

# COSTA RICA CENTRAL VALLEY GASTRONOMIC LEXICON STRUCTURING FROM AN ONTOLOGICAL ARRANGEMENT

ESTRUTURA DO LÉXICO GASTRONÔMICO DO VALE CENTRAL DA COSTA RICA A PARTIR  
DE UM ARRANJO ONTOLÓGICO

ESTRUCTURACIÓN DEL LÉXICO GASTRONÓMICO DEL VALLE CENTRAL DE COSTA RICA A  
PARTIR DE UNA ORGANIZACIÓN ONTOLÓGICA

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**ABSTRACT:** This paper describes how terminology and ontologies interact in a coherent and exhaustive manner, and how the neological appearance is obtained from the derivation of the specificity and functionality of a specific corpus. This research shows categories that do not exist either in the Glossary of Costa Rican popular cuisine (SEDÓ MASÍS, 2008), or in the Dictionary of Costarriquenismos (QUESADA PACHECO, 2012). The omission of some of these categories clearly shows that the terms have been historically organized taking into account only the lexical factor, but not the conceptual organization. Therefore, this study intends to play with the "disagreement" between speakers and specialists to show that a reorganization of the terms of an area is possible. For this, a corpus of 596 recipes and 4652 ingredients for ontological representation was compiled. Each ontological class was defined by means of its functionality in the recipes. The ontological architecture is formalized through the postulates of Basic Formal Ontology (SMITH, 2014) and is schematized by means of *Protégé*. In addition, the terminological theories of Cabré (1999), Fedor de Diego (1995) and Roche (2007, 2009) are used.

**KEYWORDS:** Ontoterminology. Terminology. Costa Rican cuisine. Lexicón. Ontologies.

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RESUMO: Este artigo descreve como terminologia e ontologias interagem de maneira coerente e exaustiva, e como a aparência neológica é obtida a partir da derivação da especificidade e funcionalidade de um corpus específico. A pesquisa mostra categorias que não existem nem no Glossário da Culinária Popular Costarricense (SEDÓ MASÍS, 2008), nem no Dicionário de Costa Rica (QUESADA PACHECO, 2012). A omissão de algumas dessas categorias mostra claramente que os termos foram historicamente organizados levando em consideração apenas o fator lexical, mas não a organização conceitual. O estudo tenta colocar em jogo a “discordância” entre palestrantes e especialistas para mostrar que uma reorganização dos termos de uma área é possível. Para isso, foi compilado um *corpus* de 596 receitas e 4652 ingredientes para representação ontológica. Cada classe ontológica foi definida por sua funcionalidade em receitas. A arquitetura ontológica foi formalizada através dos postulados da Ontologia Formal Básica (SMITH, 2014) e esquematizada através do *Protégé*. Além disso, foram utilizadas as teorias terminológicas de Cabré (1999), Fedor de Diego (1995) e Roche (2007, 2009).

PALAVRAS-CHAVE: Ontoterminologia. Terminologia. Cozinha costa-riquense. Léxico. Ontologias.

RESUMEN: En este trabajo se describe cómo interactúan, de forma coherente y exhaustiva, la terminología y las ontologías y de la que se obtiene la aparición neológica proveniente de la especificidad y funcionalidad de un corpus específico. Esta investigación muestra categorías que no existen ni en el Glosario de Cocina Popular Costarricense (SEDÓ MASÍS, 2008), ni en el Diccionario de Costarricense (QUESADA PACHECO, 2012). La omisión de algunas de estas categorías muestra claramente que los términos han sido organizados históricamente tomando en cuenta sólo el factor léxico, pero no la organización conceptual. Pues bien, este estudio intenta poner en juego el “desacuerdo” entre hablantes y especialistas para mostrar que es posible una reorganización de los términos de un área. Para esto se recopiló un corpus de 596 recetas y 4652 ingredientes para la representación ontológica. Cada clase ontológica se definió por medio de su funcionalidad en las recetas. La arquitectura ontológica se formaliza por medio de los postulados de Basic Formal Ontology (SMITH, 2014) y se esquematiza por medio de *Protégé*. Además, se emplean las teorías terminológicas de Cabré (1999), Fedor de Diego (1995) y Roche (2007, 2009).

PALABRAS CLAVE: Ontoterminología. Terminología. Cocina costarricense. Léxico. Ontologías.

## 1 INTRODUCTION

One of the aspects that generally identify the members of a speaking community and their culture is food. Additionally, whenever a place is visited (national or abroad) the various dishes, their ingredients and how they are prepared is what really grabs attention. Each region's lexicon focuses not only on their crops, but on the various preparations, derived from the contact with other cultures. For instance, Costa Rica's traditional cuisine has indigenous, African and Spanish influence (ROSS, 2001).

Despite the fact that within Costa Rican traditional gastronomy there are preparations and influence from some regions, in addition to other dishes like desserts and beverages, the so-called *Platos Fuertes del Valle Central* have been selected for this investigation. As stated by Ross (2001), Álvarez (2007, 2008 and 2009) and Campabadal (2005), this kind of dishes is clearly delimited and distinguished by their ingredients and preparations from other regions such as, for example, Limón, Guanacaste and Puntarenas. From the lexicon compiled from the main courses, a selection that corresponds to traditional gastronomy has been performed. According to Ross (2001, p. 6) the *traditional cuisine* are not only the set of cultural features that surround the act of eating, but also the culinary act that characterizes cooking techniques, sauces and spices of the recipes. Aguilar *et al.* (2014), based on their nutritional study, define *traditional cuisine* as that that is passed from generation to generation, and that is related to a specific region that has interculturality elements, as well as a variety of dishes. Because of this, recipes called *fusion* (as in *fusion cuisine*), like the ones prepared in “Italian style”, are excluded, with the purpose of solely recording the lexicon corresponding to Costa Rican Central Valley and its social and cultural implications.

The data collected from the recipes show that the lexicon presents at least three clearly delimited fields: the name, the ingredients and the preparation. These elements show a way of organization in which there is huge amount of lexical information stored. This complexity is one of the starting points of our investigation, and is aimed to be represented through ontologies given that they provide an accurate methodology on how the relationships between the terms (lexemes) behave, and how to represent them through a strict hierarchy based on their conceptual characteristics.

In this way, one of the main concerns is to represent the whole complexity and lexical richness that defines the gastronomic reign of Costa Rica's Central Valley through a formalism.

Ontologies are platforms for representing a specific area's organization through formalizations defined in categories or classes and *is\_a* (es un) type relations, which not only represent the basic ontological relationship that Smith (2003) poses (in which an element belongs to another because it shares some quality within a hierarchy), but also exemplifies the meronymic relations the mental lexicon establishes. For example, a meronym like “pimienta amarilla” (yellow pepper) is\_a type of “pimienta” (pepper), “pimienta” (pepper) is\_a type of “especias” (spices), and “especias” (spices) is\_a type of “aderezo” (seasoning). All this can be represented as illustrated in Figure 1.

