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Theories of Argument Structure: The connection between lexical information and syntactic structure

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Abstract. This work discusses the different theories that have attempted to explain the relation between the lexical information provided by a predicate and the syntactic structures that introduce arguments. The focus of the article is on the different sets of assumptions and predictions made by endo-skeletal theories, where lexical items somehow condition the syntactic projection of arguments, and exo-skeletal theories, where lexical items must adapt their meaning to whichever argument structure syntax has defined. In doing so, the article reviews the Theta Criterion, the thematic hierarchy, the notion of linking, the syntactic and semantic decomposition of lexical verbs and the different types of theta role definitions from a formal semantic perspective.

Keywords. theta roles, arguments, predicates, thematic hierarchy, Theta Criterion, UTAH, endo-skeletal and exo-skeletal theories

Resumen. Este trabajo discute las diferentes teorías que han intentado explicar la relación entre la información léxica proporcionada por un predicado y las estructuras sintácticas que introducen argumentos. El enfoque del artículo está en los diferentes conjuntos de suposiciones y predicciones hechas por las teorías endo-esqueléticas, donde los elementos léxicos de alguna manera condicionan la proyección sintáctica de los argumentos, y las teorías exo-esqueléticas, donde los elementos léxicos deben adaptar su significado a la estructura argumental definida por la sintaxis. Para ello, este artículo revisa el Criterio Temático, la jerarquía temática, la noción de enlace, la descomposición sintáctica y semántica de los verbos léxicos y los diferentes tipos de definiciones de papeles temáticos desde una perspectiva semántica formal.

Palabras clave. papeles temáticos, argumentos, predicados, jerarquía temática, Criterio Temático, UTAH, teorías endo- y exo-esqueléticas

1. Main problems posed by argument structure

It is generally accepted that a complete description of a lexical predicate must include information about its argument structure, which we will provisionally define as the set of participants that a lexical predicate requires in its syntactic structure. It is said for instance that *morir* 'to die' has an argument structure with one single participant, interpreted as an entity that undergoes or suffers a change of state ('patient') and *matar* 'to kill' has a more complex argument structure with two participants, a patient and an entity that somehow triggers the change of state in the patient ('agent' or 'causer', depending on other assumptions). This claim explains that (1a), but not (1b), is a well-formed predicate in Spanish, and it also explains that (2b) requires us to interpret a second participant, corresponding to the patient, that is implicit although it lacks (at least) a phonological manifestation, perhaps also a syntactic constituent that stands for it.

(1) a. Napoleón murió en 1821.
Napoleon died in 1821
'Napoleon died in 1821'
b. *Los británicos murieron a Napoleón en 1821.
the Brits died DOM Napoleon in 1821

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Intended: 'The Brits made Napoleon die in 1821'

(2) a. Bruto mató a Julio César en el 44 a.C.
Brutus killed DOM Julius Caesar in the 44 a.C
'Brutus killed Julius Caesar in 44 a.C.'
b. El cianuro mata.
the cyanide kills
'Cyanide kills'

'Argument structure' is a concept frequently used in any study discussing lexical predicates, classes of predicates and the structure or interpretation of verbal phrases. As such, it is a common concept in syntax, semantics, morphology and lexicology. However, the term 'argument structure' descriptively refers to a quite complex set of pieces of information that are somehow associated to specific lexical predicates. It refers not only to the number of participants associated to a lexical predicate, but also to the specific semantic relation that each one of the participants hold with respect to the eventuality. Additionally, any claim about the argument structure of a lexical predicate presupposes that syntax provides distinct positions for each one of the participants, in effect implying that the choice of the specific lexical predicate used –'kill' or 'die', for instance– plays a direct role in how many syntactic positions must be created, activated or allowed in the syntactic structure.

For these reasons, in this article I will concentrate on a discussion of the basic machinery that defines the argument structure of a predicate and how this argument structure interacts with the semantics of the lexical predicate, the syntactic configuration and the broader linguistic context where the predicate is introduced. In this article, I will therefore focus on the following set of questions:

a) How can the argument structure of a predicate be diagnosed?
b) How does the argument structure of a predicate connect with the predicate itself?
c) Which principles restrict the number of arguments and their interpretation for a given lexical predicate?

This involves discussing the elements that intervene in defining the argument structure of a predicate, including the number of argument positions and the theta roles that are available in each one of them, but also discussing principles that restrict argument positions to particular syntactic contexts.

In the rest of this section, I will present in more detail the main types of questions that the concept of argument structure raises. In §2, as a background, I will introduce the central problem of how something can be diagnosed as an argument –as opposed to a modifier or adjunct–, I will present the standard classification of predicates according to their number of participants and I will introduce theta roles, the so-called Theta Criterion and the basic division between types of argument structure theories in two types: those where predicates project their argument structure from the lexicon and those where syntax defines argument structure and individual lexical items must accommodate their meaning to that structure. After this, I will discuss different types of approaches to how argument structure is dealt with in syntax and semantics. §3 presents Baker's (1988) UTAH hypothesis and discusses some of its empirical challenges; §4 discusses approaches where syntax has been proposed to restrict the number of possible arguments, and §5 discusses how the Theta Criterion has been revised as a precondition to define purely exo-skeletal approaches to argument structure. §6 introduces and discusses linking theories proposed within projectionist approaches to account for the regularities between theta-roles and argument positions attested across languages. In section §7, I present the different theories about the nature of theta-roles and how these can be

accommodated into semantic theories, with a brief discussion about the theta role of 'agent' whose goal is to illustrate the complexity involved in finding a grammatically-relevant definition of a particular theta role. In §8, I concentrate on what I call The Rigidity / Flexibility Tension, and compare endo-skeletal and exo-skeletal approaches to show how they address cases where one lexical predicate (dis)allows different argument structures.

This means that I will leave outside this article two important issues whose complexity requires independent future articles. This article will not discuss the important problem of argument structure alternations and lexical verb classes (Levin 1993), even though I will briefly refer to some of their most common instances in the course of the discussion, as a way to illustrate some of the complications that the theories presented here have to face. Second, I will not discuss the definition and delimitation of most theta roles, including the complex problem of what types of patient / theme interpretations are grammatically relevant and which relations can be obtained between theta roles marked with the dative. These problems are so complex, and involve so many different syntactic, semantic and lexical ingredients, that they will get dedicated articles in this same journal during the next coming years. In the current article, I will limit myself to mention these issues when they are relevant for the theories that I will discuss, focusing on the more architectural issues related to the nature and format of argument structures.

1.1. Argument structure as conditioned by the lexical verb

I have already mentioned that one significant property of argument structure is that, in principle, it seems one of the ways in which individual lexical elements can condition the nature of the syntactic structure that is built above them.

Note that this strongly contrasts with what we know about other syntactic relations. Within a clause, individual lexical predicates do not have a saying in whether projections for grammatical aspect, mood, tense, subject agreement or modality should be projected and which ones in that case. Irrespective of whether the lexical verb is 'kill' or 'die', under the right conditions, the presence of grammatical aspect, mood, tense, subject agreement and modality is compulsory and without some type of information about them the structure is ungrammatical:

(3) a. Viv-ía -mos aquí.
live-impf.ind.past-1pl here
'We used to live here'.
b. *Viv-i aquí.
live-verb here

Given a specific lexical verb, in contrast to the situation sketched in (3), whether we project an agent or not –for instance– triggers anomalies that depend on some properties of the verb used; the two nominal constituents in (1b) trigger an anomaly that is not triggered by introducing two nominal constituents in (2a), for instance. Note that clausal structure –the type of sentence we use– is able to determine whether agreement must be present or not (**John wants that Mary comes*), which moods can be used (**John ordered that go* –imperative–) or whether some particular modality is available under a particular main verb (**John wants whether Mary is sick or not*) but no researcher has identified any type of subordinate clause that, for instance, only allows verbs with one single participant, or requires verbs to have at least two participants. Clausal structure may decide the syntactic function of each participant –as in active vs. passive– and its availability might be restricted by the argument structure of a predicate, but no language has a restriction of the type 'Verbs with only one participant cannot appear in subordinate clauses'.

At this point, we may expect that each (type of) lexical predicate uniformly determines how many participants are required, but this is again not the case with many of them, that allow two or more different construals differing on the number and type of participants they have. See the following example:

(4) a. El semáforo cambió.
the traffic-light changed
'The traffic light changed'
b. El operario cambió el semáforo.
the worker changed the traffic-light
'The worker changed the traffic light'

In (4a), we only have one nominal constituent expressing a patient participant 'the traffic light', and we do not necessarily interpret that there is a second participant that acts as an agent, triggering the change. Consequently, we view that change as internally caused, as happening spontaneously, as triggered by the traffic light itself, etc. In (4b) we introduce a second participant, which specifies that there was an entity, a worker, that acted as the agent of change. The verb has not changed any of its properties, apparently. This verb seems to be compatible, then, with two distinct argument structures.

