the Cybernetics Group and, thus, he had the opportunity to follow the development of the new interdisciplinary field from its early stages. As already mentioned, in 1948 Jakobson attended the Fifth Macy Conference as a guest together with Lotz, Lee and Morris. Soon thereafter, he developed an increasing interest in the mathematical aspects of language and drew selectively on cybernetics and information theory in his attempt to provide a rigorous description of phonological systems. Jakobson turned to the recent advances in communication engineering seeking not only sophisticated tools for his phonological analyses but also a solid, mathematical foundation for linguistics. This phase in the development of his linguistic thought has various aspects of special significance for the history of structuralism, some of which should be further explored. It would be beyond the scope of this monograph to engage in a detailed exposition of that particular issue. Instead, in this chapter reference will be made to some key texts written during this transitional period, in which Jakobson introduced part of the terminology and the tools of information theory into the description of natural languages. Among the terms introduced, “code” assumed an increasingly broad role, and that caused some reactions by prominent structuralist linguists. However, the term eventually found its place in the terminology of linguistics. More importantly, it also came to designate a distinct semiotic concept. With the part of Jakobson’s work that will be discussed here and in the following chapter, the analysis enters the critical phase of the emergence of the semiotic concept of code.

Jakobson’s encounter with members of the Cybernetics Group gave him the opportunity to make his first contact with the statistical approach to communication and witness its growing impact on scientists from diverse disciplines. The Fifth Macy Conference offered him the useful experience of participating in a lively exchange of ideas with prominent figures, but it also furnished him with valuable information ‘from inside’ about the evolving cybernetic movement. At the business session of the Eighth Conference on Cybernetics in 1951, Margaret Mead reported that while preparing the Fifth Conference, she and Gregory Bateson spent several hours with Jakobson, Lee and Lotz in order to explain the purpose and the procedure of the conference and provide an overview of the preceding meetings[104]. Thus, when Wiener's *Cybernetics* was published in October 1948, Jakobson had already been exposed to the engineering ideas about communication. That book made a profound impression on him. On February 24, 1949, he wrote to Wiener:

> At every step I was again and again surprised at the extreme parallelism between the problems of modern linguistic analysis and the fascinating problems which you discuss. The linguistic pattern fits excellently into the structures you analyze and it is becoming still clearer how great are the outlooks for a consistent co-operation between modem linguistics and the exact sciences. (Norbert Wiener Papers, MC 22, box 6-96. M.I.T., Institute, Archives and Special Collections. Quoted in Kay (2000, 88))

On February 14, 1950, he expressed a similar enthusiasm for *The Mathematical Theory of Communication* to Warren Weaver[105], and a week later he wrote to Charles Fahs, director of the Humanities Division at the Rockefeller Foundation:

> I fully agree with W. Weaver that "one is now, perhaps for the first time, ready for a real theory of meaning," and of communication in general. The elaboration of this theory asks for an efficacious cooperation of linguists with representatives of several other fields such as mathematics, logic, communication engineering, acoustics, physiology, psychology and the social sciences. Of course when this great collective work will be fulfilled it will mean a new epoch indeed. (Roman Jakobson Papers, MC 72, box 6-37. M.I.T., Institute, Archives and Special Collections. Quoted in Geoghegan (2011, 110))

Jakobson accompanied his vision about "this great collective work" with a proposal for a research project on the analysis of the Russian language, which would involve the Research Laboratory of Electronics at M.I.T. and the Psycho-Acoustic Laboratory at Harvard University. The project was probably intended as a concrete contribution to the aforementioned "efficacious cooperation" using some tools of Shannon's mathematical theory for the description of the Russian phonological system. Jakobson finally succeeded in securing a five-year grant of $50,000 from the Rockefeller Foundation (Geoghegan 2011, 110-111). Part of the results of that research was published in his article "Toward

[104] See "Business Session: Eighth Conference on Cybernetics", Warren S. McCulloch Papers, series II: folder "Josiah Macy, Jr. Foundation Meeting #10", American Philosophical Society. The content of the folder is available at the following address: https://diglib.amphilsoc.org/islandora/object/text:188702 (accessed: November 11, 2019).
[105] Roman Jakobson Papers, MC 72, box 6-37. M.I.T., Institute, Archives and Special Collections.

the logical description of languages in their phonemic aspect", co-authored with Colin Cherry and Morris Halle.

When Jakobson attended the Fifth Macy Conference, his linguistic research was devoted to the quest for the minimal constituents of language. We cannot know the exact content of the paper that he read before the members of the Cybernetics Group and their guests, since no proceedings were published for the first five conferences. Yet, there is a summary report among the Warren S. McCulloch papers that sheds some light on Jakobson's contribution[106]. According to that report, the meeting opened with a "joint presentation" by Jakobson and Lotz about the status of the linguistic research on the "ultimate units of language". Jakobson and Lotz introduced the units of morphemes and phonemes, and discussed the role of binary oppositions in the construction of the latter. Given the procedure of the meeting and the kind of audience they addressed, the two linguists presumably confined their presentation to the basics of linguistic distinctions and classifications. Two months later, Jakobson provided a more elaborate exposition at the Sixth International Congress of Linguists in Paris. There, he talked about the dual nature of language and underscored the fact that the "analysis of any linguistic sign whatever can be performed only on condition that its sensible aspect be examined in the light of its intelligible aspect (the *signans* in the light of the *signatum*) and vice versa" (Jakobson [1949]1971, 104; emphasis in the original). Sound and meaning, the "sensible" and the "intelligible" aspects of language, are always structured in a particular way in each linguistic system. The task of the linguist, as envisaged by structuralists, is to shed light on the structures behind linguistic phenomena, to discover the grammatical and phonological patterns underlying linguistic systems. But in order to accomplish this task, the linguist must 'dissect' the mass of language down to the minimal units at each level. As far as the "sensible" aspect of language is concerned, the linguist must reach the 'lower level of semiosis', at which the units discerned perform only a discriminative function. These units, termed "phonemes", can be further analyzed into bundles of concurrent distinctive features, which are structured as binary oppositions (e.g., grave vs acute etc.).

[106] See "Summary of Macy Meeting", Warren S. McCulloch Papers, series II: folder "Josiah Macy, Jr. Foundation Meeting #5", American Philosophical Society. The content of the folder is available at the following address: https://diglib.amphilsoc.org/islandora/object/text:181213 (accessed: November 11, 2019).

In that way, linguistic analysis can reach a point at which "[a]ll differences of phonemes in any language can be resolved into simple and undecomposable binary oppositions of distinctive features. Hence all phonemes of any language can be fully dissociated into further indivisible distinctive features. The pattern of phonemes… can be reduced to a net of few distinctive features" (Jakobson [1949]1971, 106). During the period discussed here, this "system of distinctive features and of rules governing their arrangement into bundles and sequences" (Jakobson [1949]1971, 111) was an object of study of special importance for Jakobson, who illustrated his method by analyzing with Lotz the phonological system of the French language[107].

In the 1950s, Jakobson incorporated elements of information theory into his linguistic analyses. Rather than simply borrowing technical terms and models, he sought to engage in a full cooperation of linguistics with communication engineering in which communication apparatuses and scientific instruments would play a key role[108]. His interest in twentieth century communication technology dates back to the early 1940s. In his first course at the École Libre des Hautes Études in New York, Jakobson ([1942a]1988, 330-331) referred to the new devices and instruments for the analysis and synthesis of speech, and highlighted their importance for linguistic research. By the end of the 1940s, ideas and devices, models and technological equipment, laboratory techniques and scientific practices, were integrated into a new approach to linguistic analysis, based on a peculiar fusion of structuralism with cybernetics and information theory[109]. An early application of that approach was provided by Jakobson in his famous *Preliminaries to speech analysis*, first published in 1951 and co-authored with the engineer Gunnar Fant and the linguist Morris Halle. This book, which made an important contribution to postwar linguistics, reaffirmed the crucial role of semantic criteria in the description of linguistic phenomena and presented a detailed analysis of distinctive features supported by the Acoustics Laboratory and the Research Laboratory of Electronics at M.I.T. The analysis

[107] See Jakobson and Lotz (1949).
[108] For a detailed account of this aspect of Jakobson's linguistic theory, see Geoghegan (2012, 97-138).
[109] In order to capture this fusion from a sufficiently broad perspective, Geoghegan (2012, 99) has introduced the concept of cybernetic apparatus, which covers both the "instruments and techniques… that acted as material aids or guides to research", and the ways in which "the politics of knowledge enabled these material instruments and techniques to morph into ostensibly immaterial ideals".

arrived at a set of twelve inherent distinctive features, from which all natural languages selected a particular subset in order to build “their entire lexical and morphological stock” (Jakobson, Fant and Halle [1951]1988, 639).

In that study, the link established with communication engineering was not confined to the use of the techniques and devices that were necessary for the analysis of speech sounds. That book was the first published work of Jakobson, in which key information-theoretical notions and terms were introduced as pertinent to linguistic theory. The main point of contact between the two fields was the assumption of an underlying binary structure:

> Information Theory uses a sequence of binary selections as the most reasonable basis for the analysis of the various communication processes. It is an operational device imposed by the investigator upon the subject matter for pragmatic reasons. In the special case of speech, however, such a set of binary selections is inherent in the communication process itself as a constraint imposed by the code on the participants in the speech event, who could be spoken of as the *encoder* and the *decoder*. (Jakobson, Fant and Halle [1951]1988, 600; emphasis in the original)

A parallel is drawn here between the binary selections underlying the logarithmic formula used for the measurement of information in communication systems, and the binary selections involved in speech recognition. Yet, whereas the former are *imposed* by the engineer for “pragmatic reasons”, the latter are *inherent* in language. This remark reflects the famous Jakobsonian thesis stated succinctly a couple of paragraphs later: “The dichotomous scale is the pivotal principle of the linguistic structure. The code imposes it upon the sound” (Jakobson, Fant and Halle [1951]1988, 601). By invoking information theory in this connection, the authors tried to show that the same principle had been accepted in a broad field of study unrelated to structuralism. This, in turn, might imply that binary selections were at the heart of all communication processes.

It should be noted that in both passages quoted above there is a reference to codes. This reference was not incidental. The terminological choice must be attributed to Jakobson. The texts that will be discussed below leave no doubt about that. This is the first occurrence of “code” in Jakobson’s published works. The term was introduced as a synonym for “phonemic pattern”: “Any one language code has a finite set of distinctive features and a finite set of rules for grouping them into phonemes and also for grouping the latter into sequences; this multiple set is termed *phonemic pattern*" (Jakobson, Fant and Halle [1951]1988, 594; emphasis in the original). This is the first linguistic definition of "code" as a phonological term, but soon the word acquired further senses. An indication of its subsequent semantic expansion is offered in the same book. Whereas the above definition entails that there is a single code corresponding to each natural language, several pages below it is said that "[t]wo styles of the same language may have divergent codes and be deliberately interlinked within one utterance or even one sentence" (Jakobson, Fant and Halle [1951]1988, 604). This use of the term suggests the possibility of multiple codes within a given language. Jakobson would return to this idea in his *Fundamentals of language*, co-authored with Halle in 1956, where a distinction is made between the overall code of language and its subcodes. Another important terminological innovation in the *Preliminaries to speech analysis* was the introduction of the words "encoder" and "decoder" as synonyms for "speaker" and "listener". The particular choice suggests the scheme presented by Fry and Miller in 1950-51, in which the two interlocutors in the 'speech chain' were considered the transmitter and the receiver, respectively. The initial conception of this scheme can be traced back to Weaver and his psychological interpretation of Shannon's model of communication systems. In his explanatory account of the mathematical theory of communication, Weaver (1949b, 99) 'adapted' Shannon's model to the case of verbal communication as follows: "When I talk to you, my brain is the information source, yours the destination; my vocal system is the transmitter, and your ear and the associated eighth nerve is the receiver". This straightforward parallelism soon gained wide acceptance among the social scientists who attempted to apply, in one way or another, the tools of information theory to their particular object of study.

In 1952, a second printing of the *Preliminaries to speech analysis* appeared. In the summer of that year, Jakobson attended two important meetings in which he had the opportunity to present anew the tenets expounded a few months later. At the International Symposium on Anthropology, which was held in June 1952, Jakobson talked about the pivotal problem of "pattern in linguistics", and drew a parallel between the latest contributions to phonological studies and the recent developments in physics and mathematics. Among those developments, the pioneering theoretical work done in the nascent interdisciplinary field of information theory was singled out as the most pertinent to linguistics. Once again, Jakobson highlighted the significance that both fields attributed to binary relations with respect to the study of communication. This time, however, he did not refer solely to the dichotomous structure of distinctive features but went a step further:

> The fundamental dichotomous notions of linguistics… called *langue* and *parole* in French, 'linguistic pattern' and 'speech' in America, now receive a much clearer, simpler, logically less ambiguous, and operationally more productive formulation, when matched with the corresponding concepts of communication theory, namely with 'code' and 'message'. (Jakobson [1953a]1971, 224)

The terminological shift introduced here is crucial. Jakobson proposed "code" as a generic term for all types of linguistic pattern for reasons of precision and clarity. A deeper motive behind this shift, however, could be the need to ensure a terminological coordination that would facilitate the between linguistics and information theory[110]. For Jakobson, that dialogue was especially important. As he remarked a month later, at the Conference of Anthropologists and Linguists at Indiana University, "[c]ommunication theory seems to me a good school for present-day linguists, just as structural linguistics is a useful school for communication engineering" (Jakobson [1953b]1971, 559). Jakobson repeatedly praised communication engineering for its key contribution to the study of communication, but he never thought that the passage from the mathematical theory of communication to a general theory of language would be a straightforward one that could be performed without the expertise of linguists. On the contrary, he believed that "the immense experience of linguists with language and its structure permits them to expose the inconsistencies and failings of the engineers when dealing with linguistic material" (Jakobson [1953b]1971, 556). Thus, in the dialogue between linguists and engineers, the object of study of structural linguistics would not lose its relative autonomy. Yet, it would be seen from a new, enriched perspective.

At the same conference, Jakobson was asked to sum up the linguistic results of the exchanges that took place between the participants. In his summary, he chose to discuss those results in connection with the increasing influence of communication engineering on

[110] In the next chapter, it will be shown that this terminological shift was primarily due to an essential difference in perspective between Jakobson and Saussure as regards the object of linguistics.

linguistics and anthropology. Furthermore, he grasped the opportunity to present in more detail the basic points of his view about the prospects of postwar linguistics and its quest for patterns. These points reveal the rough guidelines along which Jakobson sought to reform linguistics. The whole project of this reform might be said to comprise two main tasks. The first task was to promote the convergence between linguistics and information theory on the study of verbal communication. The second task concerned the construction of a general theory of language based on a critique of major Saussurean tenets. Part of the first task involved the appropriation of models, concepts, and mathematical tools of information theory. A famous example of that appropriation was Jakobson's functional model of language, which was first presented in 1956[111].

The main components of the model were outlined at the joint conference of anthropologists and linguists in July 1952. The backbone of the model was a considerably modified version of Shannon's scheme of communication systems. According to Jakobson ([1953b]1971, 556), the "basic factors participating in linguistic communication" included the "message and four items connected with it – the sender, the receiver, the topic of the message, and the code used". At first sight, several elements of Shannon's model seem to have been omitted. The source of information, the transmitter, the destination, and the source of noise are not mentioned. The source of noise was indeed omitted. However, the transmitter was merged with the sender and the destination with the receiver. It is doubtful whether the source of information, in the technical sense of the term, was also merged with the sender, as in Weaver's case. Jakobson avoided any explicit reference to the source of information, but it seems that this element partly overlapped with code. As regards the message, it retained its cardinal role in the process of communication, although it was understood not in the technical sense familiar to the communication engineer but rather as a meaningful sequence of symbols. The engineer is concerned with the efficient utilization of the communication channel and, thus, has to take into account all possible sequences of symbols irrespective of whether they make sense to any communicators at a given point in time. The linguist, by contrast, is *inter alia* concerned not simply with sounds but with speech, understood as a chain of audible signals with a certain semantic load. Whereas for

[111] Jakobson's linguistic model will be discussed in detail in the next chapter.

the engineering problem of communication the exclusion of semantic considerations is imperative, for linguistic analysis such considerations are indispensable. Thus, inevitably there is only a partial overlapping between the message element in Shannon's model and the message element in Jakobson's scheme.

The remaining two elements bring into relief the distinctive character of Jakobson's abstract representation of verbal communication. Concretely, the addition of the "topic of the message" reveals Jakobson's functionalist orientation. The communication model outlined at this conference was intended to portray the relation between the elements not so much in connection with the message transmission itself (as in Shannon's model), but rather with respect to the fundamental functions that language can perform. The element termed "topic of the message" captures the representational function of language and, hence, its inclusion in the model is necessary. The different functions performed are stated in terms of the message's emphasis on the four elements connected with it in the process of verbal communication. Thus, there can be an emphasis on the sender, the receiver, the topic of the message, or the code used. There is also the possibility of an emphasis of the message on itself, which is characteristic of the poetic function of language (Jakobson [1953b]1971, 558). The functions foreseen can "act separately, but normally there appears a bundle of functions. Such a bundle is not a simple accumulation but a hierarchy of functions, and it is very important to know what is the primary and what the secondary function" (Jakobson [1953b]1971, 557). The idea of a set of hierarchically ordered functions performed simultaneously in a given exchange allows for distinguishing different types of communication event according to the dominant function of language.

The last element mentioned was code. Here it was Jakobson's conception of language as a system that came to the fore. In Shannon's diagram of a typical communication system, code does not appear as a separate element but its presence is implied by the operations performed by the transmitter and the receiver. This, however, does not imply that it is treated as a component of lesser importance. Suffice it to note that several theorems of the mathematical theory of communication are about coding. After all, it would be rather unlikely for a theory predicated on the view of communication as a chain of transformations to downplay the significance of an indispensable element for transformation. Thus, code occupies a key position in Shannon's theory precisely because it lies at the heart of the transformational processes foreseen in his model. In Jakobson's scheme, code is equally important but for a different reason. From the point of view of the linguist, the "most essential problem for speech analysis is that of the code common to both sender and receiver and underlying the exchange of messages. No communication is feasible without a certain stock of what the engineers, and especially D. M. MacKay… call preconceived possibilities and prefabricated representations" (Jakobson [1953b]1971, 558). The same point was made a little earlier that year by contrasting two different types of receiver:

> The attitude of the communication engineer coincides with the attitude of the member of a speech community who participates in a speech exchange within this community and interprets signals received from a sender. This receiver is a decoder, and the decoder is not a cryptanalyst, although the two notions are often confused. The usual addressee of a message is a decoder, whereas the cryptanalyst is an unusual, marginal addressee, if not simply an eavesdropper. The decoder interprets the message in terms of a code common to him and the sender – a set of preconceived, prefabricated representations, as D. M. MacKay puts it. (Jakobson [1953a]1971, 224)

Both the decoder and the cryptanalyst need to perform the reverse operation of encoding in order to retrieve the original message from the transmitted signal. By itself, however, such a reverse operation does not ensure that the sequence yielded will match the one selected at the transmitting end. For the communication engineer, the "fundamental problem of communication is that of reproducing… either exactly or approximately" the original message (Shannon 1948, 379). The use of a common code is a prerequisite for ensuring an exact or approximate reproduction of the transmitted message.

Jakobson focused precisely on that necessary condition of communication, which the communication engineer took for granted. For the latter, the primary concern was the measurable correspondence between the sequences of symbols generated at the transmitting and receiving ends of the communication system. Rather than portraying verbal communication in terms of a crude analogy to the engineering problem, as Weaver did in his definition of the semantic and the effectiveness problems, Jakobson brought to the fore the necessity of code. As a structuralist, he was primarily interested in analyzing the diverse patterns underlying linguistic behavior, in order to determine the ultimate constituents of language and shed light on the intricate relation between the sensible and the intelligible aspect of the linguistic sign. As an element in Jakobson's scheme, code represented the (ubiquitous) presence of the linguistic system in verbal communication. It stood for the hierarchy of patterns and the concomitant rules of use that make possible the verbal interaction between the members of a linguistic community. Initially, the term was defined as phonemic pattern. However, its position in the communication model that Jakobson outlined in 1952 prefigured the additional senses it would later acquire.

An early indication of the subsequent semantic expansion of "code" can be found in the paper that Jakobson co-authored with Chery and Halle on the logical description of phonemic structures. As mentioned earlier, that paper presented part of the results of a research project on the Russian language, for which Jakobson was awarded a five-year grant from the Rockefeller Foundation. The paper was published in 1953 in *Language* and it illustrated a statistical analysis of colloquial Russian with the use of information-theoretical tools. For the purposes of the analysis, the Russian language was taken as a Markoff process[112]; that is, it was treated as a certain type of discrete source of information. This enabled the authors to apply Shannon's logarithmic measure of information in the logical description presented in their study. The Russian phonemic pattern was analyzed into eleven binary oppositions reflecting different distinctive features. On the basis of these oppositions, forty two phonemes were identified. Accordingly, the authors used Shannon's logarithmic formula in order to calculate the average number of binary distinctions required for the identification of a phoneme, taking into account first the unconditional and then the conditional probabilities of its occurrence. In that way, they sought to provide "a measure of the 'information' conveyed when the speaker selects any particular phoneme out of the 42" (Cherry, Halle and Jakobson 1953, 39). The term "code" retained in this study its meaning as phonemic pattern. Yet, in the concluding paragraphs the authors remarked that "[t]he statistical analysis of the phonemes and their sequences in connected

[112] Cherry, Halle and Jakobson (1953, 36) quoted the following definition of Weaver (1949b, 102; emphasis in the original): "A system which produces a sequence of symbols… according to certain probabilities is called a stochastic process, and the special case of a *stochastic process* in which the probabilities depend on the previous events, is called a *Markoff process* or a Markoff chain".

messages must be supplemented by a similar analysis of the dictionary, in order to understand the distribution of phonemes in the lexical code of the given language" (Cherry, Halle and Jakobson 1953, 45). Here "code" is used exactly as in Jakobson and Halle (1956, 68, 74), where it appears twice as a synonym for "lexical stock". This shift may seem trivial, but it does suggest a tendency to treat the word not as a strictly technical term of phonology.

In 1956, Jakobson published in revised form two previous studies, one on phonology and another on aphasia, in a single volume titled *Fundamentals of language*. This was one of the most influential works of postwar linguistics and played a decisive role in making Jakobson's view of language known to a wider scientific audience. The first part of the book, co-authored with Halle, presented a systematic summary of the basic tenets of structural phonology, focusing mainly on the concepts of distinctive features and phonemic pattern. Special reference was made to the fundamental role of binary relations in verbal communication. In connection with the 'dichotomous principle' underlying linguistic phenomena, the usual parallel was drawn to the developments in communication engineering, which were seen as a promising basis for a "most productive cooperation" between linguistics and information theory (Jakobson and Halle 1956, 44). The second part of the book sought to contribute to the study of language disorders by exploring the application of linguistic criteria to the analysis of aphasic disturbances.

Both parts exhibited the peculiar mixture of structuralist and information-theoretical ideas that characterized the development of Jakobson's linguistic thought during the 1950s. In the first part, speech production and perception were discussed as encoding and decoding operations based on selections from finite sets of elements. Selection, a crucial notion for communication engineering and information theory, featured prominently in the second part, too, where it was related to one of the two fundamental aspects of language. The chapter on the "twofold character of language", which set the framework for the treatment of aphasia as a linguistic problem, revolved around the Saussurean distinction between syntagmatic and associative relations[113]. This dichotomy was restated in terms of the operations corresponding to these two types of relation: "Speech implies a s e l e c t i o n

[113] See Saussure (1959, 122-127).

of certain linguistic entities and their c o m b i n a t i o n into linguistic units of a higher degree of complexity" (Jakobson and Halle 1956, 58; emphasis in the original). Seen from the perspective of these interrelated operations, language reveals itself as a multilayered system comprising units of different degrees of complexity, which can be variously grouped into partially overlapping sets of alternatives. The code of each language sets rules that result in restricting the set of possible combinations between the linguistic units. Selection "deals with entities conjoined in the code but not in the given message, whereas, in the case of combination, the entities are conjoined in both or only in the actual message". Thus, "[t]he constituents of any message are necessarily linked with the code by an internal relation and with the message by an external relation" (Jakobson and Halle 1956, 61). In that way, the "twofold character of language" was portrayed in terms familiar to the communication engineer, for whom a message is a sequence of elements generated by a stochastic selection process.

The key texts surveyed above make clear that Jakobson's relation to communication engineering, information theory and cybernetics was grounded on something more profound than mere enthusiasm for technological advances. In the statistical approach to communication, Jakobson saw fundamental insights that seemed to parallel the principles of structural phonology. The perceived convergence between communication engineering and linguistics convinced him that, at last, it was possible to construct a general theory of language (and a theory of signs, perhaps) buttressed by the mathematical tools of information theory. In his attempt to explore the possibilities of such an interdisciplinary cooperation, Jakobson undertook not only to present the new ideas about communication to his fellow linguists and other social scientists, but also to apply information-theoretical tools to linguistic analysis. In that way, he sought to pave the way for an enduring, mutually profitable dialogue between social and natural scientists interested in the study of language. Yet, it should be noted that all his efforts toward that direction were primarily intended to serve the purpose of reforming linguistics. As mentioned earlier, the project of this reform comprised also a critique of major Saussurean tenets. The writings discussed in the preceding paragraphs suggest that the application of information-theoretical notions to linguistics was substantially connected to that critique. Jakobson's terminological innovations might be seen merely as an attempt to find some fashionable labels for established linguistic concepts. After all, in the 1950s there were several similar trends across a wide range of disciplines. Yet, the exposition presented in this chapter indicates that Jakobson was rather concerned with finding more suitable terms for a new, evolving theory of language. In the case of "code", specifically, he was seeking a term to designate a new linguistic concept. Initially, it was used to designate the notion of phonemic pattern. Early on, however, the first signs of a semantic expansion appeared. It seemed that Jakobson had found a convenient word to designate the general concept of linguistic pattern or system. Nevertheless, in the *Fundamentals of language* code was defined as a phonological concept, despite the passing mentions to a "lexical code":

> If the listener receives a message in a language he knows, he correlates it with the code at hand and this code includes all the distinctive features to be manipulated, all their admissible combinations into bundles of concurrent features termed phonemes, and all the rules of concatenating phonemes into sequences – briefly, all the distinctive vehicles serving primarily to differentiate morphemes and whole words. (Jakobson and Halle 1956, 5)

Although restricted in scope, this definition contained all the key components that can be found in subsequent definitions of the semiotic concept of code. The concept of system is the first component that can be easily discerned. In fact, the above formulation implies a hierarchy of systems. Next, there is the concept of rule, which specifically refers to the interdependencies between the elements of the systems. Finally, the transition implied from phonemes to morphemes, and from morphemes to words, seems to suggest a transformational process. This idea was explicitly expressed by Jakobson a few years later in a paper presented at the Symposium on the Structure of Language and its Mathematical Aspects, which was held in April 1960 in New York. In that meeting, Jakobson repeated his earlier remarks about codes, adding this time however Cherry's definition:

> The engineer assumes a "filing system" of prefabricated possibilities more or less common to the sender and receiver of a verbal message, and Saussurian linguistics speaks correspondingly about *langue*, which makes possible an exchange of *parole* between interlocutors. Such an "*ensemble* of possibilities already foreseen and provided for" implies a code, conceived by communication theory as "an agreed transformation –usually one-to-one and reversible"– by which one set of informational units is converted into another set, for instance, a grammatical unit into a phonemic sequence and vice versa. The code

> matches the *signans* with its *signatum* and the *signatum* with its *signans*. (Jakobson 1961, 247; emphasis in the original)

By that time, "code" had begun to gain currency not only in linguistics but also in anthropology, where it was applied by Claude Lévi-Strauss to the structural analysis of myths. In linguistics, it was generally held that the term was introduced as a synonym for "*langue*". This is how Jakobson himself had introduced it in the first place, followed by Martinet (1970, 25), who also suggested that "code" and "message" could be used as alternative terms for "*langue*" and "*parole*". This use, however, caused some reactions from other linguists. Guiraud (1963, 37-38) argued that "code" and "*langue*" could not be used interchangeably, because they referred to different semiotic systems. In his view, both languages and codes were systems of conventions for transforming messages. Yet, they relied on substantially different kinds of conventions. Codes function according to explicit, imperative rules established in advance by prior agreement between the participants in communication process. The nature of such rules implies that a code is a rather rigid system that cannot undergo any change, unless its users decide to modify it. Languages, by contrast, are open systems; they constantly undergo transformations – even if minor. They are not established by any prior agreement but evolve through time. Moreover, they constitute primary semiotic systems, whereas codes always operate on messages produced by pre-existing systems. Thus, concluded Guiraud, the use of "code" as a synonym for "*langue*" can be profoundly misleading.

The issue raised by Guiraud was taken up again several years later by Mounin in a short text on "the notion of code in linguistics". Mounin (1970, 82-85) was not convinced by the absolute distinction made between codes as closed systems and languages as open systems. In relation to an idiolect, for instance, language could be taken at given points in time as a closed system of finite units, combined according to a finite set of rules. In such a case, Mounin argued, between a code and a language there would be no difference in kind but only a difference in degree. Furthermore, it would be difficult to deny that for the individual speaker the rules of language are not to some extent imperative and pre-established like the rules of codes. Hence, Mounin concluded that the fundamental difference between the two is simply the fact that codes operate on messages produced by means of other semiotic systems. Of course, languages and codes diverge in several other respects, such as those mentioned by Guiraud, but these are rather differences in degree. The crucial distinction that captures the fundamental difference between the two is that between primary and secondary semiotic systems. Mounin's argument led inescapably to the conclusion drawn by Guiraud earlier: it is misleading to use "code" as a synonym for "*langue*" in the study of language.

Both linguists viewed the application of "code" to the study of language as a purely terminological issue. They were primarily interested in specifying the extent to which the new term could be profitably used in linguistic theory. To this end, they compared the referents of "code" and "*langue*", they highlighted the major differences between the types of semiotic system that these two terms denoted, and on the basis of that comparison they drew their conclusions about the appropriateness of "code" as a linguistic term. In their accounts, Guiraud and Mounin assumed that this term was introduced in linguistics precisely in the technical sense in which it was used in communication engineering. In other words, they discerned no conceptual change behind this terminological transfer, since they assumed that the term in question came to designate the same linguistic concept designated by "*langue*", i.e. the Saussurean concept of linguistic system. In concluding his account, Mounin (1970, 85) aptly remarked that by treating "code" and "*langue*" as absolute synonyms, the linguist loses sight of the crucial differences between the corresponding types of semiotic system. To this remark, however, we could add that by treating the introduction of "code" into linguistics only as a terminological issue, we lose sight of some interesting aspects that pertain to the development of linguistic theory and the emergence of new linguistic concepts. The purpose of the next chapter is to shed light on these aspects, in order to account for the initial phase of the concept formation investigated in this monograph.

CHAPTER 7
Jakobson's Linguistic Concept of Code

The key to understanding the emergence of the semiotic concept of code lies in Jakobson's linguistic work in the 1920s and 1930s. His personal development during that period was marked by his active engagement in the activities of the famous Prague Linguistic Circle. In July 1920, Jakobson arrived in Prague as a member of a Soviet diplomatic mission. A few months later, he made his first contact with the Czech linguist Vilém Mathesius, who was a professor at Univerzita Karlova in Prague. Early on in his career, Mathesius was opposed to the dominant Neogrammarian doctrine, which privileged the diachronic study of language, and sought to draw the attention of his fellow colleagues to the synchronic analysis. In 1911, he delivered a lecture before the Royal Czech Society of Sciences on the "potentiality of the phenomena of language"[114], in which he stressed the importance of the synchronic linguistic analysis five years before the publication of Saussure's *Cours de linguistique générale*. That lecture apparently "fell practically flat and failed to evoke any response, there being no discussion" (Vachek 2002, 6). However, in his subsequent writings, Mathesius continued to emphasize the necessity of synchronic analysis (without rejecting the diachronic one), showing at the same time a growing interest in the functions of language. In those works, he "increasingly realized the advantages of the procedure going from the needs of expression to the means of language by which these needs are satisfied, or, to put the matter more briefly, of the procedure going from the function to the form, in other words, of the functional method" (Mathesius [1936]1966, 138).

Mathesius's early attempts to put forward a functional method of linguistic analysis failed to initiate a constructive discussion among his colleagues, mainly due to the Neogrammarian ideas still prevalent in his intellectual milieu. In the early 1920s, his isolation was partly counterbalanced by the encouragement and support of two young

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[114] For an English translation, see Mathesius ([1911]1983).

linguists. One of them was Bohumil Trnka, who was appointed Mathesius's assistant in 1923. In that period, Roman Jakobson, too, began to have regular contacts with Mathesius. Trnka and Jakobson were concerned with the same linguistic problems to which Mathesius had devoted the main part of his studies, and they both shared a keen interest in his views about language and its scientific analysis. Several years later, on the occasion of the decennial celebration of the Prague Linguistic Circle, Mathesius delivered a lecture in which he described his acquaintance with his new colleagues as follows:

> …I had by my side two young linguists whose research orientation was akin to mine. The lack of close contact with the Prague philological workers, which used to depress me, was felt with equal intensity now by Jakobson, who had been accustomed to a very different atmosphere in his pre-Prague years. We often discussed the need for a discussion and working center for young linguists, and it was quite natural that we attempted to form it. (Mathesius [1936]1966, 139)

In 1925, Mathesius arranged two gatherings in order to discuss about some key linguistic topics with a small number of selected linguists. The first gathering took place in March and it was attended by Jakobson, Trnka and Sergey Kartsevsky. The second gathering took place in October and included as an additional invitee the Czech linguist Bohuslav Havránek[115]. Those gatherings paved the way for a series of regular meetings of a group of scholars, which came to be known as the Prague Linguistic Circle. The inaugural meeting, which took place on October 6, 1926, was attended by Mathesius, Jakobson, Trnka, Becker, Rypka and Havránek. Henrik Becker, a young German linguist who had arrived in Prague in the fall of 1926, read a paper about European languages, which was followed by a lively discussion. During the next two years, the number of meetings and participants increased. Among the new members were the Russians Trubetzkoy, Tomaševsky and Bogatyrev, the Frenchmen Tesnière and Brun, and the Czech Mukařovský.

By the end of March 1928, nineteen meetings took place and eighteen lectures were delivered (Mathesius [1936]1966, 140, Vachek 2002, 60-61). This was a promising start

[115] At the October meeting, Mathesius read a paper about the new tendencies in linguistics. See Mathesius ([1927]1983).

for the newly formed group, but the increased activity noted during this period could not yet exert an impact on the intellectual life of Prague. However, the First International Congress of Linguists, which was held in April 1928 in The Hague, gave the members of the Prague Circle the opportunity to address a wider audience and achieve their first international success. All participants were asked to answer in advance six important questions about linguistic research. The principal question was the fourth one and concerned the most suitable method of linguistic analysis. The answers to that question prepared by four members of the Prague Circle (Mathesius, Jakobson, Trubetzkoy and Kartsevky) were in several respects similar to the theses drafted by Albert Sechehaye and Charles Bally from the Geneva School of Linguistics. In view of that essential convergence, the two groups agreed to present a common program of linguistic analysis, which was eventually approved unanimously by the Congress at the plenary session on April 12 (Vachek 2002, 7). This early success acted as a catalyst for the Prague Circle. Commenting on the approval of the joint program by the Hague Congress, Mathesius remarked:

> For the Prague Linguistic Circle this fact was significant in more than one respect. It became clear to us even more than before that in the international context we were by no means isolated with our theoretical views, and we became convinced that these views had grown so ripe that we could present them to our foreign colleagues; besides, we won friends and allies abroad. (Mathesius [1936]1966, 142)

Next came the First International Congress of Slavists, which was held in Prague in October 1929. There, the Prague Circle presented a set of nine theses, prepared jointly by Mathesius, Jakobson, Havránek and Mukařovský. That text outlined the principles of the Circle’s distinctive approach to language and linguistic analysis. The nine theses together with the works presented at the Prague Congress were published in the first two volumes of the group’s first periodical, the *Travaux du Cercle Linguistique de Prague*. These volumes reached a wide audience and marked the beginning of a very successful series of publications [116], which played a decisive role in establishing the Prague Circle as an internationally recognized school of linguistic thought. Of equal importance was the

[116] The Prague Linguistic Circle published also the periodical *Slovo a slovesnost* (Word and Verbal Arts), which was addressed to Czech and Slovak audiences.

participation of its members to major international congresses, such as the Second International Congress of Linguists in Geneva (1931), and the first two international congresses of phonetics in Amsterdam (1932) and London (1935), respectively (Vachek 2002, 7-9).