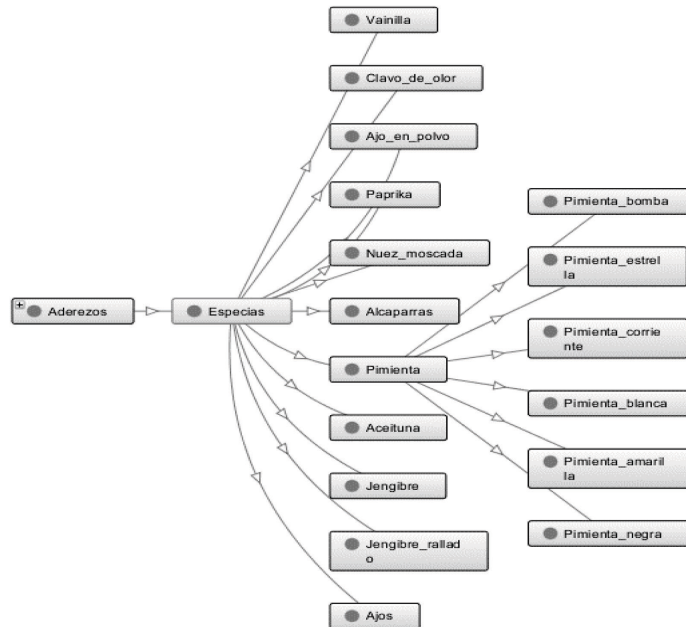


Figure 1: Subclasses of Pepper  
Source: author's elaboration

The representation shown in Figure would be the mental (conceptual) organization that Costa Rican speakers have about part of their traditional cuisine since, in order to give flavor to each ingredient, a series of meronymic relations must be selected to prepare a dish. Each pepper, olive, garlic, caper or nutmeg is selected from what Jackendoff (1994) calls *Mental Grammar*, so each selection is done considering the elements the speaker recognized through his or her experience and that allows them to prepare, for example, a special type of rice.

Now, ontologies belong to a long tradition in data management, information and the relationship between the elements that define them. At a computational level, ontologies are formalisms that allow organizing the information and facilitating their search. For Chandrasekaran *et al.* (1999) ontologies present two uses: firstly, as controlled vocabulary and secondly, as theory of contents.

It is for this reason that there are ontologies that facilitate the access and the manipulation of certain contents (classes) like, for example, biomedical ontologies (OFO, 2015). Nonetheless, the relationships between classes that are applied to the ontological organization go beyond a first definition or approach, given that they are based on their functional definition, meaning, how the concepts to which the various lexical pieces that define a terminology that comprise a terminology are interpreted and implemented by the speakers. For this reason, the ontology model has been selected to represent and describe the lexicon's organization related to gastronomy in this region and, from said organization, try to unveil the relationships between their elements based on some examples. As we will see later, major categories can be shared by other Latin American speaking communities, but as we go deeper into the organization of their classes and subclasses, we will realize that the distinction of a Costa Rican's mental lexicon regarding his or her gastronomy differs completely from that of their fellow Mexicans, for instance.

## 2 ONTOLOGIES AND TERMINOLOGY

In this investigation, two big areas converge: one, in charge of compiling lexical data and another on how to organize them.

On one hand, the lexical tradition in Costa Rica has focused on the elaboration and definition of terms from different fields of study; a special mention goes to *Programa de Estudio de Lexicografía* (ELEXHICOS)<sup>1</sup> from Universidad de Costa Rica, in which a series of investigations is registered, in charge of a critical revision of the works on the Spanish lexicon in Costa Rica and, on the other hand, the ontological classifications based on the formal representations of knowledge.

Regarding the lexicon related to the Costa Rican gastronomy, there is SANCHEZ's (2006) research: *Léxico relativo al ámbito del tamal en Costa Rica*, which compiles the available lexicon of one of the most frequent traditional dishes in the country. This corpus shows that their terms present specific formal qualities that could be grouped ontologically given that within the lexicon inventory, the author gathers terms such as *amarra* (zip tie), *alverja* (carob bean), *comino* (cumin), *envolver* (wrap), *maíz* (maize), *sancochar* (parboil), among others (SÁNCHEZ, 2006, p.194-195). From these, one can extract a structure based on, for instance: Instruments (zip tie), Ingredients (carob bean, cumin, maize) and Processes (wrap and parboil). That is to say, organizations based on their functions within the lexicon as well as on the ontological organizations (or their relations with other concepts that are more related to activities).

Furthermore, ontologies have been mainly applied to the biomedical domain or text mining, which have been used for the design of terminological definitions based on specialized information extraction. That is, they use ontological searches as platform to extract, from various sources, information about the same concept and, from there, provide a definition with said information extracted from the relations. This working methodology is called *Ontoterminology* (ROCHE *et al.* 2009).

Perhaps, the most representative example of the ontological organization of concepts and their related lexical pieces is *WordNet* (MILLER *et al.* 1993). Such network conjugates standardization procedures with an ontological hierarchy based on the semantic relations extracted from English through the distinction of their concepts. *WordNet* is distinguished for performing a search of words in a conceptual way, instead of an alphabet. For MILLER (1993), the lexical matrix of *WordNet* is a representation system that combines forms and meanings in which lexemes can present a series of definitions that is related to other meanings.

However, reducing the ontological methodology to only the search of information is too simplistic given that through ontologies one can also explain in a systematic way the structure of the objects through a hierarchy, both between the categories and within the subcategories, from which minor categories inherit the properties of the superior classes. In this way, from them, it is possible to obtain a structure that, through the instances that each one shares, one can show the organized knowledge of a certain domain.

The approach of this research tries to combine both proposals: the design of ontologies and the organization of an area's specific lexicon. On one hand, the linguistic postulates that the knowledge of the speakers represents about such determined lexical field are taken, and this is interpreted by means of an ontology. On the other hand, one has to take into account that the terminological studies are based on taxonomies under a standardization principle of the concepts (L'HOMME, 2014). This means that they search for a conventionalization within the terms that rule a class, with the purpose of facilitating the search of a general concept. Their relationship with ontologies is done through the links between general classes.

In this way, our focus will be to show that through an ontology's determination based on general definitions, we can achieve the effective arrangement of terms of a specific domain and at the same time to show the relationships between concepts that try to represent the aforementioned terms. In order to achieve this, we will briefly explain the relationship between term and concept seen from some terminological theories and then the perspective from which we will partially enrich the construction of the ontology: the *Ontoterminology*.

## 2.1 TERMS AND CONCEPTS

Concepts are mentally independent from terms and they exist before they are even named, contrary to meaning that, according to Saussure, it is inseparable from the image the sound creates (CABRÉ, 1999). If one understands that a segment of reality, like a cognition process, becomes a concept through abstraction (CABRÉ, 1999), then the established relationship between the real world and the similarities between these objects reflect the relationship and the similarities established between the concepts. The ability of a human being's mind to summarize and make abstractions allows him or her to reduce the vastness of features and properties that objects and their representations have, to a manageable quantity (FEDOR DE DIEGO 1995, p.132). Based on this, we emphasize that the quantity of features, although countable, is a human abstraction that allows us to classify and order concepts, but it is not always the case for any domain. Therefore, a concept has as many realizations as human minds can think of them. We will see how other theories have conceived the concept and how the *Teoría Comunicativa de la Terminología* (TCT) addresses it; which, in the end, is the theory we will mainly rely on in this research.