These facts trigger a second set of research questions that we will discuss in this article:

i) What determines the argument structure of a lexical predicate?
ii) Why does the argument structure seem to depend on factors that tense, aspect, mood and other syntactic properties are not sensitive to?
iii) What determines which argument structures a verb is compatible with?

1.2. Identifying argument structure: initial problems

The same verb, equivalent to English 'change', allows us to illustrate a second set of problems. Consider the examples in (5):

(5) a. El semáforo cambió de color.
the traffic-light changed of colour
'The traffic light changed colour'
b. El color del semáforo cambió.
the colour of.the traffic-light changed
'The colour of the traffic light changed'
c. El operario le cambió el color al semáforo.
the worker it.dat changed the colour to.the traffic-light

In (5a) we have added an additional phrase, this time a noun introduced by a preposition. Is this PP constituent a participant of the event? The answer is not directly clear: in (5a), in fact, we do not interpret that the traffic light, as an object, has changed; we interpret that one of its properties, which is specified with *de color* 'of colour', is what is actually subject to change. In the way we are building this sentence, one could argue that the traffic light is not a patient that undergoes a change, but some participant that triggers a change in the colour that it displays – obviously, the traffic light, as an object placed in the street, has the same colour before and after the change, and what we mean with (5a) is that the light that shines within the upper part of the traffic light has changed –for instance, from green to yellow–. So perhaps we want to say that *de color* is a patient participant of the same event where the traffic light is some type of agent or causer.

The problem, however, is that the same meaning expressed with (5a) can be expressed with (5b), where only one of the two nominals directly relates to the verb: 'the colour'. What we thought was a different participant in (5a) can in fact be expressed as some type of possessor in (5b), 'the colour of the traffic light'. The possibility of expressing the sentence like this may suggest that *de color* in (5a) should not be seen as an independent participant: after all, that PP describes one of the properties of the traffic light, and at a very intuitive level we understand that the colour cannot exist without the traffic light, as the colour that shines from it is part of what we interpret corresponds to a traffic light. In this sense, then, maybe we want to go back to (5a) and say that the PP *de color* is not actually a participant of the eventuality, but some further description that specifies (as a modifier, or as an independent predicate) the only real participant, which is 'the traffic light', which after all then should be interpreted as patient.

(5c) makes things worse, because now we have 'the colour' as the direct object of the predicate, 'the traffic light' as an indirect object and a subject acting as an agent that triggers the change of the colour. Our general assumption, which we will detail later, is that only participants can be manifiested through the major syntactic functions of the clause: subjects must always be participants, direct objects must always be participants. Things are not so clear with indirect objects, as we will see, but at the very least subjects and direct objects should correspond to participants. The fact that (5c) expresses the colour that changes as a direct object may be taken as an argument that it is, after all, a participant in the event.

Beyond highlighting that one and the same predicate may be combined with different argument structures, as we already knew, the examples in (5) introduce another set of complications: sometimes the participant status of an element is not immediately obvious, and one may want to consider the possibility that, under certain conditions, a constituent might actually be a modifier. This is particularly salient in cases where one of the constituents establishes a very strong semantic relation with another participant, because in such cases we will need criteria to determine whether that semantic relation is stronger than the one that each one of them establish with the verb, and whether the syntactic structure supports an analysis where one depends on the other, or where both depend on the verb. Secondly, if we were to propose that *de color* 'of colour' in (5a) is a participant, we will have to assign a semantic interpretation to it that is different from the one that 'the traffic light' has in that same sentence –there are both theoretical and empirical reasons for this, which we will present in §2–.

Thus, (5) directly introduces the following set of research questions:

i) How can we determine that a constituent is a participant within a structure?

ii) To what extent being a participant can be deduced from the semantic meaning of the predicate?

1.3. Limits to the number of arguments: a first approximation

Finally, another central problem in the study of argument structure is the delimitation problem. Imagine that, in order to explain why lexical predicates seem to define their argument structures irrespective of the general structure of the clause, we adopted a purely semantic view of argument structure: the argument structure of a predicate simply reflects what type of situation a predicate describes. This approach has a lot of initial appeal: we could say that 'die' takes one participant because it describes a change of state without including in the description what caused the change, and 'kill' takes two participants because it describes a more complex situation where the causer of the change is also included. We could even say that verbs like 'change' are semantically vague enough to be compatible with the two types of situations.

If one trusted that argument structure is directly related to the meaning of a lexical predicate, then it would come as a surprise that the number of participants and the semantic interpretation that is associated to each one of them is quite restricted. In the languages of the world, as we

will see in §2.2, verbs seem to be restricted to a maximum of three participants –in some cases, perhaps four–, and no verb has ever been identified that introduces five participants. However, our world knowledge tells us that we can have situations with five participants. Imagine for instance that John (participant 1) makes Mary (participant 2) drive a tractor (participant 3) over a field (participant 4) to destroy the weeds (participant 5) that cover it. No language, as far as we know, has a single verb that means 'to make someone drive a vehicle over some area to remove something from it', and therefore no language can build a sentence like (6), even using prepositions to license case.

(6) *Juan le blablabl-eó a María el tractor sobre el campo contra malas hierbas.
Juan her blabla-ed to María the tractor over the field against bad weed

Additionally, as we will see, the semantic interpretations that can be assigned to each participant seem to be quite restricted as well. Even though the amount of different relations that we can conceive between participants and eventualities is very high in our world knowledge, most accounts of argument structure manage a dozen or so of semantic interpretations, including notions like 'agent', 'theme', or 'goal'.

1.4. The delimitation of theta roles: a first approximation

In fact, the nature of these notions –called 'thematic relations' or 'thematic roles' since Gruber (1965)– is unclear, because there is no consensus with respect to which semantic characteristics define each one of the thematic relations, and how they should be differentiated from each other. Consequently, the usual theta roles that one can find in a textbook are frequently split or merged in more technical proposals.

Table 1 reproduces the definitions of the most usual thematic relations as they appear in Gruber (1965):

Table 1. Main thematic relations according to Gruber (1965)

Theta role	Definition
Theme	The entity that is conceived as moving [in spatial or abstract motion] (1965: 48); the entity whose position is asserted (1965: 61)
Agent	The intender of the action (1965: 215)
Goal	The place reached [in a spatial or abstract motion]; the ultimate destination of the motion (1965:85)
Source	The negative of goal (1965: 68-69)
Location	Place involved in the expression of an event (1965: 70-75)

Gruber (1965) never provides a full semantic analysis of these concepts, that he acknowledges are intuitively treated and described without formal definitions, partially because his goal is to show how these basic notions become non-explicit parts of lexical verbs. In some cases, he in fact splits some of these thematic relations into subclasses: he treats for instance spatial goals (*go to the shop*) differently from what he calls possessor goals –recipients, as in *give to John*–, and he differentiates between what he calls causative agents (as in *John chased the cat*) and permissive agents, where the second does not volitionally act to produce a situation but volitionally allows a situation to happen (as in *John released the cat*) (1965: 225). Gruber's (1965) treatment of theta roles is characteristic of the general non-formal characterisation of these relations. Butt (2006) shows that similar notions were already

described in an intuitive way in Panini (table 2, as a curiosity, reproduces part of that information).

Table 2. Thematic relations in Panini, from Butt (2006)

Theta role	Definition
Agent	the independent entity (the one that acts with independence of others; *kardr*)
Patient	whatever the kardr desires [to cause or accomplish]
Locative	the locus or location of the action (*adhikarana*)
Instrument	the effective means used for something (*karana*)
Source	the fixed point from which something comes (*apadana*)

To see how different researchers differ from each other in what they understand for each theta role, in Table 3 I provide the definitions found in three introductory texts, Haegeman (1995), Bosque & Gutiérrez-Rexach (2009) and Saeed (2016). Grey filling in a cell means that that theta role is not contemplated in the textbook.

