



# Visualising discourse and argumentation structures of digital cultural heritage collections

The example of the scientific estate of Ernst von Glasersfeld

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In recent years, museums, galleries and archives have digitised numerous documents and made some of them available online. This also applies to the Ernst von Glasersfeld Archive, which administers the estate of the philosopher, communication scientist and radical constructivist Ernst von Glasersfeld (1917–2010). Since 2013, a part of the archive – which is located at the Brenner Archive in Innsbruck/Austria – can be used in a digital form. In our interdisciplinary research project (DigiVis) at the Department of Media, Society and Communication at the University of Innsbruck, this digital collection served as a showcase for the development of different digital and didactic approaches for written, pictorial and other sources.

In addition to visual and interactive access to Ernst von Glasersfeld's pictures and videos, the visualisation of the written sources (academic legacy) presented a particular challenge. In order to gain access to the content, Ernst von Glasersfeld's academic papers were examined and analysed with regard to argumentative

structures and discourse strands. We used MediaWiki as basis for the storage, annotation and structuring of the texts. Humanities scholars, computer scientists as well as a data visualization expert collaborated to develop methods of visualisation, structuring and simplification in order to provide a ‘bird’s-eye view’ of the complex argumentation structures and discourses of Glaserfeld’s texts. Media (and digital humanities) experts (Rainer Leschke / Kurt Fendt) and experts in the field of argumentation analysis (Manfred Kienpointner / Peter Kügler), supported the project in workshops and in personal meetings.

For the visualisation of argumentative and discursive structures, selected academic papers from the Ernst-von-Glaserfeld-Archive, which were published between 1960 and 2006, a collection of critical commentaries in the journal ‘Ethik und Sozialwissenschaften 9 (1998)’, as well as Glaserfeld’s response to the criticisms in the same journal, were manually annotated. These three different types of texts (Glaserfeld’s texts, criticism from other authors, and Glaserfeld’s response) therefore form the basis for our annotation, structuring and visualisation of the source material.

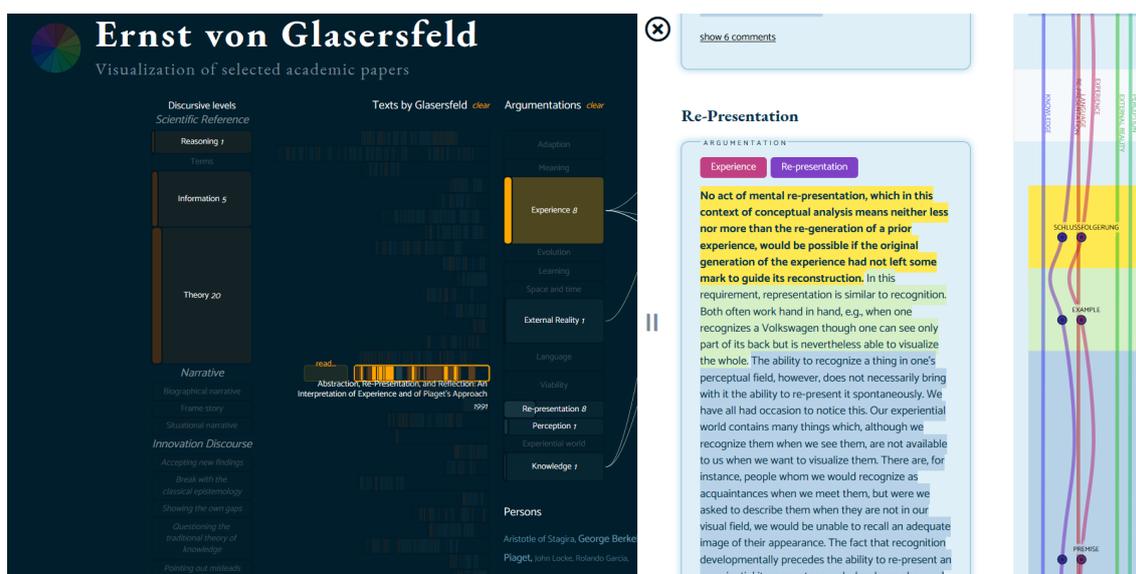


Figure 1: Visualisation of selected academic papers of Ernst von Glaserfeld. Design and realization: Jan Willem Tulp.