In the *General Theory of Terminology*, a concept is a thought element, a mental construct that represents a class of objects. Concepts consist of a series of characteristics they share by the classes of individual objects. These characteristics that are also concepts allow us at the same time to structure thought, as well as to communicate with each other. To communicate concepts and the clauses that support them, speakers use linguistic oral and written signs to create a term, a set of terms or other type of symbols (WÜSTER, 1931). The most important feature of the TGT is that it proposes the concepts as priority of the discipline; therefore, the terminological works are directed towards the normalization of terms and notions. The base of WÜSTER's proposal lies in the conceptual relationships as analysis units to reach the denominations of such established concepts. In *General Theory of Terminology* "the concept is a thought unit" (WÜSTER, 1931), exists *a priori*, and the term is a designative unit of this concept whose function is to normalize.

In the *Sociocognitive Theory of Terminology* [TST] (TEMMERMAN, 2000), concepts do not exist as isolated and independent entities, but they exist thanks to the texts where the various authors testify to their way of understanding some categories within a determined structure. When talking about terminology, TST rejects the idea of concept, and it names it as the *comprehension unit*. It considers that the comprehension of the world is possible through cognitive frames in which they connect the different units of comprehension prototypically structured, and only a few can be strictly defined as concepts, so "category" turns out to be a more ideal notion to describe the comprehension unit.

The sociocognitive approach considers ideal to combine three perspectives in the terminological description.

- a) The nominalist, where the comprehension unit is the sense of the world.
- b) The mentalist, in which the comprehension unit is an idea that exists in the mind.
- c) The realistic, in which the comprehension unit is an extreme entity that exists in the universe.

Lastly, for TCT, terms are "[...] lexical units singularly activated by their pragmatic conditions of adaptation to a type of communication" (CABRÉ, 1999, p.132). This means: a term is a linguistic element that greatly depends on the context where it is. It is the context that grants its term status. At the same time, one must think that, therefore, the meaning that that word acquires is not the one commonly used in general speech, or the most adequate to the multiplicity of daily life's contexts: it is the one that rarely arises, and that is restricted to specific communicative situations.

This particular meaning (the concept) is represented by the term that, at the same time, is the designation: the name that takes the concept into the linguistic reality. If we do an inference exercise, the context is the semantic summarization of the concept that is reflected in a term and whose functionality is restricted to the field of specialty where this context acts in order to effectively exert a communicative act.

About the concept in terminology, CABRÉ mentions that knowledge, as a manifestation of reality, does not tend toward the general or the specialized in a systematic way, but the concepts' organization is what allows speaking about one or another, depending on the communicative situation.

Within this same tenor, she indicates that reality can be conceptualized in different ways, and each of them represents a particular realization. In this way, two or more concepts can refer to a reality or object and their perception differs from case to case.

With this view, one can avoid saying that general or specialized vocabulary moves naturally between concepts and terms. That is to say, there is no set of defined rules for a word to become a term, but the selection of a lexical piece within a specialized discourse addresses to merely communicative criteria, and there can always be, like in general language, a variation phenomenon.

The emphasis in existing relationships between concepts and terms, as it can be seen, is inherent to several terminological theories, and this is why we presuppose that it is there where the semantic features are strongly projected and can give indications of other conceptual relationships that are projected on an ontology.

To better understand the stance and precepts that we will consider to address the concept and its relationship with the term in this research, it is necessary to highlight some key points derived from the TCT.

- 1.- Concepts can have different denominations, meaning, there can be a terminological variation, which proves the concept has several realizations (terms), and both terms and concepts form a network that links them (FABER *et al.* 2006).
2. The terminology's subject of study, seen from this perspective, is the term and its linguistic realizations (CABRÉ, 1999, p. 25). The term, at the same time, is a denominative-conceptual unit that is always in relation with other concepts. They are not autonomous, neither terms nor concepts themselves (CABRÉ, 1999, p. 18).
3. Terms are units that, at the same time, have a form or denomination and a meaning or content. The term's content is the concept, and this is simultaneous to the form (CABRÉ, 1999, p. 20).
4. The aforementioned relationships between concepts form a network of meanings that shapes a conceptual structure. Such conceptual structure refers to a same specialized field, in a way that the value testifies to the place in the aforementioned conceptual structure (CABRÉ, 1999, p. 91).

Once we have the postulates both of methodology and studies on ontologies as the current, most relevant perspectives for terminological work, it is worth mentioning that this work will be nurtured, in addition, by ROCHE *et al.* (2009) postulates through a set of criteria we enumerate next.

## 2.2 ONTOTERMINOLOGY

In the proposal that ROCHE and several collaborators (2007, 2009, 2012) have been working throughout several years, there is an emphasis in that conceptualization (as referred above) is not part of natural language, in a way that "the definition of the term paraphrases the formal definition of the concept denoted by the term" (ROCHE *et al.* 2009). In this manner, one of the basic distinctions they make between terminology seen from the classic point of view and the creation of ontologies differs, basically, in the relationships established between the elements that shape it. From our viewpoint, we then understand that ontoterminology makes an unequivocal distinction between lexical relations (hyponymy, hypernymy, etc.) (that would be part of a *lexical structure*) and the semantic relations (*is\_a, a\_kind\_of, part\_of*) which they call *conceptual structure*. In this way, such conceptual structure would be related to the type of relation that the elements referring to a concept establish, through the defining structure whose organization can be parallel. The lexical structure would be referring to the organization of terms in a dictionary or lexical knowledge base through, only, hyponymy, hypernymy-like relationships, etc.; that is to say, a hierarchical organization that would place the terms one below or at top of each other.

Once this is determined, a key point in this research is worth mentioning. The fact that the information used to design our ontology is based on general definitions is related to another important criterion: in corpora, in general texts (non-specialized) is where one can find certain useful information to identify semantic relations more frequently, while in specialized definitions we can more frequently find lexical relations. In this manner, the combination of both can guide us in a better way to build this specific domain's ontology through what its speakers say and by means of what the gastronomic field scholars specify. Even so, other procedures that are specifically related to the design of ontologies are put into practice once the definitions are analyzed given that they are extracted from texts; and texts, as the authors mentioned, lack certain conceptual information that has to be evidenced for the ontology's optimal design.

Namely: "Although we can extract some useful information from texts, ontology cannot be built directly from them since we need ontology for understanding text (understanding text requires extra-linguistic knowledge which by definition is not included in the corpus)." (ROCHE *et al.* 2009, p. 323).