Table 3. Thematic relations in three textbooks

Theta role	*Haegeman (1995: 49-50)*	*Bosque & Gutiérrez-Rexach (2009: 273-274)*	*Saeed (2016: 150-151)*
Agent	(or actor); the one who intentionally initiates the action expressed by the predicate	the participant that brings about the event	the initiator of some action, capable of acting with volition
Instrument		the tool or means used to perform the eventuality	the means by which an action is performed or something comes about
Stimulus			the entity causing an effect (usually psychological) in the experiencer
Cause		the reason or source of the alteration related to the eventuality	
Patient	the person or thing undergoing the action expressed by the predicate		the entity undergoing the effect of some action, often undergoing some change in state
Theme	the person or thing moved by the action expressed by the predicate	the participant that becomes affected by the eventuality, that is, that changes, displaces or	the entity which is moved by an action, or whose location is described

		undergoes some process	
Experiencer	the entity that experiences some (psychological) state expressed by the predicate	the participant that perceives or experiences the eventuality	the entity which is aware of the action or state described by the predicate but which is not in control of the action or state
Benefactive / Beneficiary	the entity that benefits from the action expressed by the predicate	the participant on whose benefit the eventuality is performed	the entity for whose benefit the action was performed
Goal	the entity towards which the activity expressed by the predicate is directed	the endpoint of movement	the entity toward which something moves, either literally or metaphorically
Destinatary / Recipient		(destinatary) the endpoint of movement (recipient) whoever gets the theme	
Via		place through which the eventuality transits	
Source	the entity from which something is moved as a result of the activity expressed by the predicate	the starting point of movement, or the participant in which a process is initiated	the entity from which something moves, either literally or metaphorically
Location	the place in which the action or state expressed by the predicate is situated	the place where the eventuality takes place	the place in which something is situated or takes place
Quantity		the spatial or temporal measure of the eventuality	

As it becomes obvious from Table 3, there is no agreement with respect to how many theta roles there are (eg., stimulus, via), how they should be differentiated from each other (eg., theme as any affected entity or theme as a displaced entity and patient as an altered entity) or even which criteria must be used to identify a particular theta role (eg., agents as voluntary or not). Sometimes, even, the same classification defines two different theta roles almost identically (eg., Bosque & Gutiérrez-Rexach 2009, see goal and destinatary) and uses as labels notions that do not strictly describe relations between participants and eventualities, like 'quantity', which seems to belong to a different dimension of meaning (for instance, an agent or any other theta role can be maniested as a quantified nominal without direct reference, as in *Many linguists apply for grants every year*). It does not help understand theta roles either that frequently the label given to the theta role is also present in the definition of the role (*beneficiary ~ benefit*, for instance).

All these problems are virtually unavoidable because theta roles are, at best, intuitively defined by examining the behaviour of similar-looking participants across verb families. This has prompted different types of reactions that we will revise in this article (see in particular §6 and §7), from decomposing the predicate into units that allow to identify clearer minimal relations with participants to proposing that theta roles are clusters of concepts with a certain degree of flexibility.

The intuitive definitions work well, however, as an introduction of what types of relations are grammaticalised across languages between eventualities and their participants. Table 4 lists the most usual theta roles, plus a non-formal definition that I think reflects the common usage of these terms in most works that do not discuss theta roles, but simply apply the labels as part of their assumptions or the description of phenomena (see §7.5 for an illustration of more principled definitions in the case of agents and causers):

Table 4. Most usual theta roles and their approximate definitions

Theta role	Possible definition
Agent	Participant that initiates the eventuality, possibly in a conscious and willing way, and controls its development
Causer	Participant that initiates the eventuality without necessarily being conscious or willing and without controlling its development
Patient	Entity affected by an event through change, creation or destruction
Theme (of movement)	Entity undergoing movement in an event
Goal	Place or entity which the event is directed to or reaches
Source	Place or entity which the event originates from
Location	Place or entity which the eventuality is located at
Experiencer	Entity that holds a mental state described by an eventuality
Recipient	Entity that obtains something during or as a result of the event
Benefactive	Entity which the event is performed for
Instrument	Entity that facilitates or is used to execute the event
Theme by default	Entity involved in the event in a way that it does not cause or gets affected by it in any way

Many authors discuss whether there are principled reasons to split some of these theta roles into subtypes –for instance, it is frequent to split 'locative' into 'location' and 'direction', and each one of these into subtypes–, or whether some of these theta roles can be merged together –for instance, some authors argue against 'instrument', and propose that instruments are either causers or agents–. Even in the most detailed lists some categories that are easy to conceive given our world knowledge are not matched by a corresponding set of grammatical properties that justify treating them as a distinct theta role. For instance, in the real world we know that sometimes humans participate in an event as spectators that see how other people perform some event –for instance, children may perform in front of their parents or 'for their parents'–. However, to the best of our knowledge no language has a set of predicates that introduce these spectators with a special preposition designated only for 'spectators': English and Spanish can both express these participants as locatives, as in (7), letting speakers deduce that, if they were in front of the event they probably were spectators of it, or as beneficiaries (8), codifying that the performance was intended for them and letting speakers deduce that in that case they probably were its spectators.

(7) a. The children performed in front of their parents.
b. Los niños actuaron ante sus padres.
the children performed in.front.of their parents
(8) a. The children performed for their parents.
b. Los niños actuaron para sus padres.
the children performed for their parents

No distinct set of grammatical or lexical properties differentiates these 'spectators' from other theta roles, which makes us conclude that nothing in the grammar of English or Spanish grants the need for a 'spectator' theta role codified in the argument structure of some predicates. Interpreting someone as the 'spectator' of something will always involve an effort on the part of the speaker, that enriches the existing linguistic information with deductions coming from our world knowledge of the extralinguistic reality: in this case, what is the normal course of events where children prepare a performance and enact it in the presence of their parents.

However, before we get into the depths of the discussion there is a number of preliminary notions that we must introduce as background.

2. Background concepts

In this section, I will introduce some basic notions about argument structure that will work as a background for the more specialised and detailed discussion in the sections to come.

The first three subsections introduce three descriptive concepts. In §2.1 I will provide definitions and tests to differentiate between arguments and whatever is not an argument, which can be either a predicate or a modifier. §2.2 presents a classification of predicates according to their number of arguments, and introduces the problem of why natural languages are unable to build predicates with four or more participants. §2.3 introduces the notion of theta role and the problems that it causes.

§2.4 and §2.5 introduce two theoretical concepts: §2.4 presents the so-called Theta Criterion and discusses its motivation and predictions; §2.5 introduces a division between so-called endo-skeletal and exo-skeletal theories that will be presupposed in the rest of the article.

2.1. Argument vs. adjuncts

One first division that is crucial in a proper account of argument structure is the distinction between an argument and an adjunct.

2.1.1. Circumstantial complements are not the same as adjuncts

Traditional grammars in Spanish often use the term *complemento circunstancial* ('circumstantial complement') to refer to syntactic constituents that are part of the predicate and add information to it, but are not participants required by the lexical verb (or the equivalent lexical noun or adjective in a nominal predicate). Note that the distinction is formulated in semantic terms, and does not make any type of reference to lexical selection or the syntactic concept of argument positions.

Given this traditional difference, in (9) the verb has one circumstantial complement, which is the adverb *bien*, probably characterisable as a manner circumstantial complement.

(9) Marcos trata bien a su mascota.
Marcos treats well DOM his pet
'Marcos treats his pet well'

In this characterisation of argument structure, the verb *tratar* 'to treat' involves only two participants: the subject 'Marcos', an agent that displays some type of behaviour, and the direct object 'his pet', a patient that is somehow affected by the behaviour that is directed to it. Traditional grammar would treat *bien* as circumstantial complement because it cannot be considered a participant in the event in the semantic sense: it does not define an entity that interacts with Marcos and the pet in the situation described by the predicate. Rather, it is a modifier of the verb that determines the specific nature of the treatment that Marcos displays with respect to the pet.

This is at odds, however, with the formal characterisation of this predicate. *Tratar* 'to treat', at least in sentences like (9), is roughly equivalent to 'to display X behaviour with some entity'. This means that the verb codifies the idea that the agent shows some type of behaviour which is directed to the patient, but does not semantically specify the nature of that behaviour. The adverb *bien* 'well' in (9) is responsible for adding this information, without which the verb is not semantically complete.

(10) #Marcos trata a su mascota.
Marcos treats DOM his pet
'Marcos has some personal interaction with his pet'

In (10), without the adverb, the interpretation that we assign to the verb is different from 'to display some type of behaviour', which confirms that the manner expression is necessary for the reading that we assign in (9). Therefore, the verb needs that some constituent denoting a manner is present in the predicate in order to be 'semantically complete'. Technically, this idea has been called 'selection'.

2.1.2. Arguments and predicate selection: a semantic approximation

The idea is that a predicate can be informally defined as follows:

(11) A predicate is a semantically incomplete expression which contains open positions which other semantic expressions must fill.

This intuition lies at the core of Model Theoretic Semantics (Montague 1970), which proposes that a predicate is an expression that contains open positions, as variables, that must be saturated by other semantic expressions in order to produce a well-formed semantic structure. This definition, which is also semantically based, does not say anything about whether the open positions of the predicate correspond to participants –roughly, persons or objects– or to any other type of semantic object, such as a manner, a quantity, a time period, etc. For the cases of *tratar* 'to treat' in the (9) reading, we would represent the verb as having at least three variable positions, corresponding to an agent, a patient and a manner. Using the standard lambda-notation, and the idea that lexical verbs are predicates of events and therefore also have an event argument (see Davidson 1967, Parsons 1990 for the event argument of eventive predicates), this is represented in (12):

(12) λxλyλzλe[tratar'(e,x,y,z) & patient (x,e) & manner (y,e) & agent(z,e)]

In this sense, we say that this verb selects for three arguments in addition to the event argument that we assume each eventive verb has just by virtue of being a predicate that describes an event.