For the Prague Linguistic Circle, the 1930s was a period of intense activity with crucial contributions to the development of linguistics, aesthetics, literary theory and semiotics. The group continued to hold regular meetings during the war, but two leading figures were missing. Trubetzkoy died in 1938 and Jakobson, the Circle's vice-president, fled to Denmark shortly after the Nazi invasion of Czechoslovakia in March 15, 1939. A few years later, the group lost also its president, Vilém Mathesius, who died in 1945. After the war, the Prague Linguistic Circle was faced with unfavorable sociopolitical conditions and eventually was led to cease its activities (Vachek 2002, 37-40). It was resurrected after the restoration of capitalism in Czechoslovakia in 1990. In those forty years of absence, the rich work produced during the so-called classical period of the Circle (1925-1942) exerted a lasting influence worldwide and was instrumental in shaping twentieth-century linguistics. The principles and methodological premises of the Circle underwent numerous elaborations by prominent linguists and, in that way, their validity was reaffirmed in different sociocultural and intellectual contexts (Vachek 2002, 43-48). Among the linguists who played a key role in that process was Roman Jakobson, who continued to work on the fundamental ideas he had developed with his colleagues in Czechoslovakia.

Jakobson was one of the founding members of the Prague Linguistic Circle and had a major contribution to both the successful activities of the group and the elaboration and formulation of its pioneering program for the scientific study of language. As Vachek (2002, 28) aptly put it, he was the Circle's "*spiritus agens*". For Jakobson, the Prague Circle proved vital for the development of his linguistic thought. The multifarious activities of the group kept him in a constant, stimulating exchange of ideas with fellow linguists and gave him the opportunity to address a wider scientific audience through the participation in important international meetings. In the Prague Circle, Jakobson found the necessary intellectual milieu for putting forward a novel approach to linguistic analysis, from which gradually emerged, through refinements and debates, a structuralist theory of language as a functional system. This theory was founded precisely during that period upon the principles laid down jointly by Mathesius, Jakobson, Havránek and Mukařovský.

The nine theses presented at the First International Congress of Slavists in Prague provided the guidelines for a new approach to linguistic research. The opening paragraph specified the essential characteristic of language as an object of scientific study and indicated the appropriate type of linguistic analysis:

> Resulting from human activity, language partakes in its purposefulness. Whether one analyses language as expression or as communication, it is the intention of the speaker which can explain it in a most evident and most natural manner. For this reason, linguistic analysis should respect the functionalist standpoint. *Seen from the functionalist viewpoint, language is a system of purposeful means of expression*. No fact of language can be understood without regard to the system to which it pertains. (Theses 1929, 77; emphasis in the original)

At the heart of the functionalist point of view, as defined above, lies the idea of a dynamic system that can be studied both synchronically and diachronically. Contrary to Saussure and the Geneva School of Linguistics, the Prague Circle insisted that "no insurmountable barriers" should be placed between the synchronic and the diachronic analysis, for it "would be illogical to suppose that changes in language are no more than cases of purposeless interference, heterogeneous in relation to the system. Changes in language are often due to considerations of the system, its stabilization, reconstruction, etc." (Theses 1929, 78). Language transformations, then, are not fortuitous but intimately connected with the behavior and the evolution of the system. On the other hand, the notion of evolution itself was taken as pertinent to synchronic analysis. Even at a specific point in time, it was argued, there is "evidence of diachronic phenomena which cannot be eliminated" from the synchronic description of a linguistic system (Theses 1929, 79). In that way, the Prague Circle specified in the very first thesis its particular place among the linguistic trends of its time. The strong emphasis on the study of language as a structured whole of interdependent elements was in stark contrast to the Neogrammarian doctrine and at the same time indicated a convergence with Saussure and his followers. Yet, the way in which the Prague Circle understood the nature of linguistic change and the relation between synchronic and diachronic analysis differed substantially from the respective

Saussurean tenets. In the following years, critical references to Saussure became a recurrent element in the writings of various members of the Circle[117].

In Jakobson, such references assumed the form of a sustained critique, focused mainly on fundamental Saussurean dichotomies, such as that between synchrony and diachrony or the distinction between *langue* and *parole*. In general, he "found the picture of language propounded by Saussure to be at the same time too abstract, too static, and too simplified… Saussure saw a conflict between the opposite ends of any dichotomy and tended to exclude one of them from linguistics altogether" (Waugh and Monville-Burston 2002, XV). Thus, early on Jakobson was engaged in a long-standing endeavor to "overcome the Saussurean polarities by showing that they imply and modify each other in an incessant process that is essential for the functioning of language as well as for its historical development" (Stankiewicz 1987, 84). In a lecture given in 1927 before the members of the Prague Linguistic Circle, Jakobson proposed a new approach to the Neogrammarian notion of immutable sound laws, based on the conception of language as a functional system. Specifically, he stressed the need to treat sound changes as goal-oriented and examine their laws with respect to the purposes that the diverse linguistic systems serve. In this connection, a reference was made to the Geneva School, with an emphasis on the Saussurean stance toward diachronic analysis:

> F. de Saussure and his school broke a new trail in static linguistics, but as to the field of language history they remained in the neo-grammarian rut. Saussure's teaching that sound changes are destructive factors, fortuitous and blind, limits the active role of the speech community to sensing each given stage of deviations from the customary linguistic pattern as an orderly system. This antinomy between synchronic and diachronic linguistic studies should be overcome by a transformation of historical phonetics into the history of the phonemic system. In other words, phonetic changes must be analyzed in relation to the phonemic system which undergoes these mutations. For instance, if the order within a linguistic system is disturbed, there follows a cycle of sound changes aiming at its renewed stabilization. (Jakobson [1928]2002, 2)

[117] See e.g. Mathesius (1929), Trnka (1934), and Kořínek (1936).

The application of the ‘teleological criterion’ to the study of sound changes led Jakobson to a conception of phonological systems as self-regulating mechanisms, which evolve through the constant interplay between disturbance and stabilization. In turn, this dynamic notion of linguistic system entailed a uniform method of analysis applicable to both the synchronic and the diachronic level. The Saussurean doctrine of the irreconcilable divide separating the synchronic from the diachronic viewpoint was challenged, and a link between the two was established with a teleological re-interpretation of the Neogrammarian notion of sound law. The fundamental ideas encapsulated in that lecture were later presented as a set of theses outlining a novel program of linguistic analysis. Jakobson’s linguistic work throughout the rest of his career unfolded precisely according to the guidelines presented at the First International Congress of Slavists in 1929.

In the same year, Jakobson illustrated the application of the systemic method of linguistic analysis in a monograph on the phonological evolution of Russian and other Slavic languages. This lengthy comparative study was published as the second volume of the *Travaux du Cercle Linguistique de Prague*, and immediately attracted the attention of various linguists around the world (Vachek 2002, 8). The main body of the study was framed with two introductory chapters and an epilogue with some concluding remarks. In the first chapter, Jakobson introduced the concepts of phoneme, archiphoneme and phonological system, and defined the two basic types of phonological opposition. The distinguishing criterion was whether an opposition could be expressed in binary form or not. In the second chapter, Jakobson outlined the guidelines for a historical phonology based on the method of structural analysis of linguistic systems. Here he actually expanded his previous remarks about diachronic analysis, choosing phonology as the testing ground for his new approach to historical linguistics. An integral part of the exposition in that chapter was the critique of the fundamental Saussurean dichotomies. Jakobson acknowledged Saussure’s view of language as a differential system as the ‘cornerstone’ of the linguistic theory of his time, but he refused to reserve that notion for synchrony alone. Once again, he argued that linguistic changes are goal-oriented and they should be viewed from the perspective of their role in the stability of the underlying linguistic system. Thus, the linguistic system was the main object of study of both synchronic and diachronic analysis. Jakobson further portrayed language as responding not only to external disturbances but also to internal problems. In this connection, he offered a general definition of synchronic systems and described the typical form of the interpenetration of synchrony and diachrony:

> I have emphasized that linguistic changes cannot be understood as detached from the system, but neither can the system be regarded as excluding changes. What is a synchronic system? It is a system existing at a given moment in the linguistic consciousness of a speech community and constituting an indispensable premise for speech. It is precisely on this point that one must consider changes as falling into the domain of synchrony. The most characteristic form taken by the projection of diachrony within synchrony is the assignment of a different function to the two terms of a change; thus, two phonological stages are evaluated like two functionally different dialects, like two "styles." Conversely, the characteristic form taken by the projection of synchrony within diachrony is the generalization of a style; two styles become two stages of the language. (Jakobson [1929]2018, 17)

The passage quoted here lays bare the crucial role of the functional perspective in Jakobson's understanding of language as an object of scientific study. The shift in focus toward functions enabled Jakobson not only to conceive of the Saussurean *langue* in dynamic terms, but also to bridge the gap between synchrony and diachrony and even introduce change in the former. In his concluding remarks, Jakobson placed the advent of his structuralist method in the context of a broader methodological shift in the early twentieth century, which was taking place independently in diverse disciplines such as economics, physics, psychology, biology or geography. The unrelated developments in those fields were said to converge to a general form of thought (an "ideology", as Jakobson called it) characterized by the primacy of functional systems over mechanical agglomerations, the emphasis on immanent structural laws, and the teleological interpretation of evolutionary processes (Jakobson [1929]2018, 163-165).

In December 1930, Jakobson read three important papers at the international phonological conference held in Prague. In one of them, he returned to the issue of historical linguistics and attempted to present in a more systematic way the principles of historical phonology. One of the main tasks of the scientific study of phonological evolution is the adequate description of phonological changes. Jakobson ([1931]1972,

122) argued that such a description required an “integrating method” that would treat “[e]very phonological fact… as a part of the whole, which is related to other parts of higher levels”, and would examine “[e]very phonological unit… in its reciprocal relations with all other units of the system before and after the given phonological change”. Once an adequate description had been accomplished, however, there remained the task of interpreting the phonological change:

> A description furnishes the data concerning two linguistic situations, the period before and after the change, and allows us to investigate the direction and meaning of this change. As soon as this question is posed, we pass from the terrain of diachrony to that of synchrony. A mutation can be the object of a synchronic investigation in the same way as invariable linguistic elements are. It would be a grave fault to consider static and synchrony as synonymous. The static viewpoint is a fiction: it is only a scientific procedure to help us; it is not a particular aspect of the way things are. (Jakobson [1931]1972, 136)

Here Jakobson took up again the cardinal problem of the relation between synchrony and diachrony introducing a new dichotomy, that between the static and the dynamic aspect. So far, in his criticism against the absolute divide between synchrony and diachrony, Jakobson focused primarily on Saussure’s view about the fortuitous character of linguistic changes. In this paper, he set the scene for a prospective critique that would be based on a thorough analysis of the Saussurean dichotomies. The basic idea seemed to be that Saussure used the same terms (e.g. synchrony and diachrony) to denote different antinomies that do not necessarily overlap, and this led him to a set of conceptual pairs whose members were taken to be mutually exclusive. Jakobson’s ‘integrating method’ pointed toward a more elaborate account of the relation between such key opposing elements, and thus it presupposed the disentanglement of the confounded antinomies. The concluding remarks of his talk about the principles of historical phonology show that he attached a special significance to the meticulous analysis of those dichotomies.

> The joining together of the static and the dynamic is one of the most fundamental dialectic paradoxes that determine the spirit of language. One cannot conceive of the dialectic of linguistic development without referring to this antinomy. Attempts to identify synchrony, static, and the domain of application of teleology on the one hand and, on the other, diachrony, dynamic, and the sphere of mechanical causality illegitimately narrow down the frame of synchrony, make of historical linguistics a conglomerate of disparate facts, and

> create the superficial and harmful illusion of an abyss between the problems of synchrony and diachrony. (Jakobson [1931]1972, 138)

During the 1930s, Jakobson continued to elaborate his theory of language, working in particular on the differential nature of phonological systems and the possibility of their adequate description from a teleological point of view. He presented for the first time in a general form the results of his research in two lectures he gave in 1939 as a visiting professor at the University of Copenhagen. The text for those lectures was written in German. It was first published in 1962, in the first volume of Jakobson's *Selected Writings* under the title "Zur Struktur des Phonems". The main part of the lectures was devoted to the discussion of the Saussurean tenets of phonology and the theory of signs (Joseph 1989, 416). As regards the basic dichotomies introduced in the *Cours de linguistique générale*, Jakobson criticized again Saussure for equating synchrony with the static aspect of language and stressed the need for a conception of the linguistic system in dynamic terms (Jakobson [1939]2002, 306). In this exposition, however, he also made some remarks on the second major Saussurean distinction, that between *langue* and *parole*. This dichotomy, too, was taken as encompassing a set of confounded antinomies. Jakobson ([1939]2002, 284-285) argued that there were at least three independent antinomies, into which the dichotomy between *langue* and *parole* could be analyzed. First, "*langue*" denoted the linguistic norm and "*parole*" stood for the linguistic utterance. "*Langue*" could also be taken to refer to a "social good", in contrast to the "private property" that the term "*parole*" signified. Finally, in this dichotomy one could further discern the antinomy between the unifying, "centripetal" forces of language, as opposed to the individuating, "centrifugal" forces exerted by *parole*. In those lectures, Jakobson did not make any suggestions as regards the lines along which the disentanglement of these antinomies should be carried out. Yet, he took up again this issue a few years later.

The two lectures given at the University of Copenhagen provided one of the two sources of Jakobson's first course at the École Libre des Hautes Études in New York, the other being an unpublished manuscript written in the late 1930s (Joseph 1989, 416). In 1942, Jakobson inaugurated his academic career in the United States with a series of "Six lectures on sound and meaning", delivered in French. Among the participants were the linguists J. Mattoso Câmara, Paul L. Garvin, Charles F. Hockett, Henry M. Hoenigswald, and Thomas

A. Sebeok, together with Jakobson's colleagues Henri Grégoire, Jacques Hadamard and Claude Lévi-Strauss. The material of this course, prepared in advance by Jakobson himself as an aid, was published in 1976 as a book titled *Six leçons sur le son et le sens*. This first series of lectures was devoted to the fundamentals of Jakobson's phonological theory and in general it followed the basic line of exposition of the Copenhagen lectures. In the next semester, Jakobson delivered a second series of lectures that covered a broad range of linguistic topics. The first part of this course provided a thorough critique of Saussure's theory of language, focusing on the nature of sign and the dichotomy between *langue* and *parole*. The material of this part survived in a French manuscript, prepared again by Jakobson himself as an aid, which was published posthumously in *Linguistics* under the title "La théorie saussurienne en rétrospection". In that text, Jakobson returned to the issue he raised in his Copenhagen lectures about *langue* and *parole*, and took on the task of disentangling the antinomies underlying this fundamental dichotomy (Waugh 1984, 157-158). This manuscript is of crucial importance for the present monograph, for it provides valuable information about the origins of the semiotic concept of code. Concretely, it allows for clarifying whether the term "code" was used by Jakobson as a synonym for Saussure's "*langue*" or it was rather introduced to designate a new linguistic concept.

The first chapter of the 1942 manuscript indicates that Jakobson began the second series of lectures with a brief historical overview intended to specify the position of both the Neogrammarian doctrine and Saussure's *Cours* in the development of Western linguistic thought. The latter was praised as a pioneering work, which signaled the transition between two radically different views of language and adumbrated the essential problems of modern linguistics. As such, Jakobson argued, it inevitably contained several contradictions. Taking as his point of departure the theses expounded in the *Cours* and focusing specifically on the contradictions he discerned therein, Jakobson attempted to arrive at a precise definition of the fundamental concepts of linguistic theory through a critical analysis of the major Saussurean antinomies. This was precisely the main task he set himself in this series of lectures he delivered in 1942 (Jakobson [1942b]1988, 397). Although the preferred subject in his criticism of Saussure during the 1930s was the dichotomy between synchrony and diachrony, now Jakobson turned to *langue* and *parole* seeking to identify and disentangle the different oppositions into which the "complex notion" of *langage* could be subdivided. When Saussure (1959, 8) introduced *langue* in his *Cours*, he remarked: "[s]peech [langage] has both an individual and a social side, and we cannot conceive of one without the other". He then characterized *langue* as "both a social product of the faculty of speech [langage] and a collection of necessary conventions that have been adopted by a social body to permit individuals to exercise that faculty" (Saussure 1959, 9). Thus, the first opposition mentioned with respect to the "faculty of speech" was that between *langue* and *parole* as representing the social and the individual aspect of *langage*. Jakobson, however, took another dichotomy as a point of departure for his critical analysis. The first opposition that he discerned behind this fundamental conceptual pair was that between potential values and their actualization in verbal exchanges. Linguistic communication, he stressed, is not possible without a repertory of linguistic means that have the same value for the members of the linguistic community. *Langue* was precisely such a 'stock' of potential values that enabled the users of a natural language to communicate with each other (Jakobson [1942b]1988, 401). *Parole*, on the other hand, represented the class of acts by means of which part of the potential values of *langue* was actualized in a given communicational situation. In more general terms, the relation between the two was taken as an instance of the opposition between model and manifestation. For Jakobson, this was the first and fundamental dichotomy into which *langage* can be resolved.

As noted earlier, Saussure identified *langue* with the social aspect of *langage* and *parole* with the individual aspect. *Langue* represented a collective model or social norm, whereas *parole* referred univocally to the individual acts or personal manifestations performed in conformity with the prevalent linguistic conventions. Jakobson called into question this unique correspondence between the four terms, and he sought to demonstrate that *langue* and *parole* had a social and an individual aspect. In other words, he sought to turn the primary opposition between the social and the individual aspect of *langage* into a secondary opposition pertaining to both *langue* and *parole*. In order to achieve that, Jakobson devised a conception of the individual subject and the verbal exchange as a whole. The conception of the individual subject he put forward allowed for introducing the notion of individual *langue*, whereas his reinterpretation of the Saussurean 'speaking circuit' enabled him to postulate the social aspect of *parole*. Starting from the facts of *parole*, and specifically from the preferences and deviations observed in the linguistic behavior of individual speakers, Jakobson was led to the conclusion that besides the linguistic and cultural habits imposed by the community there are also the personal habits of the members of a given linguistic community. These personal habits are no less important than the habits ratified collectively. The potential values of *langue* require not only the collective consent of the community but also the personal consent of the speaker. The latter manifests itself in the form of an individual system of habits that maintains the unity of the speaker's personality, in the same way that collective conventions maintain the unity of a given social body. Jakobson treated the speaker as a structured whole, and spoke of an individual norm imposed on his or her linguistic behavior analogous to the social norm imposed on every member of the community. In that way, he introduced the notion of individual *langue* (Jakobson [1942b]1988, 404-405).

The next step was to show that *parole*, too, had both a social and an individual aspect. This entailed a reexamination of the famous 'speaking circuit'. In the *Cours*, Saussure sought to outline the psychophysiological and physical processes involved in linguistic communication using as a model a simplified representation of a typical verbal exchange between two interlocutors (A and B). This complex mechanism (the "speaking circuit") was described as follows:

> Suppose that the opening of the circuit is in A's brain, where mental facts (concepts) are associated with representations of the linguistic sounds (sound-images) that are used for their expression. A given concept unlocks a corresponding sound-image in the brain; this purely psychological phenomenon is followed in turn by a physiological process: the brain transmits an impulse corresponding to the image to the organs used in producing sounds. Then the sound waves travel from the mouth of A to the ear of B: a purely physical process. Next, the circuit continues in B, but the order is reversed: from the ear to the brain, the physiological transmission of the sound-image; in the brain, the psychological association of the image with the corresponding concept. (Saussure 1959, 11-12)

The above description was far from complete, as Saussure himself acknowledged, but it did suffice for drawing some important distinctions. First, the propagation of sound (the "outer part") was contrasted to the psychophysiological processes (the "inner part"). Accordingly, the psychological processes were distinguished from the non-psychological ones. A third dichotomy was drawn between the active and the passive part of the mechanism. The former encompassed "everything that goes from the associative center of the speaker to the ear of the listener", whereas "everything that goes from the ear of the listener to his associative center" belonged to the passive part. Finally, in the subclass of the psychological processes, the active part constituted the executive element of the mechanism and the passive part was the receptive element (Saussure 1959, 12-13). In this structured ensemble, *parole* had a specific position. It did not represent the circuit as a whole but only the executive side of its psychological part. *Parole*, thus, was taken as an executive act, and as such it "is always individual, and the individual is always its master" (Saussure 1959, 13).

According to Jakobson, Saussure defined *parole* in a way that distorted linguistic reality. The very fact that every utterance is always directed toward an addressee suggests that the role of the listener is equally important for verbal exchange. Speaking, Jakobson contended, implies the act of reception performed by the listener. The executive element arbitrarily isolated by Saussure is an integral part of a complex, dynamic interaction, which entails a series of mutual adaptations by the two interlocutors. Both the executive and the receptive part of the speaking circuit are constitutive of the process of verbal communication. The interdependence between the two parts indicates that the type of act, by means of which the potential values of *langue* are actualized in concrete communicational situations, constitutes an "intersubjective phenomenon". Thus, *parole* was erroneously taken as representing the individual aspect of *langage*, since it evidently presents a social aspect as well. What Saussure termed "*parole*" is actually an integral part of a whole and, as such, can be conceived of as an autonomous element only if abstracted artificially from the broader intersubjective process to which it belongs (Saussure 1959, 406-407).

With the above remarks on the dual nature of *parole*, Jakobson completed the first and most important part of his critique on Saussure's famous attempt to provide a bipartite division of *langage*. Jakobson acknowledged the necessity of such a division, but found Saussure's approach fraught with confounded and unresolved antinomies. He, thus, sought to identify and disentangle those antinomies, in order to arrive at a precise definition of the fundamental notions of linguistic theory. It is evident from the start that his analysis was oriented toward a substantially different conception of both *langue* and *parole*. Jakobson did not choose the cardinal distinction between the social and the individual aspect of *langage* as his point of departure. Instead, he selected a certain attribute of Saussure's *langue* (the notion of system of potential values) and used it as a criterion for the initial division of *langage*. In that way, he constructed his principal dichotomy between model and manifestation[118]. Accordingly, the opposition between social and individual became a secondary dichotomy applicable to both *langue* (as model) and *parole* (as manifestation). With these two moves, he actually introduced a new pair of opposing concepts, against the backdrop of which he further examined the key issue of linguistic change. As it will be shown below, this additional step was necessary in order for Jakobson to specify the concepts of *langue* and *parole* he arrived at through his critical analysis of Saussure.

In the second part of his critique, Jakobson returned to the dichotomy between the social and the individual aspect of *langage* and tried once again to reconcile the opposites. The antinomy to be resolved this time was that between convention and variation. Among the Genevan followers of Saussure, Jakobson noted a "dangerous confusion" between the language of the individual, on the one hand, and the personal, distinctive traits observed in the verbal behavior of the speakers, on the other. Jakobson traced back this tendency to the *Cours* itself, where Saussure (1959, 125) argued that "in the syntagm there is no clear-cut boundary between the language fact, which is a sign of collective usage, and the fact that belongs to speaking and depends on individual freedom". For Jakobson, it was misleading to take *parole* as the realm of individual freedom. In order to challenge this view, he turned to the phenomena of affective language and argued that the verbal expression of emotions was much less spontaneous in nature than it was generally thought to be. Affective language relied on a system of conventions comparable to that underlying the means that served the communicative function of language. Thus, in a given community one could discern two closely interrelated systems: an intellectual *langue* and an affective *langue* (Jakobson [1942b]1988, 415-416). With these remarks, Jakobson took

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[118] Toutain (2011, 331-332) remarks that the dichotomy between model and manifestation does not occur in Saussure's *Cours*; it is rather an opposition introduced by Jakobson in his analysis.

another step toward establishing theoretically the complete interpenetration of *langue* and *parole*. The next move was to show that linguistic individualization was not a phenomenon confined to the language of the individual. To this end, he turned to the issue of the "spread of linguistic phenomena". With respect to this matter, Saussure wrote in the *Cours*:

> The laws that govern the spread of linguistic phenomena are the same as those that govern any custom whatsoever, e.g. fashion. In every human collectivity two forces are always working simultaneously and in opposing directions: individualism or *provincialism* [*esprit de clocher*] on the one hand and *intercourse* –communications among men– on the other.… Provincialism keeps a restricted linguistic community faithful to its own traditions. The patterns that the individual acquires during childhood are strong and persistent.… But intercourse, the opposing force, limits their effect. Whereas provincialism makes men sedentary, intercourse obliges them to move about.… it is a unifying force that counteracts the splintering action of provincialism. (Saussure 1959, 205-206; emphasis in the original)

The effect of provincialism was, for Jakobson, analogous to that of individualization in the case of the single speaker. In the same way that specific traits in the verbal behavior of a speaker could distinguish him or her from other members of the same linguistic community, provincialism could distinguish a linguistic community from neighboring groups of speakers. In fact, both forces, provincialism and intercourse, were taken as operating not only on the *langue* of a given community but also on the individual *langue* of the speaker (Jakobson [1942b]1988, 418-419).

Jakobson explored further Saussure's remarks on the spread of linguistic phenomena, postulating the existence of a similar pair of forces operating in the dimension of time. A linguistic community could be isolated not only from its neighboring groups but also with respect to its own past. Moreover, the force causing this temporal isolation could be combined with the force of provincialism in the spatial dimension, at the level either of the *langue* of the community or the *langue* of the individual speaker. However, provincialism could also operate simultaneously with a unifying force in the temporal dimension, by means of which the individual remained faithful to his or her linguistic habits and the community maintained its tradition. Thus, to the two opposing forces operating in the spatial dimension corresponded an analogous pair in the temporal dimension. On the one hand, there was the force of modernity promoting innovation and causing *langue* to differentiate itself from its previous state. On the other hand, there was the force of tradition, which resisted change and strove toward immutability. Jakobson's remarks on this matter foregrounded *langue* as the locus of a constant interplay between continuity and change. Indeed, returning to the example of fashion mentioned by Saussure, Jakobson ([1942b]1988, 420) argued that the essence of innovation lies precisely in the modification of the model, the norm itself. This statement was the prelude to the discussion of the crucial issue of linguistic change, a discussion that occupied a key position in Jakobson's analysis and added the final strokes to his particular conception of *langue*.

The critique now was directed against the Saussurean principle of the immutability of *langue*: "never is the system modified directly. In itself it is unchangeable; only certain elements are altered without regard for the solidarity that binds them to the whole" (Saussure 1959, 84). To refute this thesis, Jakobson invoked Saussure himself:

> Analogy, then, is one more lesson in separating language from speaking.… It shows us that the second depends on the first… Any creation must be preceded by an unconscious comparison of the materials deposited in the storehouse of language, where productive forms are arranged according to their syntagmatic and associative relations.… It is wrong to suppose that the productive process is at work only when the new formation actually occurs. The elements were already there. A newly formed word… already has a potential existence in language. (Saussure 1959, 165-166)

The *Cours*, claimed Jakobson, is absolutely right on this point. But Saussure contradicted himself when he asserted that *parole* was the source of linguistic change. His remarks about analogy suggested that *langue* was the source of change. As such, it could not of course be immutable. In order to defend his mutability thesis, Jakobson could not but find recourse to his own conception of *langue*.

Saussure (1959, 98) was explicit about innovation: "It is in speaking [parole] that the germ of all change is found. Each change is launched by a certain number of individuals before it is accepted for general use.… But not all innovations of speaking have the same success, and so long as they remain individual, they may be ignored, for we are studying language; they do not enter into our field of observation until the community of speakers has adopted them". Yet, Jakobson added, this "certain number of individuals" represented a specific collectivity whose *langue* was in some respects the latest fashion. The innovative traits introduced by this group are evidently facts of *langue*. But even if a new form is only repeated and adopted by a single speaker, it is again a fact of *langue*, a fact of individual *langue* in this case. Thus, irrespective of the number of users that initially repeat an innovation, the repetition itself implies that the new form is a fact of *langue*. A potential value manifests itself in *parole* through a series of repetitions, which indicate that the change has taken place in the model itself, in *langue* (Jakobson [1942b]1988, 422-423). With the discussion on the principle of the immutability of *langue*, Jakobson concluded his critique of the fundamental Saussurean dichotomy between *langue* and *parole*. The attempted analysis and resolution of the entangled antinomies identified therein resulted in a new conception of *langage*, which entailed a new concept of *langue* and a new concept of *parole*. The structure of this conception is represented in Figure 7.1. "*Langue*" and "*parole*" were still used by Jakobson as referring to the members of the principal dichotomy underlying *langage*, but now they denoted the model (or system of potential values) and its manifestations, respectively. Both *langue* and *parole* were further subdivided into a subjective and an intersubjective aspect. In these two aspects, *langue* and *parole* were said to be subject to two opposing forces, conformity and nonconformity, operating not only in the spatial dimension but also in the temporal dimension (Jakobson [1942b]1988, 427).

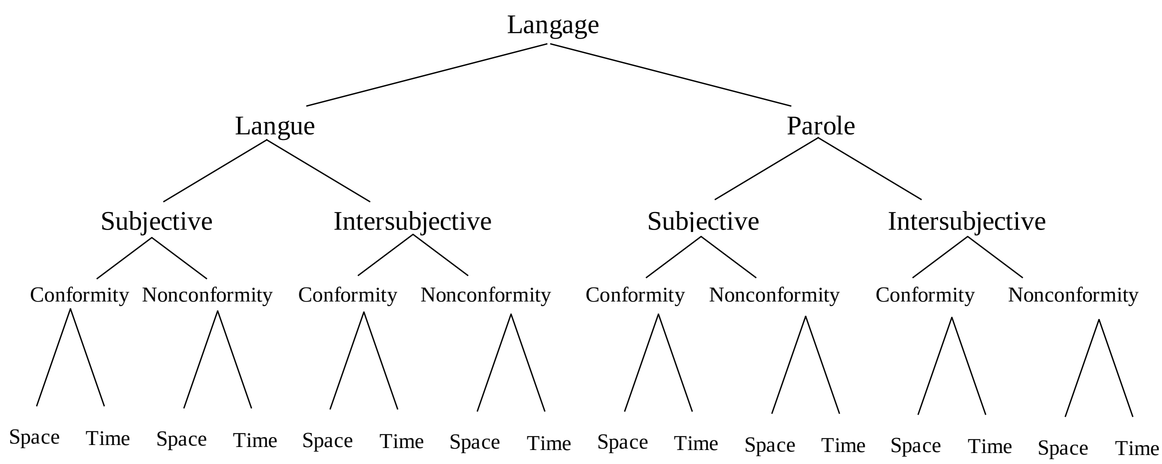

Figure 7.1

It is beyond the scope of this study to engage in an in-depth assessment of Jakobson's approach and examine whether Saussure's dichotomy between *langue* and *parole* was indeed fraught with overlapping and unresolved antinomies. In this chapter, what interests us is the conception of language articulated through the critique presented above. Yet, it would not be irrelevant to discuss briefly the general orientation of Jakobson's analysis. More than forty years ago, Koerner (1973, 228) characterized the dichotomy between *langue* and *parole* as "one of the most puzzling components of Saussure's doctrine". From the early reception of the *Cours* onwards, this distinction was variously interpreted by key linguists, and it continued to attract the interest of Saussure scholars ever since (Gordon 2004, 79-87). Its prominent position in the history of Western linguistics is primarily due to its epistemological and theoretical import. In his courses on general linguistics, Saussure raised a foundational question:

> What is both the integral and concrete object of linguistics? The question is especially difficult…
>
> Other sciences work with objects that are given in advance and that can then be considered from different viewpoints; but not linguistics. Someone pronounces the French word *nu* 'bare': a superficial observer would be tempted to call the word a concrete linguistic object; but a more careful examination would reveal successively three or four quite different things, depending on whether the word is considered as a sound, as the expression of an idea, as the equivalent of Latin *nudum*, etc. Far from it being the object that antedates the viewpoint, it would seem that it is the viewpoint that creates the object. (Saussure 1959, 7-8)

Saussure saw clearly that for the linguist *langage* was a heterogeneous phenomenon, in which several distinct but interrelated aspects could be discerned. For example, a linguistic entity taken as sound manifests itself as a complex unit comprising two complementary sides, an articulatory and an acoustical one. Viewed in relation to its ideational correlate, this sound becomes a complex unit of a different order, comprising now both a physiological and a psychological side. At a higher level of abstraction, *langage* itself presents a further series of complementarities. On the one hand, it has an individual and a social aspect, and on the other hand it "implies both an established system and an evolution; at every moment it is an existing institution and a product of the past" (Saussure 1959, 8).

The inherent heterogeneity of *langage* makes the delineation of the object of linguistics an especially demanding task. Saussure realized that an epistemological decision had to be taken. His famous response to that challenge was formulated as follows:

> As I see it there is only one solution… *from the very outset we must put both feet on the ground of language* [langue] *and use language as the norm of all other manifestations of speech*. Actually, among so many dualities, language alone seems to lend itself to independent definition and provide a fulcrum that satisfies the mind.… Language… is a self-contained whole and a principle of classification. As soon as we give language first place among the facts of speech, we introduce a natural order into a mass that lends itself to no other classification. (Saussure 1959, 9; emphasis in the original)

Saussure, thus, decided to assign a central epistemological role to the social aspect of *langage*. It was in that part that the linguist could find a "well-defined object in the heterogeneous mass of speech facts" (Saussure 1959, 14). At this point, the first principal distinction was introduced. On the one hand, there was the "social product of the faculty of speech", and, on the other hand, there was *parole*, a "wilful and intellectual" individual act (Saussure 1959, 9, 14). In choosing *langue* as his "principle of classification", Saussure gave at the same time primacy to the static aspect of language over the evolutionary aspect. The dichotomy between synchrony and diachrony is the second principal distinction in the *Cours*, and it is inextricably intertwined with that between *langue* and parole. Although the former emerged earlier in Saussure's thought, from a "theoretical viewpoint [the latter] distinction is the primary one, supporting and justifying the division of linguistics into synchrony and diachrony" (Godel 1984, 87). *Langue* and parole were not introduced through an analytical procedure performed on an object given in advance. Rather, they reflected one of the interrelated complementarities discernible in the heterogeneous mass of *langage*, and they were distinguished from each other on the basis of an epistemological decision that Saussure took in his attempt to delineate the "integral and concrete" object of linguistics.

In his 1942 lectures on Saussure's linguistic theory, Jakobson approached the distinction between *langue* and *parole* from an essentially different perspective. The basic assumption underlying his critique was that the object of linguistics was given in advance. This assumption was explicitly stated in his remarks on the third chapter of the Introduction of the *Cours*, which concerned the object of linguistics. The first and most important of these remarks was about the obviousness of the notion of *langage*. All speakers, Jakobson claimed, have an immediate grasp of the notion language, and this can be seen more clearly when we speak of the "language of animals", the "language of gestures", and so on. This metaphorical usage presupposes an immediate grasp of what language is. Jakobson had no doubt that the notion of *langage* was obvious; so did the notion of linguistics, he added. He thus found Saussure's remark about the heterogeneous nature of the 'integral object of linguistics' paradoxical. In fact, Jakobson misconstrued Saussure at this point, and this misconception is revealing. The disconnected Saussurean passages quoted by Jakobson ([1942b]1988, 399) give the erroneous impression of a statement about the heterogeneity of the "object of linguistics". However, Saussure made a statement only about *langage*, which for him was not a given object. After raising the foundational question mentioned above, Saussure proceeded with enumerating various complementarities discernible in the mass of speech, and accordingly concluded:

> From whatever direction we approach the question, nowhere do we find the integral object of linguistics. Everywhere we are confronted with a dilemma: if we fix our attention on only one side of each problem, we run the risk of failing to perceive the dualities pointed out above; on the other hand, if we study speech from several viewpoints simultaneously, *the object of linguistics appears to us as a confused mass of heterogeneous and unrelated things*. (Saussure 1959, 9; emphasis added)

Jakobson construed the last clause in this passage as a statement about the "integral object" of linguistics. Yet, for Saussure this object was not *langage* but *langue*, and it was not given in advance but it was constructed as part of a certain theory of language. The fact that Jakobson spoke of a paradox in this case is indicative of the essential difference in perspective between the two linguists. Saussure saw *langage* as a multifarious phenomenon comprising heterogeneous elements, in which linguistics should delineate its proper object of study by adopting a particular point of view. Jakobson, on the contrary, stressed that the primary and essential viewpoint was "objectively given": language was above all a tool, and it should be studied as such. Thus, linguistics should consider the constitutive elements of language in relation to the function that the latter serves (Jakobson [1942b]1988, 400).

Jakobson's preliminary remarks about the nature of *langage* are illuminating, in that they lay bare the deeper discrepancy between the linguistic theories of the two leading figures. What is at stake in his critique of the Saussurean dichotomy between *langue* and *parole* is primarily the epistemological status of language. For Jakobson, language has an independent existence as an object of study. It is a multilayered phenomenon with its internal laws. The task of the linguist is to uncover those laws, in order to shed light on the interconnections that do not lend themselves to direct observation. It is precisely this assumption about the epistemological status of language that allowed Jakobson to carry out an analysis of the kind presented in the second series of his lectures in 1942 (Toutain 2011, 331). The epistemological and theoretical import of Saussure's distinctions was overlooked, and the dichotomy between *langue* and *parole* was interpreted ontologically. Thus, when Jakobson spoke of the necessity to disentangle a series of antinomies related to that dichotomy, he had in mind not the refinement of a theoretical viewpoint but the uncovering of the internal, hierarchical structure of *langage* as an object given in advance. This is corroborated by both the procedure and the results of his analysis. This shift in perspective accounts for the way in which Jakobson treated *langue*. In the *Cours*, *langue* appeared as a theoretical model constructed for the observation of reality by the linguist. Jakobson transposed that model to the level of reality itself, and made the distinction between model and manifestation the overarching dichotomy within *langage*. "*Langue*" denoted now a family of models that governed the linguistic behavior of a given community of speakers. This essentially different understanding of *langue* as a model allowed for postulating different types and subtypes thereof, e.g. individual *langue*, affective *langue* etc. The Saussurean concept of *langue* was predicated on an epistemological decision to give primacy to the social and static aspects of *langage*. In Jakobson, the primacy was given to the notion of structured whole, to the *pattern*, and it is telling that he used precisely this English word in his French lectures as an equivalent term of "*langue*" (Jakobson [1942b]1988, 404, 428).

