# Issues in linking a thesaurus of Macedonian and Thracian gastronomy with the Langual system

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**Abstract**

In the project GRE-Taste: Taste of Greece, we have been developing a trilingual (Greek, English and Russian) thesaurus of food served in restaurants in Eastern Macedonia and in Thrace. We have designed a web lexicographic environment for the development of the thesaurus, which is structured in facets and subfacets corresponding to major categories: foods (as ingredients and as dishes), drinks, food sources (and parts thereof), places of origin, preparation methods, functions, state and nutrition. For each concept, the preferred (most common) and non-preferred (synonyms and hidden) terms are entered, as well as nutritional, cultural and other types of information as separate fields and the relationships among concepts (e.g. between a dish and its ingredients, cooking methods or place of origin). In this paper, we discuss the manner of implementing Langual thesaurus for coding foods and the issues involved in the process, such as confusing descriptions and the absence of Greek dishes. We make a suggestion for the enrichment of the Langual thesaurus towards an outcome that could ensure harmonization and interoperability among different applications. We also make a proposal towards resolving Greek terminology problems encountered in the description and classification of foods and other gastronomic concepts.

**Keywords**: multilingual thesauri; culinary terminology; culinary lexicography; Langual thesaurus; food classification; food description

## 1 Introduction

As part of the project GRE-Taste: Taste of Greece, we have been developing a trilingual thesaurus of food served in restaurants in Eastern Macedonia and in Thrace.

We have designed and implemented a web lexicographic environment that accommodates a set of texts retrieved from the restaurant menus of the study area and enables the development of a thesaurus with information about dishes and concepts related to food, which is enriched with dietary and cultural information about the dishes and their ingredients. The objective of this project is to support the traveller in the area in their quest of gastronomical and cultural experiences by developing a multilingual tool for the search, retrieval and presentation of information on food according to specific criteria: name, ingredients, source, preparation method, state, place of origin, function in the meal, health issues etc.

In this paper, we present the efforts to harmonize our work with the Langual thesaurus, an international tool for food description, we record the issues we have encountered in the lexicographic practice and we make some suggestions regarding the naming, the description and the classification of dishes.

## 2 Background

A lot of information on food is provided by the media, referring to various ingredients and preparation guidelines as well as to issues such as quality, health, nutrition etc. On the one hand, all this information may be not only overwhelming, but also confusing and, on the other hand, consumers indeed have to be informed on issues concerning their wishes, their needs and the implications of what is provided to them. Terminology has to be appropriate, familiar and properly understood by consumers in order to facilitate their culinary experience and allow them to easily make healthy choices (Himmelsbach et al. 2014).

Additionally, there is a lot of ongoing research internationally on food related issues, such as food knowledge bases and food semantics, food description and classification, food search and discovery, most of them aimed at extracting food-related information from different data sources with specific criteria (Durazzo et al. 2019; Gateau et al. 2019; Haussmann et al. 2019; Zulaika et al. 2018). Based on this research, corresponding systems are being developed taking into consideration different needs and aspects of food naming, processing, uses and other areas of interest such as local culture, health and nutrition issues.

Food classification and food description systems cover particular user needs. Therefore, for the same food product, e.g. a pork product, classification may differ in a nutrient database, in a consumption database and in a contaminant database. These systems have been implemented by regional or international organizations such as FAO/INFOODS[1], EUROFIR[2],

1 http://www.fao.org/infoods/infoods/en/
2 https://www.eurofir.org/

European Union/EFSA[3], Codex Alimentarius Commission[4] et al. (Ireland et al. 2002; Ireland & Møller 2000; Ireland & Møller n.d.; FAO 2015). Examples of such systems include: Langual Thesaurus, Agrovoc Thesaurus, EuroFIR, Eurocode/EFG, EPIC-Soft, INFOODS, etc. (Ireland & Møller 2016). Food systems at a national level are developed, too, with the aim of covering local needs due to specific cultural, economic, social and other conditions, while language and terminology aspects have to be taken into account.
Another interesting advance in food description is the development of food ontologies, such as FoodOn[5]. It is a "field to fork" food ontology, which includes, besides the relationships found in a thesaurus, additional ones such as "has quality", "has part", "is immersed in", "output of", etc. (Dooley et al. 2018).