## 1 Visualising the non-visual

Digital collections are a challenging source regarding their organisation and structuring. On the other hand, they are a great source to experiment with new approaches of visualising, exploring, and understanding cultural heritage materials. While the digitisation process itself has been the focus of development and funding for many years, it is time to make this material accessible for a broader public. Visualisations can help to find new ways to discover archival material: They can create possibilities for exploration without having to search for specific contexts, they can arouse interest and lead to new insights (Deal 2015).

Approaches to interactively visualising non-visual aspects of textual material using computational methods are not entirely new. For example, already in 1995, James A. Wise et al. published a conference paper on visual browsing and analysis of textual documents. In their paper, they wrote about the visualisation of texts:

‘The [...] representation may then be visually browsed and analyzed in ways that avoid language processing and that reduce the analysts mental workload. The result is an interaction with text that more nearly resembles perception and action with the natural world than with the abstractions of written language.’ (Wise et al. 1995)

James A. Wise et al. had a very ‘realist’ view of the visualisation of textual material. Even though the transformation of text into visualisations will create new insights into textual material, they do not depict reality. They are ordered reductions of data on the basis of relevance criteria, which are visualised with the help of creative specifications (Scharloth, Eugstger, and Bubenhofer 2013). Johanna Drucker, for example, describes graphical tools as an intellectual Trojan horse, because they conceal their biases ‘under a guise of familiarity’ (Drucker 2011). If we refer to Ernst von Glasersfeld’s theory on the construction of knowledge and reality, his theory can also be transferred to visualisations, especially in the field of the humanities. However, even for realist models, as Johanna Drucker phrases it, an ‘observer independent reality’ should not be presumed:

‘Realist approaches to visualization assume transparency and equivalence, as if the phenomenal world were self-evident and the apprehension of it a mere mechanical task. [...] even for realist models, those that presume an observer-independent reality available to description, the methods of presenting ambiguity and uncertainty in more nuanced terms would be useful’ (ibid.)

Many approaches to creating visualisations in the humanities are borrowed from a mechanistic approach to realism. To use graphical forms of display for written cultural heritage in digital archives, these mechanic approaches need to be rethought. Knowledge – as Glasersfeld phrased it – is what we experience and interpret of the external world (Von Glasersfeld and Cobb 1983). That is also how humanistic knowledge could be seen, and its graphical displays have to adapt this very foundational principles (Drucker 2011). For cultural heritage material, visualisations therefore do not have to depict reality – but they should make it possible to open up and experience archives in new ways.

Brüggemann et al., for example, use the metaphor of a fold to symbolise the thinking space for the interpretation and design of interactive visualisations. When folding in and out, unpredictable results and new connections can occur, since folding can create a sudden juxtaposition of formerly opposite points. In addition, the underlying data itself can be regarded as a fold, which reminds us that each perspective represents only one possible version of reality, while there are infinite other possibilities (Brüggemann, Bludau, and Dörk 2020).

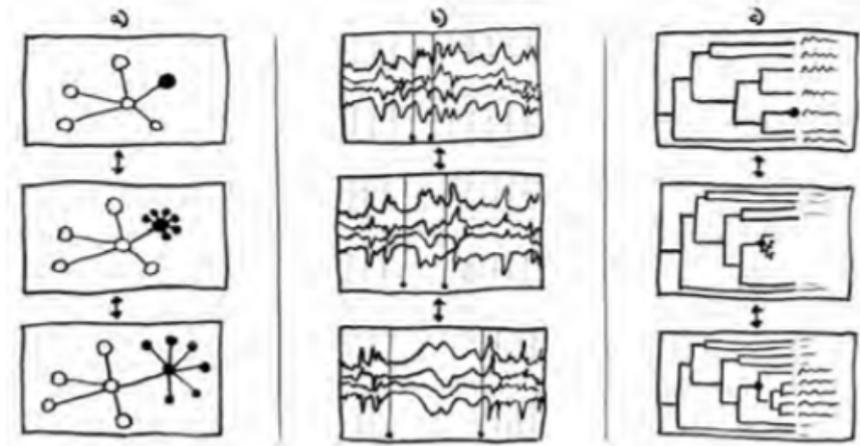


Figure 2: Examples of explication (top to bottom) and implication (reverse) in data visualisations (Brüggemann, Bludau, and Dörk 2020).