The critical analysis of Saussure’s theory of language presented at the École Libre des Hautes Études in 1942 exemplified the distinctive feature of Jakobson’s structuralism, a feature characteristic of Trubetzkoy’s thought, too. In the work of both linguists, there was no clear-cut distinction between the object of scientific study and the object as a real thing preexisting any scientific inquiry. Their objects were always assumed to be given; they were also assumed to have the form of hierarchically structured entities. Such entities were at the same time systems themselves and parts of higher-level systems. Thus, behind the observable facts amenable to scientific study there was a vast web of interconnections that had to be uncovered. The structuralism of Jakobson and Trubetzkoy was actually “a means of conceiving ties not in the sense of relations that create objects… but in the sense of relating seemingly unrelated features, features that seemed to exist independently of each other” (Sériot 2014, 247). What Jakobson tried to do in his critique of the Saussurean distinction between *langue* and *parole* was to foreground the interconnection of the various aspects of *langage* that Saussure supposedly had treated as mutually exclusive. This task was carried out as a disentanglement of overlapping antinomies and consisted in drawing connections that transcended the fundamental Saussurean divisions. The result of this process was an essentially different concept of *langue*, which reflected the Jakobsonian idea of a hierarchy of systems. Jakobson’s *langue* was not simply a necessary condition of communication but a system of interconnected models that determined entirely *parole*, the latter being solely the manifestation of the potential values contained in the former. In this scheme, there is no fact of *parole* that is not already contained potentially in *langue*, and this can be seen more clearly in the discussion about linguistic innovation (Toutain 2011, 336).

The 1942 manuscript discussed in this chapter is a particularly valuable document in several respects. First, it is the only text among Jakobson’s published and unpublished writings that provides a detailed account of the dichotomy between *langue* and *parole* (Waugh 1984, 158). Secondly, it presents together several key tenets of Jakobson’s theory of language, as developed during the previous fifteen years, and lays bare in a lucid fashion the conceptual backbone of his ‘ontological structuralism’[119]. Thirdly, it provides a clear exposition of Jakobson’s conception of language as a system. Furthermore, as regards specifically the object of study in this monograph, it sheds light on the question of the emergence of the linguistic concept of code. The critical analysis carried out by Jakobson in this manuscript resulted practically in the dissolution of the Saussurean distinction between *langue* and *parole*. A new dichotomy was introduced, which was predicated on a radically different understanding of the nature and the internal structure of *langage*. The basic Saussurean terms (*langue*, *parole*, *convention* etc.) were retained, but they were used as labels for different concepts that formed integral part of a different structuralist theory of language. Thus, the adherence to the Saussurean terminology at the surface level concealed a major divergence at the deep level of the theoretical perspective adopted and the system of concepts employed. Yet, the magnitude of the shift at the deep level was such that caused disturbances at the surface level in the form of terminological oscillations. The most striking was that concerning the new concept of *langue*.

The preceding exposition of Jakobson’s critique showed that through the deconstruction of the Saussurean distinction between *langue* and *parole* an alternative concept of *langue* emerged. Of course, that concept was not the result of a logical exercise but evolved gradually during the development of Jakobson’s linguistic thought from the late 1920s onwards. In this sense, the analysis of antinomies offered in the 1942 manuscript actually recapitulated a long gestation process that eventually yielded a new linguistic concept. In discussing the first antinomy related to the distinction between *langue* and *parole*, Jakobson used the French words “*modèle*” and “*norme*”, and the English word “pattern” as equivalent terms of “*langue*”, and he switched several times between them throughout the text according to the focus of the respective passage[120]. The use of such terms as “*norme*” or “*convention*” does not necessarily imply a terminological oscillation. These words denote attributes of the Saussurean concept of *langue* and thus they reasonably occur frequently in relevant discussions. However, “*modèle*” and “pattern” are not inherently linked with the concept of *langue*, and their use may indicate a different

[119] Sériot (2014, 249) characterized Jakobson and Trubetzkoy’s structuralism as ontological in order to emphasize their belief in the systematic nature of reality.
[120] See e.g. Jakobson ([1942b]1988, 404-405, 420, 423, 434).

understanding of the latter. As Jakobson proceeded with his analysis and established the distinction between model and manifestation as the overarching dichotomy in his scheme, the terms "modèle" and "pattern" became ever more suitable for the first of the two members of the new distinction. The dissolution of the dichotomy between *langue* and *parole* made the use of basic Saussurean terms problematic. Strictly speaking, the expression "*langue individuelle*" is a contradiction in terms, if "*langue*" is understood in the specific sense it has in the *Cours*. By the time he delivered his first lectures at the École Libre des Hautes Études, Jakobson must have felt the need for a new terminology corresponding to his system of concepts. The use of Saussurean terms might give the impression of continuity with the work of the "Genevan master", but it could also be misleading insofar as some key terms, such as "*langue*", designated concepts that for Jakobson were fraught with unresolved antinomies. The new concept of *langue* that he put forward called for a terminological innovation in the theory of language. In order to find the suitable term, Jakobson turned to information theory and chose "code" as the label for his substantially modified concept of *langue*.

As argued in the previous chapter, Jakobson's relation to communication engineering, information theory and cybernetics should not be viewed as just another episode of the scientific bandwagon that swept the natural and social sciences during the 1950s and 1960s. In the mathematical approach to communication expounded by Shannon, Wiener and others, Jakobson discerned some of the fundamental principles of his ontological structuralism. Two principles, in particular, feature prominently in his remarks about the theoretical developments in control and communication engineering: the 'teleological criterion' and the 'dichotomous principle'. The teleological criterion was introduced in his early phonological studies and expressed an opposing view to the Neogrammarian doctrine of linguistic change, a doctrine espoused also by "Saussure and his school", according to Jakobson ([1928]2002, 2). Against the notion of language development as an agglomeration of fortuitous changes, Jakobson defended the idea of a goal-oriented evolution. The former relied on 'mechanical causality'; the latter introduced the teleological criterion in linguistics and presupposed the conception of language as a functional system. Natural languages evolve through mutations determined by the functions pursued by the speakers according to the internal laws governing the linguistic system. Teleology in Jakobson encapsulated the idea of a self-regulating system and it was not merely one of the fundamental principles of his historical phonology but also a distinctive trait of his thought in general (Holenstein 1987, 16-21). Jakobson believed that goal-oriented evolution manifests itself in a wide range of natural and social phenomena, and thus he frequently turned to other sciences in search of support for the application of his teleological criterion in linguistics. Non-Darwinian biology was one of the main sources of inspiration[121]. In a text he prepared in the late 1960s for the large study of UNESCO conducted under the general title “Main trends of research in the social and human sciences”, Jakobson wrote:

> The discussion of goal-directedness in today’s biology is of vital interest for all branches of knowledge relating to organismic activities, and the judgments advanced may serve to corroborate a consistent application of a means-ends model to the language design, to its self-regulating maintenance of integrity and dynamic equilibrium (homeostasis), as well as to its mutations. (Jakobson 1970, 442)

In his writings from different periods, Jakobson drew also on other sciences that were taken as exemplifying certain principles of his ontological structuralism in diverse fields of study[122]. After his arrival in the United States and his initiation into the statistical approach to communication, he thought that in cybernetics and information theory he had found perhaps the most conclusive evidence corroborating his ontological theses about communication. Cybernetics was primarily mentioned in connection with its contribution to the construction of a universal method of teleological analysis. Jakobson’s stance towards cybernetics is illustrated in the following passage, where he tried to establish the methodological merits of his approach to linguistic change by drawing a connection with the cybernetic view on purposeful and non-purposeful behavior[123]:

> Since in the process of a change its two terms, the start and the finish, necessarily co-occur and can be compared as to their place and function in the system, we are enabled and even compelled to seek the purpose of the change. If mutations are a constituent part of the

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[121] On Jakobson’s relation to biology, see Sériot (2014).
[122] See e.g. Jakobson ([1929]2018, 163-165).
[123] In this passage, Jakobson probably refers to Rosenblueth, Wiener and Bigelow (1943), Rosenblueth and Wiener (1950), Taylor (1950a), Taylor (1950b) and Scheffler (1959). The quotation is from Rosenblueth and Wiener (1950, 326).

> purposive linguistic system, then the application of a "teleological criterion" to the analysis of phonemic changes… must be accepted as a corollary following from these premises. I cannot share that antiquated superstitious fear of teleology which is still professed by some students of linguistics. As has been made clear by the productive and inspiring discussion of "behavior, purpose, and teleology" carried on during the last twenty years in the philosophy of science (from A. Rosenblueth, N. Wiener, and J. Bigelow to R. Taylor, I. Scheffler, and others), "the adoption of a teleological approach simplifies the analysis of goal-directed behavior and enlarges the scope of this analysis." The theoretical elucidation of such notions as "goal-attainment", "goal-failure", and "negative feedback" opens new possibilities for their use in linguistic operations. (Jakobson [1962]2002, 652)

This passage lays bare in a succinct way the dependence of the teleological criterion upon the ontological premises of Jakobson's theoretical edifice. Given that language is a functional system and that there is an interpenetration between its synchronic and diachronic aspects, the application of the teleological criterion to the study of linguistic change is said to follow as a compelling logical consequence. Accordingly, Jakobson disparaged the anti-teleological reactions of some linguists as rooted in a "superstitious fear" and mentioned (without citing the source) Rosenblueth and Wiener's view about the methodological advantages of teleological analysis. The argument presented here by Jakobson is twofold. On the one hand, it was argued that the analysis of linguistic change as goal-oriented is consistent with the nature itself of language as an evolving, self-regulating system. On the other hand, Jakobson invoked cybernetics in an attempt to demonstrate the scientific validity of his teleological criterion. It should be noted that the reference to cybernetics was intended to support not simply an epistemological decision but, more importantly, an ontological thesis. For Jakobson, "linguistic phenomena do not merely behave 'as if' they were goal-directed, they *are* goal-directed" (Holenstein 1987, 21; emphasis in the original). In a similar way, Jakobson invoked the mathematical theory of communication in his attempt to support his thesis about the dichotomous structure of phonological systems. This can be clearly seen in the book he co-authored with Fant and Halle, in which key information-theoretical terms and notions were introduced for the first time in linguistic analysis. In that work, it was rightly said that in information theory binary selections were used as "an operational device imposed by the investigator upon the subject matter for pragmatic reasons". However, it was further argued that in the case of speech “such a set of binary selections is inherent in the communication process itself as a constraint imposed by the code on the participants of the speech event” (Jakobson, Fant and Halle [1951]1988, 600).

The cardinal significance of binary selections for both disciplines was repeatedly stressed by Jakobson in his writings[124]. Unlike his mention of the cybernetic view of teleology, however, the frequent references to the binary measurement scale used in information theory were not made solely for corroboration purposes. As shown in the previous chapter, Jakobson’s relation to information theory had several complementary aspects and it should be seen as part of his project for a full cooperation between linguistics and communication engineering. The latter would provide the technological means that would make possible an extremely sophisticated method of linguistic analysis. Information theory would provide the theoretical tools necessary and a solid, mathematical foundation for structural linguistics. In 1960, Jakobson outlined the prospects of this interdisciplinary cooperation at the Symposium on the Structure of Language and its Mathematical Aspects, which was held in New York[125]. The paper he read at that Symposium and his postwar phonological analyses give a sufficiently clear picture of the intricate relation between information theory and Jakobson’s theory of language. In general, it can be said that the influence on Jakobson was conditioned by his ontological and epistemological premises. His postwar linguistic studies indicate that no modification or critical re-evaluation of his fundamental theses occurred as a result of his contact with the statistical conception of communication. Instead, the information-theoretical notions and terms that eventually found a place in his writings were ‘absorbed’ by his ontological structuralism and were amalgamated into an ambitious project of reforming the science of language. As already noted, in some cases information theory was mainly invoked for corroboration purposes. However, some elements played a far more important role. This is particularly the case with the term “code” and Shannon’s model of the communication process. In Jakobson’s work, the two elements relate to each other in a very specific way. “Code” was adopted as an appropriate term for the concept of linguistic system, and Shannon’s model provided

[124] See, e.g., Jakobson ([1953a]1971, 225), Jakobson and Halle (1956, 44) and Jakobson (1961, 571).
[125] See Jakobson (1961).

the general scheme for Jakobson's model of verbal communication, which brought into relief the place and the function of the concept of code in his linguistic theory.

A cursory reading of Jakobson's postwar writings surveyed in the previous chapter might give the impression that "code" was introduced simply as an alternative term for Saussure's "*langue*". In other words, it seems as if a fashionable term from information theory came to designate a well-established linguistic concept. This is how several linguists of the time perceived the terminological shift under discussion, and on the basis of precisely this understanding some of them (such as Mounin and Guiraud) expressed their criticism of the adoption of "code" in linguistic theory. Jakobson's way of introducing the term at several meetings undoubtedly favored such an understanding. At the International Symposium on Anthropology held in June 1952, he remarked:

> The fundamental dichotomous notions of linguistics, particularly singled out by F. de Saussure, A. Gardiner, and E. Sapir and called *langue* and *parole* in France, 'linguistic pattern' and 'speech' in America, now receive a much clearer, simpler, logically less ambiguous, and operationally more productive formulation, when matched with the corresponding concepts of communication theory, namely with 'code' and 'message'. (Jakobson [1953a]1971, 224)

A month later, at the Conference of Anthropologists and Linguists held at Indiana University, he drew a wider terminological connection:

> When I read all that was written by the communication engineers, especially American and English (in particular E. C. Cherry, D. Gabor, and MacKay), on message and code, I realized of course that both these conjoined aspects have been for a long time familiar to the linguistic and logical theories of language here and abroad under various dichotomous names such as *langue–parole*, *Language–Speech*, *Linguistic Pattern–Utterance*, *Legisigns–Sinsigns*, *Type–Token*, *Sign-design–Sign-event*, etc. But at the same time I must confess that the *Code–Message* concepts of communication theory are much clearer, much less ambiguous, and much more operational than the traditional presentation of this dichotomy in the theory of language. (Jakobson [1953b]1971, 558-559)

In 1960, at the Symposium on the Structure of Language and its Mathematical Aspects, "code" was mentioned once again in tandem with "*langue*", although this time it was used in the sense of transformational mechanism:

> The engineer assumes a “filing system” of prefabricated possibilities more or less common to the sender and receiver of a verbal message, and Saussurian linguistics speaks correspondingly about *langue*, which makes possible an exchange of *parole* between interlocutors. Such an “*ensemble* of possibilities already foreseen and provided for” implies a code, conceived by communication theory as “an agreed transformation –usually one-to-one and reversible”– by which one set of informational units is converted into another set, for instance, a grammatical unit into a phonemic sequence and vice versa. The code matches the *signans* with its *signatum* and the *signatum* with its *signans*. (Jakobson 1961, 247)

Admittedly, such statements imply a common conceptual ground underlying a set of roughly equivalent terms. In the absence of explicit definitions and illuminating texts, such as the 1942 manuscript discussed above, which was published posthumously in 1984, the terminological connection drawn by Jakobson can be misleading. Other statements can even cause confusion. For instance, in the *Retrospect* that he wrote for the second volume of his *Selected Writings*, we read: “The Saussurian inner duality of *langue* and *parole*… or, to use a modern, less ambiguous terminology, ‘code’ (Saussure’s *code de la langue*) and ‘message’ –alias ‘competence’ and ‘performance’– gives rise to two divergent approaches within the same section of the *Cours*…” (Jakobson 1971, 718). In this remark, the reference to the Saussurean expression “*code de la langue*” not only gives the impression of a straightforward equivalence between “*langue*” and “code” but it also seems to suggest that the conception of language as a code has actually its remote origins in the *Cours*[126]. Arguably, it would not be incorrect to say that Saussure was the first linguist who spoke of language as a code, if by that we mean that he was the first who used the word “code” to emphasize the rule-governed aspect of language. However, if we leave aside the trivial notion of language as a social institution, it is at least questionable whether we could maintain that the expression “*code de la langue*” comes close to Jakobson’s use of “code”. The Saussurean expression cited by Jakobson occurred in the following passage:

[126] This is what Tullio de Mauro claims in his critical edition of the *Cours*, in a note referring particularly to this expression. See Saussure ([1916]1972, 423, n. 66).

> Speaking, on the contrary, is an individual act. It is wilful and intellectual. Within the act, we should distinguish between: (1) the combinations by which the speaker uses the language code for expressing his own thought; and (2) the psychophysical mechanism that allows him to exteriorize those combinations. (Saussure 1959, 14)

Apparently, Saussure used "*code*" in this passage not as a synonym for language but in the sense of a set of linguistic rules. He had also used that word in his doctoral dissertation, where he spoke of the "*code de la grammaire*" of Sanskrit[127]. In another passage in the *Cours*, devoted to the significance attached to writing by some linguists, Saussure spoke once again of code in connection with linguistic rules:

> The literary language adds to the undeserved importance of writing. It has its dictionaries and grammars; in school, children are taught from and by means of books; language is apparently governed by a code; the code itself consists of a written set of strict rules of usage, orthography; and that is why writing acquires primary importance. (Saussure, Course in general linguistics 1959, 25)

By the late nineteenth century, the French word "*code*" had already acquired its cryptographic sense and it was further used for the alphabets and wordlists employed in telegraphy. However, the passages quoted above show that Saussure used the word only in the sense of norm or convention[128]. Thus, his "*code de la langue*" is a set of rules that enable speakers to "express their thought" by means of language. Jakobson's understanding of linguistic codes certainly encompasses this notion of rule. Yet, it is intertwined with an essentially different conception of *langue*[129] and it makes a different use of the term "code", relying mainly on its information-theoretical sense. It appears, then, that Jakobson was wrong about the straightforward equivalence between his use of the English word "code" and the use of the French word "code" in the *Cours*. Likewise, his remarks suggesting an equally straightforward equivalence between "*langue*" and "code" were misleading. This is corroborated by his critical analysis of the Saussurean

[127] See Saussure (1881, 14).
[128] In the *Cours*, Saussure ([1916]1972, 36) mentioned once the Morse code but he used the term "*alphabet Morse*".
[129] It is noteworthy that there is also a fundamental discrepancy between the two linguists as regards the concept of system itself (Sériot 2014, 249-251).

concept of *langue* presented in the second series of his lectures at the École Libre des Hautes Études, where Jakobson put forward his own concept of linguistic system.

The analysis carried out in this chapter led to the conclusion that “code” was not introduced in linguistics simply as a result of a scientific bandwagon. The postwar transdisciplinary enthusiasm for the mathematical approach to communication played undoubtedly a role in this terminological transfer, mainly in preparing the ground for the adoption of information-theoretical notions and terms by linguists. The early uses of “code” by Fry and Miller in connection with the study of the psychological and neurophysiological aspects of language were also conducive to the prospective adoption of the term in linguistics. Yet, the major thrust was provided by the development of Jakobson’s theory of language. As already explained, this theory evolved in several stages through Jakobson’s long-standing work on the ‘sound shape of language’. The 1940s and 1950s belonged to a transitional period marked, *inter alia*, by the appropriation of key information-theoretical and cybernetic elements for both theoretical and research purposes. In 1951, Jakobson introduced “code” as an equivalent term of “phonemic pattern”, but soon expanded its use by associating it with Saussure’s “*langue*”. The present chapter has shown that this association was not incidental. The 1942 manuscript posthumously published under the title “La théorie saussurienne en rétrospection” offers a unique exposition of Jakobson’s concept of *langue*. The terminological oscillations identified therein with respect to this concept indicate that during the period in question Jakobson sought a new term that would express more accurately his particular conception of linguistic system, as opposed to that of Saussure. He thus turned to information theory feeling that the distinction between code and message provided an obvious analog for the dichotomy between *langue* and *parole*. This perceived analogy was one reason for which Jakobson chose the term “code”. Another reason might be the fact that this term connoted the technological and theoretical apparatus of communication engineering, part of which Jakobson endeavored to appropriate for the purposes of his linguistic structuralism. The posthumously published manuscript discussed earlier, however, suggests a third reason.

The concept of *langue* at which Jakobson arrived through his critique on Saussure referred to a structured whole, a hierarchy of systems and subsystems that determined entirely *parole*. In other words, in this scheme, as in Jakobson's worldview in general, "there was no system independence" (Sériot 2014, 249). As Toutain (2011, 336; my translation) aptly put it in information-theoretical terms, "for Jakobson every message is coded, it is nothing more than the manifestation of the values of a code, and… conversely, every code is the code of a message". This remark allows for shedding light on a key aspect of Jakobson's terminological choice. We recall that Shannon's model depicted communication as a series of successive transformations. In this model, there were two sequences of events unfolding in the communication channel. The first sequence was called "message" and the other "noise". The transformations foreseen in a given communication system are designed in such a way that the message can be sufficiently controlled and the disruptive effect of noise and signal distortion can be minimized or ideally neutralized. Code plays a decisive role in this control process. The sequence of events constituting a message represents the 'intentional element' in the channel. It is a sequence of events produced purposefully and controlled by human agents. On the other hand, noise is characterized by randomness and it cannot be entirely controlled. The sequence of events termed "noise" represents the 'unintentional element' in the channel and it is produced by sources extraneous (and detrimental) to the system. The message, on the contrary, is produced by the system and its form is determined by the code employed in the transmitter and the receiver. In that sense, the sequence of events constituting the message is a manifestation of the code's potential. Thus, Shannon's diagram provides an abstract representation of a class of material systems that exemplify Jakobson's theoretical scheme of a model that determines entirely its manifestations.

Jakobson never made any penetrating remarks on the structure of telecommunication systems and the fundamental properties of their elements, but it is rather unlikely that he failed to notice this inherent characteristic of the relation between code and message. After all, the same characteristic manifests itself in another field of communication practices with which the word "code" is associated: cryptography. In both telecommunication and cryptography, there is an element (code) that determines entirely the form of another element (message), the latter being the manifestation of the former's potential. We can now understand why Jakobson ([1953a]1971, 224) said that the "fundamental dichotomous notions" of *langue* and *parole* "receive a much clearer, simpler, logically less ambiguous, and operationally more productive formulation when matched" with the information-theoretical notions of code and message. "Code" and "message" became the preferred terms precisely because their information-theoretical sense captured the essence of Jakobson's fundamental dichotomy underlying *langage*: the dichotomy between a hierarchically structured whole that determines entirely every manifestation of its potential values. In my view, this is the most significant reason for which Jakobson chose the term "code" for the alternative concept of *langue* that he outlined in his posthumously published 1942 manuscript. Although he never explained why these terms allowed for a "less ambiguous" and "operationally more productive" formulation of this fundamental linguistic distinction, I have tried to show that we can reconstruct what he really meant by those words if we juxtapose his understanding of *langue* and *parole* with the essential characteristics of code and message in Shannon's communication model. Jakobson's conception of *langue*, which evolved during his Czech years, crystallized into the linguistic concept of code through its amalgamation with the respective information-theoretical notion. This particular linguistic concept, in turn, was the basis for the semiotic concept of code.

The place of the concept of code in Jakobson's theoretical edifice was prefigured in the critical analysis of the Saussurean distinction between *langue* and *parole* presented at the École Libre des Hautes Études in 1942. What would later be termed "code", represented in those lectures one of the two members of the primary dichotomy into which Jakobson divided *langage*. In the 1950s, the concept's place in his theory would be specified not in terms of the dichotomous structure of the object of linguistics but with respect to the typical structure of the process of verbal communication. At the Conference of Anthropologists and Linguists, which was held in Indiana in 1952, Jakobson outlined the main components of a new linguistic model of communication based on Shannon's famous diagram. As explained in Chapter 7, Jakobson modified substantially Shannon's scheme in order to adapt it to the needs and purposes of his linguistic theory. Yet, the salient feature of the model sketched in 1952 was not the linear arrangement it adopted from Shannon's diagram but the assumption that language is not confined to a single function. In Jakobson, the idea of linguistic multifunctionality can be traced back to the Russian years and the Moscow Linguistic Circle (Daneš 2003, 62-63). The same idea underlay the structural functionalism of the Prague Linguistic Circle. In the opening paragraph of the *Theses*, quoted in the beginning of this chapter, two basic functions are mentioned: expression and communication (Theses 1929 [1929]1983, 77). The third thesis starts with a section devoted to the "functions of language", and lays bare the fundamental significance of the principle of multifunctionality for the linguistic program put forward by the Prague Circle:

> The examination of language requires painstaking attention to the variety of linguistic functions and to the ways in which they are realized in the given case. If such functions and ways are not attended to, both the synchronistic and the diachronistic characterization of any language is misleading and, to a considerable degree, even fictitious. Such functions and their ways of realization, indeed, change both the phonic and the grammatical structure of the language as well as its lexical composition. (Theses 1929 [1929]1983, 88)

In other words, in the entire system of a given language one can discern different subsystems adapted to different functions. Yet, it would be erroneous to take these subsystems as independent parts or suppose that language fulfils only one function in a given speech event:

> It is desirable to examine forms of speech in which one function prevails as well as those in which more functions interpenetrate; in such research the basic question is the different hierarchy of functions in each given case.
>
> *Each functional mode of speech has its own system of conventions – its own 'language'* ('langue'); for this reason it is incorrect to identify some of the functions with 'langue' and some other ones with 'parole'. (Theses 1929 [1929]1983, 89; emphasis in the original)

Although the two passages quoted above may be said to reveal a difference in perspective as regards the notion of linguistic function (Daneš 2003, 57-58), both bespeak an unmistakable adherence to multifunctionality as a guiding principle of linguistic research. From the late 1920s onwards, Jakobson's work remained consistent with this principle throughout the rest of his career, and one can find numerous writings echoing the early statements made in the *Theses* about the "functional modes of speech". The 1942 manuscript discussed in detail in this chapter is a notable case in point. The distinction postulated in that text between different subtypes of *langue* was predicated precisely on the core assumption that there are different subsystems of linguistic means and conventions serving different functions.

In the interwar period, the functional aspect of language was a major concern for another prominent scholar, the German psychologist and theorist of language Karl Bühler. The theory of language was a field of particular interest for Bühler since at least 1907 (Koerner 1984, 5). In December 1930, Bühler read a paper on phonetics and phonology at the international phonological conference, which was held in Prague and was organized by the Prague Linguistic Circle[130]. That paper offered only a small sample of the fruits of his long-standing reflection on language. A fuller exposition was first given in his seminal essay titled "Die Axiomatik der Sprachwissenschaften", which was published in *Kant-Studien* in 1933. As the title itself suggests, in that essay Bühler followed an axiomatic procedure "in the sense that he was concerned about determining the central presuppositions of a language theory that are needed to construct an analytic framework adequate to its object: language in its representational function" (Innis 1982, 5). A year later, the essay was incorporated in his major work *Sprachtheorie. Die Darstellungsfunktion der Sprache*. Both texts exerted a significant influence on various linguistic groups, including the Prague Circle (Innis 1982, 3-4). Bühler's *Spachtheorie* opened with an introductory discussion on the theory of language and then proceeded with the four principles of linguistic research, which were first formulated in his 1933 essay. These principles were said to be "gained from the stock of successful language research itself by way of reduction", and could be taken as axioms or "at least as a basis and point of departure for continuing theoretical efforts" (Bühler [1934]2011, 25-26). The first principle concerned the speech event itself and took up a rather old idea dating back to Plato:

> I think it was a good idea of Plato's when he claims in *Cratylus* that language is an *organum* for the one to inform the other of something about the things. There is no question that such information takes place, and the advantage of taking it as the starting point lies in the fact that all or most other cases can be derived from this one typical case by *reduction*; for as far as fundamental relationships are concerned, informing by means of language is the richest of the manifestations of the concrete speech event. (Bühler [1934]2011, 30; emphasis in the original)

[130] Bühler (1931).

In this simple statement about the use of language as a tool for communicative purposes, Bühler discerned three basic elements: the speaker, the hearer and the "thing" (the object or states of affairs about which the speaker informs the hearer). These elements are related to each other through the linguistic signs used. Thus, there is a fourth element, which lies at the heart of the speech event and corresponds to the perceptible phenomenon of sign use (e.g. the speech sounds produced by the speaker).

Bühler depicted the simple structure underlying the speech event as a triangle, with the first three elements being the vertices and the fourth element the center of the triangle. The edges of the triangle were omitted. Instead, there were dash lines connecting the vertices with the center, thus suggesting a relation mediated by the linguistic sign. This scheme was the basis upon which Bühler constructed his famous *Organonmodell* by elaborating further the relations that could be discerned between the linguistic sign and the other three elements in the speech event. In elucidating these relations (or semantic functions), Bühler disclosed the different aspects of a complex semiotic entity. The multiplicity of relations manifested in the concrete speech event were defined as follows:

> [The linguistic sign] is a *symbol* by virtue of its coordination to objects and states of affairs, a *symptom* (*Anzeichen*, *indicium*: index) by virtue of its dependence on the sender, whose inner states it expresses, and a *signal* by virtue of its appeal to the hearer, whose inner or outer behaviour it directs as do other communicative signs.
>
> This organon model, with its three largely independently variable semantic relations, was first expounded completely in my paper on the sentence (Bühler 1918), which begins with the words: "What human language does is threefold: profession, triggering and representation." Today I prefer the terms *expression* (*Ausdruck*), *appeal* (*Appell*) and *representation*. (Bühler [1934]2011, 35; emphasis in the original)

The full structure of the communication process is, thus, more complex than it might appear at first glance. The linguistic sign fulfils its mediative role by means of three semantic functions, which are determined by the specific relation that the sign bears to each of the three elements: the speaker, the hearer, and the thing. There may be cases in which one function may prevail over the others, but the multifunctionality of the linguistic sign is constitutive of the speech event. The first principle (or axiom) of linguistic research posited by Bühler, then, was that language is a tool and its signs perform three basic semantic functions in the speech event. The *Organonmodell* was offered as a representation of the structure of the speech event and the fundamental relations of the linguistic sign with the elements of the communication process. As such, it was also an instrument for determining whether "each of the three relationships, each of the three semantic functions of language signs discloses and identifies a specific realm of linguistic phenomena and facts" (Bühler [1934]2011, 39).

The *Organonodell* reveals an aspect of Bühler's *Sprachtheorie*, which resembles the linguistic program expounded by the Prague Circle. In both cases, the view of language as a tool serving multiple, hierarchically related functions in speech was accorded the status of a guiding principle of linguistic research. The same principle underlay the ontological structuralism of Jakobson throughout the various stages of its development. In his 1942 manuscript on the Saussurean theory of language, Jakobson referred several times to the multifunctionality of language in his attempt to delineate different linguistic subsystems (e.g. "*langue affective*"). Ten years later, he returned to the same topic in his discussion of the "basic factors" of verbal communication. In the draft of the communication model that he presented at the joint conference of anthropologists and linguists, he discerned six different functions. Five functions corresponded, one by one, to the message's relation with each one of the other factors in the communication process, whereas the sixth function (the poetic function) referred to the emphasis of the message on itself (Jakobson [1953b]1971, 556-558). No mention was made of Bühler, although the scheme presented at that conference obviously obeyed the logic of the *Organonmodell*. In 1956, in his Presidential Address at the Annual Meeting of the Linguistic Society of America, Jakobson discussed the issue of "metalanguage as a linguistic problem"[131]. For the purposes of that discussion, he presented for the first time in full form his famous functional model of verbal communication. The same model was presented again in 1958 at the Conference on Style at Indiana University, this time in a discussion on the relation between linguistics and poetics[132]. In a sense, this scheme illustrates the core of Jakobson's approach to language as a tool of communication.

[131] See Jakobson ([1976]1985).
[132] See Jakobson ([1960]1981).

The main part of the diagram is a simplified version of Shannon's linear model. It consists of a horizontal axis standing between the two interlocutors, the addresser and the addressee. Unlike Shannon's channel, however, this axis represents both the "physical channel and [the] psychological connection between the addresser and the addressee" (Jakobson [1976]1985, 113). The scheme comprises three additional elements necessary for any verbal exchange: the message produced by the addresser, a context "referred to… seizable by the addressee, and either verbal or capable of being verbalized", and a code "fully, or at least partially, common to the addresser and addressee" (ibid.). The additional components enabled Jakobson to expand the functions foreseen in Bühler's *Organonmodell* from three to six. Typically, a given message is said to perform several functions simultaneously, albeit in a certain hierarchical order. Depending on the specific focus of the message, there is always a different dominant function. Thus, we get the following six pairs:

Focus of the message	**Dominant function**
Addresser	Emotive
Context	Cognitive (or referential)
Contact	Phatic
Message	Metalinguistic
Addressee	Conative
Code	Metalinguistic

Table 8.1

The phatic function prevails in the case of messages "serving to establish, to prolong, or to discontinue communication, to check whether the channel works… to attract the attention of the interlocutor or to confirm his continued attention" (Jakobson [1976]1985, 115). On the other hand, "[w]henever the addresser and/or the addressee need to check up whether they use the same code, speech is focused upon the code and thus performs a metalingual (or glossing) function" (Jakobson [1976]1985, 117)[133]. As before, Jakobson identified the poetic function with an emphasis on the message itself, stressing in particular that this "is not the sole function of verbal art but only its dominant, determining function, whereas in other verbal activities it acts as a subsidiary, accessory constituent…. Hence, when dealing with poetic function, linguistics cannot limit itself to the field of poetry" (Jakobson [1976]1985, 116). The remaining three functions corresponded to the semantic relations (*Darstellung*, *Ausdruck*, *Appell*) foreseen in Bühler's *Organonmodell*.

The formulation of Jakobson's functional model of verbal communication marked the full development of two seminal ideas. The first one was the idea of linguistic multifunctionality. It can be traced back to the 1920s, and it was advanced by Bühler and the Prague Circle as a guiding principle of linguistic research against the still dominant doctrine of language as a tool serving exclusively representational purposes. The second idea encapsulated the conception of language as a system of systems and it, too, can be traced back to the work of the Prague Circle. The two seminal ideas were inextricably intertwined with each other and formed part of the conceptual substratum of the Circle's functional structuralism. Jakobson summarized their cardinal role as follows:

> In the "Thèses" inaugurating the first volume of the *Travaux* and in later deliberations the Prague Circle, insisting on purposiveness in language, outlined an inquiry into languages of diverse functions and paid due attention to their different patterning. In this study of the various linguistic aims, the poetic function obtained the most fruitful treatment. The sense for the multifarious character of language saved the Prague group from an oversimplified, bluntly unitarian view; language was seen as *a system of systems* and especially Mathesius' papers on intralingual coexistence of distinct phonemic patterns opened new outlooks.
>
> The regard for the various "functional dialects", or, in other words, the different styles of language radically altered the view of linguistic change. The two stages of a change in progress were reinterpreted as two simultaneous styles of language; the change was conceived as a fact of linguistic synchrony, and as any fact of synchrony it demanded a means-ends test with respect to the whole system of language. Thus historical linguistics

[133] On the particular role of the metalinguistic function, Jakobson ([1980]1985, 157) later stated: "Metalingual operations constitute an important and indispensable part of our speech activity; through paraphrase, synonymy or via the explicit decoding of elliptical forms, they make it possible to assure full and accurate communication between speakers".

> experienced a complete metamorphosis. (Jakobson [1963]1971, 525; emphasis in the original)

From a structuralist point of view, language is a system of signs; as such, it is internally structured according to a given pattern. From a functional point of view, language provides an ensemble of means for performing certain tasks. When introduced into a structuralist-functional perspective, the idea of multifunctionality turns language into an adaptable system capable of performing multiple functions. The 'internal' (intrasystemic) correlate of this adaptability is the property of pattern differentiation, which provides a rich 'stock' of diversified linguistic means that suit the needs of different functions. Language is no longer viewed as a uniform pattern but as a constellation of subsystems forming a higher-order structured whole. In Jakobson, the conception of language as a system of systems crystallized into the linguistic concept of code.