### 3 METHODOLOGY

The sample for this research was extracted from three sources: two printed and one blog. However, only food is taken into account, given that its elaboration is more complex and has particular specifications in each recipe. From the recipe books compiled, two have been selected. The first source are the publications by the Instituto Costarricense de Turismo (ICT) compiled by ÁLVAREZ (2007, 2009, 2008), who started a contest called *Cocina Tradicional Costarricense* in 2001. The goal of this contest is to retrieve each province's traditional cuisine. Each participant sent and prepared their recipe for a jury of the region. The only requirement laid on using products native to each province. Each cookbook is composed of an index with: food, drinks, breads and desserts; 439 recipes in total were compiled. The second source for the sample was taken from the book *Comidas a la Tica* by the self-publishing house SANDY (2009). This cooking book contains food from the Central Valley, Guanacaste and Limón, but only 24 will be extracted from the Central Valley.

Finally, an electronic source was selected that had more than five years of being published and that stayed active on the web; so, the blog *Cocina Costarricense* (GONZÁLEZ, 2014) was selected. This blog has 3 433 129 views since 2007 to this year. The author updated it every month, so the reliability of both the site and the publication of each recipe is guaranteed. In addition, the publication of comments on the blog from people who visit it and make the recipes provide it with dynamism and additional data about the ingredients and preparation. The website is arranged by year, so 2013 has been selected in order to find out if there is any change in the features that the recipes published on the site share, compared to the other two printed sources. In 2013, there are 133 recipes.

Also, in the construction of the ontology presented now, general definitions have been considered using the *Diccionario de la Lengua Española* (DLE)<sup>2</sup> and specialized definitions from the *Glosario de Cocina Popular Costarricense* (SEDÓ MASÍS, 2008). The major categories: **Seasonings**, **Meats**, **Grains**, **Liquids**, **Processed** and **Vegetables** of the ontology of the gastronomic lexicon are classes with general definitions, that is, those which contain the widest and most general ingredients. By being more abstract, they allow the inclusion of subclasses without forcing the ontological structure that is intended to be formalized since, as Spear (2006) states, each ontology provides in its general definition the biggest amount of relations that can be extracted from a concept (in this particular case, of each ingredient and its function in different recipes). Also, this guarantees that the major categories always allow to include subclasses from the other Costa Rican regions such as, for example, Limón or Guanacaste.

Now, the subclasses deserve a special mention given that they comprise more specific categories based on the grouping of the ingredients that share a specific function in each recipe. Then, in order to show each arrangement a *Structural file* in which one can have a more complete vision of the arrangement of each subclass is shown.

#### 4 CONSTRUCTION OF THE ONTOLOGY OF THE GASTRONOMIC LEXICON OF COSTA RICA'S CENTRAL VALLEY

In Table 1, you can see the configuration of the class **Seasoning** which introduces three subclasses: **Spices**, **Herbs** and **Smells**. Additionally, there are the members **Salt**, **Ash** and **Achiote** that due to their specificity were not added under the same subclass, given that they are used with specific functions. For instance, edible lime is used in recipes such as *pozol* in which it is traditionally used to clean and prepare maize before incorporating it to the rest of ingredients.

| Class                     | Seasonings   |
|---------------------------|--|
| Definition                | According to RAE (online): stew or seasoning food    |
| Lexical-Semantic relation | Meronymy   |
| Members                   | Achiote<br>Salt<br>Ash<br>Spices<br>Herbs<br>Smells  |
| Discontinuous with        | Processed<br>Meat<br>Grains<br>Liquids<br>Vegetables |
| Properties                | aromatize<br>peel<br>color<br>give flavor<br>season  |

**Table 1:** Structural file for the category Seasonings

**Source:** author's elaboration

As seen in Table 1, the more general definitions were established by means of their most conventional definitions; in this case, what appears in the Diccionario de la Real Academia Española. However, this first definition has other characteristics that are incorporated in the File, for example, being in meronymic relation and being comprised of *Achiote*, *Salt*, *Ash*, *Spices*, *Herbs* and *Smells*. In addition to this, at the end of the File, one can find the most important properties for the definition *Seasonings* such as its slots; that is to say, the most prominent relation both for the ontology and to understand the function of *Seasonings* for each recipe which allows to aromatize, peel, color, give flavor and season.

Regarding the subclass **Spices**, the following members were found: *olive*, *garlics*, *clove*, *ginger*, *nutmeg*, *paprika*, *pepper* and *vanilla*. According to SEDÓ MASÍS (2008, p. 104), spices are all those parts such as sticks, roots, seeds, leaves or scents that exalt the smell in preparations. Because of this, the property that defines the members of the subclass **Spices** is *aromatize* given that that is their function in recipes.

The subclass **Herbs** are comprised of the following members: *SPEARmint*, *Curry*, *Parsley*, *Rosemary*, *Cumin*, *Oregano powder*, *Laurel*, *Celery*, *Basil*, *Chive*, *Coriander*, *Thymus*, and *Petiveria*. With these characteristics, all herbs are in charge of strengthening the flavor (RAE, online) so its property is defined as seasoning.



The last class of **Dressings** has a more colloquial definition for the Costa Rican culinary context, which is known by the name of **Smells**. We will talk more about this subclass later.

The second major category for the gastronomic lexicon is **Meat**. As well defined by RAE (online version) meat is all or part of an animal which can be edible for the human being; so, in the recipes, **Pork, Bone, Fish, Chicken and Beef** were found. By following the same definition logic which has been developed, two of the properties of meat is due to its primal cut and color. Then, one can find white meat, red meat, bone and ground meat (the complete configuration of this category can be observed in Table 2).

Now then, some recipes that have some kind of meat like, for example, Beef Stew or Tripe Soup, other parts of the animal that are “meatless” (bone) or with a distinctive feature such as being minced or grinded are used.

| Class                     | Meat   |
|---------------------------|--|
| Definition                | All or part of an animal that can be edible by the human being |
| Lexical-Semantic relation | Meronymy   |
| Members                   | pork, bone, fish, chicken, beef                                |
| Discontinuous with        | Seasonings, grains, liquids, processed, vegetables             |
| Properties                | white, bone, minced, red                                       |

**Table 2:** Structural file of the category Meat

**Source:** author's elaboration

Then, these specific properties indicated in the uses of ingredients were registered to determine their relationship with the rest of the classes. For example, in Figure 2, each of the parts of the **Pork** that were found in the recipes compiled is shown.