## 2.1 The Langual system

Langual is a multifaceted thesaurus system containing terms for the description of foods from different points of view (i.e. food groups, cooking methods, preservation methods, consumer group, geographical origin). The use of a multifaceted structure allows one to describe a food product from several aspects and also to search for foods based on a variety of criteria, e.g. search for baby food containing cereals or search for potato-based dishes that have been fried.
In order to group foods, Langual uses a number of food classification systems, each of which was created to serve a different purpose or a different application area. Each system uses its own description and classification system, which means that information about food is not modelled in the same way or the same degree of detail in each of them. A unique code (i.e. Langual code) is assigned to each concept of the thesaurus regardless of the classification system, which can be used to identify a particular food or any other concept described in Langual. Therefore, the Langual thesaurus can be used by specific food databases from different countries, ensuring harmonization and interoperability among different applications.
Controlled terms are used for the representation of concepts describing specific foods as well as of those related with food (processes, methods, states etc.). Concepts are structured into facets hierarchically, corresponding to the different points of view mentioned above. These facets are:
A. Product type
B. Food source
C. Part of plant or animal
E. Physical state, shape or form
F. Extent of heat treatment
G. Cooking method
H. Treatment applied
J. Preservation method
K. Packing medium
M. Container or wrapping
N. Food contact surface
P. Consumer group/dietary use/label claim
R. Geographic places and regions
Z. Adjunct characteristics of food
Each facet is used independently. More than one term from each facet can be used depending on specific needs and uses. Facet A is the basic facet for the description of food products by type (product type defined as a food group comprising foods with common consumption, functional or manufacturing characteristics). Concerning multi-ingredient foods, Langual suggests indexing major ingredient by weight, not counting water, but also specific mixture terms can be used if one constituent is the first ingredient and the other constituent is the 2nd to 4th ingredient (Ireland & Møller 2013).
The structure of the thesaurus follows the rules for the construction and display of thesauri in ISO international standards (ISO 25964-1; ISO 25964-2). Under each record representing the described concept, apart from the preferred term, there are abbreviations indicating the relationship or the function of terms or text following (e.g. BT for broader term, NT for narrower term, UF for use for, SN for scope note, FTC for facet term code).
Langual Thesaurus is published in the basic English version (Møller & Ireland 2018a) as well as in the multilingual version in English, Czech, Danish, French, German, Italian, Portuguese and Spanish (Møller & Ireland 2018b). Food Product Indexer is an additional tool developed by Langual to facilitate food searching.

# 3 Project description

The web lexicographic application that we have designed and implemented provides the interface for the presentation of the catalogues of restaurant menus we have collected and for the development and display of the thesaurus. The catalogues were digitized using OCR technology and the resulting data were entered in a database comprising the set of texts to be used as a source for the thesaurus entries. The content of this text collection is information found in restaurant catalogues, structured in separate fields such as dish name, category, description, place of origin.
The thesaurus is structured in facets and subfacets corresponding to major subject categories, similar to those in the Langual Thesaurus: foods (two subfacets for foods as ingredients and foods as dishes respectively), drinks, food sources (and parts thereof), places of origin, preparation methods, functions (courses in the meal), state of food, nutrition

3 http://www.efsa.europa.eu/
4 http://www.fao.org/fao-who-codexalimentarius/en/
5 FoodOn: https://foodon.org/. More information on food ontologies is given by Haussmann et al. (2019).

(nutritional and dietary characteristics, health issues).
For each entry, we enter the terms representing the term in the three main languages of the project: Greek, English and Russian, as well as in Latin if there is a scientific name (e.g. for animals and plants). The most common and/or best-known term is entered as the preferred term in each language. Alternative and dialectic or idiomatic variants are recorded as synonymous or hidden terms. The relationships of each concept with other concepts of the same or a different category are also recorded, such as relationships between a dish and its ingredients, cooking methods, place of origin, or relationship of food as ingredient with source or place of origin. Detailed nutritional information is coded in specific facets of the thesaurus while cultural information (folklore and historical data) as well as other useful elements, e.g. recipes, are entered as free text in dedicated note fields. The thesaurus contains 1,400 entries denoted by more than 3,000 terms (mainly Greek ones at the moment since translation is in progress); concepts are interrelated with 31 relation types materialized in more than 2,600 relation instances. Therefore, this is a highly complex project attempting to harmonize several very different issues related to lexicography, terminography and more, given that a) there is a variety of names and preparation ways for dishes, b) there is not a food controlled terms index in Greek and c) no similar research dealing with dishes from restaurant catalogues has been carried out in Greece.
The unique feature of the thesaurus is that all dishes and most of the ingredients are drawn from the menus of approximately 120 restaurants in Macedonia and Thrace. Consequently, the thesaurus represents the actual linguistic situation in the market. In order to list foods in categories, to define the relationships among concepts, and also to link and harmonize our thesaurus with international resources, we also draw on data from official sources, such as the National Code for Foodstuffs and Beverages (GCSL 2018), the European Regulations and finally the international food description thesaurus Langual.