The 1942 manuscript on the Saussurean theory of language laid bare the distinctive trait of the Jakobsonian concept of linguistic system, a concept that would be later designated by an information-theoretical term. Against the Saussurean understanding of *langue*, Jakobson put forward a divisible concept that could be applied to a wide array of phenomena ranging from the linguistic habits of the individual speaker to the entire system of signs of a given natural language. Such a divisible concept proved to be an efficient tool for disentangling the 'unresolved antinomies' that Jakobson discerned in Saussure's fundamental dichotomy. More importantly, this concept fit perfectly Jakobson's view of language as a multifunctional semiotic system. This can be clearly seen in several of his postwar writings. For instance, when he presented his functional model for the second time, Jakobson ([1960]1981, 21) remarked, "No doubt, for any speech community, for any speaker, there exists a unity of language, but this over-all code represents a system of interconnected subcodes; every language encompasses several concurrent patterns, each characterized by different functions". Two years later, at the Symposium on the Structure of Language and its Mathematical Aspects, he returned to the distinction between overall code and subcodes, referring this time to problems amenable to statistical treatment:

> Language is never monolithic; its overall code includes a set of subcodes, and such questions as that of the rules of transformation of the optimal, explicit kernel code into the various degrees of elliptic subcodes and their comparison as to the amount of information

> requires both a linguistic and an engineering examination. The *convertible code* of language, with all its fluctuations from subcode to subcode and with all the current progressing changes which this code is undergoing, is to be jointly and comprehensively described by the means of linguistics and communication theory. (Jakobson 1961, 248; emphasis in the original)

Finally, in the summary of the main trends in linguistics that he wrote for UNESCO, he provided a more extended comment on the nature of language as a system, contrasting explicitly his own conception with that of Saussure:

> The uniformity of the code, 'sensibly the same' for all the members of a speech community, posited by the *Cours* and still recalled from time to time, is but a fiction; as a rule, every individual belongs simultaneously to several speech communities of different radius and capacity; any overall code is multiform and comprises a hierarchy of diverse subcodes freely chosen by the speaker with regard to the function of the message, to its addressee, and to the relation between the interlocutors. In particular, the subcodes offer a scale of transforms ranging from explicitness to the gradual degrees of ellipsis. When one-sided concentration on the cognitive, referential function of language gave way to an examination of its other, likewise primordial, underivable functions, the problems of the code-massage relationship showed much greater subtlety and multivalence. (Jakobson, Linguistics 1970, 458)

The three passages quoted above show that Jakobson's early use of "code" as a synonym for "phonemic pattern" was only the first step toward a full-blown appropriation of the term. The formulation of his functional model of verbal communication was a turning point in this development. From the mid-1950s onwards, Jakobson incorporated parts of his 1942 unpublished critique into several texts, in which he explicitly distanced himself from Saussure's conception of *langue* and introduced his own concept of linguistic system under the term "code".

The analysis carried out in this chapter has shown that we can trace the emergence of the linguistic concept of code to the work of Jakobson during the 1940s and 1950s. It should be stressed, however, that this process was inseparable from a long gestation period, during which Jakobson elaborated his distinctive conception of language as a multifunctional system of systems. Another important strand in this peculiar concept formation had to do with the theoretical advances in communication engineering and especially the increasing interdisciplinary exchanges between linguistics, cybernetics and information theory. As repeatedly emphasized, Jakobson's project of a sustained cooperation between linguistics and communication engineering represents a key aspect of his postwar linguistic work, and it cannot be explained away as a mere episode of the scientific bandwagon that swept the natural and social sciences after World War II. Information theory offered potentially valuable insights and mathematical tools for linguistic analysis. It was also taken by Jakobson as corroborating the fundamental theses of his ontological structuralism. Moreover, it provided a scheme of communication that seemed to encapsulate in certain respects his understanding of the relation between *langue* and *parole*. Jakobson adopted the pair "code-message" from that scheme and eventually succeeded in introducing "code" as a properly linguistic term designating his concept of linguistic system. It is interesting that already during the stage of the emergence of the linguistic concept of code, the first signs of its subsequent transformation into a semiotic concept began to appear. This parallel development is discussed in the following chapter.

CHAPTER 8

From Language to Myth and Beyond

Jakobson's linguistic concept of code is a peculiar object of study. At first sight, it is a transparent conceptual entity, occupying an obvious place in a highly influential theory of language. The apparently straightforward relation between "*langue*" and "code", the diverse uses of the latter term scattered throughout Jakobson's postwar writings, and the definition formulated in the *Fundamentals of language*[134], all seem to leave little doubt about both the origins and the content of the concept. Yet, the analysis carried out in the preceding chapter has shown that the obviousness surrounding this concept concealed the real conditions of its emergence, against the backdrop of which its full content and theoretical import can be understood. The linguistic concept of code lies at the heart of Jakobson's ontological structuralism and reflects his conception of language as a multifunctional system of systems. As such, it is characterized by a remarkable flexibility. On the one hand, it covers language as a whole, foregrounding its structural complexity and functional diversification. On the other hand, it covers all kinds of patterns or clusters of systematic relations discernible in that whole, including the rules governing the relations and the mechanisms that make possible the passage from one linguistic level to another. Thus, Jakobson actually devised a general concept of system applicable to the entire range of linguistic phenomena that could be studied from a structuralist-functionalist perspective. Moreover, the concept was rendered so general in its scope that it seemed extensible to semiotic phenomena other than those pertaining to language. Indeed, there are certain passages in Jakobson's writings that imply such an extension. Of course, a few passing references to codes in connection with such diverse phenomena as divination, music, animal communication, or the exchange of goods or mates[135] do not indicate an elaborate semiotic concept. However, they do suggest a tentative use of "code" as a general

[134] See Jakobson and Halle (1956, 5).
[135] See Jakobson ([1968]1971, 702-704) and Jakobson (1970, 427-428, 433-434).

semiotic term for the notion of system of constraints. This could be taken as a step toward a semiotic concept of code, but in fact this transition had been largely accomplished by the time Jakobson made those references. The key figure in this development was the French anthropologist Claude Lévi-Strauss.

During the Nazi occupation of France, Lévi-Strauss found refuge in New York, where he joined a group of other French-speaking exiles at the École Libre des Hautes Études. There he met Jakobson for the first time and was initiated into structural linguistics. As noted in the previous chapter, Lévi-Strauss was among Jakobson's colleagues at the École Libre who attended his two series of lectures for the academic year 1942-43. In his preface to Jakobson's famous *Six leçons sur le son et le sens*, Lévi-Strauss recalled:

> At that time I knew almost nothing about linguistics and Jakobson's name was not familiar to me. It was Alexandre Koyré who enlightened me as to his role and who put us in touch with each other. Still keenly aware of the difficulty which, as a result of my inexperience, I had met with three or four years earlier in trying to find an adequate notation to record the languages of central Brazil, I promised myself to acquire from Jakobson the rudiments which I lacked. In fact, however, what I received from his teaching was something quite different and, I hardly need add, something far more important: the revelation of structural linguistics…
>
> What I was to learn from structural linguistics was… that instead of losing one's way among the multitude of different terms the important thing is to consider the simpler and more intelligible relations by which they are interconnected. (Lévi-Strauss 1978, xi-xii)

Structural linguistics was not the single most important source of influence. Starting from the study of kinship systems, Lévi-Strauss embarked on a structuralist program for anthropology that could be extended to other social sciences. In the course of this development, he drew various elements from a variety of sources (psychology, sociology, mathematics etc.) and integrated them into a "consistent and somewhat flexible epistemological and methodological perspective" (Rossi 1973), distinguished by its focus on the unconscious substratum of human thought and the structural aspect of social phenomena. Structural linguistics was closely connected with both these distinctive traits of Lévi-Strauss's perspective.

Early on in his intellectual development, Lévi-Strauss encountered the work of Freud[136] and Marx, both of whom had a decisive impact on him during those formative years. From the two thinkers Lévi-Strauss retained the idea that true reality lies behind the realm of immediate perception. As regards the individual, Freud showed that "there existed beyond the rational a category at once more important and more valid: that of the meaningful. The meaningful is the highest form of the rational…. Freud's works then made it clear to me that… those actions which seem most purely affective, those results which seem least logical, and those demonstrations which we call pre-logical, are in point of fact precisely those which are meaningful in the highest degree" (Lévi-Strauss 1961, 59). From Marx Lévi-Strauss claimed to have learnt that social science primarily relies on models, not empirical facts. Psychoanalysis and Marxism, together with geology, were his first sources of inspiration. In them, the young Lévi-Strauss discerned a fundamental epistemological insight:

> At a different level of reality, Marxism seemed to me to proceed in the same way as geology and psycho-analysis (in the sense in which its founder understood it). All three showed that understanding consists in the reduction of one type of reality to another; that true reality is never the most obvious of realities, and that its nature is already apparent in the care which it takes to evade our detection. In all these cases the problem is the same: the relation, that is to say, between reason and sense-perception; and the goal we are looking for is also the same: a sort of *super-rationalism* in which sense-perceptions will be integrated into reasoning and yet lose none of their properties. (Lévi-Strauss 1961, 61; emphasis in the original)

In this passage, Levi-Strauss laid bare the guiding epistemological principle of the task that he set himself as an anthropologist: to "integrate meaning and experience, the sensible and the intelligible, in a single synthesis" (Clarke 1978, 413). For Lévi-Strauss, Freud and Marx did not simply foreground the crucial significance of the unconscious. They also showed that individual or collective phenomena of irrational nature "can be subjected to rational analysis" and that "it is possible to reach beyond appearances to find a logically consistent foundation, regardless of the moral judgements one might have with respect to it" (Lévi-Strauss and Eribon 1991, 107-108). Lévi-Strauss dedicated his life to the quest

[136] On Lévi-Strauss's early contact with the work of Freud, see Dosse (1997, 112-113).

for the “logically consistent” foundations underlying symbolic phenomena of cardinal importance. However, he sought to accomplish this task without engaging in a systematic elaboration of Freudian or Marxian tenets. Rather, he strove to open his own path through diverse disciplines, such as Gestalt psychology, structural linguistics, mathematics, cybernetics and information theory, in an attempt to construct the appropriate conceptual system to support his project. A crucial challenge in this course was the development of a conception of the unconscious suited to his particular philosophical orientation.

In an interview given to George Steiner, Lévi-Strauss revealed the motivation behind his decision to become an anthropologist:

> As you know, I was brought up as a philosopher and like many in France I came to sociology and ethnology from philosophy. I had in mind to answer philosophical questions. Ethnology appeared to me as a means (and perhaps the only means) to bridge the gap between a philosophical approach and a scientific approach to the problem of man. I mean the philosophical approach such as we find it, for instance, in the work of Kant. (Steiner 1966, 33)

As a philosophy student at the Sorbonne, Lévi-Strauss was fascinated by Kant (Hénaff and Lévi-Strauss 2004, 105). Throughout his career, however, he was never concerned with a systematic elaboration of Kantian themes, as he never tried to extend consistently the Freudian or Marxian line of thought to his anthropological studies. Rather, he remained “a commonsense Kantian”, but he did retain from Kant the thesis that “the mind has its constraints, which it imposes on an ever-impenetrable reality, and it reaches this reality only through them” (Lévi-Strauss and Eribon 1991, 108). This fundamental insight led Lévi-Strauss away from Freud in search of a rationalist conception of the unconscious.

By the mid-1930s, when Lévi-Strauss left for Brazil to teach at the University of São Paulo and conduct fieldwork, he was convinced about the primary importance of the unconscious and had an unmistakable predilection for identifying invariants (ibid.). Yet, he still lacked both a rationalist account of the unconscious aspect of social and cultural phenomena and a full-fledged structural method. His arrival in New York marked the beginning of a gestation period during which he refined his epistemological principles and developed his methodological tools. These two processes were closely interconnected and both entered a new phase when Lévi-Strauss was initiated into structural linguistics. In *The*

Elementary Structures of Kinship, his first major theoretical work written between 1943 and 1947, linguistics was mentioned only in the second of the two concluding chapters. In a passing reference, Lévi-Strauss ([1949] 1969, 493) paralleled his analysis of kinship systems to phonological analysis and argued that “linguists and sociologists do not merely apply the same methods but are studying the same thing”. This was a recurrent theme in several writings of that period. In this work, however, Lévi-Strauss did not say explicitly in what the aforementioned sameness in method consisted. Only a hint was given toward the end of the book.

> The diversity of the historical and geographical modalities of the rules of kinship and marriage have appeared to us to exhaust all possible methods for ensuring the integration of biological families within the social group. We have thus established that superficially complicated and arbitrary rules may be reduced to a small number. There are only three possible elementary kinship structures; these three structures are constructed by means of two forms of exchange; and these two forms of exchange themselves depend upon a single differential characteristic… (Lévi-Strauss [1949] 1969, 493)

No doubt, this description brings to mind the structural method of phonological analysis introduced by Jakobson and Trubetzkoy, but it could hardly be taken as an indication of an elaborate transposition of the linguistic method to the study of kinship. There is, however, an implicit and indirect connection between the two disciplines in this work. Lévi-Strauss’s analysis of the elementary structures of kinship was heavily influenced by Gestalt psychology, and this was best reflected in his concept of structure (Clarke 1978, 408, Rotenstreich 1972, 489). In an entry on French sociology, written before the completion of *The Elementary Structures of Kinship*, Lévi-Strauss (1945, 509) underscored the crucial contribution of Gestalt psychology to sociology. With his first major study, he intended to highlight this affinity by means of a concrete analysis of kinship systems (Lévi-Strauss [1949] 1969, xxvi). Later, he turned again to this issue noting a wider influence of Gestalt psychology on anthropology and linguistics (Lévi-Strauss [1958]1963, 324-325). Thus, Gestalt theory served as a key link between those two disciplines and it must have played a significant role in Lévi-Strauss’s reception of the principles of structural linguistics.

It has been convincingly shown that Lévi-Strauss's structuralism did not derive from a mere extension of the structural method of linguistic analysis to the study of kinship and myth (Clarke 1978, 422-423). This, however, does not mean that linguistics played a less important role in the development of structural anthropology in comparison to other sources of inspiration (e.g. Marxism, psychoanalysis, Gestalt psychology etc.). Commenting on this issue, Lévi-Strauss once said in an interview:

> The nature and importance of my borrowings from linguistics have been misunderstood. Besides being a general inspiration, which, I admit, is enormous, they boil down to the role of unconscious mental activity in the production of logical structures, which was emphasized by Boas, who was an anthropologist as much as a linguist. Second, there is this basic principle that component parts have no intrinsic meaning; it arises from their position. This is true of language, and it is also true for other social facts. I don't believe I have asked anything else from linguistics. (Lévi-Strauss and Eribon 1991, 112-113)

The mere reference to the role of the unconscious in the above passage is indicative of the key role of linguistics as a source of influence. Indeed, a large part of its significance for Lévi-Strauss lies in the fact that "it offered on the one hand a legitimation of the path he had taken, and on the other a solution to the major problem which his theory still faced, that of developing an adequate psychological theory" (Clarke 1978, 422). The key missing link in the development of this theory was the construction of a rationalist conception of the unconscious. Structural linguistics would prove especially valuable in this respect. By the time Lévi-Strauss attended Jakobson's lectures, he was "a kind of naive structuralist, a structuralist without knowing it" (Lévi-Strauss and Eribon 1991, 44). He was "no doubt drawn by [his] own thought" toward Jakobson's "innovatory ideas", "but as yet with neither the boldness nor the conceptual tools necessary to organise them properly" (Lévi-Strauss 1978, xiii-xiv). Thus, it could be argued that Lévi-Strauss's initiation into linguistics marked his passage from a 'naïve' to a 'scientific structuralism'. It is indicative that Lévi-Strauss ([1945]1963, 31) himself argued in 1945 that among the social sciences linguistics "[was] probably the only one which [could] truly claim to be a science", thus implying that his evolving structural anthropology had not yet attained the status of a 'true' science.

Another part of the significance of linguistics as a source of influence lies in its object of study. It is not surprising that language figures prominently in an anthropologist like Lévi-Strauss. If we want, however, to apprehend the overall import of structural linguistics to the development of Lévi-Strauss's thought, we cannot content ourselves with such a trivial remark. Rather, we need to examine what place does the concept of language occupy in his theoretical edifice and how is it connected with the basic premises of his anthropological theory. A preliminary answer to these questions is adumbrated in another of his autobiographical comments:

> Man has been described as *homo faber*, the maker of tools, and this characteristic has been accepted as the essential mark of culture. I confess that I do not agree, and that one of my essential aims has always been to establish the line of demarcation between culture and nature, not in tool-making, but in articulate speech. It is with language that the leap forward occurs. (Lévi-Strauss and Charbonnier 1969, 149;)

Strictly speaking, in his work Lévi-Strauss tried to show that the "leap forward" occurred with the emergence of symbolic thought. Language marks the passage from nature to culture as a manifestation of symbolism. It is precisely this fundamental idea about the primacy of symbolism that underpins his seminal monograph on kinship systems. In *The Elementary Structures of Kinship*, Lévi-Strauss revisited the anthropological 'enigma' of the incest taboo and sought to elucidate its nature by bringing into relief its positive aspect. That is, he shifted the focus of attention from the fact itself of the prohibition to its logical consequences.

> A group within which marriage is prohibited immediately conjures up the idea of another group… with which marriage is merely possible, or inevitable, according to circumstances. The prohibition on the sexual use of a daughter or a sister compels them to be given in marriage to another man, and at the same time it establishes a right to the daughter or sister of this other man. In this way, every negative stipulation of the prohibition has its positive counterpart. The prohibition is tantamount to an obligation, and renunciation gives rise to a counter-claim…. The prohibition of incest is not merely a prohibition… because in prohibiting it also orders. Like exogamy, which is its widened social application, the prohibition of incest is a rule of reciprocity. The woman whom one does not take, and whom one may not take, is, for that very reason, offered up…. The content of the prohibition is [thus] not exhausted on the fact of the prohibition: the latter is instituted only

> in order to guarantee and establish, directly or indirectly, immediately or mediately, an exchange. (Lévi-Strauss [1949] 1969, 51)

In this dense passage, Lévi-Strauss outlined in a succinct and illuminating way the implications of the prohibition of incest, laying bare at the same time the key themes of his evolving anthropological theory. It is worth following his line of thought on the incest taboo in connection with the emergence of a new order of things.

To begin with, it is important to bear in mind that the prohibition of incest concerns a natural fact of utmost importance for the human species: procreation. In humans, this biological process involves the combination of genetic material from two individuals. The only constraint imposed by nature on this process is that the contributing organisms must belong to different sexes. Besides that, no other natural constraint is imposed on the choice of partners. That is why Lévi-Strauss ([1949] 1969, 32) says that "nature leaves marriage to chance and the arbitrary". This fact, however, opens up the possibility for humans to intervene in this field and impose some sort of order. According to Lévi-Strauss, the prohibition of incest is precisely that: "a certain form, and even highly varied forms, of intervention. But it is intervention over and above anything else; even more exactly, it is *the* intervention" (ibid.; emphasis in the original). As such, it "replace[s] chance by organization" (ibid.) in human procreation. Once the prohibition of incest is established, it brings about a split in the set of possible unions between potential partners, thus intervening in the natural order and giving rise to a different order based upon a rule. Consanguineous unions are prohibited; henceforth, reproduction depends on the exogamous exchange of women. The fundamental principle of reciprocity underlies both this type of exchange and the rule imposing it: "Like exogamy, the prohibition of incest is a rule of reciprocity, for I will give up my daughter or my sister only on condition that my neighbour does the same" (Lévi-Strauss [1949] 1969, 62). Through the exogamous exchange of women, an alliance is established between families and thus a new type of group, the social group, comes to dominate upon the biological group.

> Exogamy provides the only means of maintaining the group as a group, of avoiding the indefinite fission and segmentation which the practice of consanguineous marriages would bring about. If these consanguineous marriages were resorted to persistently, or even over-frequently, they would not take long to 'fragment' the social group into a multitude of

> families, forming so many closed systems or sealed monads which no pre-established harmony could prevent from proliferating or from coming into conflict. (Lévi-Strauss [1949] 1969, 479)

By unraveling the implications of the incest taboo, Lévi-Strauss showed that the intervention in the choice of partner brought about a transformation. While not "escaping the constraints imposed on other living creatures", humans experienced the passage "to another realm, one that is defined as *culture*" (Hénaff 2009, 182; emphasis in the original). This passage involved the consolidation of a new alliance, which became possible by virtue of the exogamous exchange imposed by the prohibition of consanguineous marriages.

> Exchange –and consequently the rule of exogamy which expresses it– has in itself a social value. It provides the means of binding men together, and of superimposing upon the natural links of kinship the henceforth artificial links –artificial in the sense that they are removed from chance encounters or the promiscuity of family life– of alliance governed by rule. (Lévi-Strauss [1949] 1969, 480)

At this point, a crucial aspect of the incest taboo is brought into relief. In light of its logical consequences, the prohibition of consanguineous unions discloses itself as pertaining to a broader sphere, the sphere of exchange and the overarching principle of reciprocity. It is precisely through its inherent connection with exogamous exchange that the intervention in the choice of partners can secure "a continuous pull towards a greater cohesion, a more efficacious solidarity, and a more supple articulation" (ibid.). Here, we seem to approach the 'lower strata' of the divide between nature and culture. The logical path from the prohibition of incest to exogamy leads, ultimately, to a more fundamental phenomenon, of which the exchange of women is but one modality. Lévi-Strauss did not proceed to a detailed exposition of this issue in his study on kinship structures. Nonetheless, on the last pages of this work he offered some interesting remarks that prefigured his view on the origin of culture.

It is telling that the main reference to linguistics in this book was made precisely on these pages. After praising structural phonology for being the only social science to have attained a synthesis of synchronic and diachronic explanation, Lévi-Strauss commented:

> When we consider its methods, and even more its object, we may ask ourselves whether the sociology of the family, as conceived of in this work, involves as different a reality as might be believed, and consequently whether it has not the same possibilities at its disposal. (Lévi-Strauss [1949] 1969, 493)

Obviously, phonology and the sociology of the family study different objects. Lévi-Strauss seems to imply, however, that behind this apparent disparity there lies the same reality, to which both disciplines ultimately refer. No matter what exactly this reality is, it is clear that it must be sought at a much higher level of abstraction. The analysis of the prohibition of incest carried out in *The Elementary Structures of Kinship* singled out two distinctive phenomena: exchange and group cohesion. Both were taken as relating to the hitherto unacknowledged positive function of the incest taboo. Towards the end of his study, Lévi-Strauss returned to this point with the following statement: "if the incest prohibition and exogamy have an essentially positive function… it must be recognized that linguists and sociologists do not merely apply the same methods but are studying the same thing" (ibid.). At this point, a reasonable question might be raised. How is this sameness in method and object of study deduced from the positive function of the prohibition of incest? The answer we find in *The Elementary Structures* is given by a quotation from Thomas (1937, 182): "Exogamy and language… have fundamentally the same function – communication and integration with others". Communication here is primarily understood in its most general sense, that is, as exchange, especially as a "total exchange" (Lévi-Strauss [1949] 1969, 60-61), through which a group of people asserts itself as society. One of the implications of viewing exogamy "as one of the modalities of a great 'communication function' which also includes language" (Lévi-Strauss [1949] 1969, 494) is that women can be conceived of as signs. In Lévi-Strauss, this is not just a metaphor used for methodological purposes but reflects an empirical fact:

> The emergence of symbolic thought must have required that women, like words, should be things that were exchanged…. But woman could never become just a sign and nothing more, since even in a man's world she is still a person, and since in so far as she is defined as a sign she must be recognized as a generator of signs…. In contrast to words, which have wholly become signs, woman has remained at once a sign and a value. (Lévi-Strauss [1949] 1969, 496)

This was the only explicit reference to the emergence of symbolic thought and it occurred toward the end of the book, where Lévi-Strauss discussed exogamy and language as manifestations of the same communicative function. The issue of symbolism is not addressed in that monograph. Yet, the analysis of the prohibition of incest as an intervention in the natural order, the emphasis on the inherent link with exogamous exchange and the principle of reciprocity, the parallel drawn with language as a form of exchange, all seemed to be the basic elements of a "most important and coherent hypothesis concerning a *symbolic origin of society*" (Hénaff 2009, 179; emphasis in the original).

Lévi-Strauss's conception of symbolism underwent several transformations[137]. Yet, there are certain assumptions to which he steadily adhered throughout the different stages of development of his work. For Lévi-Strauss, symbolism is above all a "constructed order": it manifests itself in the form of rule-governed, differential systems of intelligible terms linked together by means of oppositional relations (Hénaff 2009, 178). Such systems are "situated at the level of the unconscious" and their intelligible aspect "springs from the differential and oppositional nature of their elements" (Hénaff 1998, 132). Furthermore, symbolic systems do not signify but they constitute mechanisms for performing certain logical operations: "Symbolism produces order in a set of tangible elements, order that is intelligible from the perspective of the homologies, oppositions, and inversions that it brings into play" (Hénaff 1998, 137). Thus, a symbolic system is "the condition for a system of meaning, but it does not fuse with the latter" (Hénaff 1998, 127). In light of this brief outline, it is not surprising at all why Lévi-Strauss turned to linguistics as a source of influence. The systems of phonemes studied by structural phonology seemed to provide the best example of a symbolic system. The pioneering work of Trubetzkoy and Jakobson during the 1930s convinced Lévi-Strauss that symbolism was amenable to structural analysis not only in the case of language but also in the whole field of social interaction termed "communication". Thus, structural phonology was seen as the discipline that paved the way for the structural analysis of other fundamental forms of symbolism. However,

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[137] Hénaff (1998, 120-140) offers an in-depth account of the emergence and the various transformations of the concept of symbolism in Lévi-Strauss. Hénaff (2009), by contrast, offers a systematic exposition of Lévi-Strauss's conception of symbolism.

the transition from phonemes to objects of study of a different nature, such as kinship systems or myths, was not a straightforward one. Early on, Lévi-Strauss realized that in order to accomplish such a transition he had to break new ground.

The monograph on the structures of kinship belongs to a crucial stage in the development of structural anthropology. From the mid-1940s to the mid-1950s, Lévi-Strauss prepared and published several key texts through which he sought to consolidate both his epistemological principles and his methodological orientation. While writing *The Elementary Structures of Kinship*, he published an article in *Word*, in which he discussed the issue of a formal transposition of the structural method of linguistic analysis to anthropology. Lévi-Strauss was motivated by a deep dissatisfaction about the state of the art of kinship studies and the prevalence of 'individualistic' interpretations of kinship phenomena.

> Each detail of terminology and each special marriage rule is associated with a specific custom as either its consequence or its survival. We thus meet with a chaos of discontinuity. No one asks how kinship systems, regarded as synchronic wholes, could be the arbitrary product of a convergence of several heterogeneous institutions (most of which are hypothetical), yet nevertheless function with some sort of regularity and effectiveness. (Lévi-Strauss [1945]1963, 35)

Lévi-Strauss's complaint seems to echo Jakobson's ([1931]1972, 138) dissatisfaction about the status of historical linguistics at the turn of the twentieth century. In that respect, such a complaint implied a perceived parallelism between the development of linguistics following the advent of structuralism and the prospective development of kinship studies. Indeed, Lévi-Strauss ([1945]1963, 34) maintained that "[t]he study of kinship problems is today broached in the same terms and seems to be in the throes of the same difficulties as was linguistics on the eve of the structuralist revolution". This view, in turn, suggested a promising prospect for kinship studies along a path similar to that of structural phonology. For Lévi-Strauss, the key step toward this direction involved a methodological decision.

One might reasonably ask whether the parallel drawn between the developments of linguistics and kinship studies suffice to ensure theoretically the possibility of a formal transposition of the former's structural method into the latter discipline. We have already seen the approach adopted in *The Elementary Structures*: the sameness in object of study ensures the applicability of the same type of method in both disciplines. In the 1945 article, an early formulation of this thesis was given in terms of formal resemblance.

> In the study of kinship problems (and, no doubt, the study of other problems as well), the anthropologist finds himself in a situation which formally resembles that of the structural linguist. Like phonemes, kinship terms are elements of meaning; like phonemes, they acquire meaning only if they are integrated into systems. "Kinship systems," like "phonemic systems," are built by the mind on the level of unconscious thought. Finally, the recurrence of kinship patterns, marriage rules, similar prescribed attitudes between certain types of relatives, and so forth, in scattered regions of the globe and in fundamentally different societies, leads us to believe that, in the case of kinship as well as linguistics, the observable phenomena result from the action of laws which are general but implicit. The problem can therefore be formulated as follows: Although they belong to *another order of reality*, kinship phenomena are *of the same type* as linguistic phenomena. Can the anthropologist, using a method analogous *in form* (if not in content) to the method used in structural linguistics, achieve the same kind of progress in his own science as that which has taken place in linguistics? (Lévi-Strauss [1945]1963, 34; emphasis in the original)

The bulk of Lévi-Strauss's voluminous work was written precisely as a response to the challenge of developing a structural method for anthropology. The theoretical justification of this project was outlined in the passage above. The thesis about the formal resemblance between phonological systems and kinship systems not only accounts for the possibility of a formal transposition of the linguistic method but also contains an implicit claim. By their very nature, kinship (or other social) systems call for a method of analysis that focuses on the internal relations of systems belonging to the "unconscious infrastructure" of social phenomena, with the aim of discovering the general laws underlying their manifestation. In other words, such systems call for a method of the type introduced by Trubetzkoy and Jakobson in the study of phonological systems (Lévi-Strauss [1945]1963, 33). Having thus tackled the issue of the theoretical justification of the possibility of a structural method for social sciences other than linguistics, Lévi-Strauss proceeded accordingly with a preliminary exploration of this possibility in the case of the study of kinship. His primary task in this connection was to establish the proper unit of analysis.

In a typical kinship system, two “orders of reality” are discerned. On the one hand, there is a “system of terminology”, comprising the terms used for denoting various kinship relations (e.g. father, sister etc.). On the other hand, there is a “system of attitudes”, comprising the forms of prescribed behavior associated with these relations. Lévi-Strauss ([1945]1963, 35-36) showed that the former system was not amenable to an analysis analogous to that applied to the phonemes of a given natural language. Any attempt to break down kinship terms into some sort of distinctive features would lead to an abstract, complex system with no explanatory value. Thus, he turned to the system of attitudes for a tentative formal transposition of the linguistic method, choosing as a testing ground the problem of the maternal uncle (avunculate). Drawing on the available data from different cultures and the insights offered by other anthropologists, he delineated a “global structure” comprising two types of attitude (free or familiar vs antagonistic or tabooed), four terms referring to two generations (brother, sister, brother-in-law, nephew), and four types of relation (brother–sister, husband–wife, father–son, mother’s brother–sister’s son). The relations in this structure appear always as two sets of oppositions correlated in a specific way according to the following general law: “the relation between maternal uncle and nephew is to the relation between brother and sister as the relation between father and son is to that between husband and wife” (Lévi-Strauss [1945]1963, 42). In the Trobriand Islanders of Melanesia, for instance, the relation between maternal uncle and nephew is antagonistic, and the relation between brother and sister is extremely tabooed; on the other hand, the relation between father and son is familiar, and the relation between husband and wife is intimate. Thus, the first pair of relations exhibits attitudes that fall under the ‘negative’ type, whereas the second pair of relations is characterized by attitudes that fall under the ‘positive’ type. Moreover, in each generation there are always both types of attitude. In different cultural groups, the ‘polarity’ may change, but the correlation between the oppositional pairs remains invariable. In that way, “if we know one pair of relations, it is always possible to infer the other” (ibid.). The elementary structure yielded by this structural analysis is for Lévi-Strauss ([1945]1963, 48; emphasis in the original) the “true *atom of kinship*” and, as such, it is regarded as “the sole building block of more complex systems”.

Lévi-Strauss was aware that his solution to the problem of the avunculate was not complete. He acknowledged, for instance, that the bipartite typology of attitudes was simplistic and that, instead, four types of attitude should be envisaged (Lévi-Strauss [1945]1963, 49). However, he did not intend to provide an exhaustive account of the avuncular relationship but rather to use it as a testing ground for a structural method suited to the study of kinship systems. Guided by the general principles of structural analysis formulated by Trubetzkoy, he managed to reduce the problem of the maternal uncle to a limited set of invariants present in all manifestations of the avuncular relationship. This set comprised the necessary terms, the relations between them, and the correlation between these relations. In that way, Lévi-Strauss drafted an analytical scheme capable of providing a minimal description of any conceivable manifestation of the avuncular relationship. The description could be extended to forms not yet actualized, since the scheme allowed for observing the overall transformation that would be caused by a change in a single pair of oppositional relations. In other words, the analytical scheme outlined by Lévi-Strauss provided a system of necessary relations together with the set of possible permutations of its elements. The 'atom of kinship', conceived of as the building block of kinship systems, was the particular form in which Lévi-Strauss introduced his conception of social structure in anthropology. A systematic exposition of this conception was offered in a paper he read at the Wenner-Gren Foundation International Symposium on Anthropology (New York, 1952), where he returned to the key epistemological and methodological issues of structural analysis in the social sciences.

Lévi-Strauss started with a sharp distinction: "The term 'social structure' has nothing to do with empirical reality but with models which are built up after it.… social relations consist of the raw materials out of which the models making up the social structure are built, while social structure can, by no means, be reduced to the ensemble of the social relations to be described in a given society" (Lévi-Strauss [1953]1963, 279). This is a strong statement introducing a contrast of special epistemological significance for the social sciences in general. Social structures are distinguished from social relations in that they do not belong to the realm of observable phenomena but they can only be known through their reconstruction in models. This distinction, however, was not intended to establish an autonomous field of study but rather to define social structure as a "method to be applied to any kind of social studies" (ibid.) and introduced models as the proper object of structural analysis. There remained, of course, another step to be made toward this direction: the specification of the properties that a model should have in order to qualify as a structure. Lévi-Strauss posited the following conditions:

> First, the structure exhibits the characteristics of a system. It is made up of several elements, none of which can undergo a change without effecting changes in all the other elements.
>
> Second, for any given model there should be a possibility of ordering a series of transformations resulting in a group of models of the same type.
>
> Third, the above properties make it possible to predict how the model will react if one or more of its elements are submitted to certain modifications.
>
> Finally, the model should be constituted so as to make immediately intelligible all the observed facts. (Lévi-Strauss [1953]1963, 279-280)

The first requirement bespeaks the early influence of Gestalt psychology on Lévi-Strauss. A fundamental property of all systems is the interdependence of elements, which ensures the internal coherence of the whole. This is the logically prior condition for a model to qualify as a structure. To this typical conception of system, however, Lévi-Strauss adds another important condition: predictability. A model must not only lay bare the arrangement of relations between its elements but it must also provide the means for knowing in advance the behavior of this arrangement when subjected to change. This property presupposes some sort of regularity underlying the behavior of the model, which in turn means that the structure reconstructed through the model allows for discovering the invariants of the phenomenon under study. Insofar as this requirement is met, the model will allow for accounting for the entire set of observed facts. However, both the third and the fourth properties are logically dependent on the second condition. Unless there is a "possibility of ordering a series of transformations" neither the generality of the model nor the predictability of its behavior can be attained. Thus, it is the idea of transformation that seems to confer distinctiveness to this conception of social structure. As Lévi-Strauss ([1960]1967, 30) himself acknowledged, "there is a very close relationship between the concept of transformation and the concept of structure which is so important in our work".

The first two conditions referred to above are the backbone of Lévi-Strauss's conception of structure. The main thesis behind this conception is that invariance must be sought in transformation. The same fundamental idea was expressed in an early essay on the relation between history and anthropology. Discussing the role of history in the task of revealing the unconscious structures underlying the diverse institutions and customs, Lévi-Strauss remarked:

> By showing institutions in the process of transformation, history alone makes it possible to abstract the structure which underlies the many manifestations and remains permanent throughout a succession of events. (Lévi-Strauss [1949a]1963, 21)

The search for invariants cannot content itself with the study of the internal relations connecting the elements of a system. It needs to consider the transformations that the system may undergo and discern immutable patterns amidst change. Thus, structural analysis is ultimately concerned, in its particular way, with the interplay between invariance and transformation, the indissoluble unity of which is encapsulated in the overarching concept of structure. In his inaugural lecture at the Collège de France, Lévi-Strauss emphasized once again that a structure does not simply amount to a system of elements.

> No science today can consider the structures with which it has to deal as being no more than a haphazard arrangement. That arrangement alone is structured which meets two conditions: that it be a system, ruled by an internal cohesiveness; and that this cohesiveness, inaccessible to observation in an isolated system, be revealed in the study of transformations, through which the similar properties in apparently different systems are brought to light. (Lévi-Strauss [1960]1967, 31)

Accordingly, both properties were said to be found in semiotic systems: "Signs and symbols can only function in so far as they belong to systems, regulated by internal laws of implication and exclusion, and the property of a system of signs is to be transformable, in other words, *translatable*, in the language of another system with the aid of permutations" (ibid.; emphasis in the original). The latter passage quoted here suggests that in Lévi-Strauss the concept of transformation reflects the general principle of the translatability of signs (Rotenstreich 1972, 499). Yet, another important source of influence can be discerned behind the emphasis on permutations.