The process of ‘total unfolding’ – i.e. the access to the original data through the visualisation – should be the most important part of every visualization of cultural heritage in order to enable seamless traceability of the archival material to be examined. Therefore, we argue for a design principle as follows:

Visualisations of textual material should help to facilitate access to the original material. They should lead to new and/or hidden places of the material. Therefore, visualisations must be closely linked to the original documents. The graphic representation and the original material cannot be perceived as two different elements of the archive, they are much rather interwoven and interact with each other.

## 2 What is discourse (in Glasersfeld’s texts) and why visualise discourses for digital archives?

Michel Foucault – who decisively shaped the concept of discourse – defined a discourse as a group of related texts that belong to a common system of formation (Foucault, Seitter, and Konsermann 1998). Linguists – inspired by Foucault’s understanding of discourse – have defined the concept of discourse as follows: For Dietrich Busse, discourses represent a network of traces, tracks and signs of segments of knowledge (Busse 2000). Ingo Warnke and Sigurd Wichter understand discourses as texts that are merely in connection with coexisting texts or in dialogue with other texts (Warnke and Wichter 2002). Jürgen Link defined discourse as ‘an institutionally consolidated way of speaking, in so far as such a way of speaking already determines and consolidates action and thus also already exercises power’ (Link 1983).

Klaus Krippendorff has a somewhat more open understanding of discourse. For Krippendorff, discourses live in communities of people and every person in this community helps design the discourses (Krippendorff 2011).

When it comes to critical constructivism, Ernst von Glasersfeld was certainly a very active designer of this discourse, whereby he saw himself more as a ‘Lumpensamm-

ler‘ (rag picker) than someone who created novel practices. In 1990, for example, he wrote:

‘I just picked up the fragments that were lying around like some kind of epistemological rag picker [Lumpensammler] and put them together as best I could. The history from which these fragments come is at least two and a half millennia old and the building blocks are many.’ (Von Glasersfeld 1990).

Over decades, Ernst von Glasersfeld published papers and books on the theory of Radical Constructivism. He created arguments by combining the research, theories and philosophies of other people with his own experiences, interpretations and perceptions in everyday life. Furthermore, he used his very own rhetoric to legitimise his work and explain his own doing. Glasersfeld’s work has definitely shaped the discourse on how the world is perceived and how knowledge is created.

At the same time, his theories have led to a number of criticisms and counter-arguments, which play an important role in the discourse community, because discourses are kept alive by the communities of their practitioners, as Krippendorff put it (Krippendorff 2020). People, and especially scholars, practice their own discourse by talking, reading, writing and publishing. They do not only describe what they analyse, they construct the discursive world we are attending to (*ibid.*). To discover and reconstruct this discursive world is the goal of discourse analysis.

Digital collections create a great opportunity to examine and visualise discourses in order to explore the discursive structures that construct the world we are living in.

### 3 Identifying and classifying scientific arguments for the ‘bird’s eye view’

Even though argument mining, the automatic identification and extraction of arguments (Lawrence and Reed 2019), is rapidly growing in importance, techniques of this field could not have been adapted for the identification of arguments in Glasersfeld’s texts. Possibly the most developed approaches are the works carried out by Moens et al. (Mochales and Moens 2011), and Lippi et al. (Lippi and Torroni 2016). While Moens et al. attempt to detect the argumentative parts of a text by first splitting the text into sentences and then classifying each of these sentences as either an argument or not, Lippi et al. extract argumentative components from arbitrary text provided by the user. However, both approaches do not perform well when they are applied to academic texts. In addition, using our own annotations in Glasersfeld’s texts as training material was not very effective, either.