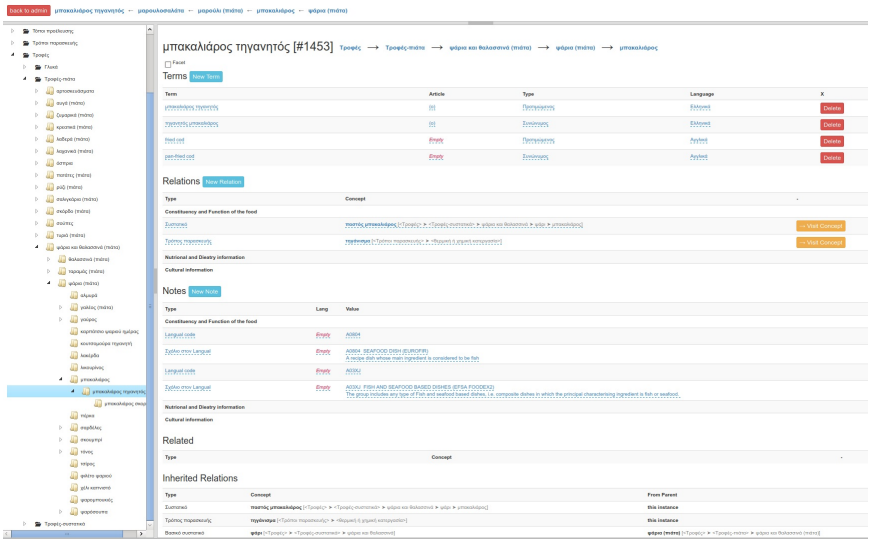


Figure 1: The web environment for GRE-TASTE thesaurus.

## 3.1 Semantic and terminological issues

Considering, on the one hand, that names of foods in catalogues do not usually follow any particular rules and that the same dishes may have different names in different restaurants and, on the other hand, that we wished to keep the names used in restaurant menus in our system, we had to make decisions on the naming of food products, especially dishes, on the syntax and on the selection of preferred and non-preferred terms.
The grouping of foods in the thesaurus is based on the main ingredient, the definition of which often depends not always on quantity only, but also on the essential property of the product connected with particular local and cultural data. Such groups include meat dishes, fish and seafood dishes, vegetable dishes, pasta dishes etc., while the facility for multi-hierarchical relationships in the platform allows us to classify foods into more than one hierarchies. So, for instance, specific legumes-based dishes, such as “arakás” (peas) are classified under legumes as well as under “laderá”: the latter is a particular and prominent type of Greek dishes, cooked in olive oil basically, for which we decided to create a separate category (although olive oil cannot be considered as the main ingredient).
There are problems in Greek culinary terminology and lexicography regarding the description of food. A usual problem is that there are several names for the same dish or very similar dishes. For example, the restaurants serve “Greek salad” or “horiátiki”, both with the same content; therefore, these have to be listed as synonyms in the thesaurus with “horiátiki” as the preferred term based on frequency. Another example of this type is lettuce salad. In Greek, it may be “maroulosaláta”, “maroúli”, “saláta maroúli”, but it may also have a particular name in a specific restaurant, e.g. “to maroúli tis Elénis” (Helen’s lettuce). These dishes have the same main ingredient but may differ otherwise. So, lettuce salad may include or not onion, rocket etc., while specially named dishes have a unique description. For example, the salad “to maroúli tis Elénis” contains yoghurt sauce and prosciutto. In our thesaurus we choose to have alternative and optional ingredients in order to cover different types of dishes as specific concepts to the generic one, like in our example here “to maroúli tis

Elénis" is specific to "maroulosaláta".[6]

## 3.2 Working with Langual, comparisons and issues thereof

As already mentioned, the various food coding systems have different levels of detail, depending on the kind of the applied system, the use, the needs etc. So, the coding is different, for example, if the system focuses on nutrient intake (mostly covering processed foods and foods as consumed) or on hazard occurrence in food (interest on raw commodities) (Ireland & Møller 2016). Our system contains entries of dishes served in restaurants and, additionally, on ingredients used to prepare those dishes. To implement the Langual encoding, we had to decide which coding used in it is the most appropriate in our case in combination, of course, with the general decisions we have taken concerning the objectives of the project, the intended users, the structure of our thesaurus, the depth of indexing etc. Taking into account such parameters, we decided to use EFSA coding as a more complete system and as the one with the highest detail in description and classification analysis and the EuroFIR for typical reasons (requirement for member countries, although in most cases it is very generic and not always helpful), or any other system if these two do not cover a particular food product.