(12) does not only specify how many arguments are selected by this predicate by introducing a series of variables with x,y,z..., but also defines the interpretation of each one of the arguments

with labels like 'patient', 'manner' and 'agent'. These second set of expressions are called 'theta-roles'. As should be clear from (12), theta-roles are types of relations between the event described by the verb and the different arguments that the verb introduces.

Some authors keep the term 'argument structure' restricted to specifically the set of variables that, leaving aside the event argument, each lexical predicate introduces (see §1.2); the term 'thematic structure' or 'theta structure' is used, instead, to the set of semantic relations that the predicate defines for each one of its arguments. We will adopt this terminological distinction in this article, in order to keep the purely syntactic aspects of arguments separate from their semantic translation once their meaning contribution is integrated in the event description; as we will see in §2.5, there is a debate with respect to whether thematic structure is also dealt with in syntax or not.

Thus, when talking about a predicate like *tratar* 'to treat', its argument structure is represented in (13a) and its thematic structure is represented in (13b).

(13) a. x, y, z (and the event argument)
b. agent, manner, patient

Given (13), it is usual to say that the verb *tratar* selects three arguments, which are respectively interpreted as agent, manner and patient. Sometimes this statement is simplified and it is said that the verb *tratar* selects an agent, a manner and a patient, but we will see in the course of this overview that this way of putting things is potentially misleading.

2.1.3. Limits of the semantic definition of argument

So far, we have provided a semantic definition of arguments, one that did not have the problems that 'circumstantial complement' has, but one that is still incomplete. The reason is that the purely semantic definition cannot easily be operationalised in many cases, in practice. The notion of argument as 'the expression that completes the meaning of a predicate' implies that the situation described by the predicate necessarily entails that the argument is somehow involved, as it is the case of the three arguments of *tratar*: if we say that someone behaves in some way with someone, which is what we assume the verb means, then necessarily we need to specify who behaves in what way with respect to whom.

Therefore, any claim about the number of arguments of a predicate presupposes a particular hypothesis about what the predicate actually means. Consider, in this respect, the example in (14).

(14) Juan escondió el documento.
Juan hid the document
'Juan hid the document'

There is a strong intuition that no argument is implicit in this sentence. In particular, if we compare with (15), we clearly see that in the latter we must identify an implicit patient for the predicate to be well formed, but intuitively this does not seem to be required by (14):

(15) El cianuro mata.
the cyanide kills
'Cyanide kills (people)'

This would lead us to define *esconder* 'to hide' as a predicate with two arguments (16), roughly defined as 'someone prevents something from being found'.

(16) λxλyλe[esconder'(e,x,y) & patient (x,e) & agent(y,e)]

Consider now (17), where we have added a PP constituent:

(17) Juan escondió el documento de la policía.
Juan hid the document from the police
'Juan hid the document from the police'

Now we have added a constituent that describes the entity that is prevented from finding the document. It makes sense that we can add this constituent; after all, if we defined 'hide' as 'someone prevents something from being found', what the PP ads is the information that tells us 'from being found by whom'. If we only rely on the semantic criterion, what prevents us from defining the verb as 'someone prevents something from being found by someone', therefore with three arguments required for the verb to denote a semantically complete situation? If we decide to define the verb as just described, then it has three arguments, where the last one may be interpreted as a theme.

(18) λxλyλzλe[esconder'(e,x,y,z) & patient (x,e) & theme (y,e) & agent(z,e)]

However, hiding generally implies putting the object that should not be found in a location where it was not before, so that people cannot see it –for instance, putting the document under a carpet–. In fact, we can also say (19):

(19) El documento, Juan lo escondió de la policía debajo de la alfombra.
the document, Juan it hid from the police below of the carpet
'The document, Juan hid it from the police below the carpet'

Given (19), what prevents us from defining the verb as 'someone puts something in some place where it cannot be found by someone', with four arguments? If so, the verb would have the representation of (20), where we add a location.

(20) λxλyλzλmλe[esconder'(e,x,y,z) & patient (x,e) & location(m,e) & theme (y,e) & agent(z,e)]

Examples can be multiplied, and I must readily admit that (19) is not completely natural. However, the point I want to make here is that a purely semantic procedure to identify arguments will trigger this type of complications, where broader or more specific definitions of one and the same predicate will produce different analyses about how many arguments a verb can take, which theta roles these arguments get assigned and which notions, when not expressed, are actually implicit and must be reconstructed by speakers in order to assign complete interpretations to the predicate.

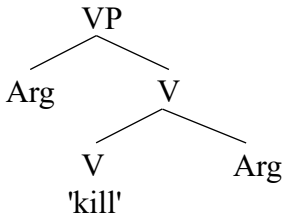
For this reason, argument is not simply a semantic notion in linguistics. In fact, the notion of argument is defined in syntactic terms: within the structure of a subject-predicate construction, being an argument means being located in specific positions within the structure. In other words, the general assumption is that there are specific syntactic locations where a syntactic constituent must be placed at some point of the derivation in order to be a syntactic argument. A different question, which we will discuss in §3-§5 below, is whether the theta role is equally associated to a specific syntactic position or not.

Therefore, the syntactic definition of argument proposes that arguments must be introduced in specific syntactic locations within the tree; these locations vary in different analyses, but the claim in (21) is common to all of them.

(21) Arguments must be introduced in designated complement or specifier positions within the lexical predicate area.

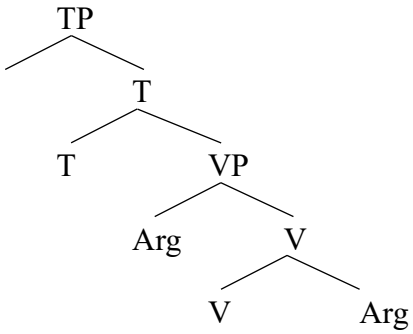
The notion of 'lexical predicate area' refers to the chunk of structure within a bigger construction –for instance, a clause– where the descriptive properties of the predicate receive their syntactic encoding. In the simplest theory –and see §4 for details– the lexical predicate area corresponds to the projection of the lexical verb, represented as V:

(22)



In a simple structure like (22), which could represent the syntactic phrase headed (or projected) by the predicate 'kill', there are two positions to introduce arguments, corresponding respectively to the complement and the specifier of the structure. Let us assume for the time being that (22) is correct and that it is the whole representation of the lexical predicate area. This means that the grammatical encoding of what 'kill' means is fully contained inside the structure of (22); as we build clausal structure above this predicate, we will introduce additional information that will not belong to the lexical predicate area –because it will not alter the descriptive properties of the predicate–: for instance, we will add tense.

(23)



As (23) shows, there is an open specifier position in TP. The syntactic definition of argument has as a consequence that this position cannot be used to introduce an argument of the predicate, because it is outside the lexical predicate area whose upper limit is VP. This means, among other things, that a pronoun directly merged in spec, TP will never be interpreted as an argument of the lexical verb, whichever it is. In fact, expletive subjects such as the pronoun in (24) below are directly introduced in that position without first occupying an internal VP-position, in many analyses.

(24) It seems [that you are late].

2.1.4. Syntactic tests for argumenthood

If the notion of argument is syntactically encoded, then we expect to identify syntactic tests that will help us determine if a constituent within the clause is an argument of the lexical predicate or not. Let us overview these tests, and apply them both to the case of *tratar* and the case of *esconder* above.

The test that is considered to be most reliable, even if it is not perfect, is the use of the pro-form *hacerlo* 'do so'. It is generally assumed that this expression acts as a pronominal form that substitutes the lexical verb area. Therefore, arguments –which are introduced within the lexical verb area– are part of the structure that *hacerlo* substitutes. The immediate consequence is that arguments cannot be combined with *hacerlo*, as *hacerlo* stands for the very same structure that would introduce them and combining them with this form implies that they are outside the lexical verb area.

(25) applies this test to a standard transitive verb with two arguments, agent and patient:

(25) a. Juan comió una manzana en el jardín.
Juan ate an apple in the garden
b. Juan comió una manzana en el jardín y María también lo hizo en la cocina.
Juan ate an apple in the garden and María also it did in the kitchen
'Juan ate an apple in the garden, and María also did so in the kitchen'
c. *Juan comió una manzana en el jardín y María también lo hizo un plátano.
Juan ate an apple in the garden and María also it did a banana
Intended: 'Juan ate an apple in the garden and María also ate in the garden, but a banana'

In (25b), the pro-form combines with *en la cocina*, which we expect to be an adjunct –'eating' does not need us to specify any place–. By assumption, the patient argument is part of what 'do so' substitutes, so in this case 'do so' is interpreted as 'eat an apple'. The reason is generally believed to be that the patient stays within the lexical verb area (note that the agent is compatible with 'do so' in this case because it is a subject and by hypothesis subjects move out of the lexical verb area anyways).