Lévi-Strauss's conception of models and structures attests to the strong influence of abstract algebra on his thought. Although "it has not been his practice to apply a particular mathematical theory to a specific area (e.g. in kinship, totemism, or mythology)" (Almeida 1990, 369), Lévi-Strauss used systematically rough versions of a variety of mathematical structures as integral part of his methodology, relying heavily of the mathematical concept of transformation group. The idea of transformation group and the concomitant concern for the existence of symmetry in the diverse manifestations of symbolic thought permeated the entire range of Lévi-Strauss's analyses from kinship systems to totemism and myth. Yet, both the semiotic and the mathematical influences behind the idea of transformation belonged rather to the stage of shaping an early inspiration. The initial source should be sought elsewhere. When asked by Didier Eribon whether he found the idea of transformation in logic, Lévi-Strauss replied:

> Neither in logic nor linguistics. I found it in a work that played a decisive role for me and that I read during the war while I was in the United States: *On Growth and Form*, in two volumes, by D'Arcy Wentworth Thompson… The author… interpreted the visible differences between species or between animal or vegetable organs within the same genera, as transformations. This was an illumination for me, particularly since I was soon to notice that this way of seeing was part of a long tradition: behind Thompson was Goethe's botany, and behind Goethe, Albrecht Dürer and his *Treatise on the Proportions of the Human Body*. (Lévi-Strauss and Eribon 1991, 113)

As with the concept of the unconscious, in this case, too, there was a blending of different strands of thought pertaining to diverse fields of study. The inspiration from the "long tradition" stretching back from D'Arcy Thompson to Goethe came at a time when Lévi-Strauss was seeking to develop a rationalist conception of the unconscious, drawing on structural phonology and cybernetics[138]. The concept of transformation was especially valuable in this connection, for it provided the key link for a rationalist account of the transition from the unconscious to the conscious levels of sociocultural phenomena. In this respect, it also provided the key link for an analytical method that would allow the social scientist to follow the path backwards, as it were, in order to shed light on the unconscious

[138] On the role of cybernetics in the development of Lévi-Strauss's concept of the unconscious, see Rossi (1973, 32). For a general account of Lévi-Strauss's relation to cybernetics, see Geoghegan (2011) and Le Roux (2009).

infrastructure underlying the manifold manifestations of customs and institutions. Obviously, the concept of transformation could not fulfil that special role unless it corresponded to the rationalist conception of the unconscious that sustained the entire theoretical edifice. Thus, the latter accounts for the specific form that the former assumed in Lévi-Strauss's analyses.

In his attempt to conceptualize the unconscious, Lévi-Strauss pursued a line of thought deeply influenced by Kant. Instead of focusing on the psychic content, he turned his attention to the fundamental properties of the human mind and sought to shed light on the universal constraints imposed on mental activity. He thus embarked on a life-long project "proceeding in the manner of Kantian philosophy, although along different lines leading to different conclusions" (Lévi-Strauss [1962]1969, 10). Contrary to Kant, Lévi-Strauss did not rely on introspection nor did he take as his point of departure the forms of thought of his own society. Rather, he preferred "to study empirically collective forms of understanding" as "revealed… in countless concrete representational systems", choosing in particular those that were "the most markedly divergent, in the hope [of] reveal[ing] a pattern of basic and universal laws" (Lévi-Strauss [1962]1969, 11). In that respect, he claimed to have transposed Kant's search for the categories that structure human experience into the field of anthropological study (Lévi-Strauss 1963, 631). At the heart of Lévi-Strauss's quest was the unconscious, conceived of as an aggregate of structural laws devoid of any particular content.

> The unconscious ceases to be the ultimate haven of individual peculiarities – the repository of a unique history which makes each of us an irreplaceable being. It is reducible to a function – the symbolic function, which no doubt is specifically human, and which is carried out according to the same laws among all men, and actually corresponds to the aggregate of these laws…. The unconscious… is always empty – or, more accurately, it is as alien to mental images as is the stomach to the foods which pass through it. As the organ of a specific function, the unconscious merely imposes structural laws upon inarticulated elements which originate elsewhere – impulses, emotions, representations, and memories. (Lévi-Strauss [1949b]1963, 202-203)

The above passage is illuminating in that it brings into relief the distinctive feature of Lévi-Strauss's rationalist conception of the unconscious. The key to understanding this fundamental concept for his work is to be found in his assertion that the unconscious "is always empty".

The concept of the unconscious at which Lévi-Strauss arrived by the late 1940s was the logical outcome of an 'initial scission': the sharp distinction between psychic content and mental structure (or structural law). By relegating the former to a preconscious level, Lévi-Strauss dissociated the unconscious from any sort of "individual peculiarities" and portrayed it as a "mediating term between self and others".

> Going down into the givens of the unconscious… is not a movement towards ourselves; we reach a level which seems strange to us, not because it harbours our most secret self, but (much more normally) because, without requiring us to move outside ourselves, it enables us to coincide with forms of activity which are both at once *ours* and *other*: which are the condition of all the forms of mental life of all men at all times. (Lévi-Strauss [1950]1987, 35; emphasis in the original)

Once distinguished from the purely individual, the unconscious is at the same time dissociated from the contingency and particularity of psychic contents and is thus taken as belonging to the realm of necessity and universality. Lévi-Strauss was able to construct a rationalist conception in terms of universal structural laws precisely because he assumed that the unconscious is an empty form. The unconscious's emptiness is ultimately the premise on which rests his understanding of unconscious phenomena and symbolic thought, a premise that moreover reveals his essential affinity with Jakobson's structural phonology. Following, in his own distinctive way, the pioneering work of Saussure, Jakobson sought to explain the generation of linguistic meaning in terms of a differential mechanism based on oppositional relations between terms devoid of meaning. Lévi-Strauss went a step further and sought to account for symbolic thought in general in terms of a differential mechanism operating at the level of the unconscious substratum of mental activity. The unconscious was supposed to provide only a limited number of structural laws, and since it was taken as devoid of any content, it follows that it could perform its function only by means of some basic logical operations. It is no surprise, then, that the concept of transformation, which was introduced by Lévi-Strauss in his attempt to account for the passage from the unconscious to the conscious levels of symbolic phenomena, was actually about such operations.

The concept of transformation figures prominently in Lévi-Strauss's numerous analyses of myths. In 1952-54, Lévi-Strauss devoted his courses at the École Pratique des Hautes Études to the analysis of a certain myth (the emergence myth) among a number of Amerindian groups (Godelier 2018, 246-247). That was the beginning of a long-standing project that lasted almost twenty years. The bulk of this research is contained in the four-volume series under the general title *Mythologiques* (1964-1971). The whole work spans over two thousand pages and offers the analysis of more than eight hundred myths and their variants from different parts of the world (mostly from North and South America) (Godelier 2018, 308-309). The basic premises underlying this grand project were laid in *The Structural Study of Myth* (1955) and were first tested in *The Story of Asdiwal* (1958). Lévi-Strauss was not interested in just adding some more pieces of interpretation to the stock of analyses of his time. Rather, he sought to lay the basic principles of the study of myth as a distinct scientific discipline. To this end, he addressed the two major issues involved: the definition of the proper unit of analysis and the specification of the respective method of analysis. As regards the first task, Lévi-Strauss took as his point of departure the fundamental principle of structural linguistics that meaning resides not in the isolated elements that make up a whole but rather in the relations between them. However, the material of which myths consist poses a difficulty. It would be all too easy to say that myth is a form of speech and thus belongs to *parole*. Yet, Lévi-Strauss argued that in myths one could find both a reversible time (characteristic of *langue*) and a non-reversible time (characteristic of *parole*). In other words, in that case there was a "double structure, altogether historical and ahistorical, which explains how myth, while pertaining to the realm of *parole* and calling for an explanation as such, as well as to that of *langue* in which it is expressed, can also be an absolute entity on a third level which, though it remains linguistic by nature, is nevertheless distinct from the other two" (Lévi-Strauss [1955]1958, 210). To this "absolute entity" corresponded a specific kind of unit, the mytheme or gross constituent unit, which belonged to a higher level of complexity with respect to the standard linguistic units (phonemes, morphemes and sememes).

Mythemes were to be found at the level of the sentence and were said to consist of bundles of relations exhibiting a common feature (Lévi-Strauss [1955]1958, 211). In the Oedipus myth, for instance, Lévi-Strauss identified four groups of relations, the first two of which concerned blood relations while the other two had to do with the "autochthonous origin of man". In order to understand the myth, the analyst must not only identify the proper bundles of relations but also specify the logical connection between them. In the example of the Oedipus myth, the common feature in the first group of relations was the "overrating of blood relations", whereas the second group exhibited the inverse feature: "underrating of blood relations". Analogously, the third group of relations was about the "denial of the autochthonous origin of man", while in the fourth group the common feature was the "persistence of the autochthonous origin of man". In that way, an equivalence could be discerned between the two pairs of groups as regards the way in which each member of the pair was logically related to the other (Lévi-Strauss [1955]1958, 213-216). On the basis of that finding, Lévi-Strauss was able to reveal a latent meaning.

> The myth has to do with the inability, for a culture which holds the belief that mankind is autochthonous… to find a satisfactory transition between this theory and the knowledge that human beings are actually born from the union of man and woman. Although the problem obviously cannot be solved, the Oedipus myth provides a kind of logical tool which relates the original problem –born from one or born from two?– to the derivative problem: born from different or born from same? By a correlation of this type, the overrating of blood relations is to the underrating of blood relations as the attempt to escape autochthony is to the impossibility to succeed in it. (Lévi-Strauss [1955]1958, 216)

In *The Structural Study of Myth*, Lévi-Strauss used the Oedipus myth and two other myths from the Amerindian mythology to outline a new method of analysis. The units specific to this method were bundles of relations drawn from the text of the myth. Yet, the analysis should not content itself with identifying the pertinent groups of relations but must seek to determine their logical interconnection. In doing so, it can bring to the fore a latent meaning that cannot be deduced by the linear reading of myth as a temporal succession of events. In order for a structural analysis to function as such, however, all known variants should be taken into account, for a myth is actually defined "as consisting of all its versions; or to put it otherwise, a myth remains the same as long as it is felt as such" (Lévi-Strauss [1955]1958, 217). This entails that "[t] here is no single 'true' version of which all the others are but copies or distortions. Every version belongs to the myth" (Lévi-Strauss [1955]1958, 218). By treating a given myth as an ensemble of different versions and by applying to this ensemble the method of structural analysis, “it becomes possible to organize all the known variants of a myth into a set forming a kind of permutation group, the two variants placed at the far ends being in a symmetrical, though inverted, relationship to each other” (Lévi-Strauss [1955]1958, 223). In that respect, myths were portrayed as exemplifying an essential feature of transformation groups, namely, that “transformations have no necessary direction” (Almeida 1990, 373).

Lévi-Strauss concluded this seminal theoretical text with some general remarks about the function of myth and the nature of mythical thought. First, he argued that “the purpose of myth is to provide a logical model capable of overcoming a contradiction (an impossible achievement if, as it happens, the contradiction is real)… myth grows spiral-wise until the intellectual impulse which has produced it is exhausted. Its *growth* is a continuous process, whereas its *structure* remains discontinuous” (Lévi-Strauss [1955]1958, 229; emphasis in the original). The basic mechanism by means of which myths strive to resolve contradictions consists in the deployment of “a series of mediating devices, each of which generates the next one by a process of opposition and correlation” (Lévi-Strauss [1955]1958, 226). The algebraic expression of the role of these mediating devices was given in the so-called canonical formula[139], a highly abstract representation of the inner process by means of which the series of a myth’s variants evolved as a closed transformation group.

> [W]hen we have succeeded in organizing a whole series of variants into a kind of permutation group, we are in a position to formulate the law of that group…. it seems that every myth (considered as the aggregate of all its variants) corresponds to a formula of the following type:
>
> $$F_x(a): F_y(b) \simeq F_x(b): F_{a-1}(y)$$
>
> Here, with two terms, *a* and *b*, being given as well as two functions, *x* and *y*, of these terms, it is assumed that a relation of equivalence exists between two situations defined respectively by an inversion of *terms* and *relations*, under two conditions: (1) that one term be replaced by its opposite (in the above formula, *a* and *a-1*); (2) that an inversion be made

[139] On the canonical formula, see (Maranda 2001).

> between the *function value* and the *term value* of two elements (above, *y* and *a*). (Lévi-Strauss [1955]1958, 228; emphasis in the original)

Although the attention is usually drawn to the inversion that takes place at the extremes of the formula, it should be noted that the role of *b* is of primary importance. For it enters successively as a term in the two functions[140] (F_x and F_y) acting thus as a mediating device that makes possible the transition from $F_x(a)$ to $F_{a-1}(y)$.

The canonical formula seems to suggest that the interrelated logical operations identified in myth obey a rigorous algorithm. However, Lévi-Strauss introduced it with a different purpose in mind, as he explained much later.

> From various quarters I have been reproached for failing to explain, develop or, according to some, even employ the formula I had set out…. Therein lies a misunderstanding that several scattered references in the Mythologics have not succeeded in dispelling. Despite its vaguely algebraic appearance, my formula does not constitute an algorithm according to which calculations can be made. I put it forward as an image or picture, a graphic design that, I thought, could facilitate the intuitive grasp of a chain of relations. (Lévi-Strauss 1987, 4)

The caveats expressed here and elsewhere[141] about the use of mathematical formulas do not of course invalidate the observations made about the complex pattern of logical operations performed by means of myths. Indeed, Lévi-Strauss ([1955]1958, 230) went a step further arguing that "the kind of logic in mythical thought is as rigorous as that of modern science" and that "the difference lies, not in the quality of the intellectual process, but in the nature of the things to which it is applied". This was a central thesis to which Lévi-Strauss firmly adhered throughout his career. *The Structural Study of Myth* was a genuine manifesto. It laid out the fundamental hypotheses and the basic procedure of the structural analysis of myth, and it concluded with a strong view about the nature of mythical thought. Yet, it did not provide the set of operative concepts necessary for implementing the method. Most of these concepts were introduced in *The Story of Asdiwal*, the first test of the structural method outlined in 1955.

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[140] The functions in this formula can be taken as attributes of the terms or as actions performed by them (Godelier 2018, 385).
[141] See e.g. Lévi-Strauss ([1964]1969, 30-1).

In 1958, Lévi-Strauss published an analysis of four versions of a Tsimshian myth taken from Boas. The myth related the adventures of Asdiwal, a Tsimshian hero who eventually was transformed into stone at the peak of a mountain. The story begins with the journey of two women, a mother and her daughter, who decided to reunite after the death of their husbands. Both traveled along the frozen Skeena River, coming from opposite directions, and met halfway. They camped on the bank and started searching in vain for food. Doomed to die of hunger, the two women were saved by a mysterious visitor who helped them have a regular supply of food. His name was Hatsenas, a word denoting a bird of good omen. The young wife became his wife and had a boy called Asdiwal. Apparently, Hatsenas had supernatural powers and used them to make his son grow up fast. When Asdiwal became a young man, his father gave him several magical objects (a bow and arrows, a lance etc.) and then he suddenly disappeared. Soon, the elder widow died and the younger woman returned to her relatives accompanied by her son. From that point onwards, Asdiwal was engaged in a series of events including several journeys to real and imaginary places (different regions of the Tsimshian territory, the heavens, and the underworld), three marriages, and some hunting expeditions and contests. In his last hunting expedition, Asdiwal was trapped: he could neither move forward nor return, for he had forgotten his snowshoes. Thus, he became stone, together with his dog and his lance, and remained forever in that form on the top of the great mountain at the lake of Ginadâos.

In setting about to analyze this myth, Lévi-Strauss had in mind two specific aims.

> First, to isolate and compare the *various levels* on which the myth evolves: geographic, economic, sociological, and cosmological – each one of these levels, together with the symbolism proper to it, being seen as a transformation of an underlying logical structure common to all of them. And, second, to compare the *different versions* of the myth and to look for the meaning of the discrepancies between them, or between some of them. (Lévi-Strauss [1958]1967, 1; emphasis in the original)

The two aims of this early study reflect two fundamental theses of Lévi-Strauss's approach to myth. The first thesis considers the 'surface' arrangement of a myth to be the outcome of a series of combined transformations of a deep logical structure. The second thesis postulates the existence of a latent message besides the patent message conveyed by the narrative. According to Lévi-Strauss, the latent message can be 'retrieved' if the analyst succeeds in following backwards the path of the logical transformations that leads from the deep structure to the narrative. In order to trace this path, the analyst should first seek to reveal an additional arrangement of the narrated events that runs parallel to their chronological ordering but rests on a different organizing principle. For the purposes of this procedure, Lévi-Strauss introduced in *The Story of Asdiwal* four operative concepts. The first two are already present in the statement of the aims of the study: on the one hand, we have the various levels of the myth and, on the other hand, there are the symbolisms proper to them, which later in the text will be termed “codes”. The levels are abstracted from the body of the narrative according to the referents of the linguistic expressions used. For instance, the textual segments of the story of Asdiwal referring to institutions, customs, social practices and positions can be subsumed under a common class, termed “sociological level”. The ‘symbolism’ proper to this level will be the sociological code, consisting of the subset of interrelated linguistic means used to denote any event, situation, action etc. pertaining to the specific social framework portrayed in the narrative. In analogous manner, Lévi-Strauss discerned three more levels (economic, geographical and cosmological) together with the respective codes.

Given that a narrative typically unfolds as a succession of events, actions, places etc. that pertain to different sets of referents, it follows that the levels posited by structural analysis interpenetrate in the textual body of a myth. Drawing on this fact, Lévi-Strauss introduced a key analytical distinction that enabled him to posit an additional type of arrangement different from that manifested on the ‘surface’ level of the narrative.

> The… analysis leads us to draw a distinction between two aspects of the construction of a myth: the sequences and the schemata (*schèmes*). The sequences form the apparent content of the myth; the chronological order in which things happen… But these sequences are organized, on planes at different levels (of abstraction), in accordance with schemata, which exist simultaneously, superimposed one upon another. (Lévi-Strauss [1958]1967, 17)

Six different schemata were discerned, four of which corresponded to the quadripartite distinction of levels. All of them involved binary oppositions. Thus, the geographic schema involved the directions of Asdiwal’s four journeys into the Tsimshian territory, expressed in terms of the four cardinal points (East-West, West-East, South-North, and North-South).

The cosmological schema, on the other hand, was based on the dichotomy below-above, which was used to characterize Asdiwal's journeys to the heavens and the underworld, Hatsenas's visit to the younger widow[142] and Asdiwal's final expedition, in which he was trapped halfway up a mountain. Accordingly, Lévi-Strauss posited the existence of a composite schema.

> The above two schemata are integrated in a third consisting of several binary oppositions, none of which the hero can resolve, although the distance separating the opposed terms gradually dwindles. The initial and final oppositions: high/low and peak/valley are 'vertical' and thus belong to the cosmological schema. The two intermediate oppositions (water/land and sea-hunting/mountain-hunting) are 'horizontal' and belong to the geographic schema. But in fact the final opposition (peak/valley), which is also the narrowest contrast, brings into association the essential characteristics of the two preceding schemata: it is 'vertical' in form but 'geographical' in content. (Lévi-Strauss [1958]1967, 19)

This passage is particularly interesting, for it portrays with sufficient clarity Levi-Strauss's third operational concept. The resulting schema described above consists of a hierarchy of oppositions that implies a double progression: on the one hand, from more abstract to more concrete oppositions and, on the other hand, from wider contrasts to narrower ones. Moreover, the hierarchy in question implies also a passage from the cosmological and the geographic schemata to their integration in the final opposition.

To the sociological level of the story of Asdiwal corresponded the respective schema, which rested on the opposition of patrilocality and matrilocality and seemed to have the form of a circle (patrilocality→ matrilocality→ patrilocality). However, this schema does not have "a closed structure… since, at the beginning, it involves a mother and her daughter, in the middle, a husband, his wife, and his brothers-in-law, and, at the end, a father and his son" (Lévi-Strauss [1958]1967, 20). The remaining economic schema "begins by evoking a winter famine; it ends with a successful hunt. In between, the story follows the (real-life) economic cycle and the seasonal migrations of the native fishermen" (Lévi-Strauss [1958]1967, 21). Finally, there comes a "global integration", in which the

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[142] Hatsenas symbolized "the bird of good omen associated with the atmospheric heavens" (Lévi-Strauss [1958]1967, 18) and thus his visit was taken by Lévi-Strauss as involving a movement along a vertical axis.

myth is reduced to the contrast between its initial and final state of affairs. This contrast was portrayed as a short series of oppositions distributed according to a specific order. To express the idea of an ordered distribution of oppositions, Lévi-Strauss introduced the operational concept of axis[143]. The form of the global integration of schemata was depicted by Lévi-Strauss (ibid.) in a simple diagram like the following:

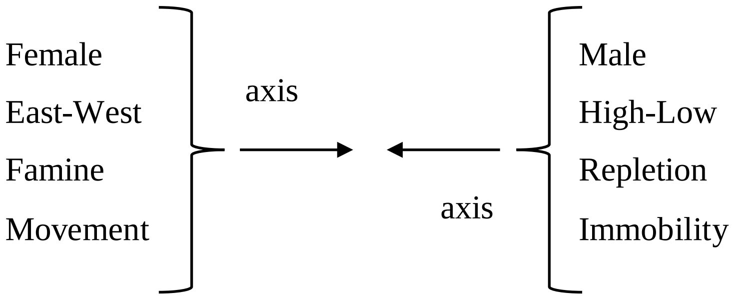

Figure 8.1

At this point, Lévi-Strauss claimed to have "analyzed the structure of the message" (obviously he meant the latent message of the myth) and had accordingly to proceed with "decipher[ing] the meaning" (ibid.). To this end, he turned to a fourth version of the story of Asdiwal, which differed from the previous three in several respects. Among other things, it included another series of adventures, those of Asdiwal's son Waux. The discrepancies identified in the fourth variant were actually "significant permutations", which led Lévi-Strauss ([1958]1967, 23) to conclude that "the story of Waux… reveals a progression, since it is with this variant that a structure which had remained open in certain respects is finally closed". The key transformation introduced by the fourth version had to do with Waux's marriage with his matrilateral cousin, a kind of marriage of special importance for the Tsimshian Indians, since it was intimately associated with the internal antagonisms in their society. During this second stage of his analysis, Lévi-Strauss arrived at a crucial remark that shed light on the myth's latent meaning.

> All the paradoxes conceived by the native mind, on the most diverse planes: geographic, economic, sociological, and even cosmological, are, when all is said and done, assimilated to that less obvious yet so real paradox which marriage with the matrilateral cousin attempts

[143] For more on this concept, see Godelier (2018, 354-357).

> but fails to resolve. But the failure is *admitted* in our myths, and there precisely lies their function. (Lévi-Strauss [1958]1967, 27-28; emphasis in the original)

Thus, in pursuing the method of structural analysis consistently until both the structure and the content of the latent message were revealed, Lévi-Strauss was able to specify the "semantic function" of myth, as he would later call it. Precisely at this point, "we see the beginnings of a theme that would be developed in his Mythology series. The substance of myths consists in contradictions that must be either veiled or dissimulated" (Godelier 2018, 256).

The Story of Asdiwal was a successful experiment that marked a turning point in the development of structural anthropology. In that study, Lévi-Strauss introduced a distinction of fundamental significance for structural analysis, the distinction between the apparent content and the latent message of myths, and he further outlined the appropriate method for accessing both the structure and the content of the latter. In moving from the structure to the content of the latent message, the analyst is able to show that myths perform an additional function besides the one associated with their patent message. Myths typically offer explanations of certain phenomena or orders of things. At the same time, however, they perform a semantic function, which is instrumental in providing "local and temporary answers to the problems raised by feasible adjustments and insoluble contradictions that [myths] are endeavouring to legitimize or conceal" (Lévi-Strauss [1971]1981, 629). The semantic function can be brought into relief only when the various schemata in a myth have been identified and their interconnection has been successfully reconstructed by the analyst. This cannot be done, however, without recourse to the relevant ethnographic information. In *The Story of Asdiwal*, Lévi-Strauss ([1958]1967, 1) began "by calling attention to certain facts which must be known if the myth is to be understood", and proceeded to a very brief exposition of the essentials of Tsimshian ethnography. The information provided was intended to facilitate the reader not only to follow the sequence of narrated events (the 'syntagmatic chain') but also to apprehend its latent message, as retrieved by the analyst. To this end, further information about the Tsimshian kinship system was given as the analysis proceeded with specifying the semantic function of the myth (Lévi-Strauss [1958]1967, 24-27). Of course, the details provided to the reader were only a small part of the body of ethnographic data on which the analyst relied to identify the mythic schemata (the 'paradigmatic sets') and the patterns of their interconnection. Prior to this part of the analysis, myths "are little more than a syntagmatic chain, the message of which is to be decoded by reference to paradigmatic sets that… must be sought outside the mythic field, that is in ethnography" (Lévi-Strauss [1966]1973, 356). In other words, a strictly formal analysis is in itself insufficient, for "[i]t explains how the myths are composed but tells us nothing about what they say" (Lévi-Strauss [1971]1981, 272). Thus, to understand a myth means to move beyond its apparent content and grasp both the structure and the content of its latent message.

The Story of Asdiwal laid out the procedure and the basic requirements of a structural method designed to enable anthropologists to descend to the depths of mythical thought. Lévi-Strauss set himself the task of demonstrating the potential of the method in his famous four-volume series of *Mythologiques*, in which he took up the challenge of identifying the fundamental patterns of Amerindian mythology by analyzing large and complex transformation groups of myths. Except for the concept of armature, which appeared several years later[144], all the operative concepts that sustained this demanding project were introduced in the early demonstration of the method in 1958. Code is the operative concept that has attracted the least attention in the ever-growing body of literature on Lévi-Strauss, presumably because it has been generally regarded as being of no particular theoretical interest. When seen, however, in the wider context of the concept formation studied in the present monograph, Lévi-Strauss's concept of code assumes a special importance.

The operative concept of code was introduced in *The Story of Asdiwal* in a rather indirect way. The respective term occurred only twice, in the sense of the set of symbolic means proper to a given level of myth. This sense can be deduced from the term's first occurrence, in conjunction with the statement of aims at the beginning of the study:

> In this analysis of the myth, we have distinguished four levels: the geographic, the techno-economic, the sociological, and the cosmological. The first two are exact transcriptions of reality; the fourth has nothing to do with it, and in the third, real and imaginary institutions are interwoven. Yet in spite of these differences, the levels cannot be separated out by the

[144] See Lévi-Strauss ([1964]1969, 199).

> native mind. It is rather that everything happens as if the levels were provided with different codes, each being used according to the needs of the moment, and according to its particular capacity, to transmit the same message. (Lévi-Strauss [1958]1967, 13-14)

Lévi-Strauss's remark that the different codes identified in the myth are used "to transmit the same message" is not as straightforward as it might seem at first sight. It is worth trying to elucidate its meaning, for it may help us understand his view about the function of codes in myths. To begin with, it should be pointed out that by "message" Lévi-Strauss means (once again) the latent message of the myth. We recall that this message had a particular structure and content. The structure was laid bare when the analysis arrived at the global integration of the mythic schemata operative in the myth, and it was shown to consist of a series of oppositions distributed along two axes. The content was disclosed when Lévi-Strauss succeeded in specifying the semantic function of the myth, and it concerned the failure of marriage with the matrilateral cousin as a solution to a conflict inherent in Tsimshian society. Now, if the diverse codes manifest in the story of Asdiwal were used to "transmit the same message", their functioning must somehow be related to both the structure and the content of the latent message. The key to grasping this relation lies perhaps in the fact that the syntagmatic chain of this particular myth unfolds as a succession of unresolved conflicts. Concretely, "from a logical point of view, [Asdiwal's] adventures can be seen… [as] a series of impossible mediations between oppositions which are ordered in a descending scale" (Lévi-Strauss [1958]1967, 16), this series being ultimately "assimilated to that less obvious yet real paradox which marriage with the matrilateral cousin attempts but fails to resolve" (Lévi-Strauss [1958]1967, 28). Evidently, that series of unresolved oppositions can be expressed in the narrative only by means of various linguistic constructions. Thus, it seems reasonable to assume that the elements of the codes used in the story of Asdiwal are to be found among those constructions that express, directly or indirectly, some sort of contrast. For instance, several expeditions of Asdiwal involve the opposition between hunting and fishing, which in turn implies the opposition between land and water. We could say that words used to express the former opposition belong to the techno-economic code of the myth, whereas the opposition itself falls under the techno-economic schema. However, Lévi-Strauss ([1958]1967, 19) classified this opposition under the geographical schema, taking presumably as criterion the places in which those kinds of activities were performed. Analogously, words implying the opposition between land and water could be taken as belonging to a geographical code, whereas the opposition itself belongs to the geographical schema.

In *The Story of Asdiwal*, the use of the term “code” is not sufficiently clear. Given that the analysis offered relied on binary oppositions, we can assume that codes, too, must comprise pairs of opposing terms. Yet, among the numerous such pairs there is none explicitly characterized as belonging to some code. In the text, “code” occurred only twice, the last occurrence appearing right after the description of the four schemata and their integration, where Lévi-Strauss ([1958]1967, 21) signaled the transition to the second phase of his analysis as follows: “Having separated out the codes, we have analysed the structure of the message. It now remains to decipher the meaning”. Codes, thus, were supposed to have been separated in the formal analysis of the myth. However, no distinction whatsoever was drawn between codes and schemata, nor did Lévi-Strauss distinguish between more general and particular oppositions, as he would do in effect several years later with the introduction of the concept of armature. Be it as it may, in its first use as a term for an operative concept, “code” seemed to refer to a set of lexical units capable of expressing binary oppositions correlated in particular ways. It should also be noted that it evidently formed a pair with “message”, a connection implying an influence from information theory. In what follows, it will be shown that there was indeed an analogy between certain aspects of Lévi-Strauss’s concept of code and the respective information-theoretical concept. Other aspects, however, bespoke an influence from other fields, such as structural linguistics. The diverse aspects of the concept of code would manifest themselves in subsequent writings, starting with *Totemism* and *The Savage Mind*, both published originally in 1962, and culminating in the volumes of *Mythologiques*.

Lévi-Strauss used “code” in a variety of ways in connection with diverse phenomena. It is as if he sought to exploit the entire semantic potential of the word. Thus, in *Totemism* he spoke of codes with reference to the division of social groups into subgroups. For instance, he argued that “each tribe possesses two codes to express its social structure – kinship system and rules of marriage on the one hand, organization into sections or sub-sections on the other”, both of which are not “destined to transmit different messages”.

Rather, "[t]he message remains the same; only the circumstances and the recipients differ" (Lévi-Strauss [1962]1963, 50). Elsewhere, he used the same term with reference to the interpretation of symbolic behavior: "Psycho-analytical theory… sets itself the task of teaching us that the behavior of disturbed persons is symbolic, and that its interpretation calls for a grammar, i.e., a code which, like all codes, is by its very nature extra-individual" (Lévi-Strauss [1962]1963, 69). Finally, with respect to totemic systems we are told that "[t]he alleged totemism is no more than a particular expression, by means of a special nomenclature formed of animal and plant names (in a certain code, as we should say today), which is its sole distinctive characteristic, of correlations and oppositions which may be formalized in other ways" (Lévi-Strauss [1962]1963, 88-89). In *The Savage Mind*, totemic systems are explicitly characterized as codes "suitable for conveying messages which can be transposed into other codes, and for expressing messages received by means of different codes in terms of their own system" (Lévi-Strauss [1962]1966, 75-76).

The last passage suggests that totemic systems are treated as codes primarily because they "ensure, in the form of conceptual systems, the convertibility of messages" pertaining to different cultural levels (Lévi-Strauss [1962]1966, 90). Indeed, Lévi-Strauss ([1962]1966, 172) seemed to take intertranslatability as the defining property of codes in general, insofar as he defined them as "means of fixing significations by transposing them into terms of other significations". Evidently, "code" is used here as a generic term in what appears to be a minimal definition encapsulating the distinctive aspect of an evolving semiotic concept. Further key aspects of that concept were progressively revealed in subsequent writings, especially those of the *Mythologiques* series, through the analysis of Amerindian mythology. Besides the diverse mythological codes described in those texts, several other types were discussed. Such non-mythological codes were first introduced in *The Raw and the Cooked*, originally published in 1964 as the first volume of *Mythologiques*. Part of the opening chapter (the "Overture") was devoted to music and painting as compared to language. With respect to painting, Lévi-Strauss ([1964]1969, 20) remarked: "If painting deserves to be called a language, it is one in that, like any language, it consists of a special code whose terms have been produced by combinations of less numerous units and are themselves dependent on a more general code". Likewise, in music "all modal or tonal (or even polytonal or atonal) systems depend on physical and physiological properties, selecting some from among the infinite number no doubt available, and exploiting the contrasts and combinations of which they are capable in order to evolve a code that serves to distinguish different meanings" (Lévi-Strauss [1964]1969, 21-22). The notions of musical and pictorial codes invoked here were obviously modeled on Jakobson's concept of phonological code. Lévi-Strauss takes the diverse sets of phonological constraints underlying natural languages as particular instances of a universal mechanism of generating meaning by means of contrasts and combinations. At the lower level, the mechanism operates with a limited number of terms forming the initial pattern upon which higher-level systems can be build. This differential mechanism can replicate itself both 'horizontally' and 'vertically'. Depending on the physical properties exploited as material substratum, the mechanism can develop its potential through different semiotic systems. Within each system, moreover, the mechanism operates recursively generating a hierarchy of structured wholes belonging to distinct levels. Like Jakobson, Lévi-Strauss chose "code" as the generic term for both the universal mechanism in its abstract form and its particular manifestations, including non-verbal semiotic systems as well. Unlike Jakobson, however, Lévi-Strauss focused primarily on the transformational function of the mechanism.

The references to musical and pictorial codes in the Overture of *The Raw and the Cooked* imply something more than a mere metaphor. Lévi-Strauss's aim was to shed light on the unconscious structure symbolic thought taking as a point of departure the study of mythology. Given the structuralist orientation of his anthropology, the concept of a universal differential mechanism inherent in all semiotic phenomena was indispensable for his ambitious research project. The emergence of the semiotic concept of code in his work was ultimately necessitated by the very development of his theoretical edifice. Lévi-Strauss needed precisely Jakobson's divisible concept of code extended to the entire range of communication. Even his structural analysis of myth could not content itself with an operational concept of code but required a flexible and divisible semiotic concept capable of capturing the hierarchy of transformational mechanisms operating in mythology. Again, the Overture of *The Raw and the Cooked* is illuminating.

> …what I am concerned to clarify is not so much what there is *in* myths (without, incidentally, being in man's consciousness) as the system of axioms and postulates defining

> the best possible code, capable of conferring a common significance on unconscious formulations which are the work of minds, societies, and civilizations chosen from among those most remote from each other. As the myths themselves are based on secondary codes (the primary codes being those that provide the substance of language), the present work is put forward as a tentative draft of a tertiary code, which is intended to ensure the reciprocal translatability of several myths…. However, this code, like the others, has neither been invented nor brought in from without. It is inherent in mythology itself, where we simply discover its presence (Lévi-Strauss [1964]1969, 12; emphasis in the original)

The idea of tertiary code was first expressed in "Language and the Analysis of Social Laws", published in *American Anthropologist* in 1951. In that text, Lévi-Strauss addressed the relation between language and other social phenomena as objects of scientific study from both an epistemological and ontological point of view. The crucial question that could be raised, he argued, was "whether the different aspects of social life… can not only be studied by the methods, and with the help of concepts similar to those employed in linguistics, but also whether they do not constitute phenomena whose inmost nature is the same as that of language" (Lévi-Strauss 1951, 160). To verify such a hypothesis, Lévi-Strauss proposed a specific type of analysis.

> It will be necessary to develop the analysis of the different features of social life, either for a given society or for a complex of societies, so that a deep enough level can be reached to make it possible to cross from one to the other; or to express the specific structure of each in terms of a sort of general language, valid for each system separately and for all of them taken together. It would thus be possible to ascertain if one had reached their inner nature, and to determine if this pertained to the same kind of reality. (Lévi-Strauss 1951, 160-161)

It is interesting that in the French translation of this article, which appeared in 1958 as the third chapter of Lévi-Strauss's famous collection of essays titled *Anthropologie Structurale*, the expression "general language" in the passage quoted above is rendered as "*code universel*" (Lévi-Strauss [1951]1958, 71). What is important about this expression is not the trivial analogy between code and language that it implies. In light of the preceding remarks, we can say that this rendering provides another indication of the increasing significance of the concept of code in Lévi-Strauss's thought from the late 1950s onwards. Drawing on linguistic and information-theoretical sources, Lévi-Strauss introduced “code” in his terminology as both a technical term and a name for a general semiotic category, expanding progressively its range of referents.

The “general language” of the 1950s is the “tertiary code” of the 1960s. This terminological shift is telling. In “Language and the Analysis of Social Laws”, it is not clear whether the “general language” mentioned by Lévi-Strauss refers to an analytical tool of the social scientist or implies an immanent semiotic structure. In *The Raw and the Cooked*, the ambiguity is emphatically resolved: the tertiary code is neither “invented nor brought in from without”. It belongs, together with the primary and secondary codes, to social reality. It is precisely a tertiary code insofar as it forms part of a hierarchy of codes belonging to different orders. Lévi-Strauss was not, of course, the first who introduced the notion of hierarchy of codes. He rather adopted it from Jakobson’s structural linguistics but sought to expand it to the realm of other semiotic systems, such as painting and music (Lévi-Strauss [1964]1969, 20-22). At any rate, this idea, too, points to a broad semiotic conception, part of which was the operative concept of mythological code. That semiotic conception was first outlined, even if incompletely, in the Overture of *The Raw and the Cooked*, and its distinctive feature was the principle of intertranslatability, or mutual convertibility, between different semiotic systems. In Lévi-Strauss, the principle of intertranslatability reflected the overarching idea of transformation, which permeated both his concept of structure and his understanding of the key mechanism underlying symbolic activity. The latter informs his concept of tertiary code, which seems to extend as far as the unconscious structure of symbolic thought. Lévi-Strauss sought to shed light on the deep structures of mythical thought by exploring the paths that lead from secondary to tertiary codes in mythology.