The identification of arguments is complex, since meaning is created beyond sentences. Although there are linguistic indicators of premises (for, since, etc.) and conclusions (hence, therefore, etc.), many arguments have no indicators at all. Therefore, a semi-automatic approach was chosen to identify and structure arguments. While the annotation itself was conducted manually, MediaWiki was used as a base for the annotation and structuring. In order to visualise a large number of arguments over a longer time of period, arguments as well as counter-arguments

needed to be identified, structured and linked to each other. After identifying and segmenting arguments, premises, examples and conclusions were annotated within the argument in order to open up the internal structure of the arguments.

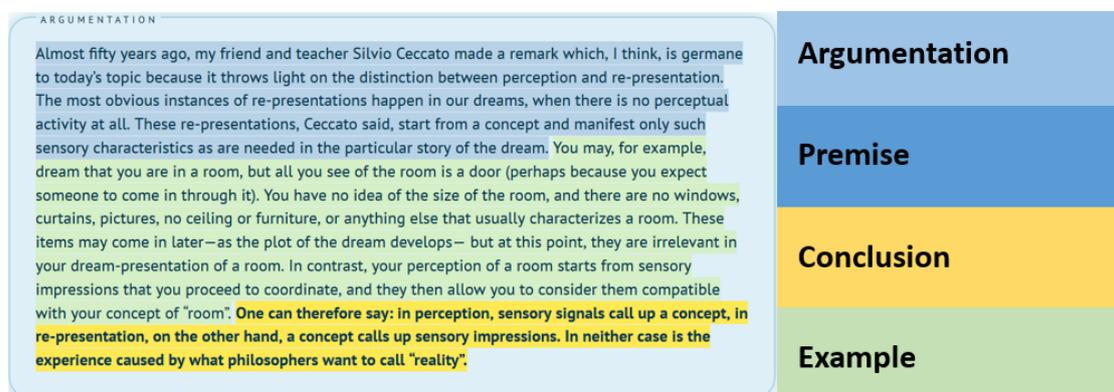


Figure 3: Annotation of arguments in Glaserfeld's texts.

For the structuring of the arguments, methods that require a strong interpretative intervention in the text were avoided for the reason of simplification and openness. Our goal was to structure the arguments for the 'bird's eye view' in order to find 'access points' to the original material of the archive. Therefore, we avoided the drawing of complex relations between arguments, which would have been very difficult to visualise as a whole. The analysis and visualisation of argumentation structures creating networks of single arguments and their relations to each other, as Lawrence et al. proposed, would have been too complex for a visualisation that tries to disclose the argumentation structure as a whole.

In order to be able to structure the arguments, ways of classification had to be found. As with the structuring, as little interpretation as possible was taken into account in the classification. Therefore, classification models using implicit warrants (the underlying connection between the claim and evidence) to assign arguments using causal paraphrases such as 'if x, then y or y, because x' (Wengeler 2012) have proven not to be particularly suitable for scientific argumentation that cannot be generalised in a meaningful way as easily as everyday arguments can.

Based on the methodical concept of Siegfried Jäger that a strand of discourse consists of fragments of discourse on the same topic, the classification of arguments in Glaserfeld's texts was based on thematic units. These thematic units or topics can be understood as the substantive core of a statement. According to Jürgen Link, there is something like a 'discursive energy' in a topic. In other words, a topic has a high probability that discursive debates will emerge in it. In addition, a topic is like a 'magnet' that binds many statements around itself, often for a long time period (Link 1999).