In (25c), in contrast, the ungrammaticality is due to the patient being combined with 'do so'. As the patient is an argument, it should be inside the lexical verb area, but 'do so' already covers that whole area, so the patient cannot be introduced in an argument position.

In addition to coordination, the same test can be used in pseudo-clefts, with 'do':

(26) a. Lo que hizo Juan en el jardín fue comer una manzana.
it what did Juan in the garden was to.eat an apple
'What Juan did in the garden was to eat an apple'
b. *Lo que hizo Juan una manzana fue comer en el jardín.
it what did Juan an apple was eat in the garden

Note that *hacer* 'do' is transitive, so in principle we could combine it with a direct object (eg., *hacer una pregunta* 'to pose a question'). The ungrammaticality, by hypothesis, comes from the argument nature of 'an apple', that makes it incompatible with a pro-form that covers the whole lexical verb area.

This test confirms that *bien* 'well' with *tratar* is an argument:

(27) a. Juan trató bien a su mascota en la fiesta, y María también lo hizo en el concierto.
Juan treated well DOM his pet at the party, and María also it did in the concert
'Juan treated his pet well at the party, and so did María in the concert'
b. *Juan trató bien a su mascota en la fiesta, y María también lo hizo mal.

Juan treated well DOM his pet at the party, and María also it did bad
Intended: 'Juan treated his pet well at the party, and María treated hers badly in the concert'

Applying the same test to the example with *esconder* 'hide' shows that the PP-complement with *de* 'from' behaves like an argument, while the locative seems to be closer to an adjunct, although (28b) is not perfect either.

(28) a. *Juan escondió a su pareja de la policía en el establo, y María también lo hizo de
Juan hid DOM his partner from the police in the barn, and María also it did from
la CIA.
the CIA
Intended: 'Juan hid his partner from the police in the barn, and María hid hers from the CIA'
b. ?Juan escondió a su pareja de la policía en el establo, y María también lo hizo en
Juan hid DOM his partner from the police in the barn, and María also it did in
el desván.
the garret
'Juan hid his partner from the police in the barn, and María hid hers in the garret'

The fact that (28b) is not completely natural suggests that *hacerlo* is not always a reliable test. Another reason not to limit oneself to this test is that the pro-form can only be used to substitute lexical verbs that are eventive, because *hacer* 'do, make' keeps part of its meaning, which is also eventive. Stative verbs do not work fine with it, irrespective of the combination with arguments or not.

(29) a. Juan merece un castigo.
Juan deserves a punishment
'Juan deserves to be punished'
b. *Juan merece un castigo y María también lo hace.
Juan deserves a punishment and María also it does

Another test to identify something as an argument is VP-preposing. By hypothesis, in (30) we have movement of the lexical verb area to the exclusion of the clausal structure:

(30) John said he would read 'War and Peace' in one day, and [read 'War and Peace'] he did.

A bona fide equivalent in Spanish of roughly the same structure is (31):

(31) [Leer 'Guerra y Paz'] puede Juan.
to.read 'War and Peace' can Juan

If the lexical verb moves in this structure, and if non-subject arguments are contained in the material that moves, then adjuncts may be left behind and appear after the modal, but arguments may not. This is confirmed.

(32) a. [Leer 'Guerra y Paz'] puede Juan en un día.
to.read 'War and Peace' can Juan in one day
b. *[Leer en un día] puede Juan 'Guerra y Paz'.
to.read in one day can Juan 'War and Peace'

The third test uses linear order. If, by hypothesis, arguments must be introduced within the structure projected by the lexical predicate, but adjuncts are introduced outside, then we expect that in unmarked word order arguments should appear closer to the verb than adjuncts. This is again confirmed: (33b) is not impossible, but involves focalisation of the argument.

(33) a. Juan leyó 'Guerra y Paz' en el salón.
Juan read 'War and Peace' in the living-room
b. #Juan leyó en el salón 'Guerra y Paz'
Juan read in the living-room 'War and Peace'

The fourth test is the 'weak island' test: some subordinate structures, like indirect interrogatives, allow extraction of an argument but not of an adjunct. Let us embed our example under a predicate that selects for indirect interrogatives.

(34) No sabes [si Juan leyó 'Guerra y Paz' en un día].
not know.2sg whether Juan read 'War and Peace' in one day

As can be seen in (35a), extracting an interrogative that corresponds to the patient of *leer* 'read' outside of the indirect interrogative is possible. In contrast, extracting the adjunct is impossible (35b).

(35) a. ¿Qué libro no sabes [si Juan leyó _____ en un día]?
which book not know.2sg whether Juan read in one day?
'Which book don't you know if Juan read in one day?'
b. ??¿En cuánto tiempo no sabes [si Juan leyó 'Guerra y Paz'_____]?
in how.much time not know.2sg whether Juan read 'War and Peace'?
??'In how much time don't you know if Juan read 'War and Peace'?'

There is a clear tendency, despite semantic incompatibility, to interpret the interrogative in (35b) as associated to the main verb, not the subordinate it should be coming from.

The fifth test is the iterability: excluding coordination, once a nominal constituent occupies an argument position it cannot be filled again by a different constituent –you may merge it, but then it will be located in a different position in the tree–. Semantically, if something is an argument, this is because it fills an open position in the structure of the predicate, and once that position is filled it is not available for other elements. In contrast, adjuncts do not satisfy open positions, and therefore are in principle iterable.

The test works at least with time and place adjuncts: see (36) for the iteration of temporal adjuncts.

(36) a. Juan leyó 'Guerra y Paz' [el año pasado].
Juan read 'War and Peace' the year last
'Juan read 'War and Peace' last year'.
b. Juan leyó 'Guerra y Paz' [el año pasado] [en junio].
Juan read 'War and Peace' the year last in June
'Juan read 'War and Peace' last year in June'.

(37) a. Juan leyó 'Guerra y Paz' [en su cuarto].
Juan read 'War and Peace' in his room
'Juan read 'War and Peace' in his room'.
b. Juan leyó 'Guerra y Paz' [en su cuarto] [al lado de la ventana].

Juan read 'War and Peace' in his room at.the side of the window
'Juan read 'War and Peace' in his room next to the window'.

The same is impossible for arguments, excluding coordination (see §2.4 below).

(38) a. Juan leyó ['Guerra y Paz'] en su cuarto.
Juan read 'War and Peace' in his room
'Juan read 'War and Peace' in his room'.
b. *Juan leyó ['Guerra y Paz'] ['El castillo'] en su cuarto.
Juan read 'War and Peace' 'The castle' in his room
Intended: 'Juan read both 'War and Peace' and 'The castle' in his room'.

This test is not entirely reliable either because the iterability of adjuncts is often restricted by their semantic relation among them, and also because some types of adjuncts are non-iterable. For instance, manner modifiers are generally not iterable.

(39) a. Juan leyó 'Guerra y Paz' [rápidamente].
Juan read 'War and Peace' quickly
'Juan read 'War and Peace' quickly'.
b. Juan leyó 'Guerra y Paz' [bien].
Juan read 'War and Peace' well
'Juan read 'War and Peace' well'.
c. *Juan leyó 'Guerra y Paz' [rápidamente] [bien].
Juan read 'War and Peace' quickly well
Intended: 'Juan read 'War and Peace' quickly and well'.

The sixth and final test is sometimes difficult to apply. In a language like Spanish, it is sometimes possible to extract from within nominal constituents even when they are introduced by a preposition, as in (40).

(40) a. Juan vio a un amigo de Jorge.
Juan saw DOM a friend of Jorge
b. (?) ¿De quién vio Juan [a un amigo ____]?
of whom saw Juan [DOM a friend]?

While judgements are famously subtle, these extractions improve if the nominal constituent is postverbal and indefinite. If we set the testing sentences accordingly, it is possible to find a contrast between extraction from an argument and extraction from an adjunct, even when the preposition used, the article used and the lexical noun are identical –again, let me emphasise that the judgements are so subtle that the reader may want to use this test only in cases of emergency–. In (41a), the PP with *con* 'with' is a bona fide argument (one has to marry someone else), while in (41b) the same constituent should be an adjunct (one can fall asleep alone).

(41) a. Marcos se casó con una amiga de su ex.
Marcos SE married with a friend of his ex.
b. Marcos se durmió con una amiga de su ex.
Marcos SE slept with a friend of his ex.