The four volumes of *Mythologiques* contain the bulk of the hundreds of occurrences of the word “code” in the writings of Lévi-Strauss. A working definition was given only once, in the first volume of the series:

> I propose to give the name *armature* to a combination of properties that remain invariant in two or several myths: *code* to the pattern of functions ascribed by each myth to these properties; and *message* to the subject matter of an individual myth” (Lévi-Strauss [1964]1969, 199).

Both armature and code comprise series of (mostly binary) oppositions[145]. The difference between the two seems to be that the former comprises the more general or abstract oppositions (e.g. high vs low, or male vs female) on which a series of more specific oppositions can be developed. The relation between armature and code is a fundamental one and reflects a basic tenet of Lévi-Strauss's structural anthropology, namely, that myths operate by means of an interplay between variance and invariance.

> The truth of the myth does not lie in any special content. It consists in logical relations which are devoid of content or, more precisely, whose invariant properties exhaust their operative value, since comparable relations can be established among the elements of a large number of different contents. (Lévi-Strauss [1964]1969, 240)

Here Lévi-Strauss returned to the fundamental principle of structural linguistics that meaning does not inhere in isolated linguistic units but emanates from oppositional relations holding between them. As discussed earlier in this chapter, Lévi-Strauss explored the possibility of transposing this principle into the study of myth and addressed the basic theoretical and methodological issues involved in "The Structural Study of Myth". Seeking to define the ultimate unit of analysis specific to mythology, he devised the mytheme, a unit comprising a bundle of relations exhibiting a common feature. Yet, in order for the formal part of the structural analysis of myth to attain a status comparable to that of phonological analysis, it was necessary to treat "the significations of the entities figuring in the myths [as being] merely 'of position', like the entities that have the property of being permutable with others within certain limits" (Godelier 2018, 278). Thus, a distinction was drawn between the "logical structures" that remain invariant throughout a series of myths and the "different lexical resources" by means of which these structures are each time constructed (Lévi-Strauss [1962]1966, 53). That is precisely the distinction introduced in *The Raw and the Cooked* between armature and code.

The three operative concepts defined in that book (armature, code, message), together with the concept of axis, provided the anthropologist with a framework for identifying and

[145] Lévi-Strauss relied heavily on binary oppositions throughout the analyses performed in *Mythologiques*. Later, however, he acknowledged that this kind of opposition "only intervenes in the analysis of myth as the smallest common denominator of the changing values arising from comparison and analogy" (Lévi-Strauss [1991]1995, 185).

analyzing the transformations that characterize a given group of myths. In particular, the meticulous analyses carried out in the four volumes of the *Mythologiques* revealed certain patterns of interdependence between armatures, codes and messages. For example, a transition between myths, which leaves the armature intact and causes the code to change, will result in an inverted message (Lévi-Strauss [1964]1969, 199, Lévi-Strauss [1966]1973, 27). This finding, however, does not seem to be consistent with Lévi-Strauss's oft-repeated thesis that myths (or even kinship and totemic systems) employ different codes to transmit the same message. There is indeed a discrepancy here, but it is caused by a confusing use of the term "message". Already in "The Story of Asdiwal", a distinction was drawn between the apparent and the latent content of a myth, and the word "message" was used with reference to the latter. In *The Raw and the Cooked*, however, a terminological inversion occurred: "message" was defined as the "subject matter of an individual myth" and "theme" was used instead to denote the latent content of myths[146]:

> …I have shown that one particular theme, such as the origin of man's mortality, occurs in myths that appear quite different from each other in subject matter, but that in the last analysis these differences can be reduced to a variety of codes, evolved on the basis of the different sense categories… (Lévi-Strauss [1964]1969, 240)

Notwithstanding this terminological oscillation, Lévi-Strauss was quite clear about the way in which code relates to content (both apparent and latent). As regards the apparent content, there seems to be an inversely proportional relation:

> Compared with those of other myths, the message of any one myth may seem to have been either more or less transformed or to be identical. But these differences affect the lexical material, too. In two myths belonging to one set, the lexical material may remain all the more similar because the corresponding messages have undergone a profound transformation; and if the transformational area is reduced in respect of the message, it will tend to increase in respect of the lexical material. (Lévi-Strauss [1964]1969, 212)

In other words, there is a direct interdependence between the apparent content of a myth and the lexical material (i.e. the code) employed. The latent content, however, is much

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[146] Elsewhere in the same book, however, Lévi-Strauss ([1964]1969, 164) used again the term "message" to refer to the latent content: "when considered from the formal point of view, myths which seem very different but all deal with the origin of man's mortality transmit the same message and can only be distinguished one from another by the code they use".

more abstract in nature and cannot be directly affected by a change in the use of lexical resources. Rather, in a group of myths all transformations of the basic components (armature, code etc.) are exploited in a way that makes possible the transmission of the 'same' (latent) message throughout different sociocultural groups. Thus, the lexical material yields, as it were, to the logical structure of the narrative according to the requirements of the semantic function of the myth.

In one of his later texts, Lévi-Strauss divided the material of which myth is made in two main categories.

> Mythical thought operates through means of oppositions and codes…. [The] different modes of opposition belong to heterogeneous categories. Moreover, they never present themselves in an abstract form and, so to speak, in a pure state. Rather, they take on a concrete aspect within codes that are used to formulate messages, messages that themselves can be transposed into the terms of other codes and that can in turn transpose into their own system messages received through the channels of different codes. These codes are themselves heterogeneous… (Lévi-Strauss [1991]1995, 185-186)

Codes and abstract oppositions form an indissoluble unity in myth. In this relation, however, codes do not simply amount to plain lists of labels for the opposed terms. Rather, they "comprise both a grammar and lexical material" (Lévi-Strauss [1964]1969, 212); that is, they are systems whose elements enter in diverse relations of contrast and combination. Thus, codes present their own structure, which in some cases can be particularly complex. In the second volume of *Mythologiques*, for instance, Levi-Strauss ([1966]1973, 327-333) analyzed an acoustic code, whose structure was represented as a complex polyhedron. The terms of the code were divided into three different levels according to the type of object or behavior to which they referred. Between these levels Lévi-Strauss ([1966]1973, 331) discerned "a complicated network of cross-connections, some parallel with each other, others oblique". This example suggests that the identification and analysis of the codes employed in a group of myths can be an arduous task. Furthermore, it may often involve (initially, at least) a lot of intuition, as Lévi-Strauss himself once admitted.

> …in the first stages of the research, the selection and the definition of the axes on which are located the oppositions, and the selection and the definition of the codes to which they

> are applicable, owe much to the analyst's subjectivity, and thus they have an impressionistic character. (Lévi-Strauss [1991]1995, 186)

In order to avoid the pitfall of arbitrary interpretations, Levi-Strauss sought to ensure that his analyses were exhaustive and that they provided "the unique and most economical coding system to which [they could] reduce messages of a most disheartening complexity". For "[e]ither structural analysis succeeds in exhausting all the concrete modalities of its subject, or we lose the right to apply it to any one of the modalities" (Lévi-Strauss [1964]1969, 147). As a result, he engaged in a long-standing, meticulous analysis of several hundreds of myths, which yielded a rich inventory of codes employed in Amerindian mythology. It has been estimated that in the four volumes of *Mythologiques* Lévi-Strauss described twenty different types of code (meteorological, sociological, sensory, botanical, culinary etc.), most of which consisted of interrelated binary oppositions (Godelier 2018, 352-353). The sheer volume of pages replete with both mythological and non-mythological codes attests to the key position that the emerging semiotic concept came to occupy in Lévi-Strauss, a position necessitated by the theoretical premises of his structural anthropology.

The preceding exposition sought to foreground the conditions of emergence of a genuine semiotic concept in structural anthropology. It would be tempting to account for the uses of "code" in Lévi-Strauss's work in terms of a metaphor he himself employed to characterize mythical thought. In *The Savage Mind*, Lévi-Strauss invoked the figure of *bricoleur* to draw attention to what he saw as the defining feature of mythical thought. A *bricoleur* is someone who "make[s] do with 'whatever is at hand', that is to say with a set of tools and materials which is always finite and is also heterogeneous" (Lévi-Strauss [1962]1966, 17). Analogously, mythical thought was said to constitute "a kind of intellectual bricolage", in that it "expresses itself by means of a heterogeneous" and limited repertoire "because it has nothing else at its disposal" (ibid.). Arguably, the way Lévi-Strauss employed "code" gives the impression of a different kind of intellectual bricolage, insofar as he appears to have gathered most of what the rich semantic history of the word had to offer, including the specific linguistic uses made in language studies by Jakobson and others. Yet, in his writings Levi-Strauss did not simply switch between different senses according to the needs of the exposition. Building on Jakobson's concept of code, a true amalgam of linguistic and information-theoretical elements, he constructed a semiotic concept of transformation as part of his theoretical scheme that was devised to account for the transition from the unconscious structure of symbolic thought to its manifestations in diverse symbolic systems. Of course, the concept was general enough to be applicable to any kind of transformation, whether conscious or unconscious. In other words, in Lévi-Strauss "the code is not so much a mechanism which allows communication as a mechanism which allows transformations between two systems. It is irrelevant whether these are systems of communication or something else; what matters is that they are systems which communicate *among one another*" (Eco 1984, 168; emphasis in the original). However, all codes discussed in the four volumes of *Mythologiques* and elsewhere pertained to communication systems. The passing references to nomenclatures, classificatory systems etc. were meant to specify the particular type of code each time discussed, whereas the references to grammar were meant to emphasize the rule-governed nature of codes.

Jakobson's ontological structuralism and Lévi-Strauss's structural anthropology represent the two key 'moments' of the concept formation studied in this monograph. Both were crucial for the emergence of the semiotic concept of code, despite the fact that the latter eventually appeared in the writings of Lévi-Strauss. Still, it surfaced in a rather underdeveloped form. Unlike the concepts of structure and the unconscious, there was no theoretical elaboration of codes. Jakobson's linguistic concept comprised various aspects (system, model, rule, transformational mechanism, structured whole) whose interconnection remained unclear. Lévi-Strauss did not attempt to disentangle these aspects and specify the relations between them. He simply integrated the concept to his theoretical arsenal emphasizing transformation as the principal aspect pertinent to his research. Thus, any ambiguities besetting Jakobson's concept carried over to Lévi-Strauss's structural anthropology. On the other hand, however, such ambiguities conferred a remarkable flexibility that allowed for exploiting an evolving semiotic concept in an ever-increasing number of fields. During the 1960s and 1970s, the diffusion of the term "code" in the humanities and social sciences accelerated. Lévi-Strauss's contribution to this development was enormous. He managed to integrate Jakobson's linguistic concept of code into a wider semiotic conception and established the use of the word not as a mere metaphor but as the term of a fundamental mechanism underlying the functioning of diverse semiotic systems. To be sure, the semiotic concept introduced in structural anthropology was exploited in divergent ways not necessarily consistent with Lévi-Strauss's emphasis on binary oppositions and logical operations. Yet, as a rule such divergences were the product of experimentation, not of theoretical elaboration. This was still a period of enthusiasm and expansion; there was hardly "enough time to make subtle formal distinctions" (Eco 1984, 166). Nonetheless, this period culminated in the first semiotic theory of codes, presented by Umberto Eco in 1976, which marked the full development of the concept.

CHAPTER 9

The Theory of Codes

In roughly a quarter of a century, the word "code" entered an astonishing number of discursive practices in various fields. This expansive phase was triggered by the mid-twentieth century advances in communication engineering and their impact on the natural and social sciences. The main thrust, however, during this phase was provided by the distinct development of the respective disciplines, especially in connection with the transdisciplinary influence of information theory and cybernetics throughout the third quarter of the twentieth century. As a result, the appropriation of "code" followed several paths, each one unfolding within a different cluster of disciplines. The path that led to the semiotic concept of code was formed out of the varied applications of the word in problems and issues pertaining to the scientific study of signs. From the point of view of their function, these applications were significantly diversified, ranging from trivial metaphorical uses to terminological appropriations for specific theoretical purposes. In general, there was no unidirectional transition from naïve analogies to elaborate applications. "Code" never ceased to fulfil diverse functions in social-scientific discursive practices. It is noteworthy that it began to gain wide currency as a fashionable term precisely when the semiotic concept of code emerged. The works of Jakobson and Lévi-Strauss played a key role in this development, but they also paved the way for further theoretical elaborations.

In the 1960s, while Lévi-Strauss was in the early stage of his long-standing research that yielded the *Mythologiques* series, codes began to attract the interest of prominent semioticians. In a series of influential essays published in that decade, Sebeok embarked on an investigation of 'coding phenomena' in living organisms, taking as his point of departure an essentially information-theoretical conception of code. Those writings laid the foundations of zoosemiotics, a distinct discipline "within which the science of signs intersects with ethology, devoted to the scientific study of signalling behavior in and across animal species" (Sebeok 1963, 465). In the first essay of this series, Sebeok (1962, 430) sought to "investigate the analog and digital characteristics of human communication and… compare human and animal communication systems as to the manner in which they code information". The main hypothesis put forward was that "whereas subhuman species communicate by signs that appear to be most often coded analogly, in speech… some information is coded analogly and other information is coded digitally" (Sebeok 1962, 431). Coding was taken to be "an operation, governed by strict and logical rules, aimed at gaining increased efficiency by having elementary signals organized into patterns of alternative actions", whereas code was "everything that the source and the receiver know *a priori* about the message" (ibid.). To test his hypothesis, Sebeok used Jakobson's model of linguistic functions as a framework. He found out that "of the six communicative functions [foreseen in the model], two –the emotive and the phatic– certainly occur in subhuman species as well; two others –the cognitive and the conative– probably occur; but the remaining two –the poetic and the metalingual– seem to be exclusively human" (Sebeok 1962, 435). Moreover, in speech certain functions, e.g. the emotive function, seemed to obey the logic of analog rather than digital (i.e. binary) coding. In "Animal Communication", published in 1965, Sebeok probed further the heuristic value of Jakobson's model of linguistic functions, seeking to establish the counterpart of each element (addresser, addressee, channel, context, code, message) in animal signaling interaction. To this end, he employed an expanded conception of code, integrating its transformational function with its conventional nature and presupposing the existence of "social conventions of certain sorts which may be at the root of all social behavior in animals" (Sebeok 1965, 1011). Based on this presupposition, he postulated the operation of species-specific codes in animal communication, hierarchically organized in higher-order codes regulating the communicational behavior of the entire organism:

> A code is that set of transformation rules whereby messages are converted from one representation to another, a message being a string generated by an application of a set of such rules, or an ordered selection from an agreed, that is, conventional, set of signs. The physical embodiment of a message, a signal, is a sign-event or a sequence of sign-events where, in the domain at issue, a small amount of energy or matter in the source, an animal, brings about a large redistribution of energy or matter in the destination, the same or another animal. The overall code which regulates an animal communication system often seems to

> include a set of subcodes, grouped in a hierarchy, fluctuations among which depend on such factors as the availability of alternative channels and the distance between source and receiver. (ibid.)

Having thus established the possibility of conventional transformational rules among the animals, Sebeok (1965, 1011-1012) subsequently drew on available data to argue for a metacommunicational function in animal communication, analogous to the metalinguistic function foreseen in Jakobson's linguistic model.

The two essays briefly discussed above, together with other texts published in the 1960s [147], lay bare the distinctive mark of Sebeok's approach to human and animal communication during his "first zoosemiotic period" (Cobley 2014, 35). For the present monograph, these texts are especially interesting in several respects. In the first place, Sebeok sought to integrate in zoosemiotics the early applications of information-theoretical and cybernetic ideas to the neurophysiology of speech into a wider semiotic perspective, which would also encompass the neurophysiological and biological studies in animal signaling. From within this perspective, he explored the possibility of exploiting Jakobson's linguistic model for the construction of a functional scheme adapted to animal communication, thus suggesting a path towards a prospective cooperation between linguistics and ethology. At the heart of this foundational work for zoosemiotics was a conceptual amalgam combining Jakobson's linguistic concept of code with an information-theoretical understanding of coding processes. Compared to Lévi-Strauss, Sebeok offered a much broader semiotic conception of codes, a conception that comprised all forms of human and animal communication. Moreover, contrary to the prevalent tendency among structuralists at the time, Sebeok shifted the focus from binary coding to the interrelation between analog and digital codes. From his major contribution to zoosemiotics sprang a new thread in the development of the semiotic concept of code. As discussed in chapter 4, one of the main tasks of cybernetics was the construction of a unified framework for the natural and social sciences based on the groundbreaking advances in control and communication engineering. To attain this goal, cybernetically inspired social or natural scientists had to reconceptualize neurophysiological and

[147] See e.g. Sebeok (1963b, 1965b, 1969)

biological processes in communication engineering terms. A significant part of this reconceptualization involved the use of code and coding as models of certain processes in humans and animals. Research in the neurophysiology of speech was one of the first fields in which those models were tested. In that way, the information-theoretical notion of code was ‘reinterpreted’ in biological terms, but in itself this reinterpretation did not suffice for a new concept formation in linguistics or semiotics.

Sebeok’s early work in zoosemiotics stood between two different strands. On the one hand, there were the early attempts of the 1950s (by Fry, Miller, Cherry and others) to account for speech production and perception in coding terms. Such endeavors remained relatively faithful to the technical definitions of the information-theoretical notions employed. On the other hand, there were the grand projects of Jakobson and Lévi-Strauss, in which key information-theoretical ideas were blended into theories of language and symbolism with a rich theoretical background quite distinct from control and communication engineering. The core of the semiotic concept of code emerged out of this blending. An essential part of Sebeok’s pioneering work in zoosemiotics shared with the first of the two aforementioned strands the emphasis on the technical understanding of codes. However, Sebeok was interested in examining coding processes in human and animal communication not from a strictly biological perspective but within an enlarged semiotic framework, which also encompassed codes of the types found in the works of Jakobson and Lévi-Strauss. Thus, his concept of code should somehow accommodate the partially overlapping conceptions employed in linguistics, anthropology, semiotics and information theory. This was achieved by abstracting the distinctive feature of the information-theoretical notion of code (the idea of rule-governed transformation) and raising it to a universal phenomenon in living organisms, from the lowest biological level up to the diverse responses and forms of behavior in human communication and interaction. In that way, Sebeok added another thread to the evolving semiotic concept of code, providing a bridge between the early neurophysiological investigations of coding and the structuralist study of codes as systems of signs in human communication. The link between the two lies in the logical operations involved in coding. Insofar as such operations are taken to be ubiquitous in semiosis and communication, a generalized concept of code seems to deserve a prominent place among the fundamental concepts of semiotics. This stance implicit in Sebeok's early zoosemiotic writings was exemplified in Sebeok and Danesi's (2000) biosemiotic theory of meaning based on the concept of modeling system.

Sebeok shared with Lévi-Strauss a keen interest in the logical aspects of codes, which can be largely attributed to the strong influence of cybernetics and information theory on their views about communication. Although their approaches to coding differed in significant respects, both Sebeok and Lévi-Strauss pointed to a general concept of a transformational mechanism that generates structures by correlating different orders of elements. A similar idea can be found in Prieto's *Messages et signaux*, which added another important thread to the development of the semiotic concept during the 1960s. Prieto shed light on the logical aspects of codes from a different point of view reflecting his particular structuralist approach to communication. As a result, he arrived at a semiotic conception of code that differed in significant respects from those espoused by Sebeok and Lévi-Strauss, notwithstanding the shared ground partially underlying their research projects. With Prieto, there is a shift in focus from the transformational function of codes to their systematic nature. In a sense, there seems to be, at first sight, a regression to the trivial notion of system of signs, inasmuch as code is defined by Prieto as a system of pairs of signifiers and signifieds. However, these familiar Saussurean terms acquired a new meaning within a meticulously elaborated structural theory that sought to explore the potential of Saussure's *Cours* in a distinctive way. In *Messages et signaux*, Prieto (1966, 6) set himself the task of laying the foundations of semiology, the science of signs as envisaged by Saussure. At the heart of Prieto's semiological theory we find the process of communication, especially the element that represents its material aspect: the signal. For Prieto, the signal is not merely the sensible part of the sign; it is, above all, a tool. In viewing signals as tools, Prieto grounded his theory in an anthropological fact of utmost importance highlighting, at the same time, the practical character of all sign use.

Every tool is constructed with a certain purpose in mind and has a specific utility, the latter being defined as the class of operations that can be performed by using that tool. Therefore, tools not only enable humans to manipulate the external reality but they also provide them with classes of elements (that is, 'concepts') by means of which they can grasp the world. However, the use of a given tool is not intertwined with a single class (the set of operations that can be performed by using that tool) but with a group of classes. A tool's utility implies the complementary class of all the operations that cannot be performed with the specific tool. The two classes form a higher-order set, a 'universe of discourse'. Since these two classes are defined as such with reference to something (the tool) that lies outside their universe of discourse, the utility and its complementary set are intertwined with another universe of discourse, which takes tools rather than operations as its members. With respect to a given operation, this second higher-order set can in turn be divided into two complementary classes of tools, the appropriate and the inappropriate ones. Thus, a tool is inseparable from a set of classes interrelated in a specific way (Prieto 1966, 1-4). These considerations form the backdrop against which Prieto formulated the principles of his general semiological theory based on an account of the process of communication in set-theoretical terms.

Among the diverse types of tool used by humans, signals occupy a privileged position since they are indispensable for communication. Granted that the function of a signal is the transmission of messages, a signal's utility can be defined as the set of all messages that can be transmitted by it. Prieto (1966, 5) termed "signified" the set that constitutes the utility of a signal. A signified and its complementary class (i.e., the class of messages that cannot be transmitted by the signal under consideration) form a "noetic field". In analogous manner, Prieto discerned another universe of discourse, termed "sematic field", which took signals rather than messages as its members. This universe, too, could be divided into two complementary classes, one of which would be the signifier. To specify the signifier of a given signal, one should take into account not just the actual message transmitted but an entire set of alternative messages. Signals operate by means of a series of indications. When a signal is emitted, the addressee receives a "notificative indication" about the intention of the addresser to transmit a message. A "significative indication" provided by the signal allows for the delineation of the set of alternative messages from which the addressee should select the message that corresponds to the one actually transmitted. This selection is made possible thanks to a third type of indication, provided by the circumstances of the signal emission (Prieto 1966, 29-48). The division of the sematic field into a signifier and its complementary class depends upon the significative indication of the signal. Concretely, in a given communicative act the signifier encompasses the signal produced and all other signals capable of providing the same significative indication. The signals that can provide a different significative indication form the complementary class of the signifier (Prieto 1966, 37).

From what has been said so far, it is deduced that the noetic and sematic fields can undergo different divisions depending on the specific signals produced each time. Signifiers and signifieds are delineated in the act of communication itself and on the ground of their correspondence the "fundamental semiological units" termed "semes" are established. Semes should not be confused with signs[148]; they are higher-order units roughly corresponding to supralexical units in verbal systems (Prieto 1966, 39, fn. 2). "Seme", a term borrowed from Buyssens (1943)[149], actually denotes a correspondence between a particular division of a sematic field and an analogous division of a noetic field (ibid.). Of course, such correspondences are always embedded in comprehensive systems of interdependences called "codes". Prieto (1966, 32-33) found the existing definitions of code at the time insufficient for the purposes of his theory. He nonetheless adopted the concept, initially resorting to "our practical knowledge" of such codes as natural languages or traffic signs. However, once the concepts of noetic and sematic fields were introduced, Prieto (1966, 39) defined code as a whole consisting of two universes of discourse whose divisions into complementary classes stood in a relation of mutual correspondence. In short, a code was a "system of semes". An important characteristic of codes thus defined concerns the nature of the elements that can be members of its sematic field. To speak of a code, in the sense in which the term is used in *Message et signaux*, is to speak of a system comprising a specific kind of indices. To illustrate this point, Prieto cited the example of someone who seeks to predict the weather by observing the different colors of the sky. In this type of forecasting, we can discern two universes of discourse (the different colors of the sky, on the one hand, and the possible weather conditions, on the other), divided in complementary classes. Any correlation between these two sets, however, is established without the use of tools. The colors of the sky are indices abstracted from natural facts;

[148] In Prieto (1966, 105), signs constitute a specific type of unit into which certain types of seme can be analyzed. Like semes, signs, too, can be said to comprise a class of signals (signifier) and a class of messages (signified).
[149] This work appeared in a revised and expanded form as the first part of Buyssens (1967).

they are not produced with the intention of imparting information. They can serve, no doubt, as components of a system of indices, but codes according to Prieto constitute a special type of system in that they rely on the use of signals, that is, they operate with indices produced deliberately for the transmission of messages (Prieto 1966, 40-41). Thus, Prieto's conception of code is predicated on the distinction between indices and signals, a distinction of fundamental importance for his semiological theory.

Following Buyssens (1967, 20), Prieto put a special emphasis on the distinction between index and signal. The former was defined as an observable fact capable of providing information about an associated, non-observable fact (Prieto 1968, 95). The signal, on the other hand, was taken as an "artificial index", since it is deliberately produced for providing information (Prieto 1966, 15, fn.1). Later, Prieto (1975, 15-16) presented a tripartite distinction between spontaneous indices, spurious spontaneous indices, and intentional indices. The first type corresponds to the innumerable natural indices available in the world, such as the colors of the sky mentioned earlier. The third type is what Prieto called "signals", the tools that serve the purpose of transmitting messages. Spurious spontaneous indices are also purposeful in nature, but they are intended to appear as spontaneous indices. Evidently, Prieto's classification of indices rests on the concept of communicative intention and it is precisely for this reason that it was accorded a special status in his theory. In fact, the basic distinction between natural and artificial indices, and especially the second member of this pair, encapsulates the essence of Prieto's conception of communication. An addresser produces a signal with the intention of transmitting a specific message to an addressee. The signal produced, however, cannot fulfil its role in this kind of interaction unless the addressee recognizes the addresser's specific communicative intention. This is one of the two necessary and sufficient conditions for a successful "semic act", the other being the identification by the addressee of the concrete message that the addresser intends to transmit (Prieto 1966, 10). Thus, communication is portrayed as a purposeful activity that involves, *inter alia*, an intentional index and a particular kind of intention recognition. The crucial question raised in this connection is how can the addressee recognize the addresser's communicative intention in the first place. According to Prieto (1966, 11), the answer is simple: by the very fact of being produced, the signal indicates to the addressee that the addresser intends to transmit a given message.

However, postulating a notificative indication inherent in signal production can only be taken as a first step toward the elucidation of such an intricate phenomenon. Unfortunately, Prieto did not elaborate on the necessary and sufficient conditions of intention recognition, but there are some remarks that suggest the proper point of departure of a thoroughgoing account of this matter.

Prieto defined codes as systems of correspondences between parts of two comprehensive sets called “universes of discourse”, both of which are divided in specific ways into complementary classes according to the communicative act each time performed. One universe of discourse, called “sematic field”, represents the sensible element in communication, in that it comprises the perceptible facts used for the transmission of messages. For the reasons explained above, Prieto argued that the members of this set belonged to a specific type of intentional index, the signal. Signals constitute tools specifically devised for communication. The other universe of discourse, called “noetic field”, comprises the messages that can be transmitted by signals and, as such, it represents the intelligible element in communication. In Prieto’s conception of communication processes, the correspondences between signifiers and signifieds called “semes” are always organized into higher-order systems. These systems can be verbal or nonverbal and are termed “codes”. In his description of a successful semic (i.e., communicative) act it is presupposed that the addresser and the addressee share the same code. It is precisely this presupposition that according to Mounin provides the key to understanding how the addressee recognizes the communicative intention of the addresser upon receiving the emitted signal. As we saw, Prieto contented himself with postulating a notificative indication produced by the fact itself of signal emission. Commenting on this view, Mounin (1982, 8) argued that such a notificative indication presupposed the social acquisition of the code used in a given semic act. This, however, is only one in a series of presuppositions that reach as far as the diverse communicative and other sociocultural practices and the accompanying habits, predispositions and forms of behavior socially acquired by individuals throughout their lives. Thus, a notificative indication is ultimately of social nature and it can function as such precisely because it rests on a multiplicity of diverse codes variously interrelated in the innumerable communicative acts in social life (Mounin 1982, 13-15). It is interesting that in Prieto’s *Pertinence et pratique*, published in

1975, we can discern a view converging Mounin's remarks in the discussion about the system of intercomprehension. This system does not concern the process of communication itself but the conditions that make communication possible, and it lies at such a fundamental level that includes the very criteria of sameness and difference determining the production and understanding of messages (Prieto 1975, 52-54).

Mounin's comments on Prieto's concept of notificative indication suggest the depth and scope of the issue of communicative intentions and offer insights of fundamental importance for semiotics. The key to unraveling the intricacies of intention recognition was said to be the social acquisition of codes that social agents share in communication. Shared codes are indeed a presupposition of the semic act as portrayed in *Messages et signaux*. However, Mounin (1982, 8) argued that Prieto failed to see the specific importance of this presupposition for the notificative indications postulated in his theory, and this is reflected in the discussion of the types of communication failure, in which misrecognitions regarding the codes employed in a semic act are not taken into consideration. Yet, in that discussion Prieto did refer to such misrecognitions, although not as a distinct type of communication failure but as a phenomenon leading to one of the types discerned. Concretely, Prieto (1966, 51-55) distinguished between two types of communication failure: miscomprehension and ambiguity. In the first case, there is a discrepancy between the message transmitted by the addresser and the message attributed to the received signal by the addressee. In plain words, the addressee understands something different from what the addresser had in mind when emitting the signal. In the second case, the addresser fails to ascribe a single message to the signal and, thus, the addressee is faced with two or more equiprobable messages under the given communicational circumstances.

Both types of failure have two common sources. On the one hand, there may be a misjudgment on the part of the addresser as regards the circumstances of communication. The communicators engaging in some exchange have knowledge of certain facts relevant to the given communicative act. Each communicator, moreover, makes certain assumptions about the facts of which the other communicator is aware. If the addresser assumes that the addressee has knowledge of certain facts that are actually unknown to him or her, then there is a misjudgment about the circumstances of communication, which can lead either to miscomprehension or to ambiguity. Another source of failure is the discrepancy in the significative indication. As explained earlier, a significative indication delineates a set of alternative messages correlated with the emitted signal. The message that the addresser intends to transmit belongs to this set, and it can be 'retrieved' by the addressee with the help of a further type of indication provided by the circumstances of communication. Thus, both parts assume a certain correspondence between the given signal and a set of alternative messages. A discrepancy between the sets of messages that the two communicators take as corresponding to the same signal can equally lead either to miscomprehension or to ambiguity. Such discrepancies are commonly caused by errors in signal emission or reception (e.g. slips of the tongue or mishearing). Another reason, much more interesting according to Prieto (1966, 56), is a discrepancy in code. When the addresser and the addressee do not use exactly the same code, or use different variants of it, a discrepancy in the significative indication will occur, which in turn will lead either to miscomprehension or to ambiguity[150]. It is interesting that Prieto mentioned in this connection only slight differences in code employment. Obviously, he did not deem it necessary to discuss the possibility of a total divergence, since in that case there would be no communication at all.

Prieto argued that the consideration of such small divergences in the use of codes as potential sources of communication failure allows for drawing some important conclusions about the nature of semes and codes. Every communicative act involves a series of divisions into different classes of signals and messages and a series of correspondences between them. In order for communication to fulfil the diverse purposes determined by the exigencies of social life, communicators have to agree in the divisions of classes they make and the correspondences established between them. Thus, semes and codes can never be formed on the basis of an individual decision but always result from the influence that the members of a social group exert on each other. In this respect, the signifiers and signifieds that make up the semes, and the systems of semes that make up the codes of a given social

[150] Later, Prieto (1975, 54-57) defined as a source of miscomprehension the employment of a "false code" by the addresser.

group, are all social institutions (Prieto 1966, 58). This is an important statement about the nature of codes in that it excludes several phenomena that other scholars, such as Sebeok, were willing to subsume under the category in question. Prieto offers a genuinely semiotic concept insofar as he takes into consideration codes pertaining to both verbal and nonverbal systems. However, he is interested in these systems primarily as social institutions. It is precisely this specific focus that makes his account of the logical aspects of codes so distinctive.

Prieto's reference to social institutions should not be taken as a trivial remark about the conventional character of codes. Rather, it should be seen against the backdrop of the basic tenets of his semiological theory. Concretely, the conception of codes as social institutions derives from his definition of the communicative act, and especially from the underlying distinction between natural and artificial indices. Communication, according to Prieto, operates exclusively with intentional indices (signals). One of the two necessary and sufficient conditions for a semic act to take place is the recognition of the addresser's communicative intention by the addressee. The crucial question raised in this connection is how this recognition can be achieved. Prieto's answer consisted in postulating a notificative indication produced by the act of signal emission itself. However, he did not elaborate on this idea. Mounin's comments on this matter pointed to the social acquisition of codes, norms and cultural practices as a presupposition of intention recognition, a view that can be partially deduced by Prieto's conception of communication in conjunction with his remarks about the systems of intercomprehension in *Pertinence et pratique*. In short, the pivotal significance attached to the recognition of communicative intentions led to the view that communication rests on the social acquisition of codes, which in turn implied a kind of agreement typical of social institutions.

Except for the studies dedicated to the investigation of the so-called coding phenomena in the neurophysiological processes involved in communication, all linguistic and semiotic approaches to codes discussed so far implied some sort of normativity. In the first place, normativity manifests itself in the form of rules governing the functions of codes. Beyond that level, however, there lies a long chain of conventions governing the behavior of communicators. The social and normative aspects of codes were not especially foregrounded by the early linguistic and semiotic approaches. Prieto's theory was an exception in this respect, in that it sought to provide the theoretical framework for the structural study of codes as social institutions. In that way, Prieto may be said to have contributed in its own particular way to highlighting the social significance of codes. It is worth mentioning, in this connection, a parallel development outside semiotics, which resulted in the emergence of a sociolinguistic concept of code. In a series of influential papers published in the 1960s, Basil Bernstein introduced "code" as a proper term in the sociology of language and education. The main task that Bernstein set himself throughout his career[151] was the elucidation of the relationship between language use, social class and control. One of the basic analytical tools he developed to accomplish this task was a distinction that allowed for a systematic classification of language use variation. Initially, the distinction appeared in the form of a contrast between public language and formal language. The two members of this pair referred to different modes of language use, distinguished in terms of the different functions allocated to verbal and nonverbal communication systems, the structure of discourse, and the structure and particular significance of the diverse speech acts performed in communication. Thus, public language was said to contain

> a high proportion of short commands, simple statements and questions where the symbolism is descriptive, tangible, concrete, visual and of a low order of generality, where the emphasis is on the emotive rather than the logical implications… Feelings which find expression in this language… will be diffuse and crudely differentiated when a public language is being used, for if a personal qualification is to be given to this language, it can only be done by non-verbal means, primarily by changes in volume and tone accompanied by gesture, bodily movement, facial expression, physical set. (Bernstein 1958, 164)

Formal language, on the contrary, "is rich in personal, individual qualifications, and its form implies sets of advanced logical operations; volume and tone and other non-verbal means of expression although important take second place" (ibid.). These modes were accordingly correlated with the working class and the middle class via two major institutions that constitute basic units of analysis in Bernstein's work: schooling and

[151] See Bernstein (1971-1990).

family. Specifically, it was found that "the working-class child has only learned to respond to one [mode of speech]", whereas the "middle-class child is capable of manipulating the *two* languages – the language between social equals (peer groups) which approximates to a public language and a formal language which permits sensitivity to role and status" (Bernstein 1958, 162, 165; emphasis in the original). The way language use and social class are correlated in this early paper is indicative of a typical characteristic of Bernstein, namely, the absence of a straightforward equivalence in his theory (Atkinson 1985, 75).

Following the development of Bernstein's thought, the initial distinction between public and formal language was further elaborated in subsequent writings, where the word "code" was introduced as a more specific term for the contrasting modes of speech. The shift, however, was not merely a terminological one. We cannot proceed, of course, to a detailed analysis of Bernstein's investigation of language use. Yet, some key remarks need to be made about this particular aspect of his work that will also shed light on his sociolinguistic concept of code. Even in its earliest form, the cardinal distinction between the aforementioned speech modes was not intended to capture the structural differences of two contrasting class dialects. The structures of the public and the formal language were not seen as an object in itself but rather as an index to relations and phenomena lying at a much deeper level. Concretely, in studying speech variation, Bernstein attempted to bring into relief "orientations to means, ends and objects, relationships between objects, the creation and re-creation of identities, and modes of social control" (Atkinson 1985, 40). Bernstein's interest, then, was in language as a means, as "one of the most important means of initiating, synthesising, and *reinforcing* ways of thinking, feeling and behaviour which are functionally related to the social group" (Bernstein 1959, 312; emphasis in the original). Specifically, in speech variation Bernstein sought to discern the ambiguities and shared assumptions that remain implicit, as well as those that are rendered explicit. Thus, underlying the distinction between public and formal language was another one, that between explicit and implicit assumptions, which represented "the extent to which the *principles* underlying the social structuring of relevant meaning were made public and elaborated through the use of language *in the process of socialization*" (Bernstein [1973]1974, 242; emphasis in the original).