We chose to work mainly on Facet A, i.e. food products, which is the most important one for the description of the type of foods covered in our project. At the same time, however, Facet A presents difficulties as regards the identification and selection of the appropriate coding and the harmonization with our data, due to language issues, of course, but also to cultural, geographical, environmental and other particularities. The other facets are also used for coding, but concept correspondence is more straightforward in their case.

So, our concern is a) to describe and classify foods using the Langual system, and b) to decide on the names of foods, especially the dishes. We present here a few examples indicating the kind of problems we have faced with Langual:

- Both our thesaurus and the Langual system are based on the description of the main ingredient (Facet A), which, as noted in 3.1, may depend not only on quantity (in Langual) but also on cultural and historical data connected with particular dishes. The use of poly-hierarchical relationships such as those in Langual is the solution for cases where more than one place is necessary for coding food (either a dish or any other food product).
- A basic problem is that Langual does not contain several culture-specific foods of Greece; this is something we had expected, but in several cases we think that such dishes should be included, not only because of the local interest they have for native users but, much more, due to the need for understanding, for communication and for compatibility among various local cuisines and cultures.
- In Greek cuisine we find several types of dishes of the same overall concept but with varying main ingredient. Such is the case of the various croquettes and "keftédes": the menus propose a large variety of this dish in which the main ingredient can be tomatoes, fava (split peas), eggplants, pumpkins, meat, fish, potato, cheese etc. Some of them, i.e. "meatballs" ("keftédes"), "fish balls" ("psarokrokétes") and "potato croquettes" ("patatokrokétes") are contained in Langual, but "cheese croquettes" ("tyrokrokétes") and the others are not. Furthermore, the use of a generic concept such as "vegetable-based dishes" does not cover the requirement that these dishes be coded as members of a particular family of foods. So, in the facet for "methods of preparation", apart from the subfacet for "cooking methods" we have introduced another one for "shape, texture" and form". The "keftés" is a term in this subfacet; others are "avgolémono" (egg and lemon sauce), "kebáp", "gemistá" (stuffed vegetables), etc.
- The same problem is observed in the case of legume-based dishes, that is, not all kinds of legumes are found, while in the case, for instance, of pea-based dishes, we only find "mushy peas", which is a rather uncommon type of dish in Greece ("arakás").
- "Stifádo" is another typically Greek dish which is not included in Langual. In restaurant menus, "stifádo" may concern particular dishes such as "rabbit stew" ("kounéli stifádo"), "calf stew" ("moschári stifádo»), "cuttlefish stew" ("soupiés stifádo"), or a cooking method which goes as back as Byzantine times. So, in our thesaurus we have assigned a particular code for "stifádo" as a cooking method, while we keep the term "stifádo" on the name of particular dishes, classifying them in the group of basic ingredient (rabbit dishes, calf fishes, cuttlefish dishes etc.).
- The ingredients in some composite dishes may also be served as separate dishes, for instance "codfish with garlic dip" ("bakaliáros skordaliá"), "pasta with minced meat" ("makarónia me kimá"), "sautéed potatoes with bacon and mushrooms" ("patátes soté me béikon kai manitária") etc. The general rule for dish classification is applied here as well, i.e. by main ingredient, while they can also be assigned one or more additional codes corresponding to additional classifications, if necessary, as we noted above. The latter case concerns, for example, the dish "makarónia me kimá", which is coded as a pasta dish, but it is also assigned a code in meat dishes. Concerning coding in Langual, there are composite dishes coded in it, though not covering all special types of dishes. In this case, we can classify the dish as to the nearest category or we may decide that a new code is necessary if the dish is connected with specific cultural and local background. So, "patátes soté me béikon kai manitária" (sautéed potatoes with bacon and mushrooms) is assigned the Langual code for "potatoes, meat and vegetable meal", which is followed by the description: "The group includes any type of composite dish based on Potatoes, meat, and vegetables. More detailed information on the characterising ingredients can be added with additional facet descriptors". Such a facet descriptor is the way of cooking (sautéed). But in the case of "bakaliáros skordaliá" (codfish with garlic dip), a famous Greek traditional dish, we think that it should be assigned a new code.
- The case of the lettuce salad: The Langual system is based on the description of the main ingredient (Facet A) and so we can assign the same code from facet A to all these salads; the particular dish with the name "to maroúli tis Elénis"

[6] More detailed information is given in Markantonatou et al. (2019).

(Helen's lettuce) that we found in the menu of a particular restaurant under lettuce salads may not constitute a new kind of dish but it can be classified as a synonym to lettuce salad. In this entry, if we think that any additional ingredients should be mentioned (in this case, yoghurt sauce and prosciutto), we can add them as optional or mention in a note. An option would be to use ingredient ADDED as described in Facet H.