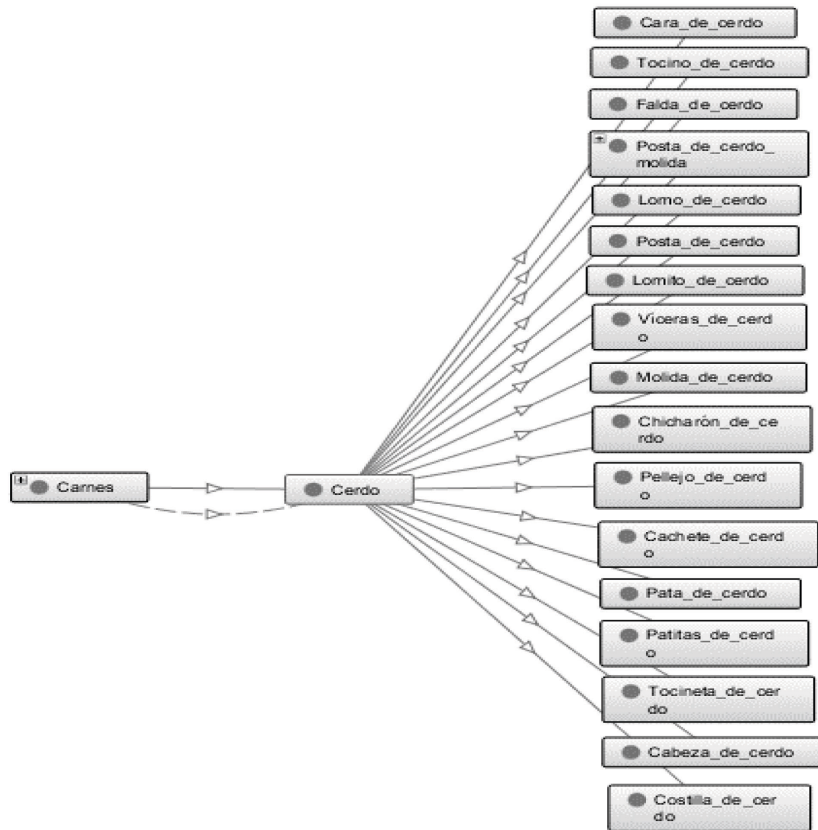


Figure 2: Meat subclasses: Pork

Source: author's elaboration

That very pattern guaranteed that the property *White* can group not only the subclass **Pork**, but also **Chicken** and **Fish**. That very arrangement was established for **Meat** which is not a primal cut or a specific part of the animal, but only “minced” is obtained. Then, this property specific to a kind of meat was considered as property to distinguish meat that is grinded, and that eventually could include other parts of the animal; likewise, the property *Bone*, which was interpreted as “meatless” and from which only some of the properties that are extracted from its cooking are needed. For example, it is specified as fleshy bone, neck bone, shank bone, etc.

In the same way, the subclass **Beef** has a specific property since it is a kind of red meat. This subclass comprises members such as *flank steak, entrails, tail, meat, slice, sirloin steak, rib, in pieces, beefsteak, loin, tripe, beef slice, beef tenderloin* and *jerky*.

The third major category is **Grains**. Now then, the category *grains* is preferred over *cereals* given that the latter has other entries in the Costa Rican lexicon given that it is understood as a synonym of corn flakes or oats. Due to this, **Grains** was established as RAE (online) and GÓMEZ DE SILVA (2004) define it: small seeds of some plants. The complete definition appears in Table 3:

| Class                     | Grains   |
|---------------------------|--|
| Definition                | RAE: small seeds of several plants. Guido (2004): hard seed or fruit similar to a harvest seed |
| Lexical-Semantic relation | Meronymy   |
| Members                   | Rice, chickpeas, maize, beans, peanut, petit pois, coffee                                      |
| Discontinuous with        | Processed, liquids, vegetables, meat, seasonings   |
| Properties                | cooked, raw  |

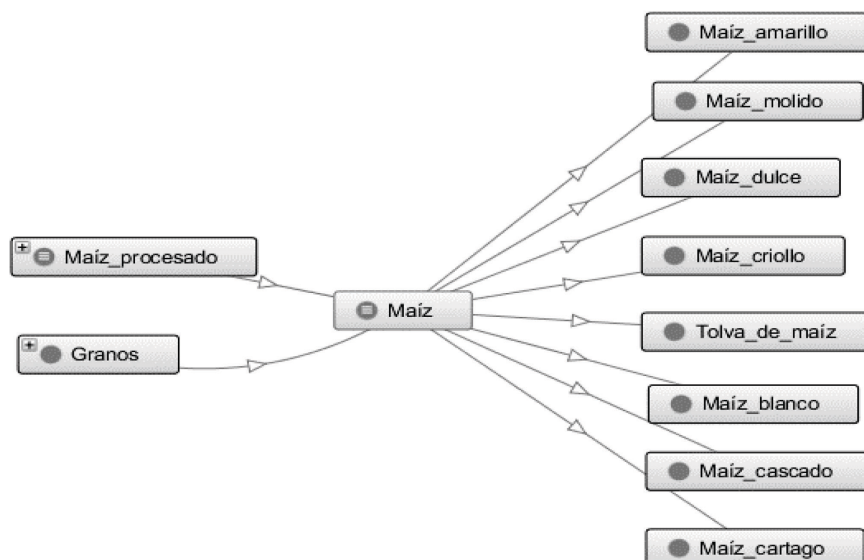
**Table 3:** Structural file of the category Grains

**Source:** author's elaboration

On one hand, each property was determined by the function it has in the recipes and, on the other hand, by how they should be incorporated to the recipes. In most dishes, the way in which the ingredient should be added is specified. In this case, category *grains* has 2 properties; add them raw or precooked.

The difference between how grains should be added, either raw or cooked, helps distinguishing recipes such as *Gallo Pinto* (cooked beans) and a *Tamal asado* (raw maize). The “discontinuous with” box in the File merits special attention since it restricts the combination possibilities that each class has, both in its same level and with major categories. This optimizes the search in the ontology, and allows to obtain a satisfactory result. For instance, if one searches for the term “maize” in the ontology of Central Valley’s ontology, two results are obtained: on one hand, “maize” (raw) and “maize” (cooked-processed). What comes after would be the selection of the term and the context of the kind of maize that is intended to be used (see Figure 3).

The fourth category, **Liquids**, was arranged according to the physical properties of the members that delimit it as category such as *water, soups, juices or sauces, hot water and eggs*. Now, although the majority of terms have a more culinary entry, **Liquids** does not seem to have that attribute, but in the same way as **Grains**, **Liquids** is a category in a superior level that guarantees that any ingredient with liquid or thick base, or that needs to be contained can be included in this class.



**Figure 3:** Grains subclass: Maize

**Source:** author's elaboration

In the same way as the rest of categories, it is mandatory to emphasize on each element of the File (Table 4) that summarizes the treatment each class receives since it is this that shows the behavior of each one and its members in an ontology, based not only on each element that delimits it, but also on the demarcation, the difference that presents against the rest of classes. In the case of **Liquids**, its complete definition is shown in Table 4, so for this class, its definition is the simplest possible, and its classificatory elements polish that simplicity.

| Class                     | Liquids   |
|---------------------------|---|
| Definition                | State in which the ingredients that have that distinctive feature are mentioned |
| Lexical-Semantic relation | Meronymy  |
| Members                   | Water, hot water, soup, eggs, juices, sauce                                     |
| Discontinuous with        | seasonings, meat, grains, processed, vegetables                                 |
| Properties                | cooked, boiled, mixed, natural  |

**Table 4:** Structural file of the category Liquids

**Source:** author's elaboration

Now, the properties of this category should show the different types of liquids that should be added with specific features of each recipe. Taking this aspect into account, as well as the characteristic of its members, each property was defined as cooked, *boiled*, *mixed* and *natural*. Each subcategory that appears in **Liquids** arises from the delimitation of its meronyms in **Sauces**, **Juices**, **Soup** and **Eggs**, which respond to the properties.