In the early 1960s, a shift in focus took place, which was reflected in Bernstein's terminology. The analysis of language was gradually oriented toward a higher level of abstraction. Put simply, the analysis moved "away from *what* people say to the rules that govern *how* it is that they come to speak in specific ways" (Danzig 1995, 148; emphasis in the original). The term "code" was introduced to denote precisely that kind of rules. There is a clear trace of the transition to the new terminology in a paper published in 1960, which also sheds some light on the source of the term. In that paper, Bernstein returned to the issue of the relationship between social structure and language use in order to refine the analytical tool he had introduced two years ago. Drawing on Hughlings Jackson's (1958, 189) distinction between "the most automatic or 'oldest' or 'earliest' speech, applying to well-organised external relations of things" and the "newest speech, applying to now organising external relations", Bernstein introduced the dichotomy between "highly-coded utterances" and "now-coding utterances".

> Highly-coded utterances tend to be utterances which are the result of common conditioning and learning. They are shared by a given language community and possess a relatively high transition probability. In the case of now-coding utterances the individual is emitting a series of signals which symbolize the speaker's separateness and difference. These utterances are symbolic of an individuated experience. This is not the case with highly-coded utterances, for the signals tend to symbolize the normative arrangements of a group. Social symbols are created, which are reinforced in the speaking. Highly-coded utterances will tend to be short, fast, fluent and relatively unpaused and, because of their well-organized or automatic character, permit high affective ventilation and the use of gross expressive symbolism. They will also tend to refer to, and become a vehicle for, concrete rather than analytic thought processes. On the other hand, now-coding utterances will tend to be slower, longer, utterances with relatively longer pauses within the speech sequences and become a vehicle for analytical thought processes. (Bernstein 1960, 314)

The parallel with the earlier distinction between public and formal language is evident. Indeed, the connection between the two pairs was stated in the form of a redefinition of public and formal language in terms of the new dichotomy:

> I shall call a system of communication dominated by highly-coded utterances the *pure* form of a *public* language, whilst a system which permits and encourages now-coding utterances,

> or one where they may be frequently signalled and elicited, the *pure* type of a *formal* language. (ibid.)

This partial redefinition did not amount, of course, to a mere coupling of terms.

Bernstein acknowledged that the source of his new dichotomy was Goldman-Eisler's "refined use" of Hughlings Jackson's distinction (ibid.). This explains the occurrence of the term "transition probability" and the reference to fluency and pause in the lengthy passage quoted above. Bernstein drew on Goldman-Eisler's recent work on fluency and hesitation pauses, which sought to explore the potential of the latest advances in speech analysis for psychotherapy[152]. To this end, Goldman-Eisler used techniques and notions deriving from information theory. Bernstein met Goldman-Eisler in the Department of Phonetics at University College, London, and he was deeply influenced by her work in speech analysis (Atkinson 1985, 64). It was probably through this contact with Goldman-Eisler and the phoneticians at University College that he acquainted himself with the information-theoretical ideas, which were especially popular in phonetics during the 1950s. Bernstein saw in speech analysis a rigorous method that would enable him to pursue his research on language use, moving progressively toward the deep level of the principles that govern verbal planning. To express this key concept for his evolving theory, Bernstein borrowed the term "code" from information theory and shaped its content accordingly.

The famous distinction between restricted code and elaborated code first appeared in two papers, published in 1962, reporting an experiment on hesitation phenomena[153]. In 1964, Bernstein devoted a separate essay to this cardinal opposition[154], to which he returned several times in the following years in order to refine his initial conception of code. The shift in orientation in Bernstein's approach to the analysis of language use is already apparent in the first definition of the contrasting terms. At a linguistic level, the two types of code were said to be distinguished "in terms of the probability of predicting for any one speaker which structural elements will be used to organise meaning". This criterion was coupled with a psychological one concerning the possibilities offered for the

[152] See Goldman-Eisler (1958a-c).
[153] Bernstein (1962a-b).
[154] Bernstein (1964).

verbal expression of individual intent. Thus, "[i]n the case of an elaborated code, the speaker will select from a relatively extensive range of alternatives and therefore the probability of predicting the pattern of organising elements is considerably reduced. In the case of a restricted code the number of these alternatives is often severely limited and the probability of predicting the pattern is greatly increased". Moreover, the former code is said to facilitate the verbal signaling of subjective intent, contrary to the latter code that inhibits the orientation to such verbal signaling (Bernstein 1962a, 32). The general characteristics of restricted and elaborated codes point, accordingly, to different types of social relationship. The social forms producing restricted codes are typically "based upon some common set of closely shared identifications, self-consciously held by the members, where immediacy of the relationship is stressed. It follows that these social relationships will be of an exclusive character. The speech is played out against a background of communal, self-consciously held interests which removes the need to verbalise subjective intent and make it explicit" (ibid.). An elaborated code, on the contrary, "has its origins in a form of social relationship which increases the tension on the individual to select from his linguistic resources a verbal arrangement which closely fits specific referents. The code becomes a vehicle for individuated responses" (Bernstein 1962a, 33). Bernstein may have termed "codes" the two general modes of speech outlined above, but the word was not intended as a descriptive term of speech patterns. To make things clear, Bernstein devoted a special section to the definition of "code". Not surprisingly, he started by providing a simplified model of verbal communication.

Bernstein's (1962a, 35) scheme offered a minimal representation of two interlocutors split vertically in two levels. The lower level indicated the 'store' of verbal and nonverbal signals with which each interlocutor is equipped. The upper level represented the encoding and decoding processes performed by both. A signal emission by the addresser triggers a series of processes at the other end. First, the addressee is oriented toward the signal emission by scanning "the incoming message for a pattern of dominant signals". Accordingly, associations are established to the pattern identified, which in turn guide the selection of signals from the addressee's store. The selection process is followed by the organization of the message by means of the integration of verbal and nonverbal signals into a "sequential reply". The role of code in this chain of events was outlined as follows:

> The term ‘code’ as I use it implies the principles which regulate these three processes. It follows that restricted and elaborated codes will establish different kinds of control which crystallise in the nature of verbal planning. The latter is a resultant of the conditions which establish the patterns of orientation, association and organisation. The originating determinants of this trio would be the form of the social relationship or more generally the quality of the social structure. (ibid.)

Right after this definition came Bernstein’s main sociological argument:

> [T]he form of the social relationship acts selectively on the type of code which then becomes a symbolic expression of the relationship and proceeds to regulate the nature of the interaction. Simply, the consequences of the form of the social relationship are transmitted and sustained by the code on a psychological level. (ibid.)

Codes, then, are systems of organizing principles that regulate speech production and perception according to the “quality of the social structure”. In fact, they are “function[s] of the social structure” making possible the transition from language, conceived of as “the totality of options and the attendant rules for doing things with words”, to speech, taken as the concrete realization of the possibilities provided for by the linguistic system (Bernstein 1964, 56).

Following the initial presentation in 1962, Bernstein revisited the distinction between restricted code and elaborated code in order to clarify certain points and refine the sociolinguistic concept of code. In the 1964 essay, several variants of both types were examined, especially with regard to the relation between the verbal and nonverbal signs used in the respective modes of speech. Moreover, the question of the relationship between code and social structure was discussed in more detail. Back in 1962, the experiment on hesitation phenomena had shown that “[m]iddle-class and working-class subjects… [were] orientated to different levels of verbal planning which control the speech process”, with the latter subjects being confined to restricted codes whereas the former subjects had the option of elaborated codes (Bernstein 1962a, 44). Yet, it was stressed that there could not be “a one-to-one correlation between the use of a restricted code and the working-class stratum but the probability is certainly very high” (ibid.). Returning to this issue, Bernstein (1964, 62; emphasis in the original) pointed out that “a restricted code is available to *all* members of society as the social conditions which generate it are universal. But… there is relatively high probability of finding children limited to this code among sections of the lower working-class population". Bernstein's thesis of the relationship between code and social class was summed up in that essay as follows:

> The different normative systems create different family role systems operating with different modes of social control. It is considered that the normative systems associated with the middle-class and associated strata are likely to give rise to the modes of an elaborated code while that associated with some sections of the working class is likely to create individuals limited to a restricted code. Clearly, social class is an extremely crude index for the codes, and more specific conditions for their emergence have been given in this paper. Variations in behavior found within groups who fall within a particular class (defined in terms of occupation and education) within a mobile society are often very great. It is possible to locate the two codes more precisely by considering the orientation of the family role system, the mode of social control, and the resultant verbal feedback. (Bernstein 1964, 66)

Evidently, Bernstein's early attempts to specify the nature of sociolinguistic codes and delineate their role in social interaction raised several crucial questions whose treatment was intertwined with the overall development of his sociological theory. The relationship between code and social class remained a key issue, and indeed Bernstein sought in subsequent writings to refine his analysis on that matter[155]. Closely associated with this was the issue of context in the sociolinguistic theory of codes.

Early on, Bernstein realized that there was a tension between the sociological and the linguistic aspect of his analysis of the relationship between code and social class. The sociological aspect highlighted the available role options in different types of family and "so it directed attention to interactional contexts or situations; whereas the linguistic aspect defined codes independently of context or situation". Despite this tension, "the major research activity was [thenceforth] directed towards examining code realizations in different contexts" (Bernstein [1973]1974, 245). Drawing on the work of M.A.K. Halliday on language functions and systemic grammar[156], Bernstein succeeded in bringing together the two aspects, progressively integrating context in the definition of code. Based on a

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[155] See e.g. Bernstein ([1971]1974).
[156] See Halliday (1969) and Halliday (1961, 1966), respectively.

solid linguistic theory, he was able to "show the *different* linguistic realizations of different contexts *and* decide whether each context had evoked either a restricted or an elaborated variant". He could also "examine both the emphasis and the range of choices (alternatives) an individual took up in the network. In this way, it was possible to return to the definition of codes in terms of the range of alternatives; *yet these alternatives would always be context specific*" (Bernstein [1973]1974, 248; emphasis in the original). Thus, many years later a new definition was offered:

> A code is a regulative principle, tacitly acquired, which selects and integrates:
>
> a) relevant meanings
> b) forms of their realization
> c) evoking contexts
>
> (1) It follows from this definition that the unit for the analysis of codes is not an abstracted utterance or a single context, but relationships *between* contexts. Code is a regulator of the relationships *between* contexts and through that relationship a regulator of the relationships *within* contexts….
>
> (2) It follows from the definition that, if code selects and integrates relevant meanings, then code presupposes a concept of irrelevant or illegitimate meanings; [it also] presupposes a concept of inappropriate or illegitimate forms of realization… [as well as] a concept of inappropriate, illegitimate contexts. (Bernstein 1981, 328-329; emphasis in the original)

The new definition underlying the distinction between restricted and elaborated codes encapsulated in some respects the long transition that began with the early dichotomy between public and formal language and culminated in a comprehensive sociolinguistic theory of codes. Many aspects of this theory have inevitably been left unaccounted for in this brief excursus, but what has been said so far suffices to lay bare the distinctive features of this particular conception of code.

In Bernstein's texts published in the 1960s and 1970s, there are no references to the evolving concept of code in linguistics, structural anthropology and semiotics. As already suggested, "code" entered his work from information theory in the sense of a mediating transformational mechanism. Bernstein constructed his own sociolinguistic concept relying precisely on this sense. Despite the particular content that it acquired in the course of Bernstein's long-standing research on speech and social structure, the concept retained a deep formal affinity with its information-theoretical counterpart, which has been largely overlooked. The discussion on the quantification of information in chapter 4 foregrounded two fundamental elements common in the definition offered by Shannon: uncertainty and choice. The internal relation between the two was elegantly expressed in Shannon's famous mathematical formula. It has also been shown that both uncertainty and choice depend on the overall alternatives available in a given signal transmission. Thus, there seems to be a conceptual triangle (uncertainty–choice–set of available symbols) at the heart of the scientific conception of information as developed in communication engineering. The same conceptual triangle is reflected in a particular way in Bernstein's theory of codes.

It is not by sheer coincidence that "code" first appeared in Bernstein in connection with a dichotomy of speech modes defined in terms of probability. Both the term used for the two modes and the concern for predictability derived from information theory and reached Bernstein's work through the postwar advances in speech analysis. Calculating transition probabilities in speech samples was an effective way of discerning patterns in the use of language (including pauses and other hesitation phenomena), which in turn could lead to uncovering certain organizing principles behind language variability. Analyzing 'surface phenomena' in language use from this perspective allowed for revealing non-random dissimilarities in the range of options and verbal means available in social interaction. Such dissimilarities were accordingly attributed to different sets of organizing principles ranging between two basic modes of speech in their pure form. Bernstein envisaged such sets of principles as codes regulating speech perception, production and interpretation according to the characteristics of the social structure underlying verbal exchanges in a social group. In that way, he gave a specific answer to the question of the relationship between social structure and language. Social structure intervenes between the potential of a linguistic system and its realization in everyday life by means of codes governing the use of language in concrete situations. Codes were shown to perform this function by determining the range of available means for different modes of speech. However, this was only the formal aspect of their functioning, which still partially echoed the information-theoretical conception of communication. Unlike a communication engineer, Bernstein was not interested in a purely quantitative analysis of symbol selection and combination. The crucial characteristic of sociolinguistic codes is not that they consist of organizing principles but that they operate on a material that has *meaning* for the speakers. This aspect of codes was increasingly highlighted in the successive reformulations of the initial typology, which culminated in the redefinition of code as a regulative principle that selects and integrates "relevant meanings", the "forms of their realization", and the "evoking contexts" (Bernstein 1981, 328). Unfortunately, "[d]espite the empirical work in which Bernstein and his collaborators engaged… the precise specification of this principle has remained confused and elusive" (Atkinson 1995, 87). Yet, the revised definition attests to a significant transformation of the information-theoretical ideas implicit in the early formulation of the dichotomy between restricted and elaborated code, and suggests "that an essentially structuralist, semiotic approach unifies and underpins all of Bernstein's work" (Atkinson 1985, 83).

The sociological theory of codes, which was developed independently of the early attempts to establish a semiotic theory of codes in the 1960s, is indicative of a broader concern for the social aspects of codes. The major linguistic, anthropological and semiotic approaches discussed so far focused predominantly on the formal aspects and the logical properties of codes. However, it should be noted that in most cases those aspects and properties were studied against the backdrop of the assumption that codes constitute a particular kind of convention. By the time Prieto presented his semiological theory, the social character of codes had already begun to receive increasing attention. It is telling that a few years later, Guiraud (1971, 51) defined code as a system of explicit conventions. Yet, in the early 1970s a semiotic conception of code based on a neat distinction between system and convention was still lacking. In 1976, Umberto Eco published his famous treatise titled *A Theory of Semiotics*. This book had a wider impact on the study of communication and culture and marked a key turn in the development of semiotics. For the present monograph, Eco's treatise has a special significance in that it offers the first comprehensive theory of codes based on a systematic elaboration of the protean concept under consideration. The theory of codes formulated by Eco can be seen as the culmination of the long process that started with Jakobson's critique of the Saussurean distinction between *langue* and *parole* and led to the semiotic appropriations of "code" examined in this study. As such, Eco's theory represents at the same time the point at which the evolving semiotic concept of code exhausted its potential.

A Theory of Semiotics marked the beginning of a crucial transition from code semiotics to interpretive semiotics via Peirce's pragmatism (Bianchi and Gieri 2009, 17, Petrilli 2017, 196). Eco's interest in interpretation has its roots in his early work in aesthetics, in which he sought to oppose Benedetto Croce's idealism and provide an aesthetic theory for the new forms of art that emerged after World War II. As a result of his close contact with the media[157], Eco was led to view art as another form of communication and he realized that "[t]he problem was… to explain, prior to art, communication and the way communicational processes worked" (Proni 1988, 6). Thus, in *Opera Aperta* [*The Open Work*], published in 1962, he drew on information theory in order to establish that "art is a kind of knowledge, and can be described by scientific cognitive models", and that "[t]he interpretive explanation of the artistic form requires the cooperation of the addressee" (Proni 1988, 8). Right after the publication of that book, Eco acquainted himself with the structuralist ideas of Jakobson, Lévi-Strauss and Barthes, which provided him with a rigorous method for investigating communication. He adopted, however, a critical stance toward structuralism, rejecting in particular any approach that attributed a real existence to structures. A thorough critical analysis of structuralism was offered in 1968 in his seminal *La Struttura Assente* [*The Absent Structure*], in which he laid the basis of his semiotic theory. The 1976 treatise grew out of that book as a step forward in his semiotic investigations, a step toward a theory of interpretation. The path leading to interpretive semiotics, however, had to pass through the full exploitation of code semiotics, a task which in turn called for a preliminary conceptual clearing.

Eco articulated his project of general semiotics on the ground of some basic distinctions closely connected with the 'natural boundaries' of semiotics[158], the latter being "principally those beyond which a semiotic approach cannot go" (Eco 1976, 6). The fundamental distinction underlying this project was that between signification and

[157] Eco worked for the Italian television (RAI) from 1954 to 1959.
[158] Eco (1976, 9-14, 28-29) discerned also political and epistemological boundaries. The former pertained to the relation of semiotics to other disciplines, whereas the latter depended not "on the definition of the semiotic object but rather on the definition of the theoretical 'purity' of the discipline itself".

communication. Signification presupposes "the socially conventionalized possibility of generating sign-functions, whether the functives of such functions are discrete units called signs or vast portions of discourse, provided that the correlation has been previously posited by a social convention". Communication, on the other hand, occurs "when the possibilities provided by a signification system are exploited in order to physically produce expressions for many practical purposes" (Eco 1976, 4). However, the concept of communication here is not confined to instances of sign production. In general, "communication" covers all cases of signal production.

> [L]et us define a communicative process as the passage of a signal (not necessarily a sign) from a source (through a transmitter, along a channel) to a destination. In a machine-to-machine process the signal has no power to signify in so far as it may determine the destination *sub specie stimuli*. In this case we have no signification, but we do have the passage of some information.
>
> When the destination is a human being, or 'addressee' (it is not necessary that the source or the transmitter be human, provided that they emit the signal following a system of rules known by the human addressee), we are on the contrary witnessing a process of signification – provided that the signal is not merely a stimulus but arouses an interpretive response in the addressee. This process is made possible by the existence of a code. (Eco 1976, 8)

In this definition, a lower threshold of semiotics is implied. Eco drew a distinction between the study of signals and the study of signs. The former concerned disciplines, such as information theory, which focus on the statistical properties and the quantitative measurement of signal transmission. Semiotics, on the other hand, is concerned with the study of signs, without disregarding however the insights that can be drawn from the quantitative analysis of phenomena pertaining to the realm of non-meaningful signal transmission. Rather, such phenomena should be taken "as indicating the point where semiotic phenomena arise from something non-semiotic, as a sort of 'missing link' between the universe of signals and the universe of signs" (Eco 1976, 21). What distinguishes the field of sign production from the "universe of signals" is the existence of codes.

In positing the dichotomy of signification and communication, Eco introduced at the heart of his general semiotic program the established structuralist distinction between potential values and their actualization in social interaction. He further associated code with signification, that is, with the system of potential values, thus following a standard, Jakobsonian approach to the relation between code and communication process. The specific form in which code partakes in potentiality is that of a rule correlating different classes of elements.

> A code is a system of signification, insofar as it couples present entities with absent units. When –on the basis of an underlying rule– something actually presented to the perception of the addressee *stands for* something else, there is *signification*. In this sense the addressee's actual perception and interpretive behavior are not necessary for the definition of a significant relationship as such: it is enough that the code should foresee an established correspondence between that which '*stands for*' and its correlate, valid for every possible addressee even if no addressee exists or ever will exist. (Eco 1976, 8; emphasis in the original)

Of course, Eco could not content himself with such a simple definition. In alluding to the medieval formula *aliquid stat pro aliquo* at this point, he effectively inscribed the issue of code in the traditional problematics of the nature of sign, a problematics that in his treatise would be restated in terms of codes. However, in order for the concept of code to fulfil this role a preliminary elaboration was deemed necessary.

In the quarter of a century preceding the publication of *A Theory of Semiotics*, the emergence and gradual consolidation of the concept of code in linguistics, structural anthropology and semiotics was marked by a constant oscillation between the notions of system, structure, and rule. This oscillation was vital during that stage, for it allowed "code" to perform multiple functions as specific term in different theories, which in turn proved instrumental in the development of the semiotic concept of code. For the purposes of Eco's general semiotic project, however, this ambiguity was undesirable and it was deemed necessary to give a narrower definition of code. In particular, Eco sought to put forward a conception of code based on a sharp distinction between system and rule. To illustrate his approach, Eco used the so-called water gate model, an idealized model of communication first presented by de Mauro (1971, 33-51).

The water gate model refers to an elementary communication system designed to provide information about the water level in a watershed protected by a water gate. The system comprises a sensor, a transmitter, a receiver, and a destination apparatus. The sensor activates the transmitter, which sends electrical signals through the appropriate channel. Once received, each set of electrical signals is converted into a mechanical message, which is fed into the destination apparatus in order to elicit the proper kind of command for the regulation of the water flow. The system is designed to operate with four types of message, each message being a combination of two signals selected from a set of four available types of signal. The four types of message foreseen correspond one-to-one to four different types of water level, which in turn correspond one-to-one to four types of response of the destination apparatus. Thus, the communication system described in the water gate model comprises three subsystems: a) a "set of *signals* ruled by internal combinatory rules"; b) a "set of states of the water which are taken into account as a set of *notions* about the state of the water"; and c) a "set of possible *behavioral responses* on the part of the destination" (Eco 1976, 36-37; emphasis in the original). Eco called "syntactic system" the set of signals and "semantic system" the set of notions about the water level. The three subsystems discerned can exist independently, but as parts of a communication system they are interrelated in a specific way, each one being assigned a concrete function. This is made possible by virtue of a complex rule, which establishes one-to-one correspondences between the elements of the three subsystems. Although both the communication subsystems and the correlational rule could be equally called "codes" according to the semiotic usage at the time, Eco (1976, 38) insisted that a terminological differentiation was necessary. He, thus, termed "s-codes" (codes as systems) the interrelated sets of signals, notions, and responses, while reserving the word "code" for the rule that establishes the one-to-one correspondences between them.

The analysis of the water gate model revealed two basic components of communication, which are of different nature. An s-code, "[t]aken independently of the other systems with which it can be correlated… is a *structure*; that is, a system (i) in which every value is established by positions and differences and (ii) which appears only when different phenomena are mutually compared with reference to the same system of relations" (Eco 1976, 38; emphasis in the original). In communication, s-codes enter in a particular kind of correlation, which comprises two distinct planes, conventionally referred to as the "expression plane" and the "content plane", respectively. A code is the kind of social convention that establishes such correlations, which form the fundamental type of semiotic relation called "sign function".

> A sign-function is realized when two *functives* (expression and content) enter into a mutual correlation; the same functive can also enter into another correlation, thus becoming a different functive and therefore giving rise to a new sign-function. Thus signs are the provisional result of coding rules which establish *transitory* correlations of elements, each of these elements being entitled to enter –under given coded circumstances– into another correlation and thus form a new sign. (Eco 1976, 49; emphasis in the original)

The above passage may help us shed some light on the main reason behind the distinction between code and s-codes. Assuming that communication can be seen as involving a dialectical relationship between a relatively static and a relatively dynamic element, we may say that s-codes (as structures) represent the former whereas codes stand for the latter. An ambiguous concept of code, oscillating between the notions of structured whole and correlational rule, would probably fail to bring into relief the distinction between the static and the dynamic element in communication. Moreover, it would make the application of the Hjelmslevian concept of sign function problematic, since both the functives of the sign-function and the underlying correlation rule would be indiscriminately regarded as codes. The concept of sign function, however, was crucial for Eco's general semiotic theory, for it provided the basic tool for constructing a dynamic conception of sign, which in turn was the key for the transition toward an interpretive theory of semiotics. Therefore, Eco's approach to communication required a restricted conception of code based on a sharp distinction between system and rule. The dichotomy between code and s-codes served precisely this purpose. The restricted conception put forward allowed for the fusion of the concept of code with the Hjelmslevian concept of sign function, a fusion that yielded the basic semiotic unit of Eco's theory of codes. In turn, the reconceptualization of sign function paved the way for a further redefinition of other key semiotic concepts.

The last quotation implies a view of semiosis as an incessant interplay of different correlational rules producing several chains of sign functions in a given instance of communication. The remaining part of the exposition of the theory of codes was devoted to outlining the complex character of that interplay, taking as a point of departure the distinction between denotation and connotation. At this point, two key themes were introduced: the simultaneous operation of different codes, and the so-called referential fallacy. Both themes were of special importance for Eco's semiotic conception of meaning, which was laid out in the form of a semantic model of componential analysis. Connotation has been typically associated with vague, indeterminate or unstable meaning (Leech 1981, 12-13). In contrast, denotation has been typically viewed as invariable and it has been associated with reference (Lyons 1995, 77-79). In traditional logic, denotation is the extension of a term, whereas connotation is its intension (Cohen and Nagel 1993, 31). Evidently, in both logic and semantics, the standard definition of the dichotomy of denotation and connotation rests on some distinguishing feature, which lies at level of content. Eco's redefinition of the dichotomy attacked precisely this shared approach. Following Hjelmslev's ([1943]1969, 114) distinction between denotative and connotative semiotics, Eco proposed a reconceptualization of denotation and connotation in terms of sign functions and coding rules.

> The difference between denotation and connotation is not (as many authors maintain) the difference between 'univocal' and 'vague' signification, or between 'referential' and 'emotional' communication, and so on. What constitutes a connotation as such is the connotative code which establishes it; the characteristic of a connotative code is the fact that the further signification conventionally relies on a primary one… So the difference between denotation and connotation is only due to a coding convention, irrespective of the fact that connotations are frequently less stable than denotations: the stability concerns the force and the duration of the coding convention, but once the convention has been established, the connotation is the stable functive of a sign-function of which the underlying functive is another sign-function.
>
> A connotative code, insofar as it relies on a more basic one, can be called a *subcode*. (Eco 1976, 55-56; emphasis in the original)

Eco thus shifted the criterion of distinction from the content plane to the expression plane. Connotation is not opposed to denotation because it involves a different type of meaning. Rather, the essential difference is that connotation relies on a more complex sign function than denotation, a sign function that takes as its expression another sign function. In that way, both phenomena were dissociated from meaning typology and could be subjected to a uniform, structural analysis designed to foreground the hierarchical relations between different sign functions. Moreover, the possible reference of a term to actual objects or states of the world became irrelevant for distinguishing between its denotative and connotative meaning. Taking a step further, Eco relegated the problem itself of the referent to the theory of sign-production, considering it both irrelevant and detrimental to the theory of codes.

Reality is not insignificant for semiotics. Admittedly, the existence of objects and states of the world is necessary for the design of systems such as the one involved in the water gate model discussed earlier, but "it is not a necessary condition for their *functioning*" (Eco 1976, 58; emphasis in the original). Rather than basing his theory of codes on some kind of correspondence between signs and things in the actual world, Eco (1976, 58-59; emphasis in the original) sought to ground semiosis on the very possibility of lying: "*[e]very time there is possibility of lying, there is a sign-function*… A theory of codes must study everything that can be used in order to lie. The possibility of lying is the *proprium* of semiosis". In everyday life, countless references to actual objects or states of the world are constantly being made in various communication instances. According to Eco, however, the study of these references falls within the scope of a theory of sign-production. A theory of codes, on the other hand, concerns the realm of potential values and, as such, has to take into account the fact that a code may be used to serve purposes other than signifying things in the actual world. Furthermore, the relation between a thing and a sign is not as straightforward as it has typically been assumed. For, "even when the referent could be the object named or designated by the expression when language is used in order to mention something, one must nonetheless maintain that an expression does not, in principle, designate any object, but on the contrary *conveys a cultural content*" (Eco 1976, 61; emphasis in the original). If we consider the plethora of sign functions operating in a single act of communication, the preceding thesis of Eco invites us to envisage a *sui generis* universe behind semiosis.

> Within the framework of a theory of codes it is unnecessary to resort to the notion of extension, nor to that of possible worlds; the codes, insofar as they are accepted by a society, set up a 'cultural' world which is neither actual nor possible in the ontological sense; its existence is linked to a cultural order, which is the way in which a society thinks,

> speaks and, while speaking, explains the ‘purport’ of its thought through other thoughts. (ibid.)

Meaning is taken as residing precisely in that ‘cultural order’ set up by codes. In order, however, to provide an adequate account of meaning for his theory of codes, Eco had to construct the appropriate analytical framework, within which the cultural content conveyed by a given sign vehicle could be defined in a more rigorous manner. To this end, he turned to structural semantics and componential analysis.

Every analytical framework requires units of some kind. For the purposes of his semiotic project, Eco posited the content of a sign vehicle as a cluster of cultural units. Evidently, a cultural unit, taken as “anything that is culturally defined and distinguished as an entity”, is of little theoretical or practical value unless employed “as part of some relatively distinct, self-contained system” (Schneider 1968, 2). In his semiotic theory, Eco treated cultural units as parts of a semantic system.

> We are… entitled to give a definite response to the question: what is the meaning of a sign-vehicle (or what is the functive ‘content’ of a sign-function)? It is a semantic unit posited in a precise ‘space’ within a semantic system…. [However] to say that a sign-vehicle conveys a given position within a semantic field constitutes a shorthand definition (as does saying that a phoneme is a position within a phonological system). As a matter of fact one must assume that a sign-vehicle may refer (i) to a network of positions within the same semantic system, (ii) to a network of positions within different semantic systems. These positions constitute the *semantic markers* of a given sememe. These markers can be either *denotative* or *connotative*. (Eco 1976, 84-85; emphasis in the original)

The concept of cultural unit enabled Eco to avoid the usual difficulties arising in componential analysis with regard to the nature of semantic markers. In his particular approach to semantic analysis, semantic markers are not theoretical constructs that cannot be further analyzed. Rather, they are posited as cultural units and, as such, they can perform a double role, insofar as “*every semantic unit used in order to analyze a sememe is in its turn a sememe to be analyzed*” (Eco 1976, 121; emphasis in the original). In that way, it is possible to ‘cut through’ different semantic fields and capture the relations of complementarity and mutual exclusion that may hold between the semantic markers in a given sememe (Eco 1976, 95). In other words, Eco envisaged the content of a sign vehicle as a network of cultural units spanning a range of diverse semantic systems, each of these units being in turn the point of departure of another network and so on *ad infinitum*. This analytical representation of the sememe encapsulated Eco's conception of semiosis and laid bare the key role of the concept of cultural unit.

> Thus a cultural unit never obliges one to replace it by means of something which is not a semiotic entity, and never asks to be explained by some Platonic, psychic or objectal entity. *Semiosis explains itself by itself*; this continual circularity is the normal condition of signification and even allows communication to use signs in order to mention things. (Eco 1976, 71; emphasis in the original)

The idea of 'continual circularity' referred to above echoes a famous definition of Peirce, according to which a sign is "[a]nything which determines something else (its *interpretant*) to refer to an object to which itself refers (its *object*) in the same way, the interpretant becoming in turn a sign, and so on *ad infinitum*" (2.303)[159]. Eco isolated this definition of sign from the series of successive definitions that Peirce offered throughout the development of his theory[160], and focused exclusively on the relation between interpretant and sign. This relation, he claimed, implied "a process of *unlimited semiosis*, which, paradoxical as it may be, is the only guarantee for the foundation of a semiotic system capable of checking itself entirely by its own means" (Eco 1976, 68; emphasis in the original). Unlimited semiosis was the conceptual cornerstone of Eco's general semiotic theory[161], as outlined in 1976, and this explains the particular significance attached to the Peircean concept of interpretant.

> Insofar as a theory of codes provides a description of all the markers attributed by one or more codes to a single sememe, then the interpretant is clearly a category that may suitably take its place within the framework of a theory of codes, but at the same time its usefulness goes beyond such a theory; thus the interpretant also has to be considered as a category that may suitably find a place within the framework of a theory of sign production, for it also

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[159] The reference to Peirce writings follows the standard citation practice of a parenthetical indication of the volume and paragraph number in *The Collected Papers of Charles Sanders Peirce*.
[160] On Peirce's different definitions of sign, see Short (2007, 164-168).
[161] In *The Role of the* Reader, Eco (1979, 3) stated that unlimited semiosis constituted the "philosophical scaffolding" of his 1976 treatise. Several years later, Eco (1990, 1995) returned to his fundamental thesis in an attempt to show that the principle of unlimited semiosis does not entail the possibility of unrestrained textual interpretation.

> defines many kinds of proposition and argument which, beyond the rules provided by codes, explain, develop, interpret a given sign. In this sense one should even consider as interpretants all possible semiotic judgments that a code permits one to assert about a given semantic unit, as well as many factual judgments. (Eco 1976, 70-71)

Eco treated the interpretant as an extremely flexible concept capable of performing various roles in his project. In the theory of codes, the concept in question covered i) "[t]he *meaning* of a sign-vehicle, understood as a cultural unit displayed through other sign-vehicles"; ii) "[t]he *intensional* or componential analysis by which a cultural unit is segmented into its elementary semic components, or semantic markers"; iii) "[e]ach of the *units* composing the componential tree of a sememe" (Eco 1976, 72; emphasis in the original).

Eco's revised model of componential analysis relied on a set of well-defined concepts. The concept of syntactic marker was used to express the rules that govern the combination of different sign vehicles. The concepts of denotative and connotative markers, on the other hand, captured the denotations and connotations that make up the content of a given sign vehicle. Lastly, a set of contextual and circumstantial selections was also foreseen in the model. The former "record other sememes (or groups of sememes) *usually* associated with the sememe in question", whereas the latter "record other sign-vehicles (or groups of sign-vehicles) belonging to different semiotic systems, or objects and events taken as ostensive signs, *usually* occurring along with the sign-vehicle corresponding to the sememe in question" (Eco 1976, 106; emphasis in the original). By means of these analytical concepts, the model was capable of representing a sememe[162] in the form of a compositional tree, in which the denotations and connotations of a given term were connected with each other via specific paths determined by certain contextual and circumstantial selections. Insofar as Eco's componential model was equipped with the necessary analytical concepts, it could be said that the concept of interpretant was rather redundant in the theory of codes – at least as an analytical tool. We should recall, however, that *A Theory of Semiotics* was a transitional work, in which Eco took the first steps toward an interpretive semiotics. The discussion of interpretants in that book was of an exploratory

[162] In Eco's theory of codes, a sememe is the entire set of semic units that make up the content of a sign vehicle.

character and, thus, it would be rather unlikely for Eco to have developed, at this stage, an analytical tool out of Peirce's theory of signs. Yet, from a theoretical point of view, the concept of interpretant was especially important. First, it made "a theory of signification a rigorous science of cultural phenomena, while detaching it from the metaphysics of the referent" (Eco 1976, 70). Furthermore, it demonstrated that "in cultural life every entity can aim at becoming independently both meaning and sign-vehicle" (Eco 1976, 72), thus implying an 'infinite recursivity' as a manifestation of the principle of unlimited semiosis. Lastly, the concept of interpretant was, according to Eco (1976, 68), "that which guarantees the validity of the sign, even in the absence of the interpreter". The last point relates to a decision to exclude any consideration of the acting subject from the theory, on the grounds that this subject falls outside the natural boundaries of semiotics. The subject could appear in Eco's project only diffracted through the process of unlimited semiosis.

> Semiotics can define the subject of every act of semiosis only by semiotic categories; thus the subject of signification is nothing more than the continuously unaccomplished system of systems of signification that reflects back on itself. (Eco 1976, 317)

Once again, Eco invoked the semantic recursions brought about by interpretants, this time in order to provide a theoretical justification of the exclusion of the empirical subject from semiotics. Thus, both the objects and states of the external world and the acting subjects can be treated semiotically only as possible referents, that is, as content units determined by a set of coding rules. The core idea behind Eco's approach is that of signification as a functionally self-contained system. The theoretical import of the concept of interpretant lies precisely in its instrumental role in the conception of unlimited semiosis as the overarching principle of signification.

The elaboration of an account of signification as a self-sufficient, dynamic system was a demanding task that posed a real challenge to the structuralist framework of code semiotics. In order to avoid the risk of reducing signification to a rigid network of codes, Eco moved beyond the logic of equivalence and introduced inference to the theory of codes. Inference occupied a prominent position in Eco. In *A Theory of Semiotics*, the discussion about the natural boundaries started with the "two definitions of semiotics", proposed by Saussure and Peirce, and immediately proceeded with the relation between inference and signification. The crucial question, in this connection, was whether there are any acts of inference that fall within the natural boundaries of semiotics. Eco (1976, 16-17) maintained that the cases of “physical events coming from a natural source” and of “human behavior not intentionally emitted by its senders” involve inferences that can be taken as semiosic acts, insofar as such inferential associations are “culturally recognized and systematically coded”. Assuming that “[t]here is a sign every time a human group decides to use and to recognize something as the vehicle of something else”, the aforementioned types of physical event and human behavior can be treated as specific types of sign, provided that “there is a convention positing a coded correlation” between the perceived event or behavior and a given content (ibid.). Thus, at the outset Eco raised the issue of the intertwinement of equivalence and inference in semiosis, an issue explored in more detail toward the end of the exposition of the theory of codes, where he discussed the case of extra-coding.