The discursive energy that runs through Glaserfeld's main themes shows itself in the form of arguments, counter-arguments, and reactions by Glaserfeld to counter-arguments. All of them can be assigned to a specific topic (language, viability, external reality, experience, space and time, adaption, experiential world, perception, knowledge, learning, evolution, re-presentation, meaning). The relationship between arguments by Glaserfeld and counter-arguments by other authors was created with attributes such as supplementary, compatible, supporting, conflicting, alternatively,

and questioning. The same applies to the relationship of Glasersfeld's answers to the counter-arguments:

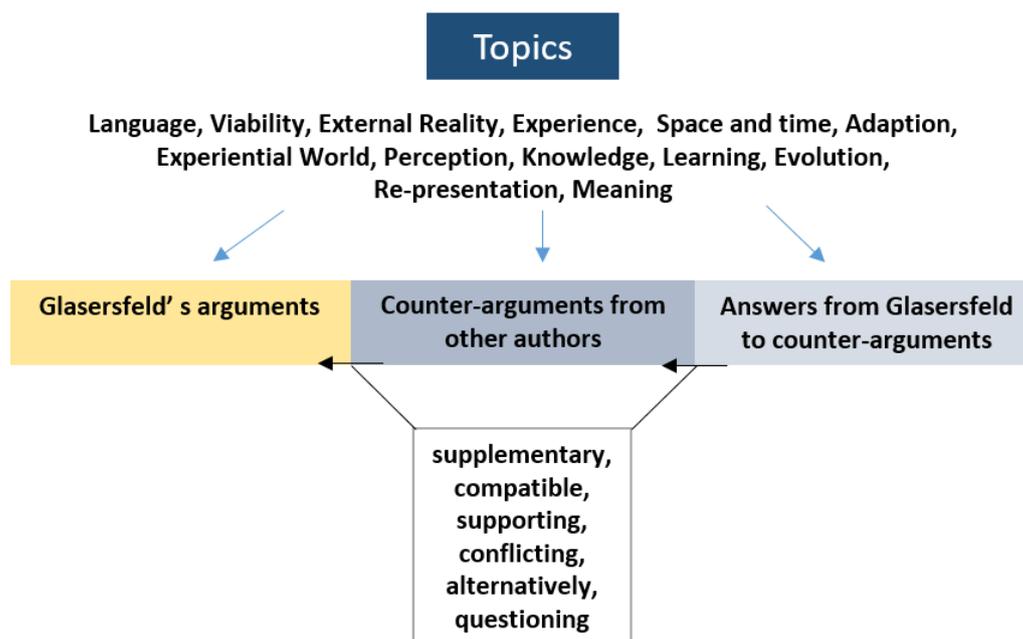


Figure 4: Topics of arguments, counterarguments and answers, as well as their relationship to each other.

The classification and linking of arguments for the ‘bird’s eye view’ opens up the structure of a collection for further investigation. The mapping of the discourse and the argumentation structures does not provide an analysis of the logical structure of the arguments, which, however, could be a next step when diving into the discourse strands.

## 4 Narratives, scientific references and legitimating strategies as further discourse elements

Academic arguments are only one part of the overall structure in Glasersfeld’s texts. Narratives, legitimating strategies (innovation discourse) and scientific references can be seen as a framework contextualising the arguments. While the arguments are the core of the texts, the framework is also needed in order to grasp the arguments in their entirety, to underline the arguments, and to legitimise them.

While the biographical or situational narratives in Glasersfeld’s texts were used to underline his theory or to describe the way how his thinking developed, the innovation discourse served the legitimisation of his theory, his research and his thinking. For example, he pointed out that his new findings could be shocking for those believing in the traditional theory of knowledge and reality. He underlined the difference between his and the traditional theories, or he pointed out misleads, as the example in figure 5 shows. Lastly, with references to scientific literature, he connected his thoughts and theories to those of other scholars.