**Soup**, is a subcategory that appears mentioned in that way in the recipe books of Central Valley, among which one can find: *chicken soup*, *substance of shank bone*, *beef soup* and *meat substance*. With these entries and, according to SEDÓ MASÍS (2008, p. 63), every soup is any kind of soup that can be only the liquid, or with vegetables or meat, then, for example, in the case of the meronyms *chicken soup* and *beef soup*, they are the liquids that result from the cooking or seasoning of some foods such as chicken and beef.

The following entity, **Eggs**, contains those meronyms that, in spite of coming, mainly, from an animal, are not included as subclass in **Meat**, given that the defined instances for this category only comprise parts of an animal from which its meat has been extracted. Also, with a class besides these meronyms, if the sample is amplified, others can be added without having to define, first the animal from which it comes to later relate them to this entity, but only would directly be included in **Eggs** and from egg would continue with the line of terms that resemble the culinary art. Then, for **Eggs** the following members appear: *whole eggs*, *boiled eggs*, *chopped eggs*, *raw eggs*, *Egg torta*, *scrambled eggs* and *eggs in torta*. As it can be seen about these concepts, some are cooked while others are in their natural state; due to this, the properties *natural* and *cooked* are preferred given that they are based on characteristics of each ingredient according to the recipe. These properties do not alter the reliable limits of the definition of each class (SMITH, 2014).

Another entity that shares the same range of the instance *natural* is **Juices**. This class is defined by the meronyms, generally fruits, from which only the liquid is used, so it is not considered as a subclass of **Liquids**, in which *lemon juice*, *orange juice* and *pineapple juice* appear.

The last entity of the class **Liquids**, **Sauces**, has meronyms in which, despite its characteristic is that of being watery, it is mostly **Processed**, such as: *tomato paste*, *sauté*, *tomato sauce*, *Tabasco sauce*, *Lizano sauce*, and *Worcestershire sauce*; meaning, they are ingredients that have gone through the industry and can be acquired in different places.

The subclass **Sauces**, is defined by its meronymic relationship, in which they are not used in their natural state given that, for instance, Lizano sauce contains water, sugar, iodized salt, vegetables concentrated, molasses and spices, among others. All these

ingredients are not specified in the recipe due to the fact that they are previously bottled; due to this, in the ontology it is specified that **Sauces** shares some of the properties of the class **Processed** by means of an “equals” sign.

Referring back to its arrangement’s File, the property *mixed* adequately responds to these characteristics since what it is used in the recipes is the final result of a series of mixes.

The fifth category, **Processed**, contains the majority of ingredients mentioned in the recipes. All the ingredients that do not involve a home-made elaboration comprise the class **Processed**, that is to say, those meronyms which are recognized because they can be bought in different commercial establishments. Also, they have a series of meronyms that delimits it, characterized by the particular properties that are extracted from each of them. Again, it is important to observe its arrangement in the File that appears in Table 5.

| Class                     | Processed  |
|---------------------------|--|
| Definition                | The ones that are elaborated in an industry, they are bought, ready  |
| Lexical-Semantic relation | Meronymy   |
| Members                   | oil, bicarbonate, chorizo creole, Argentine chorizo, consommé, asparagus cream, sweet cream, fat, flour, ham, milk, milk powder, liquor, lard, butter, margarine, mayonnaise, maize, bee honey, mortadella, mustard, custard, baking powder, cheese, sausage |
| Discontinuous with        | seasonings, meat, grains, liquids, vegetables  |
| Properties                | condiments, cold cuts, fermented, fats, baked, dairies, doughs   |

**Table 5:** Structural file of the category Processed

**Source:** author’s elaboration

In this particular case, the definition of the class **Processed** was determined by means of the function and origin of each of the ingredients that appear as members in the File (Table 5). Another of its features is, on one hand, being discontinuous with the classes that do not delimit it such as **Seasonings, Meat, Grains, Liquids** and **Vegetables**, and on the other hand, having properties that have gone through some industrial or chemical treatment. To better understand this category and its structure, see the following figure.

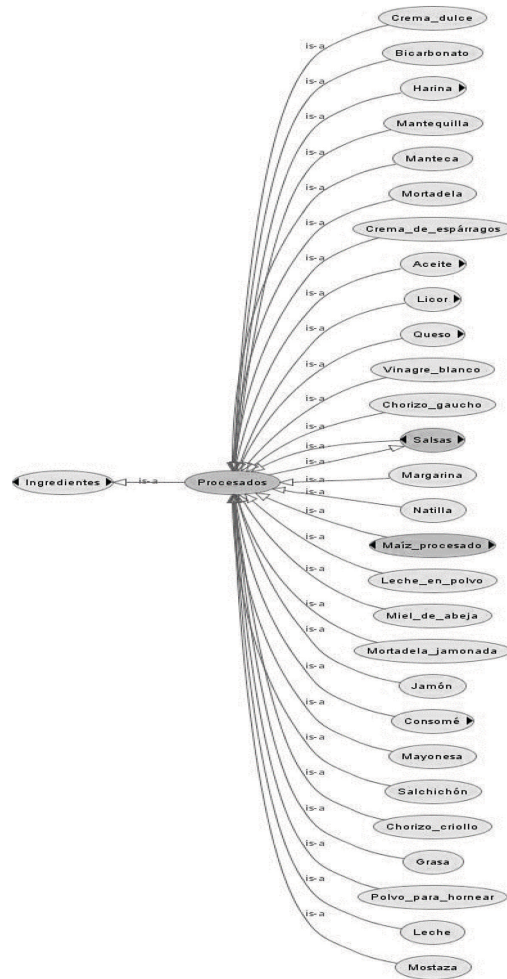


Figure 4: Structure of the category *Processed*

Source: author's elaboration

As we can see in Figure 4, the delimitation of the category **Processed** has both individual ingredients: *mustard*, *sweet cream*, *salchichón*, *mayonnaise* or *lard*; and ingredients that are a subclass that provides the major category with specificity since it allows to confirm that that class works adequately to group a series of classes and subclasses.

The wide relationships between the subclasses of **Processed** show that within the corpus, there are two poles. On one hand, the meronyms that are extracted directly from a plant or part of an animal or vegetable, meaning, natural and used directly in the recipes. On the other hand, the ones that present an additional elaboration external to the sample, the ingredients that are generally bottled or artificial, For example, *consommés*, *sodium bicarbonate* or *baking powder*, produce specific chemical reactions that in combination with other ingredients, results in an increase of temperature or growth in the mass of food.

The subclasses that delimit this category are found in: **Oil**, **Consommé**, **Flour**, **Liquor** and **Cheese**. Then, each definition of these subclasses arises from a chemical change previously industrialized. The subclass **Oil** comprises those greasy liquids that cannot be dissolved in water, and that can have different origins, either animal or vegetal. Among these there are: *vegetal oil* and *olive oil*. The meronyms of the category **Oil** are defined by means of the property based on their implementation in the recipes, either to fry or season the types of salads in which its more general feature consists in being a *fat*.