- Another issue is decisions concerning features offered in menus for which there is no corresponding entry in Langual. For example, very often we find the description "handmade dish" ("tzatziki handmade", "marinated sardines handmade" etc.). We have opted to ignore these descriptions in our thesaurus because these features are not discriminating for the dish (i.e. they do not identify the dish). It is open to discussion, however, whether this is a feature of interest for customers of a restaurant that our thesaurus may have to take into account.
- Issues arise from differences among the names of foods and their varieties, ranging from the description of specific concepts (that could be enriched with additional content not contained in this version of the international thesaurus), to differences in the classification of concepts in the menus and in Langual etc. For example, Langual includes "Greek salad" as a particular dish under salads, it describes it in the same way as "horiátiki", but it does not mention that "horiátiki" is an alternative name for "Greek salad" (although it is a rather well-known term for the so-called Greek salad). In addition, in Langual we do not find "tomato salad" ("ntomatosaláta") or "tomato and cucumber salad" (angourontomáta), two types of salad often served in Greek restaurants and included in our source menus. Green salad may also vary, as lettuce salad in the example above.
- In some cases, similar situations may be coded in different facets, which may result to inconsistencies or may cause difficulty to select the right classification concept. For example, fat content in food is found in facet P (for label claim), in facet Z (for fat content in EUROCODE2), in facet H (for fat removed), while for specific food products with fat content in facet A we find mixture terms for milk, milkpowder, mayonnaise, salad dressing and cheese.
- It is not always clear what is defined by the terms used, often because of different classification systems in the same platform, which do not have any relation to each other and this is why Langual managers often emphasize that the term alone is not enough to select a concept and that the description text is more useful. So, for example, searching for salted seafood, i.e. fish, prawns and other seafood preserved by salting, in Facet A we only find one specific product represented by the mixture term, "salted cod" (with the scientific name "bacalao"), and the general category "salted seafood" in the same system (EFSA FOODEX2) with the description "The group includes Seafood (any non-mammal, non-fish marine animal) product essentially preserved by salting" (i.e. fish is not included in this category!). The solution is given, of course, in Facet J with the descriptor "preserved by salting". As far as cod is concerned, in Facet A we also find "cod, dried" (with the scientific name "gadus"), including, as noted in the description, "any type of dried cod" (i.e. salted and unsalted). It may cause confusion as to where to classify the Greek food "pastós bakaliáros" (salted and dried cod).
- Similar confusion is created in Langual in the case of salads with various basic ingredients (potatoes, pasta, rice etc.). So, in EFSA "pasta salad" is classified under salads as a special salad dish, while in Eurofir "macaroni salad" and all other salads are coded as "prepared salads" together with "potato salad", "rice salad", "tuna salad" etc. In our case, each salad is classified by its basic ingredient (e.g. pasta, potato, rice, tuna), while all these dishes are also connected with the concept "salad" in the functions facet.
- Another general issue is the lack of recipes in Langual, which sometimes may be connected with poor representation of basic ingredients.

## 4 Conclusions and further work

Langual is a useful tool for food coding systems, but the problems presented above show that it cannot be used as is for applications such as the one described here. The GRE-Taste Food Thesaurus is based on data collected from restaurant menus, appropriate to be used mainly by end users, customers in restaurants, taverns and other catering establishments. The food served varies widely as far as the content of dishes is concerned; the terminology used also varies widely as it represents several language-specific, local, idiomatic characteristics, often not easily understood by users. So, adjusting our data to Langual content is not enough. Working with Langual coding, we have to add new information, which in some cases could supplement the description of existing concepts but sometimes new concepts need to be added for dishes that do not exist as separate entries in it.

Thereafter, we will continue the implementation of our thesaurus with the classification scheme and the structure of the ontology we have designed. Langual itself is not a classification system, rather it has embodied other similar systems, but the uniform Langual code for foods that it provides independently from those systems makes it a very useful tool for the harmonization and interoperability among food databases.

Food "*constitutes a rich and complex cultural system […] embracing history and geography*", together with language, social studies, race and ethnic identity and other disciplines, as correctly noted by Faber & Vidal Claramonte (2017: 156). Langual and the other food systems show less interest on specific local and cultural parameters. Our project aims to play a vital role in this direction as well, by improving and supplementing existing systems with this local wealth of information on food connected with particular historical, cultural and social data contributing, simultaneously, to the tourism economy, to communication among different peoples and cultures and, of course, to sustainable health and nutrition.

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