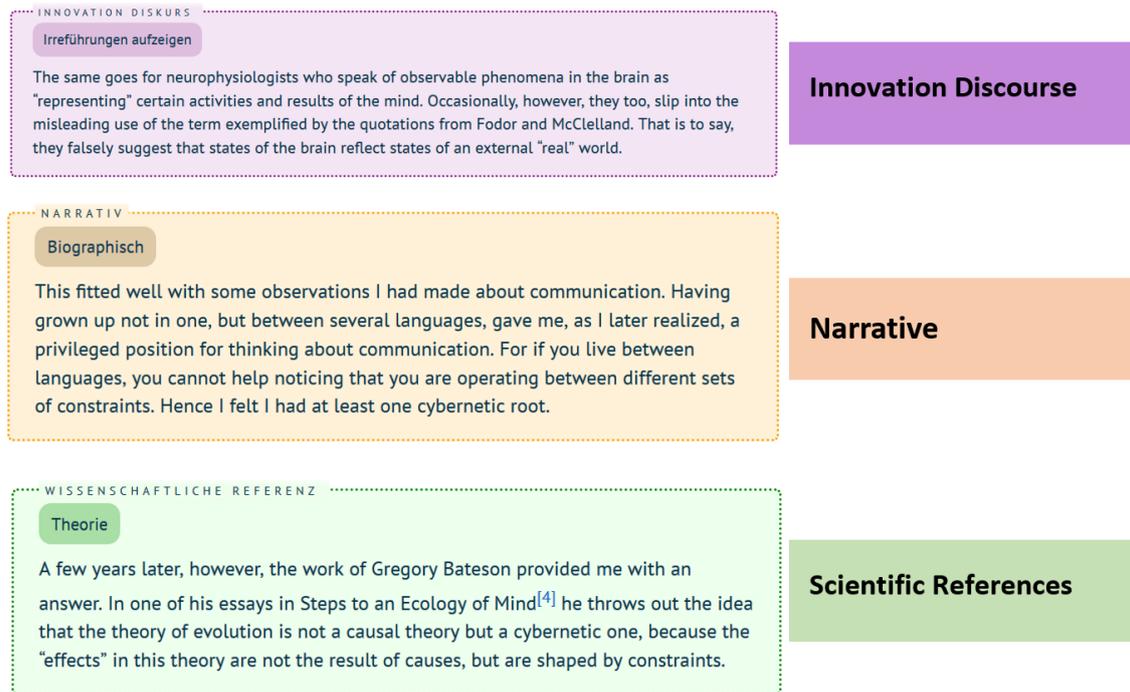


Figure 5: Innovation discourses, narratives, and scientific references in Glasersfeld's texts.

All three strands of discourse were not explicitly assigned to topics (as was the case with the arguments). However, they are related to the topics if they appear in the same text as the topics, which means they are indirectly linked to the arguments and their topics. This makes it possible to connect those elements for the mapping of discourses and argumentation structures.

## 5 Mapping discourse and argumentation structures

The goal of discourse and argumentation mapping is both to identify the overall structures within a text as well within a collection of texts, and to create a meaningful visual representation of these structures (Winston and Monikowski 2000). Siegfried Jäger has made a significant contribution to the question of how discursive structures can be detected and understood. Jäger used the metaphor of strands: For him, a strand of discourse consists of fragments of discourse on the same topic. The strand has a synchronous and a diachronic dimension. The synchronous dimension looks at the language at a given time (with a certain qualitative finite bandwidth), while the diachronic perspective looks at the discourse as it changes over time. In their historical dimension, strands of discourse are sequences of sets of thematically uniform discourse fragments, or in other words, thematically uniform flows of knowledge through time and space. Jägers visualisation of the strands also shows clearly that discourses are always intertwined, i.e. they influence and support each other. These interconnections usually already appear in the original texts. Often – and this also applies to Glasersfeld's texts – they contain thematic references to various strands of discourse. This means that a text can contain various fragments

of discourse. Such an interconnection occurs when a text addresses different topics or makes references to other topics (Jäger 2009).