The instance *fats* relates those subclasses in which their feature, non-soluble in water, is shared by the meronyms such as: *Bee honey*, *Sweet cream*, *Asparagus cream*, *Butter*, *Oil*, *Lard*, *Custard*, *Margarine* and *Mayonnaise*. The six subcategories of **Processed** (Figure 4), although different entities, their ontological relationships establish that each of them has at least a property that bonds them, and make them members of a specific category, and for this reason are different from **meat**. Then, that property places them as part of another entity that was defined as *cold cuts* (Table 5).

The property of **Processed**, for these subclasses, is defined as *cold cuts*, according to the RAE (online version); a cold cut consists of an intestine filled with ground meat, which is added with some spices or condiments to preserve its flavor.

In addition, the way these ingredients are obtained is in a cylindrical way, so the property adapts to the description of the individuals that comprise each class such as *chorizo creole*, *Argentine chorizo*, *ham*, *mortadella* and *sausage* (salchichón).

The next class in which the lexicon of Central Valley's gastronomy is structured is **Consomme**. In general terms, *consommé* consists of a concentrated chicken soup; but, in the case of the data found in the sample, *consommé* is indicated as a type of artificial condiment that contains added salts to emphasize the flavor in the preparations. In the same way as the classes that belong to the instance *cold cuts*, *consommé* consists of small bags with condiments ready to use that can be bought, and it is for this reason that they are placed in this category.

All subclasses of *consommé* such as *small cubes*, *mixed condiment*, *whole seasoning*, *beef small cubes*, *ajinomoto*, *beef rib consommé*, *chicken small cube*, *salt* and *meat seasoning* are ingredients that are added according to the type of animal fat that is intended to be prepared with. The majority of these are pulverized and previously industrialized, so it is common to find them in the corpus with the name of the company or *ajinomoto*. All these characteristics are part of the definition, in their hyponymy relationship, given that their general sense is to salt, preserve and increase the flavor of food; due to this, the property that ontologically links these classes is named to *condiment* (see Table 5).

Another subcategory within **Processed** is **Flour**, which comprises a series of meronyms such as *bread*, *angel hair*, *bread crumbs*, *grated bread*, *bread powder* and *mature bread*. The instance that relates the category **Flour** with the meronyms that are within its class is the property *baked*.

This property describes those individuals that represent a previous baking process before being incorporated to the recipes.

The entity **Cheese** is defined by a series of subtypes of cheese used in different recipes of gastronomy, so the ontological hierarchy keeps responding to the lexicon found, in which each subcategory reaffirms the structure since it arises from the most general sense within the hyponymic relations that were defined by their relations. The feature, its property, its definition, in its most general sense among each meronym, is that they are part of, or are obtained from a *dairy product*.

The category **Liquor** includes those ingredients that, contrary to the class **Liquids**, are comprised by a type of liquid different to the one that the individuals share with the instance *natural*. The value of its property is obtained from the meronyms' features within a set defined by *wine*, *beer* and *red wine*. One of the characteristics of the conceptual structure of the meronyms in the category **Processed** that the gastronomy lexicon presents in the entity **Liquor** is that the relation with the rest of the individuals is due, mainly, to its condition of "previously elaborated". This process that is characteristic to *beer* and *wine* is fermentation, which was established as property that links these meronyms in the ontology.

Finally, the entity **Processed Maize** has been added to the class which it is a member. This entity follows the distinctive features of the meronyms found in the gastronomy lexicon that differentiates the category **Processed** since in this class there are entities registered that are completely ground such as *rich dough*, *tortilla dough* or *cornstarch*, which are obtained from maize, but they imply a different production from the rest of meronyms in the ontological hierarchy such as *maize dough*, *cheese tortilla*, *home-made tortilla*, *tortilla dough*, *store-bought dough*, *windmill dough*, *cornstarch* and *MasaRica*<sup>3</sup>. The instance that characterizes the class **Processed Maize** is called *dough*. According to the RAE (online version) dough consists of a mixture that comes from the addition of a liquid to a pulverized matter to obtain a whole; due to this, and according to the sample data, it is the property shared by the meronyms in this class.

The last category of the ontology of the gastronomic lexicon is **Vegetables**. This category covers all those meronyms that are part of vegetables, tubers, leafy vegetables, legumes and fruits found in the corpus. The definition of this category is based on the distinctive

features of the meronym's composition; that is to say, if in previous classes one was defined that represents the lexicon related to animals, it is not strange that by opposition there is an ontological category that gathers the vegetables' lexicon, which can be eaten by humans. This can be completed with data in Table 6.

|                           |  |
|---------------------------|--|
| Class                     | Vegetables   |
| Definition                | RAE: organic being that grows, lives, but does not move from one place to another  |
| Lexical-Semantic relation | Meronymy   |
| Members                   | cushaw pumpkin, sugar, watercresses, sweet potatoes, chayotes, chaya, indian shot, cauliflower, spinach, fried, guinea, cauliflower leaves, beetroot, cabbage, yucca, mushrooms, <i>kaywa</i> , lettuce, eddoe, heart of palm, potato, fruits, plants, tubers, cucumber, pipián, banana, leek, poró flower, pumpkin sprouts, beetroot, green cabbage, radish, tacacos, bamboo, arrowleaf elephant ear, tomatoes, green beans, vegetables, yucca, carrot, ñampi |
| Discontinuous with        | seasonings, grains, meat, processed, liquids   |
| Properties                | raised, fruits, tubers   |

**Table 6:** Structural file of the category Vegetables

**Source:** author's elaboration

This major category is delimited by those vegetables that are plants, fruits or tubers, that is, "organic beings that grow", and that in this case are extracted from the land's cultivation. Due to this, the properties that delimit this class are obtained such as *raised*, *fruits* and *tubers*.

The property *raised* comprises the entity **Vegetables** since it is extended over the majority of subcategories. This property is characterized because it relates the meronyms *cabbage*, *spinach*, *cucumber*, *green beans*, *lettuce*, *mushrooms*, *cauliflower*, *chaya*, *leek*, *watercresses*, *pumpkin sprouts*, *tomatoes* and *heart of palm*. The RAE (online version) defines *tubers* as underground stems or roots from which different vegetables are extracted. This feature bonds subcategories like **Potato**, **Arrowleaf Elephant Ear**, **Yucca** or **Ñampi**.

The last universal of the category **Vegetables** is **Fruits**. According to the meronyms found in the sample, there are those entities which are in this class that are fruits and are obtained from certain edible or wild plants such as *papaya*, *mango*, *bananas*, *apples*, *almonds*, *raisins*, *peach-palm* and *nacaderos*. Then, each definition strengthens its use in different recipes.

## 5 CONCLUSIONS

Throughout the construction of the ontology, we have seen that this methodology, and the work in general, is guided by the clues and the structuring of the consulted dictionary definitions (both general and terminological), which gave as a result a systematic lexical organization that opened the path to the configuration of classes. Now then, it is important to emphasize; however, that this attends to the information proceeding from known, popular recipes, so the conceptual arrangement was modified according to what Costa Rican speakers have established as subclasses from major categories. In this manner, the arrangement of the terms referring to Costa Rican Central Valley gastronomy takes these three aspects into account and are identifiable at first sight: the ontological, the terminological and the ontoterminological.