Extraction of the constituent equivalent to *de su ex* 'of his ex' is marginally better in (42a) than in (42b).

(42) a. ?¿De quién se casó [con una amiga ____]?
Of whom SE married with a friend?
b. *¿De quién se durmió [con una amiga ____?
Of whom SE slept with a friend?

As the reader can see, despite how central the distinction between adjuncts and arguments is in syntax and semantics, it is unclear that we have a set of tests, or even one single test, that is completely reliable and does not depend on ancillary assumptions.

2.2. Number of arguments

Some theories accept that individual lexical predicates declare their argument structure at some level, specifically as part of their lexical entry. (43) provides a simple example, stated in terms as neutral as possible at this point.

(43) kill(agent, patient)

(43) declares that 'kill' is a lexical predicate which takes two arguments. One of these arguments is interpreted as an agent, and the other one is interpreted as a patient. The representation, then, conflates two levels of information that in some theories are assumed to match each other: how many arguments the predicate selects, and how each one of them is involved in the situation described.

In this section we will focus on the basic ideas about the number of arguments. Predicates can be classified according to the number of arguments that they take –in addition to what we called above (§2.1) the event argument–. Using as a metaphor the chemical concept of valence, which determines with how many other atoms a particular element must combine, the standard classification divides predicates into four classes:

a) predicates with zero valence, sometimes called 'inert'
b) predicates with valence-1, also called 'monovalent'
c) predicates with valence-2, also called 'bivalent'
d) predicates with valence-3, also called 'trivalent'

Traditional examples of zero valence predicates are meteorological verbs, which some analyses treat as not taking any additional arguments, and therefore as being semantically complete once they satisfy their event argument (Ruwet 1991) –but see Bolinger (1973) for the claim that these verbs do indeed take a contentful subject argument–.

(44) Llueve
rains
'It rains'

In (44), some analysis propose that the verb describes a situation that does not need to involve any participant not already codified in the meaning of the predicate itself. The subject that overtly appears in English and that in Spanish is perhaps materialised as an empty category is never an argument of the verb, and does not get any theta role. The term 'expletive' is used to label such elements that, within a clause, are formally required but are not integrated in the predicate.

Sometimes the term 'impersonal' is used for these verbs without arguments, which if anything take an expletive subject. However, impersonality is not equivalent to having zero

valence: you must be impersonal if you do not introduce any arguments: it is assumed that adjuncts cannot act as subjects, so if you do not introduce arguments there is no element associated to the lexical verb that can act as subject. However, note that you can be impersonal and still have valence-1. This is the case of presentational *hay* in Spanish.

(45) Hay varios problemas.
there.are several problems
'There are several problems'

The verb is impersonal in most varieties, at least in the sense that in those varieties it cannot combine with first or second person subjects and it does not display agreement –it is fixed in 3sg form–.

(46) a. %Hay-n varios problemas.
there.is-3pl several problems
b. %Habe-mos muchos.
there.is-1pl many
'Many of us are here'

However, the verb takes one argument that in the same varieties mentioned acts as a direct object, pronominalisable with the bona fide accusative pronouns *lo, la, los, las*.

(47) a. *Hay.
there.is
b. Hay varios problemas.
there.are several problems
c. Los hay.
them there.are

Moreover, in some analyses not even meteorological verbs have zero valence. In these analyses, rather than lacking an argumental subject, verbs like 'rain' select for spatio-temporal pronominals as their only argument: the event of raining is being predicated of an expression meaning something like 'in place X' (Bolinger 1973). The unavailability of plural subjects, or person-marked subjects simply follows from the proviso that spatiotemporal objects are always singular and can never be identified with the participants in the utterance situation. One reason why it has been proposed that even meteorological verbs have one argument that ends up acting as subject is the fact that the subject pronoun of one of these verbs can control a big PRO in an infinitive of another meteorological verb. See (48).

(48) Llueve sin [PRO nevar].
rains without to.snow
'It rains [without PRO snowing]'

The infinitive *nevar* takes an empty subject, formally labelled PRO, that in theories where the verb takes no arguments would be expletive. Following the so-called PRO theorem, this PRO must be identified by some other expression in the main clause or get a generic human interpretation. This explains why (49) is ungrammatical.

(49) *Nevar es necesario.
to.snow is necessary

*'Snowing is necessary'

(49) is out because the PRO subject of *nevar* 'snow' lacks any expression in the main clause that can identify it, and the generic human interpretation is obviously out because in any analysis this verb does not select human subjects.

Therefore, in (48) it must be the case that the PRO associated to *nevar* 'snow' is controlled by some expression in the main clause, *llueve* 'it rains'. The only candidate is the subject of *llover* 'rain'. This subject should be expletive if the verb indeed lacks any arguments, and it would be argumental if the verb indeed takes a spatiotemporal entity as subject.

The question of what type of subject 'rain' (and 'snow') have can then be settled by determining whether expletive subjects can control PRO. (50) shows that this is not the case: the expletive *there* is not enough to control PRO in the infinitive.

(50) a. *There is fire [without PRO being smoke].
b. There is fire [without there being smoke].

Hence, the conclusion is that the subject of *llover* is not expletive. Generalising this argument would imply that a verb that does not select any argument cannot be found, which is a claim made in some theories that we will revise in §4 below (Hale & Keyser 1993, 2002; Baker 2003).

Verbs with valence-1 are standardly recognised in the literature; among others, we have cases such as the following:

(51) a. Luis murió.
Luis died
b. Pedro nació.
Pedro was.born
c. Marta despareció.
Martha disappeared

(52) a. Juan sudó.
Juan sweated
b. Miguel estornudó.
Miguel sneezed
c. Pablo entrenó.
Pablo trained

The set of 1-argument verbs in (51) is known as unaccusative (Perlmutter 1978), while the set in (52) is known as unergative; there is a number of (not extremely systematic) empirical differences among the two sets, that we revise in §3.1 below, and the traditional analysis is that the reason is that the subjects in each one of the groups get different theta roles and are in different syntactic positions, although this is a controversial issue.

Sometimes these verbs are called 'intransitive verbs'. That terminological choice is also unfortunate, because transitivity is also used to refer to a formal property within some types of clauses, namely that one argument gets accusative case and becomes direct object. When used in this sense, mismatches with 'intransitivity' understood as 'selecting only a subject argument' immediately arise, as we will immediately see.

Verbs with valence-2 are illustrated in (53).

(53) a. Juan escribe una carta.
Juan writes a letter

b. Petronila va a París.
   Petronila goes to Paris
c. A Emilio le gustan esos documentos.
   to Emilio him like those documents
'Emilio likes those documents'

The idea is that these verbs require two arguments, and in fact many verbs of this class build active sentences that treat one as the subject and another one as the direct object, as in (53a). However, note that selecting two arguments does not imply that these two syntactic functions will be present in the clause. (53b) does not take a direct object, as the second argument is a spatial direction. (53c) takes two arguments, but one is an indirect object and the other is a subject. Also, a passive construal of (53a) removes the accusative object and treats it as a subject, making the predicate intransitive in one of the uses of the term, but not the other.

(54) La carta fue escrita por Juan.
the letter was written by Juan

Verbs with valence-3 are also easy to identify.

(55) a. Pedro le dio la noticia a Isabel.
Pedro her gave the news to Isabel
'Pedro gave the news to Isabel'.
b. Pedro puso el libro en la mesa.
Pedro put the book on the table
c. Juan obsequió a María con un libro.
Juan gifted DOM María with a book

Again, a typical situation with such verbs, which prompts the term 'ditransitive', is that in addition to a subject and a direct object the verb projects an indirect object, as in (55a). This situation is typical with verbs of transference and verbs of communication, that often comply to this schema. Again, this is not a must: (55b) shows an example where in addition to a direct object we have a PP-constituent expressed with a locative preposition, and in (55c) the goal that receives the gift is a direct object and the gift itself is expressed with the preposition *con* 'with'.

The immediate question is whether there are verbs of valence-4, valence-5 and so on. It is generally agreed that three is the maximal number of arguments that one single predicate selects, even if sometimes candidates to being verbs with four arguments have been proposed. One such example is the verb *apostar* 'to bet', which seems to semantically require a participant that makes the bet, someone else that the participant bets with, some object that will be given to the winner of the bet, and some state of affairs that the bet revolves around:

(56) Juan le apostó diez euros a María a que iba a llover.
Juan her bet ten euros to María to that was.going to rain
'Juan bet ten euros to María that it was going to rain'

However, the 'do so' test suggests that the last component is not really a syntactic argument:

(57) ...y Pedro lo hizo a que iba a nevar.
and Pedro it did to that was.going to snow
'and Pedro bet the same to Maria that it was going to snow'

Some verbs denoting protecting events or hidding events seem also to take four arguments in some cases, where they both denote a directed motion where an object changes location, and some entity that the motion intends to protect or hide the object from:

(58) a. ?Moriarty protegió de Sherlock al fugitivo en su casa.
Moriarty protected from Sherlock DOM-the fugitive at his house
b. ?Moriarty ocultó de la policía los documentos bajo la alfombra.
Moriarty hid from the police the documents under the carpet

We have already mentioned that such examples are not completely natural, and also that tests such as the 'do-so' test do not clearly identify all constituents as arguments.