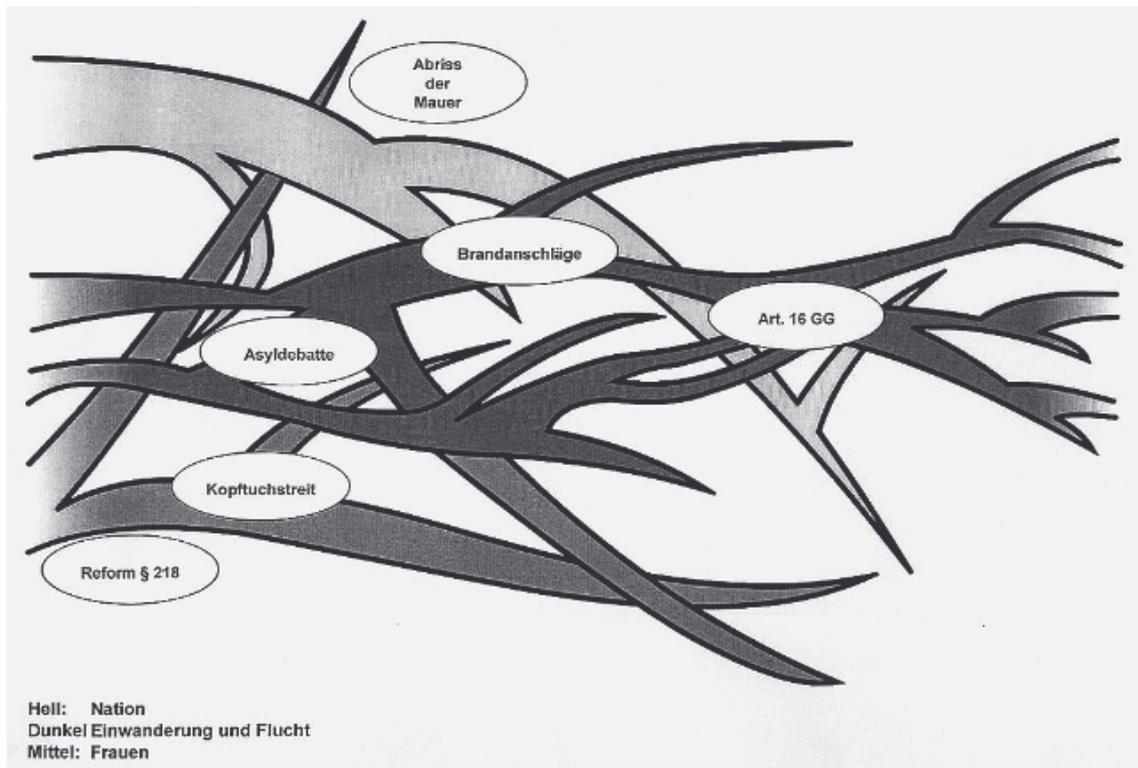


Figure 6: Visualisation of discourse strands by Siegfried Jäger (Jäger 2009: 182).

Inspired by Siegfried Jäger's methodological concept and especially his idea of strands, the project team worked on visualisation strategies that come close to this metaphor. Three main principles have accompanied this work:

### **Everything in the visualization is related to each other**

Just like intertwined strands, every element of the visualization is connected to other elements. If, for example, the interest lies in a certain topic, it is easy to find out which texts by Glaserfeld include arguments that are associated with that topic. At the same time, it is possible to see which discourse types can be found in the same texts. Furthermore, there is a clear connection between arguments and counter-arguments from other authors within a specific topic as well as between Glaserfeld's answers to counter-arguments.