Codes provide the complex correlational rules that enable social agents to generate and interpret messages in concrete communication instances. These rules include sets of conventionally recognized contexts and circumstances specifying the denotations and connotations that may be assigned to sign vehicles. Besides these, there are always “possible contexts which can be foreseen but cannot be coded”, and “possible circumstances which are either unforeseeable or excessively complex and which make up a cluster of different extra-semiotic factors. In all these cases one is entitled to speak of extra-semiotic and *uncoded determinants of the interpretation*” (Eco 1976, 130; emphasis in the original). Faced with such uncoded determinants, the interpreting subject is “obliged both to challenge the existing codes and to advance interpretive hypotheses that work as a more comprehensive, tentative and prospective form of codification” (Eco 1976, 129). Such cases occur regularly thus giving rise to a constant need for extra-coding, which can take two forms: overcoding and undercoding. An overcoding is performed when “on the basis of a pre-established rule, a new rule [is] proposed which govern[s] a rarer application of the previous rule”. Overcoding may produce a subcode when the new rule put forward is gradually established as a semiotic convention. Undercoding, on the other hand, is “the operation by means of which in the absence of reliable pre-established rules, certain macroscopic portions of certain texts are provisionally assumed to be pertinent units of a code in formation, even though the combinational rules governing the more basic compositional items of the expressions, along with the corresponding content-units, remain unknown” (Eco 1976, 135-136). In other words, “overcoding proceeds *from existing codes to more analytic subcodes* while undercoding proceeds *from non-existent codes to potential codes*” (Eco 1976, 136; emphasis in the original). Both types of operation are an integral part of semiosis and constitute the means of code generation and transformation.

In the chapter on the theory of semiotics, the major part of the exposition was devoted to an outline of the structure and the basic mechanisms of signification. In that exposition, Eco sought to account for the way in which signification, conceived of as the realm of potential values, makes possible the production and interpretation of signs. The chapter on the theory of sign production was accordingly devoted to explaining how the potential values are actualized in concrete communication instances. Before entering in this matter, however, Eco discussed at some length the issue of extra coding, which was of key importance for both the theory of codes and the theory of sign production. As far as the latter is concerned, the concept of overcoding enabled Eco to provide a code-theoretical account of stylistic, rhetorical and ideological phenomena. As regards the theory of codes, on the other hand, the discussion on extra coding highlighted the ways in which “the very activity of sign production and interpretation nourishes and enriches the universe of codes” (Eco 1976, 129). Moreover, it revealed that inference (mainly in the form of abduction) lies at the heart of semiosis. Rather than treating inference and equivalence as mutually exclusive opposites, Eco was interested in examining the interplay between them in the act of communication. In a later account of the semiotic concept of code, Eco (1984, 182) pointed out that except for some “rare and blatant cases of transcription tables, such as the Morse code and the most elementary ciphers”, codes typically involve “an inextricable web of pseudocorrelations that involve instructions and inferences on one hand and, on the other hand, sets of instructions that can generate relationships of signification”. He concluded, then, that “the basic characteristic of semiosis is inference, while the equivalence established by a code (a = b) is only a scleroticized form of semiosis, fully found only in *ciphers*” (Eco 2000, 127; emphasis in the original). In *A Theory of Semiotics*, the transition from equivalence to inference was also reflected in the conceptual pair of decoding and interpretation, the latter being “taken to mean understanding, on the basis of some previous decoding, the general sense of a vast portion of discourse…. Logically speaking this kind of interpretation is more akin to *inference*. Moreover, it is similar to that specific type of inference that Peirce called *abduction*" (Eco 1976, 131; emphasis in the original).

In subsequent semiotic writings, Eco was increasingly interested in the conditions and limits of interpretation, focusing in particular on texts[163]. The concept of code did not disappear from his later work, but henceforth it had to be understood as part of a conceptual matrix comprising the concepts of inference and interpretant. In Eco, the semiotic concept of code reached a limit. To take a quick look at what lies beyond that limit we need only consider Barthes's definition, as formulated in the outline of his famous analysis of Honoré de Balzac's *Sarrasine*.

> We are, in fact, concerned not to manifest a structure but to produce a structuration. The blanks and looseness of the analysis will be like footprints marking the escape of the text; for if the text is subject to some form, this form is not unitary, architectonic, finite: it is the fragment, the shards, the broken or obliterated network – all the movements and inflections of a vast "dissolve," which permits both overlapping and loss of messages. Hence we use *Code* here not in the sense of a list, a paradigm that must be reconstituted. The code is a perspective of quotations, a mirage of structures; we know only its departures and returns; the units which have resulted from it… are themselves, always, ventures out of the text, the mark, the sign of a virtual digression toward the remainder of a catalogue… they are so many fragments of something that has always been *already* read, seen, done, experienced; the code is the wake of that *already*. (Barthes 1974, 20; emphasis in the original)

This is a typically post-structuralist way of disentangling the concepts of system and structure from that of code. All logical relations implied by code are dissolved into an endless chain of haphazard referrals. There is no hierarchy of systems but only a vast, intertextual web of free-floating fragments of discourse. In the passage quoted above, we can thus discern the limit where code fades into "a mirage of structures".

[163] See e.g. Eco (1979, 1990).

Eco did not trespass this limit but he did recognize in Barthes's conception an idea occupying a pivotal position in his own semiotic theory. Commenting on Barthes's use of "code" in *S/Z*, Eco remarked:

> *Prima facie* here Barthes mistakes codes for the infinite process of semiosis, or with what later will be called intertextuality. But, wrong from the point of view of the weak sense of code, Barthes is right from the point of view of the strong one. What he calls here code is the whole of the encyclopedic competence as the storage of that which is already known and already organized by a culture. It is the encyclopedia, and therefore the Rule, but as a Labyrinth. A Rule which controls but which at the same time allows, gives the possibility of inventing beyond itself, by finding new paths, new combinations within the network….
>
> A code is not only a rule which *closes* but also a rule which *opens*. It not only says 'you must' but says also 'you may' or 'it would also be possible to do that'. If it is a matrix, it is a matrix allowing for infinite occurrences, some of them still unpredictable, the source of a game. (Eco 1984, 187; emphasis in the original)

In *A Theory of Semiotics*, the notion of encyclopedia was invoked in an attempt to construct a componential model that could reflect the intricate nature of meaning. The model of Katz and Fodor, Eco (1976, 98) argued, could "only lead to the making of a very elementary dictionary unable to explain social competence in all its living contradictions". Eco's revised model sought thus to represent not an ideal competence as an abstract dictionary, but a real social competence as a concrete encyclopedia. The analysis of sememes in the form of componential trees was precisely devised to provide snapshots of the ever-changing landscape of the 'global semantic universe'. Viewed from this perspective, code reveals itself as "the sum of individual competences that constitute [it] as a social convention". As such, it is a 'hypercode' gathering "together various subcodes, some of which are strong and stable, while others are weak and transient" (Eco 1976, 125).

Hypercode was the notion that expressed Eco's conception of code in its fully developed form. The exposition of the theory of codes took as a point of departure the 'microscopic view' of code as a rule correlating the two functives of a single sign function. As the exposition proceeded from the elementary structure of the sign function to the exploration of the format of sememes and semantic fields, the initial, microscopic representation of code gave progressively its place to a more complex one. The dense, labyrinthine texture of the semantic universe, the internal tension in the interpretive act between convention and change, between equivalence and inference, the continual circularity of semiosis – all these pointed to a macroscopic view of code as a hypercode. Therefore, the notion of hypercode did not simply refer to an immense, hierarchical system of variously interacting rules of correlation. Rather, it epitomized the basic premises of Eco's theory of codes and, thus, exhibited the liminal character of his project: it was a notion on the cusp between code semiotics and interpretive semiotics. The semiotic concept of code can be said to have reached a limit in this case precisely insofar as it moved toward transcending the logic of equivalence and the structuralist matrix out of which it had emerged. In *A Theory of Semiotics*, the concept assumed the most important role in its development, which at the same time revealed the limits of its potential. Eco's elaboration marked a key turn in that development but it did not succeed in establishing a concept free from ambiguity. In the decades following the publication of Eco's seminal treatise, the concept of code consolidated its position in semiotics and related disciplines. It eventually crystallized into the notion of a set of constraints capable of generating meaningful forms, but it continued to oscillate between the concepts of system, structure, and rule. Thus, in effect it has largely retained the essentially protean character it acquired in its early postwar development.

CONCLUSION

The analysis offered in the preceding chapters sought to shed new light on a neglected case of concept formation in the humanities and social sciences. Paradoxical as it may seem, the case in question concerns one of the most widely used concepts in the study of communication across a broad range of disciplines. An important reason for the striking lack of interest in elucidating the origins of this concept lies perhaps in the deceptive obviousness surrounding the concept's early development. The standard accounts of the semiotic concept of code rightly focused on the postwar transdisciplinary influence of information theory and cybernetics. But instead of taking the scientific bandwagon of the 1950s and 1960s as a point of departure for an in-depth investigation of the attempted convergence of linguistics and communication engineering, they rather contented themselves with an explanation limited to terminological issues. In that way, those accounts failed to consider the possibility of a genuine concept formation taking place in tandem with the migration of the technical term "code" from information theory to structural linguistics. Moreover, they failed to examine the possibility of an indirect but essential influence of other presemiotic senses of "code" on the linguistic and semiotic usages.

In order to address both issues, the present study pursued two different strands of analysis corresponding to the methodological distinction between word and concept. On the one hand, it followed the path leading from the Latin word "*codex*" to its descendant cognates in English and French, passing from ancient manuscript formats, ancient and medieval law collections, early modern diplomacy and cryptography to the far-reaching advances in telecommunication at the turn of the twentieth century and the breakthrough of communication engineering around World War II. This part of the research was not intended to offer a survey of a large corpus of texts where "*codex*" and "code" occurred. Instead, it sought to bring into relief the constellation of networks, artifacts, institutions, techniques, devices, social practices, and intellectual achievements with which the words in question were inextricably intertwined. The basic assumption underlying the first strand of analysis is that we can attain a much deeper understanding of the persistence of senses and the semantic shifts if we turn our attention from the social agents' encyclopedic knowledge of codes to the threads of material, cultural, and intellectual history underlying the usage of the word in diverse spheres of social life. The second strand of analysis was of a different character. Rather than simply registering the early linguistic and semiotic uses of "code", it focused on the scientific practices and theoretical frameworks within which the word was employed. Thus, the research in this part was primarily concerned with the analysis of theoretical texts and intellectual trends in an attempt to determine the conceptual constellations, methodological principles, and epistemological assumptions that formed part of the 'system of coordinates' of the new uses of "code". It was precisely this 'system of coordinates' that allowed for examining the possibility of a genuine concept formation beneath the surface of the attested terminological shifts. The link between the two strands of analysis may be not perfectly apparent, but it is crucial; it lies in a long tradition of systematizing and coding methods that form part of the foundations of present-day communication technology, institutions and practices.

The first chapter of this monograph opened with a comment of Eco about the age-old association of codes with communication. It is worth quoting here the full passage in which this comment was made.

> Until the second half of this century, *code* was used as dictionaries suggest, that is, in three senses: paleographic, institutional, and correlational.
>
> The *paleographic sense* provides a clue for understanding the other two: the *codex* was in Latin the stock or the stem of a tree from which wooden writing tablets, smeared over with wax, were made; thus the term came to designate parchment or paper books. Thus a code is something which tells something else; it has had to do with communication or signification since its most remote origins. (Eco 1984, 165; emphasis in the original)

Playing with the metonymic association of "*codex*" with a certain type of manuscript, Eco saw in codes as books a principle analogous to that governing the use of signs: *aliquid stat pro aliquo*. Taken as a book, a code "is something which tells something else", and thus it is closely connected with communication, insofar as it obeys the same logic with that of signs. As I have tried to show in the first chapter, however, the initial relation of "*codex*" with communication was rather external, so to speak, but no less important for that reason. Specifically, it was a relation mediated at the outset by writing. The history of "*codex*" and its descendant cognates has always been wrapped around the development of writing, and that close connection played a crucial role not only in the semantic shifts of these words but also in the persistence of their basic senses. "*Codex*" acquired the meaning of manuscript because the precursor of papyrus and parchment *codices*, the *tabulae ceratae*, were made of wood ("*caudex*" in Latin). It seems, though, that the consolidation of this sense owed much more to the manuscript format rather than the material used. Papyrus and parchment *codices* were seen as sophisticated variants of the earlier diptychs and polyptychs. Despite the use of different materials and methods of binding in their production, they were perceived as belonging to the same family of manuscripts precisely because of their format, and for that reason they were called "*codices*" in contrast to the papyrus rolls called "*libri*". Once this association was established, the word "*codex*" followed the manuscript format in question in its development, thus entering into a range of discursive practices that variously involved the use of *codices* in diverse fields of social life.

As a result, the semantic potential of the word was enlarged and accordingly the possibility of a new sense acquisition increased significantly. "*Codex*" was given the additional meaning of law collection at the point where the course of development of the particular manuscript format intersected with the course of development of the systematization of law in the Middle East and the Mediterranean. When the latter reached a peak, in terms of both the sophisticated methods of abstraction and categorization attained and the volume and diversity of enactments produced, *codex* provided the solution to the problem of the appropriate manuscript format for the voluminous Roman law collections. The sociopolitical developments discussed briefly in chapter 2 and the gradual predominance of *codex* in the evolving market of manuscripts provided the main driving force behind this sense acquisition. Metonymy was, once again, the mechanism by means of which "*codex*" acquired a new sense.

Chapters 1 and 2 allow for attributing the attested connection of the two aforementioned senses of "*codex*" to an ever-growing set of discursive practices that formed an integral part of long-standing and far-reaching sociopolitical, economic, and cultural transformations. At the heart of these transformations, we find writing and its tremendous impact spread throughout different aspects of social life over the centuries that separate modern world from Antiquity. Among those consequences of writing, one stands out as especially pertinent to the subsequent development of "code". Writing evolved as a key agent of systematization in the administration, organization, and control of society, being itself at the same time subjected to continuous systematization as a result of the ever more diversified functions it assumed. The accumulated innovations introduced through the diffusion of the use of writing crystallized into new institutions and social practices, which in turn provided the ground for further multilevel transformations. In that way, writing became an indispensable part not only of long- or medium-term changes but also of the consolidation of long-term structures. Thus, the practices of systematization relying on writing may have several temporal dimensions, and the practices associated with long-term structures can transcend the distance of centuries and become part of the background conditions of temporally remote events[164]. In such cases, several linguistic expressions together with their initial meaning can persist in time precisely because they are perpetuated through discursive practices inscribed within specific long-term structures. Writing law is a case in point.

As we saw in chapter 2, the use of writing in ancient legal practices was associated, among other things, with the early attempts to systematize law. When the practice of compiling law collections attained a high level of sophistication in Romans, *codex* became the preferred manuscript format for the voluminous law collections, which were thenceforth named after this particular medium. As a result, the Latin word "*codex*" came to denote law collections, and this sense passed to its descendant cognate in Old French[165]. As long as writing law, and especially the systematization of enactments, became an integral part of legal institutions and practices, "code" came progressively to denote any set or systematic collection of laws, prescriptions, principles or rule – and it is still used today in this sense. In that way, the word came also to connote rule, convention, collection

[164] On the relation between event and structure, see Koselleck (2002, 29-37, 123-126).
[165] *Dictionnaire de l'Ancienne Langue Française et de tous ses dialectes du IX*^e^ *au XV*^e^ *siècle*, s.v.

or even system. Such connotations undoubtedly facilitated the migration of the word from the mathematical theory of communication to the study of language, where “code” first appeared as an alternative term for Saussure’s *langue*. The connotations of rule, system, collection and convention were registered in the encyclopedic knowledge of successive generations through the lived experiences of speakers, particularly through those experiences of discursive practices associated with various normative aspects of social life. This seemingly trivial fact has never been examined in connection with the early uses of “code” in structural linguistics as it was reasonably overshadowed by the direct relation of these uses with information theory.

Until the early nineteenth century, “code” related to communication in a rather ‘external’ way. As a term denoting a specific manuscript or book format, it referred to a dominant medium of written communication. As a term denoting law collections or other sets of rules or principles, it referred to the rule-governed aspect of social life, with which communication is in a relation of interdependence and constant interaction. When the word “code” entered cryptography, it came to be associated with the ‘inner strata’ of the phenomenon of communication, the strata residing at the core of the communication process itself. In this case, too, it took several strands of heterogeneous developments, social practices, and long-term structures in order for the word to acquire a new sense. By its very nature, cryptography seeks to segment messages into discrete units to which different substitution methods can be applied. As discussed in chapter 3, the earliest attempts of text encryption in Mesopotamia made use of both meaningful and meaningless units. For many centuries, these were the two options available as regards the type of unit used in secret communication. “Code” was introduced in cryptography rather late, in the nineteenth century, as a technical term for substitution methods operating with meaningful units. Behind this new sense acquisition there lay a long and complex historical process that transformed Europe and gave rise to modern diplomacy and cryptography. One of the most important implications of this transformation was the revaluation of information as a new, effective weapon. Cryptography evolved precisely as a response to the increasing need for control and manipulation of information from the early modern period onwards. With its adoption as a technical term of cryptography, “code” entered a new field of practices of special significance for communication, practices that had to do with some fundamental operations involved in communication exchanges. In its new, technical sense "code" denoted a class of rules for the systematic correlation –one-to-one and reversible– between different semiotic units. Such correlational rules were devised for secrecy purposes, but they could be seen as a particular instance of a general principle underlying any semiotic transformation necessary for human communication. Thus, the use of "code" as a cryptographic term could be extended to other types of practice involving some sort of manipulation of information for specific purposes. The advent of telegraphy provided a new field of communication practices where "code" could be used as a technical term.

In light of the structural similarity between secret and commercial codes, one could speak of a general method of substitution by means of which an array of semiotic units can be transformed into another set of units according to a pre-arranged pattern. At this juncture of its semantic development, "code" began to converge toward more abstract aspects of communication while retaining its reference to specific technical aspects of the exchange of written messages. Through its association with the standard substitution methods employed for the purposes of secrecy and transmission cost reduction in telegraphy, "code" came to connote a core communication mechanism necessary for the passage from one set or system of signs to another. In this connotation, we find again the notions of rule, system, and control, this time transposed from the macro-level of social institutions and conventions to the micro-level of the manipulation of discrete semiotic units for various communication purposes. Despite this implicit and partial association with such fundamental operations involved in the process itself of communication, the correlational sense of "code" remained for long confined to a neatly delineated field of communication practices. As shown in chapters 4 and 5, it took several decades and a chain of crucial sociopolitical, military, economic, and scientific developments for the word to acquire a generalized correlational sense. This new sense acquisition was an especially interesting process that started with the early twentieth century technological and theoretical advances in communication engineering and culminated in the emergence of the semiotic concept of code. A preliminary examination of this sense acquisition allows for envisaging the concept formation under study as part of the overall semantic development of "code". Of course, such an examination, even if complete, cannot in itself account for the concept formation analyzed in this monograph. However, it does show that the history of "code" played a non-negligible role in the word's fusion with the structuralist conception of semiotic systems developed from the 1920s to the 1950s.

The semiotic concept of code is a unity of a word and a theoretical conception that originated in a particular intellectual movement in the humanities and social sciences. While a historical account of the concept formation under discussion should primarily focus on 'content', it would be misleading to treat the historical background of the word as practically insignificant for an analysis of the type presented in this monograph. In order to assess more accurately the impact of the word's history on the emergence of the semiotic concept of code, we need to re-examine its migration from information theory to linguistics. Miller and Fry adopted "code" and used it as a technical term in their attempt to introduce certain information-theoretical tools into the study of speech. In Jakobson's early use of the word, however, we can discern a blending of senses that extend beyond the confines of communication engineering. In effect, Jakobson fused under the same term the notions of correlational rule, convention, and system of signs, drawing tacitly on the rich semantic potential of "code". It should be stressed that, as the relevant documents indicate, this conceptual fusion did not result from any terminological elaboration. "Code" owes much of its early postwar popularity in the humanities and social sciences not only to a scientific bandwagon but also to the diverse institutions and social practices that made the word so familiar in many different spheres of social life. Practices pertaining to secret communication, telecommunication, and the normative aspects of life proved especially important, for they played a decisive role in the accretion of a large 'semantic sediment' that provided the ground for a potential semantic extension based on a blending of the word's senses at a level of considerable abstraction. The first strand of analysis presented in this study was precisely intended to show how such a semantic sediment was formed in the course of several centuries.

The later stages of the semantic development of "code" exhibited signs of an acceleration typical of the overall transformation of the world in the first half of the twentieth century. The parallel advances in cryptography and telecommunication facilitated the use of "code" as a near synonym for "communication system", and the mathematical theory of communication gave the word a place in a general communication model. However, Shannon's 1948 seminal paper addressed a limited audience and it is at least doubtful whether it would have an impact on the usage of "code" in everyday life without the intertwined sociopolitical, economic, cultural and scientific developments that determined the reception of Shannon's theory in the academia and beyond. The successive waves of enthusiastic attempts to exploit information theory and cybernetics for social-scientific purposes triggered a semantic extension of "code" based on the blending of the senses of system, rule, transformation, and convention. Yet, as explained above, the conditions of such a semantic extension were provided by the entire history of the word, especially by the later stages of its semantic development taken as a long-standing, cumulative process. Seen against the backdrop of this multilevel interaction between mid-term changes and structural transformations, the migration of "code" from information theory to linguistics presents itself as a complex event of a rather thick texture. On the one hand, there were cases in which "code" was adopted precisely as a technical, information-theoretical term and was employed in the study of the neurophysiological or psychological aspects of speech. These were cases of a 'restricted' semantic extension, which did not entail a non-technical application. On the other hand, there were several instances of an 'unrestricted' semantic extension, in which "code" oscillated in various ways between the notions of correlational rule, system of linguistic units, and linguistic convention. Jakobson's appropriation of "code" seems to fit this pattern, but it should be noted that in itself such an 'unrestricted' semantic extension could not have given rise to a new concept. The emergence of a genuine linguistic concept of code presupposed a disciplinary re-orientation.

The emergence of the semiotic concept of code is inseparable from the consolidation of linguistics as an autonomous discipline in the early twentieth century. Jakobson's attempt to establish "code" as an alternative term for Saussure's "*langue*" provides the clue that allows us to follow backwards one of the principal threads of his intellectual development and trace the origins of his conception of language as a system. This conception may have its deepest roots in Jakobson's 'futurist years' but it was formed through the sustained confrontation with the fundamental premises of Saussure's unfinished theoretical edifice. Jakobson sought to redefine the object of linguistics and introduce a uniform method of analysis for both the synchronic and diachronic aspects of language. The theoretical framework for such an ambitious project was laid out in the late 1920s by the Prague Linguistic Circle, and Jakobson set himself the task of testing the new ideas on the ground of phonology, focusing in particular on the nature of sound changes. Jakobson tried to demonstrate that sound changes are not "fortuitous and blind" but goal-oriented. In order to support his famous "teleological criterion" in linguistic analysis, he resorted to the notion of a dynamic, self-regulating system operating with differences and binary oppositions. The extremely powerful and rich notion of dynamic system, which was at the heart of a growing wave of shifts in perspective in diverse disciplines during that period, encapsulated in embryonic form Jakobson's linguistic concept of code. The path that led from the groundbreaking *Theses* of the Prague Linguistic Circle to the exposition of Jakobson's model of linguistic functions in 1956 bears the unmistakable traces of a core process involved in the concept formation analyzed here. In that process, two nodal points stand out: teleology and binarism.

As shown in chapter 7, Jakobson's teleological criterion emanated from his firm thesis about the ontological status of systems. In a sense, this criterion acted as an operator that enabled Jakobson's ontological thesis to evolve into a full-fledged theory of language through a radical reinterpretation of Saussure's major dichotomies. Insofar as a language spirit (like Jacob Grimm's *Sprachgeist*) that could account for the goal-oriented nature of language was precluded, Jakobson's teleological criterion came inescapably to depend on the notion of a dynamic linguistic system directing itself toward its own *telos* by virtue of its inherent self-regulating capacity. In effect, Jakobson's conception of teleology entailed a radically transformed concept of *telos*, an "emptied *telos* in action" (Pourciau 2017, 193) cast in the mold of a systems-theoretical approach to communication[166]. If teleology accounted for the view of language as a functional self-sufficient system, binarism accounted for the fundamental principle governing the functioning of that system. Both binarism and the teleological criterion were two crucial nodal points where Jakobson's evolving conception as a system intersected with cybernetics and information theory. The former offered a reconceptualization of teleological behavior in terms of the communication-engineering concept of feedback. The latter introduced a universal

[166] For an in-depth account of Jakobson's conception of teleology, see Pourciau (2017, 189-242).

logarithmic measure of information based on binary selections. Both contributions were especially important for Jakobson in two respects. On the one hand, they were taken as corroborating his theses about language and communication. On the other hand, they provided the ground for a thorough reform of linguistics along the lines of a cooperation with communication engineering. As a result of such a cooperation, linguistics was expected to acquire for the first time a solid mathematical foundation and a rigorous method of analysis. At this point, "code" entered Jakobson's work as a purported synonym for "*langue*". However, beneath this seemingly insignificant terminological shift a new linguistic concept was coming to life, a concept designated by a word leading a dual existence in ordinary language and the world of communication engineering.

The entire linguistic work of Jakobson can be regarded as an endeavor to provide an account of the complexity of the phenomenon of language in terms of a mechanism based on a limited set of logical relations applied recursively to units of different order. The concept of code was in several respects an indispensable element of that account. First, it represented the format of language conceived of as a multifunctional dynamic system structured as a whole comprising different sets of hierarchically organized subsystems. Secondly, it also represented the rules governing the interrelationship between different subsystems. As such, it implied, thirdly, the binary logic of the core mechanism residing at the heart of the functioning of language. Structural phonology seemed to have opened the path for a universal method of linguistic analysis, a rigorous and precise method devised in such a way that would make possible the use of computing machines in the scientific study of language. In the wider context of the reshaping of the natural and social sciences after World War II, the structural method of analysis was taken by some people as providing the key to the mathematization of the social sciences. Among them, Lévi-Strauss was the one who undertook to expand Jakobson's project to the research on symbolic activity.

In the case of Lévi-Strauss, we face once again a deceptively straightforward terminological appropriation. In the numerous analyses of myths, "code" seems to have been used as a convenient, fashionable term of different sets of lexical pairs. In other instances, such as the discussion on music and painting in the Overture of *The raw and the* *cooked*, Lévi-Strauss appears to have slipped into a fairly liberal use, following a growing trend at the time. Yet, when examined against the backdrop of the premises of Lévi-Strauss's anthropological theory, many of these uses lay bare a nascent semiotic concept emanating from Jakobson's multifaceted conception of code. Structural phonology proved a valuable source for Lévi-Strauss's major theoretical project of constructing an integrated account of meaning and experience in terms of a rule-governed transition from the unconscious to the conscious levels of symbolic thought. Jakobson's phonological analyses offered the model method of such an account. Lévi-Strauss took on the challenge of developing a method of structural analysis for anthropology drawing on various sources of inspiration. Jakobson's concept of code was introduced in anthropology as part of Lévi-Strauss's attempt to transpose the principles and method of the structural analysis of phonological systems into the study of myth. Initially, "code" was used in the sense of logical pattern with respect to phonemic systems. Subsequently, this word's reference was extended to supralexical units. In the analysis of the special kind of units called "mythemes", code appeared as an operational concept detached from a strictly linguistic framework. Lévi-Strauss's quest for logical patterns in the diverse manifestations of symbolic thought gave the concept a general semiotic character. In this transitional phase, however, it was a rather latent aspect of the linguistic concept of code that came to be brought into relief.

Lévi-Strauss maintained that intersystemic transformations were the key to discerning invariant patterns in the incessant flow of symbolic activity. Identifying such patterns, in turn, was crucial for reconstructing the path leading from the manifestations of symbolic thought to its foundations at the deep level of the unconscious. Thus, from the point of view of the researcher transformations are the 'entry points' that allow for grasping those layers of reality that do not lend themselves to direct observation. The internal relation between invariant pattern and transformation was inevitably reflected in the nascent semiotic concept of code under the form of a conceptual ambiguity similar to that observed in Jakobson's writings. In Lévi-Strauss, the concept retained much of its protean character, yet what prevailed was the sense of a generic mechanism of intersystemic transformations. It is interesting to point out, in this connection, the structural similarity between the Lévi-Straussian and the information-theoretical concepts of code. Both presuppose, minimally, two sets or systems of units between which there is a relation of transformation. Code is the mechanism by means of which the transformation is performed. Seen outside the context of its proper development, Lévi-Strauss's concept of code might be taken as the outcome of a simple metaphorical extension from the information-theoretical model of communication. However, the analysis offered in chapter 8 showed that no such extension occurred. Lévi-Strauss's concept resulted from a complex formation process that involved the development of structural phonology and structural anthropology. The structural similarity with the concept of code in information theory should be rather attributed to the fact that both Shannon and Lévi-Strauss conceived of their object of interest (signal transmission and symbolic thought, respectively) in terms of interrelated transformations.

Lévi-Strauss's conception of code exemplified a typical approach in the 1960s that emphasized the logical relations underlying signaling or communication phenomena. Sebeok extended this approach to animal communication in an attempt to construct an integrated framework for the study of correlational and transformational processes in living beings based on a synthesis of insights drawn from structural linguistics, information theory and cybernetics. Prieto presented his own account of semiotic codes in *Messages et signaux*, in which he sought to lay the foundations of a structuralist semiology along the lines outlined in Saussure's *Cours*. Prieto examined the logical properties of codes from a set-theoretical perspective, focusing on the internal structure of codes rather than on their transformational capacity. This approach, too, took correlation as its point of departure, but it was mainly interested in the patterns produced by recurrent reciprocal relations between units of different order in the process of communication. Specifically, for Prieto semiotic codes were higher-order systems of interdependent classes and subclasses of units pertaining to the orders of the sensible and intelligible elements of communication. Thus, in their logical aspect codes were taken as providing the overall set of divisions and correspondences on which every act of communication necessarily relies. However, communication presupposes some sort of agreement about the distinctions and correlations according to which messages can be produced and interpreted. From this rather trivial fact, Prieto deduced the social origins of the logical pattern of codes after examining the common sources of communication failure. In light of this understanding, codes revealed themselves as social institutions.

The important threads in the development of the semiotic concept of code during this period converged to the notion of system of constraints. Different aspects of this notion were each time highlighted, with the various shadings being distributed along the intersecting conceptual axes of regularity and normativity. Accounts that focused on the logical aspect of codes –on their internal structure, correlational pattern or transformational function–, tended to emphasize the inherent regularity of communication phenomena. Codes, however, present also a social aspect insofar as they are conceived of as conventions that make possible the use of signs. When codes were examined as models or systems of potential values, their normative character was brought to the fore. Throughout the development of the semiotic concept of code, these two fundamental aspects remained entangled in a single conception of sign systems, which was carved out under the triple influence of structuralism, cybernetics, and information theory. Eco's redefinition of the concept of code aimed precisely to disentangle the intertwined aspects of regularity and normativity. A sharp distinction between system and rule was necessary for Eco's dynamic conception of sign as a transitory correlation of elements. Code and sign function were the core concepts of Eco's semiotic theory. Code was dissociated from system and structure and assumed the role of the correlational rule that establishes sign functions by coupling different units in socially ratified correlations. This was, though, only a minimal definition offering a 'microscopic view' of codes. With the introduction of the principle of unlimited semiosis in Eco's semiotic account of meaning, the 'microscopic view' gave its place to a 'macroscopic' one, which culminated in the notion of hypercode. The same principle allowed Eco to transcend the logic of equivalence and postulate an incessant interplay of equivalence and inference at the heart of semiosis. Thus, in *A theory of semiotics* code came eventually to be conceived of as a complex, evolving network of hierarchically ordered rules involving correlations and inferences. This conception, epitomized by the notion of hypercode, marked both the limit of the concept's potential and a tentative transition from code semiotics to interpretive semiotics.

Eco did not succeed in establishing an unambiguous concept of code, but his work was crucial in securing the concept's central position in semiotics after the demise of structuralism. Ever since, no significant conceptual shift has occurred, since the concept has not formed integral part of another major theoretical project or disciplinary reorientation. The semiotic usage of "code" crystallized into the cluster of notions indicated by the definitions quoted in the introduction. Yet, this usage may now accommodate partially differing conceptions of semiotic systems or rules. As stated in the introduction, the aim of the present study has been to offer an historical exposition of the semiotic concept of code as a prerequisite for a full-fledged systematic exposition. In pursuing this aim, the analysis inevitably engaged in a parallel, preliminary exploration of the concept from a systematic point of view. It is worth getting together here the main pieces of this exploratory account in the hope of providing a useful guiding thread for a future systematic exposition. Chapters 7-9 focused on the work of the three main figures in the concept formation that has concerned us in this monograph. Chapter 7 entered the conceptual core of Jakobson's ontological structuralism, in an attempt to determine whether "code" was adopted as the proper term for a distinct linguistic concept. Chapter 8 examined the conceptual system sustaining Lévi-Strauss's anthropological theory of symbolism, in order to determine within that system the position that Jakobson's concept of code came to occupy, transposed into a general semiotic level. Chapter 9 delved into the foundations of Eco's semiotic theory, seeking to lay bare the deeper theoretical shift underlying his redefinition of the concept of code. In pursuing its objective, each of these chapters foregrounded pertinent aspects of the major theoretical issues in the study of language, meaning, and symbolism, within which the linguistic and semiotic concepts of code were inscribed. The broad scope and cardinal significance of these issues become apparent when we consider the conceptual pairs in terms of which they are usually stated: whole-part, potentiality-actuality, sensible-intelligible, conscious-unconscious, variance-invariance, abstract-concrete.

The dichotomy between whole and part figures prominently in Jakobson's thought. His concept of code belongs to the large family of concepts that have been devised at various times for introducing the idea of wholeness to specific philosophical and scientific problems. The function of the linguistic concept of code in Jakobson's theory of language has been analyzed in chapter 7. Seen in the wider context of the development of language sciences, however, the concept of code finds a place in the chain of transformations of the conception of language as a whole from the nineteenth century onwards, especially in the gradual transition from an organicist to a systems-theoretical model. Insofar as both organicism and systems theory extended far beyond the confines of the study of language, the concept of code appears to have been entangled in a much broader, multilayered intellectual transformation during that period. Kondylis (2010) has captured this transformation in terms of the transition from a 'synthetic-harmonizing' (*synthetisch-harmonisierenden Denkfigur*) to an 'analytical-combinatorial' scheme (*analytisch-kombinatorischen Denkfigur*) permeating diverse spheres of cultural and intellectual life in Western societies. It is worth noting that Kondylis (2010, 268-272, 275-280) included cybernetics, structuralism, and semiotics among the major manifestations of the analytical-combinatorial scheme in the twentieth century. Thus, seen from the point of view of its function with respect to the dichotomy between whole and part, the semiotic concept of code reveals itself as part of a particular manifestation of far-reaching intellectual shifts that played a key role in the shaping of the humanities and social sciences in the preceding century. Another major stream of shifts is brought into relief when we approach the concept from the point of view of the dichotomy between consciousness and the unconscious. In its early development in structural linguistics and anthropology, the concept of code became integral part of a doctrine that put forward a rationalist conception of the unconscious as an empty form, an aggregate of structural laws from which the multiformity and complexity of semiotic phenomena emanate. Behind this 'turn' to the unconscious as the ultimate source of order in the facts of mental or social life there is a long intellectual tradition in Western literature and philosophy, whose roots must be sought in German idealism and romanticism[167]. Amid the maze of the different conceptions devised ever since, it may not be easy to discern the path leading to structuralism. However, there can be no doubt that the structuralist concept of the unconscious[168] is part of the incessant flow of ideas that sprang out of the 'discovery' of the unconscious more than two hundred years ago in European thought. Thus, seen against the backdrop of the structuralist thematization of the unconscious, the semiotic concept of code reveals a further cluster of threads linking its function to some of the fundamental theoretical issues

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[167] See e.g. Buchholz and Gödde (2005-6), Marquard (1987), Hemecker (1991), Ellenberger (1970), Whyte (1960), and Völmicke (2005).

[168] Here I am referring to the conceptions of Jakobson and Lévi-Strauss. Lacan's view requires a separate discussion.

and debates in the development of the humanities and social sciences. The web of connections underlying the concept appears even thicker when we consider that in the process of its development the dichotomies whole-part and conscious-unconscious are variously intertwined with other key dichotomies, such as potentiality-actuality or abstract-concrete. Chapters 7-9 shed some light on the shifting interdependences of such dichotomies in different theoretical projects, but evidently a more detailed analysis is required.

The preceding remarks suggest a rough system of coordinates for an in-depth systematic exposition of the semiotic concept of code in its various stages of development as outlined in this book. It is the task of a systematic analysis to specify the extent to which the connections indicated above bear on the concept formation under consideration. The present study was primarily devoted to an historical exposition aiming to dispel the misconceptions surrounding the emergence of the concept, thus paving the way for a future systematic exposition. In pursuing this aim, the analysis offered sought to highlight aspects of the history of structuralism and semiotics that may be of particular interest to scholars investigating the shaping of the humanities and the social sciences in the mid-twentieth century, especially in connection with the multifarious influence of information theory and cybernetics on the postwar study of language and communication. In elucidating the conditions of the emergence and early development of the semiotic concept of code, this monograph aspires precisely to contribute to the interdisciplinary investigation into the foundations of the modern scientific conceptions of communication.

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