A more frequent, systematic and natural family of examples, noticed first by M. Cristina Cuervo (p.c.), is a set of verbs of directed motion that may take an extra dative constituent, illustrated in (59):

(59) a. Juan le dejó a María un plato de sopa en la mesa.
Juan her left to María a dish of soup on the table
b. Marcos le puso a María la mano sobre el hombro.
Marcos her put to María the hand over the shoulder

In both cases, it seems that we have four arguments: the verb needs an agent that starts some motion, an object that is moved, a place where it ends as a result of motion, and a goal that the object is intended for. The 'do so' test confirms that none of the non-subject constituents is an adjunct.

(60) a. *...y Marta se lo hizo a Lucas.
and Marta SE it did to Lucas
b. *...y Marta lo hizo en la silla.
and Marta it did on the chair
c. *...y Marta lo hizo un trozo de tarta.
and Marta it did a piece of cake

A solution that can be proposed in these cases is that, despite appearances, there are actually two predicates in this structure, and none of them takes more than three arguments.

An immediate question that emerges at this point is what explains that overwhelmingly the maximal number of arguments for one single predicate is three, and that examples involving four are at least difficult to find, exceptional and analysable as other types of structures. Some of the theories that have discussed argument structure have proposed language-internal reasons for this (see in particular §4, and also §2.4 below), but it is fair to say that we still lack a complete account that is completely free of complications.

2.3. The notion of theta-roles

In addition to the number of arguments, the selection of a predicate manifests itself in the set of semantic relations that it encodes, specifying what role each one of the arguments plays within the situation described. The technical name given to the semantic interpretation of an argument according to the predicate that selects it, is theta-role or θ-role. In example (43), repeated here as (61), there are two theta roles, 'agent' and 'patient'.

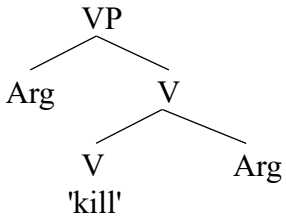
(61) kill(agent, patient)

The traditional idea is that the predicate does not only determine how many arguments (if any) it requires to be semantically complete, but also how each one of these arguments relates to the eventuality. Having an agent theta role means, roughly speaking (see §7.5 below for details) that whichever entity that fills that role will be interpreted as initiating and controlling the event of 'killing', irrespective of how conceptually plausible that is.

The traditional view of the relation between arguments and theta roles is that a predicate specifies in its lexical entry its argument and thematic structure as in (61), and that the information provided by these structures has to be somehow matched in the syntactic structure.

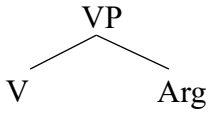
The core idea is that syntax must make room for as many syntactic argument positions as the lexical predicate specifies in its lexical entry. As the additional condition is that these positions must always be within the lexical predicate area, this means that the internal complexity of the VP must match the argument and thematic structure of the head verb. Like this, the verb in (61) will head a VP with two positions for arguments.

(62)



A verb with a single theta role in its lexical entry, in contrast, would head a less complex VP projection, for instance one like (63), which was assumed for unaccusative verbs for some time.

(63)



The core idea that the number of theta roles had to be matched by the number of argument positions created an apparent redundancy between argument and thematic structure: apparently, syntax had to replicate the semantic information about theta roles, as encoded in a lexical entry. In order to reduce the redundancy, this correlation was subsumed under the so-called Projection Principle (Chomsky 1981: 29):

(64) Representations at each syntactic level (i.e., LF, D-structure and S-structure) are projected from the lexicon, in that they observe the subcategorisation properties of lexical items.

This principle gives priority to whichever information each individual verb (or noun, or adjective, or preposition) stores about the semantic relations that it encodes, and need to be satisfied by entities merged in argument positions. D-structure corresponded to the level of syntactic structure that directly reflected the argument-predicate relations –prior to any movement operation, agreement or case assignment–, and it was taken to be a faithful reflection of the lexical idiosyncrasies of each lexical item.

This traditional account suffers from a number of shortcomings, which have been considered more or less serious depending on ancillary assumptions that will be reviewed in §5.1 below. Here we will just list them.

The proposal that syntactic argument structure at D-structure reflects the information codified in the verb's lexical entry faces the complication that, as we have seen, sometimes one and the same verb is compatible with two or more argument structures.

(65) a. Juan despertó.
Juan awakened
b. Juan despertó al niño.
Juan awoke DOM-the child

Something has to be said about these cases, and four different solutions are conceivable. First, one can claim that syntax always projects two argument positions in a VP headed by this verb, even if one of them is not filled in (65a); this solution is banned by the Theta Criterion, that will be revised in §2.4 below. Second, one could argue that there are two homophonous entries *despertar* in the lexicon, one with one theta role (patient, 65a) and one with two theta roles (agent and patient, 65b); this solution may increase the number of lexical entries postulated for one and the same language, duplicating many entries that are identical in every respect but the number of theta roles, but it has been proposed. Third, one could propose that there are some special operations within the lexicon, prior to syntax, that alter the thematic structure of a predicate, turning (patient) into (agent, patient) or vice versa; these lexical rules have also been proposed. Finally, one could simply give up the Projection Principle and not make the projection of argument positions dependent on the lexical requisites of the verb used, but instead invert the timing of operations and make lexical items accommodate their interpretation to the argument structure that syntax has projected in the structure. This solution has also been proposed; the details and discussion of these options is in §5 below.

Another complication of the Projection Principle and the architecture of grammar where it is proposed is the problem of how semantically specific theta roles should be. If argument structure is ultimately encoded in the lexicon, we must ask how many theta roles there are. As the lexicon can encode very complex meanings (eg., *procrastinate, malingering, thumb*...), we may expect theta roles to be virtually unbounded and only restrained by the cognitive capacities of humans when naming events and states. However, the number of thematic interpretations that are somehow differentiated in the grammar of languages is much more restricted, as we saw with the 'spectator' relation in §1 above.

A less obvious instantiation of the same problem is the question of how many distinct theta roles should be differentiated in cases where the semantic interpretations share some core but are distinct otherwise. A prime example of this situation comes from the agent theta role, broadly considered. If we focus on a notion like 'the entity that is responsible for starting an eventuality', I am aware of at least six distinct categories complying to this definition that have been argued for one reason or the other to require some differentiation: (volitional) agent (66a), teleological agent (66b), (immediate) causer (66c), indirect causer (66d), instrument (66e) and experiencer (66f).

(66) a. Juan asesinó a Marta.
Juan murdered DOM Marta
b. La impresora hace copias.
the printer makes copies
c. El terremoto lanzó a Juan al otro lado de la habitación.
the earthquake threw DOM Juan to-the other side of the room
d. La crisis justificó los recortes del gobierno.
the crisis justified the cuts of-the government
e. Este bolígrafo escribe rojo.

this pen writes red
f. Juan se preocupa por su hijo.
Juan SE worries for his son

(66a) has a subject which we interpret as volitionally and consciously starting the murdering event, and as controlling is development –otherwise, we could use *matar* 'kill'–. The subject in (66b) has the capacity to start and control the event, but obviously cannot do so willingly or consciously. As for the subject in (66c), it starts the event but does not control its development: throwing means propelling some object, but not directing its motion after the initial push. In (66d), the subject does not even start the event, but is construed as one link in a logical chain that eventually makes the event start. The subject in (66e) initiates and partially controls a writing event, but it is not enough to make the event happen, as it must be manipulated by some other entity (volitional or not). Finally, in (66f), what triggers the worry-state is not the son, who might even not be aware of his father's mental state, but the internal properties of the father, which lead him to experience that feeling and direct it toward the son.