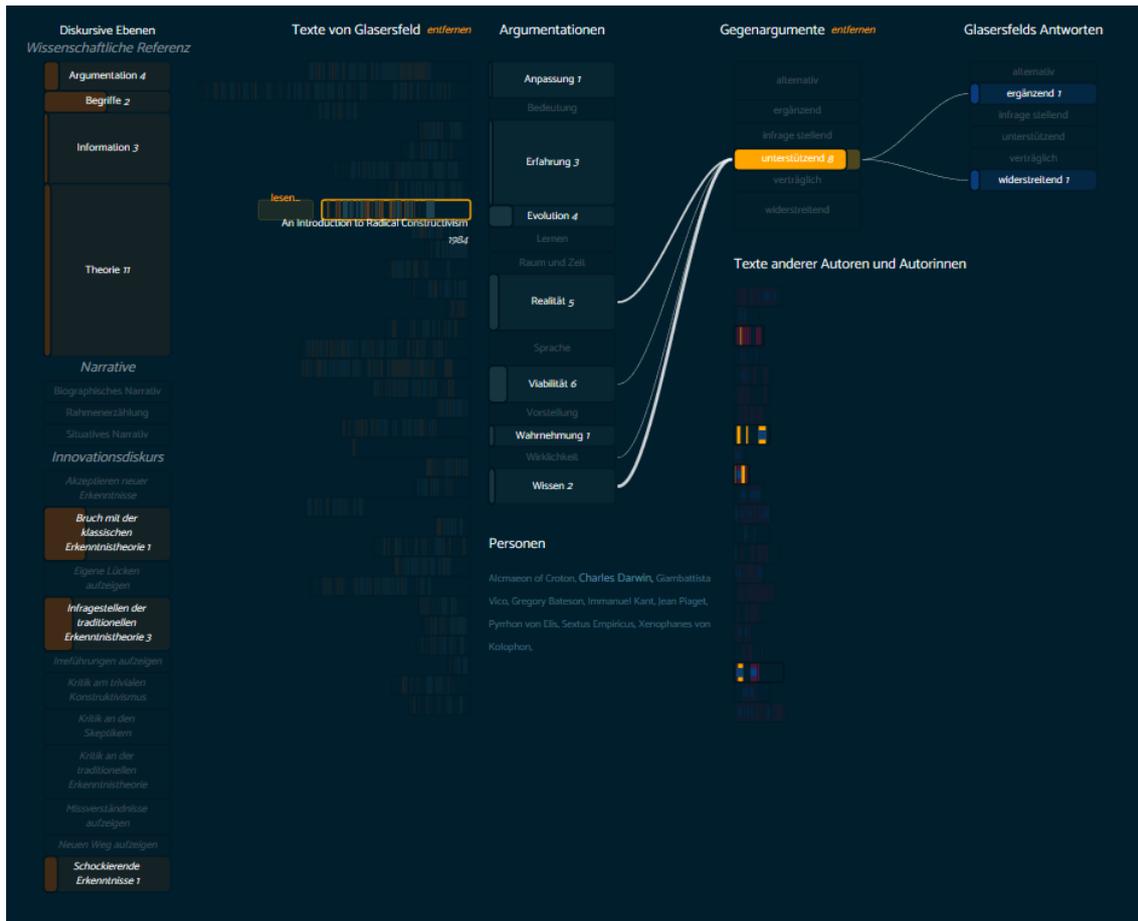


Figure 7: Visualisation of selected academic papers of Ernst von Glasersfeld. Everything is connected with each other.

The goal of this intertwined connections (or strands) is to identify the overall structure of Glasersfeld's texts. All of this 'strands' have a synchronous and a diachronic dimension. The Glasersfeld texts - which build the highest level of visualization - are ordered from the earliest publication date on the top to the latest publication date on the bottom. By clicking on one of the text, the synchronous dimension of this text will be visible.

The challenge, however, is that relationships do occur at different levels. To meet this challenge, the visualisation reflects the order of these different levels. The highest level of the visualisation is the text-layer (1). Every text contains specific arguments, which have been assigned to one or more topics (2). In addition, Glasersfeld's texts contain further discursive elements (3), visualized on the right side of the texts. Glasersfeld's arguments, on the other hand, are connected to counter-arguments (4) by different authors. When Michael Flacke, for example, criticises Glasersfeld's arguments on the subject of knowledge, this refers to all arguments on 'knowledge'. Glasersfeld himself wrote answers to some of the critiques (5), which are related to these specific critiques. So when Glasersfeld responds to Michael Flacke's concrete criticism, this response is directly related to this text. In addition, person names, which appear within the arguments, are shown on the bottom of the arguments (6). The texts by other authors (7) are visualized on the bottom of the counter-arguments



## Simplicity over complexity

One way to make sure that the visualization does not get too complex is that there is always only one selection per dimension possible: It is not possible to select more than one topic at the time, or more than one Glasersfeld text. If that would be possible, one would also have to reason if this is a selection where the combination is regarded as OR or as AND, for example, ‘is it this Glasersfeld text, OR that Glasersfeld text, OR both’, or is it ‘this Glasersfeld text AND that Glasersfeld text’. If this were true, and also true for all the dimensions it would be very hard to understand what a selection actually means.

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