In this way, in this meronymic ontology of the ingredients, the different categories were modeled in which one can arrange the lexemes of Central Valley's gastronomy. The categories arise from the definitions found not only through the relations that they establish with the meronyms that delimit them, but also through the definitions given by different gastronomic researches like that of SEDÓ MASÍS (2008) and GÓMEZ DE SILVA (2004).

Regarding the latter, we are interested in showing an interesting finding related to the neological factor. This research shows that the proposed ontology for this gastronomic lexicon, in this specific region of the Spanish speaking world, testifies to categories that *do not exist* neither in the *Glosario de cocina popular costarricense* (SEDÓ MASÍS, 2008), nor in the *Diccionario de Costarriqueñismos* (QUESADA PACHECO, 2012). The omission of these categories clearly shows that the terms have been arranged historically taking only the lexical factor into account but not the conceptual arrangement. The design of this ontology under the scope of the postulates corresponding to different terminological theories and their conception in the *term/concept* differentiation together with the differences on *lexical structure/conceptual structure* that we have rescued from the ontoterminology postulates allows us, then, to integrate categories that have to do with the words in the Central Valley recipes. As an example, we can find the categories *Seasonings* and *Vegetables*. In this case it is important to see the root that they have through the analysis of their components and the subclasses that comprise them. Next, we will see the first case.

During the compiling, there were recipes in which, although it said "add vegetables", the ontological arrangement generated that the aforementioned term was in fact a category and it is even, in plural. In these cases, we believe the authors of the recipes thought that people knew which elements of the semantic field *vegetables* could be used or perhaps they foresaw that readers would choose the ones they preferred the most. These two categories, in this manner, give us a good sign of the traditional gastronomy evolution as well as the current terminological rearrangement. In this sense, the elements that correspond to the category give rise to, even, the discovery of specific subclasses. Now, we will see the second case.

In the category *Seasonings* we found a subclass called **Smells** (olores). Traditionally, when spoken about smells, it is understood that the preparations include chili and onion. In some recipes there is a direct mention to that designation. Costa Rican traditional cuisine glossaries such as Sedó Masís's (2008) acknowledge the term *Smells* as "natural products to emphasize the flavor of other ingredients like chili and onion". Also, Sedó Masís (2008, p. 166) mentions that this designation is excluded from the herbs group, so within the ontological architecture it must have its own subclass:

**Olores:** término para referirse, de manera general, a los productos naturales para realzar el sabor de las comidas. En el caso de Costa Rica, los "olores" más utilizados son la cebolla, el ajo, el culantro y el chile dulce. Generalmente, las hierbas no son incluidas dentro de este grupo, tal es el caso de orégano, tomillo o albahaca. En algunos casos, a estas últimas se les conoce como "yerbas de olor".

Figure 5: Definition of "olores"

Source: Glosario de cocina popular costarricense, Sedó, 2008

Finally, with these two cases as examples, among others<sup>4</sup>, we can add that this research provides a clearer visual perspective on the Central Valley ingredients arrangement in the different recipes in such a way that, if we pay close attention to it, the definition of **smells** leads us to think, as shown in the consulted glossaries, as a term, but when we move on to the use (to the recipes and the corpus) it is evident that it is more than a term, that it refers to a whole conceptual category that is, in turn, a subclass of *Seasoning*. A contribution like this has only been possible through the review and comparison of specialists and speakers' information.

We can mention three unavoidable categories that make this ontology different from the rest and that correspond with the different terminological perspectives we have reviewed. First of all, regarding the General Theory, it is confirmed that the concept can represent a class of individual objects. Even when they were not present, the two categories mentioned above enabled to see how the gastronomic lexicon was structured in relation to the speakers' thought. This perspective allowed us to focus on the relationships of the elements with the concepts and, therefore, determine that some term was not such, but rather the denomination of a category. This, finally, helped us knowing that some terms are more normalized than others according to their attachment to certain categories.

Secondly, it is worth noticing that, according to the TST, if concepts do not exist as isolated entities, but they do thanks to the texts where authors identify the categories of a specific area, then the appearance of those texts is necessary for a correct arrangement of a terminology. It is because of this that we included the recipes and the texts comprising the corpus, and not only dictionary definitions. When we find cases like that of gastronomy, and this is very important, the validity of the lexicon's arrangement does not strictly lie on the specialists but, as we have also mentioned, the speakers of the community (and sometimes the less knowledgeable) are the ones who preserve the conceptual structuring of such area. It is important not to ignore that the recipes, the names of the ingredients and many more preparations are patrimonial; meaning, more than being object of a specialty discourse, they are preserved in the oral, the colloquial, in shared knowledge. Taking this into consideration, it is worth mentioning we think that there are comprehension units that not always can be structured in a logical or ontological way, but we also consider that the categories that this theory refers to correspond with the analyzable categories from the definitions we used and that go through the mentalist and nominalist description, but not always through the realistic one. (It is worth mentioning the classic example of someone's silence when somebody gives them something they have never eaten and are asked: what does it taste like?).

Thirdly, and finally, we think we have shown with clarity the idea we share with the TCT regarding that knowledge does not always tend toward the general or the specialized, but that the arrangement of concepts adapts to the communicative situation. This also becomes tangible in an important resource: people who cook, even without being specialists, have been able to identify the concepts associated to the dishes they prepare and have been able to transmit them through recipes; in fact, they have identified categories that specialists have not taken into consideration for the construction of their glossaries and dictionaries. This leads us to an interesting reflection: would recipes enter in the area of specialized discourse or would they belong to a general, cultural discourse that is related to home topics? The answer seems clear. This type of linguistic emissions adapts to the communicative situation, or it is structured in such a way that readers, whatever their academic level may be, can follow it to the letter. The communicative focus of the terminology, in regards to this topic, seems to have a point in favor.

This very "disagreement" or arrangement according to the communicative situation (between the terminological arrangement and the conceptual arrangement) is tangible, for example, in supermarkets, where we can find products such as tomato or avocado, which, clearly, from the viewpoint of a botanist are fruits, in the sections exclusive to vegetables, along with pumpkin, potato or chayote, just to name a few.

So, what this research has intended is to put the "disagreement" in play between speakers and specialists to demonstrate that an arrangement of an area's terms is possible, in this case regarding gastronomy, to observe the conceptual arrangement a culture has in regards to its ingredients, recipes and flavors. Such rearrangement is only possible if the terminological, ontological and social dimensions (which here has been contextualized as *ontoterminological*) of the group of people that use part of their lexicon to refer to a specific reality. We wanted to show that these words or terms refer to that part of their reality and the conceptual relationships that intertwine between terms and concepts, must always observe the use their speakers give them depending on the region where they live given that it will be a reflection of the mental arrangement, together with the social structure of a speaker community.

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