I want to highlight that these cases pose a general problem which can be extended to other theta roles: how much semantic information is codified in a theta role? Are notions like 'willingly', 'consciously', 'autonomously or manipulated by others' or distinctions like 'involved in the starting point of the event' vs. 'involved in the development of the event' codified in the grammar, so that these theta roles are distinct? Does syntax, correlatively, project different positions within VP for agents, instruments, experiencers, causers and so on? If argumenthood is a direct reflection of the information that is lexically codified, we may expect so, given that the lexicon may differentiate between all these notions through distinct lexical verbs, as can be easily shown:

i) pairs like 'murder' and 'kill' seem to encode differences in volitionality and consciousness
ii) pairs like 'shove' and 'drag' encode differences between involvement in a starting phase of the event vs. moving an object in a controlled way across a path
iii) pairs like 'committ (a crime)' and 'incite (a crime)' encode differences with respect to how directly the subject causes something
iv) pairs like 'suffer' and 'be wounded' encode differences with respect to whether a psychological state can be internally justified or requires an external causer

This problem is quite acute in the case of 'agents', broadly considered, but we will see that it is also reflected in the relations between spatial theta roles –goal, source, path...– and non-spatial interpretations that may be close to them, and a few other cases. In the case of patients, again broadly considered, the situation is almost the opposite: even though it is in principle possible to be as highly specific with patients as with agents, patients are almost never subdivided into subclasses, with the exception of a broad notion of 'affectedness' whose specific role is still unclear (see Beavers 2011).

2.4. The Theta Criterion

In §2.1.4 above we showed that arguments cannot be iterated while adjuncts can be iterated:

(67) a. *Juan leyó ['Guerra y Paz'] ['El castillo'] en su cuarto.
Juan read 'War and Peace' 'The castle' in his room
Intended: 'Juan read both 'War and Peace' and 'The castle' in his room'.
b. Juan leyó 'Guerra y Paz' [el año pasado] [en junio].
Juan read 'War and Peace' the year last in June
'Juan read 'War and Peace' last year in June'.

This observation is quite old in formal linguistics. For many years, it was believed that the reason for this contrast relied on the interface between syntax and semantics –in the level of grammar that came to be known as D-structure or 'deep structure'–. The proposal was that each argument must receive one and only one theta-argument, and conversely that each theta-argument must be assigned to one and only one argument. This condition on argument and thematic structure was stated as the Theta criterion or θ-criterion:

(68) Each argument bears one and only one θ-role, and each θ-role is assigned to one and only one argument (Chomsky 1981: 35)

The ungrammaticality of (67a) above follows from this criterion, through a three-step reasoning: (i) 'read' has two theta-roles to assign; (ii) one of those theta-roles has been assigned to *Juan*, and the other has been assigned to *'War and Peace'*; (iii) therefore, there is no theta-role left for *'The Castle'*. The possibility that the two books share one theta-role as distinct constituents is explicitly forbidden by the Theta criterion.

As can be seen, the Theta criterion is stated in terms that presuppose the distinction between theta roles and arguments that we presented in §2.3 above, where a predicate carries a number of theta roles that are projected in syntax. What the Theta criterion adds to the Projection Principle is the restriction that, once theta roles are projected in D-structure, each one of the theta roles must be assigned to one and only one argument, and conversely each argument may only occupy one position. Note, then, that the Theta criterion has two parts, which I split in the following reformulation for clarity.

(69) a. Each argument must bear one and only one theta role.
b. Each theta role must be assigned to one and only one argument.

The first part of the criterion excludes sentences like (70) below, where the internal argument would not have any theta role assigned –assuming the verb still means 'die'–.

(70) *Juan murió a María.
Juan died DOM María

The second part of the criterion should exclude sentences like (71) below, where the verb has a theta role 'patient' that has not been assigned to any argument –even a phonologically empty argument– (again, assuming the verb still means 'crease' in that sentence).

(71) *Juan arrugó.
Juan creased.

Sentences like (67a) above are banned by the two principles: the first part prevents one of the two arguments to lack a theta role and the second part prevents them from sharing one theta role.

The two parts of the Theta Criterion, together, restrict the maximal number of arguments to whichever is the maximal number of theta roles that one single predicate can encode. This is problematic, however: as we have seen, there is strong evidence that cross-linguistically three is the maximal number of arguments that a predicate can introduce in syntax –four, at most, depending on the analysis adopted for the extra dative participants–. The adoption of the Theta criterion can only mean that somehow the number of theta roles that a predicate can encode is a maximum of three or four. As theta roles are the semantic relations that determine how an

entity participates in an eventuality, this should mean that there is some cognitive constraint that only allows humans to encode three semantic relations when naming a situation through a verb.

In our current state of knowledge, nobody has identified any such constraint, and intuitions suggest that we can conceive of situations with at least five participants. Therefore, from the perspective of the Theta criterion it is mysterious that arguments are restricted to three, perhaps four in some cases.

With the advent of the Minimalist Program (Chomsky 1995), the Projection Principle –and hence also the Theta criterion– was abandonned. Part of the reason for this was that Minimalism does not allow syntax to have an initial stage that directly reflects the argument-predicate relations as they are desirable for semantics. Tough-sentences like (72) constitute an empirical argument against starting the derivation with a direct reflection of the argument-predicate relations:

(72) This book is easy to read.

The verb *read* in the sentence should have two theta roles to assign, and hence two arguments. Satisfying the Projection Principle and the Theta criterion involves that the initial stage of the derivation projects the structure in (73):

(73) to read [this book]

At a later stage, the constituent that is interpreted as patient moves to the subject position. However, what Chomsky (1995) notes is that this movement would not have any motivation, given that the transitive verb *read* should be able to assign accusative case to it. The alternative would be to satisfy the theta criterion with some empty category located in the position where 'patient' is assigned:

(74) to read [Op / trace / pro]

In this case, however, the subject *this book* would not receive a theta role. If empty categories could form chains with their antecedents, there would be a chance to transmit the theta role across the chain from the empty category to the antecedent, but in Minimalism there are no chains, and hence no operation that allows the transmission. Chomsky's conclusion is that, in line with a language architecture where semantic interpretation follows syntax and does not precede it, argument-predicate relations are handled after syntax is complete, subject to a principle of Full Interpretation that forces every syntactic element to be interpretable at the end of the derivation.

Consequently, there is no stage where the positions projected by the lexical predicate are driven by the need to discharge theta roles. Therefore, the Theta criterion cannot be maintained. As we will see in §5.1, part of it is now considered empirically incorrect ('An argument only can receive one theta role'), while the parts that are still considered to be empirically correct ('Each theta role must be assigned to only one argument') follow from other independent principles. We will see in §3 below that the independent principle was already identified in Baker (1988), who moved from feature-based to configuration-based accounts of argument structure through his Uniformity of Theta Assignment Hypothesis.

2.5. Endo-skeletal and exo-skeletal accounts

Once one assumes that being an argument is a syntactic, and not just a semantic, property, the next basic theoretical choice that one has to make when discussing argument structure is the one reproduced in (75):

(75) Do lexical verbs project their argument structure in syntax or does syntax define the argument structure of verbs?

So far we have been assuming that argument structure is projected by a lexical predicate. Essentially, we have assumed –as was standard until the early 90s– the following claims:

(i) lexical predicates specify their number of arguments and their thematic interpretation
(ii) these arguments must be projected in syntax, specifically within the lexical verb projection
(iii) their projection must comply with the Theta Criterion.

In other words, we have taken a verb like *kill* as being idiosyncratically listed as carrying the argument structure [agent, patient], and we have claimed that a VP (or equivalent structure) headed by *kill* must make available two and only two positions for arguments in order to be well-formed. If three argument positions are projected, the Theta Criterion bans the structure because one of them will lack a theta role, and if one argument position is projected, the same principle with make the result ungrammatical because one of the verb's theta roles is unassigned in syntax.

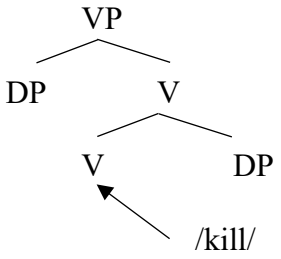
Theories that follow some version of these assumptions are called 'Projectionist' or 'Endoskeletal' (Borer 2003). The first name is justified by the claim that the predicate must project as a head, determining through its lexical properties how many positions will be made available in its projection; the second name focuses on the idea that which positions are made available follow from the internal lexical information of the head, which is displayed as the syntactic structure is built. Each lexical predicate contains within it the commands to build a particular structure, and those commands can be metaphorically considered a 'skeleton' that determines the final configuration when specific arguments are introduced in each position. This type of theory is generally identified with lexicalism.

Other theories, however, make a completely different set of assumptions, turning upside down the prevalence relation between syntax and the lexicon:

(i) syntax defines, before having access to the meaning of the lexical verb, the set of argument positions
(ii) these positions are biunivocally associated to specific thematic interpretations
(iii) at a later stage, specific lexical predicates are inserted from (some part of) the lexicon and the compatibility of the syntactic structure and the lexical item is somehow checked

In other words, according to this second view (called 'Constructionist' or 'Exo-skeletal'), by the time that syntax projects a VP –or equivalent– there is no information about the specific lexical predicate that will be used. All that syntax has access to at that point is information like whether the verbal structure is eventive or stative, the number of heads involved in building that area and the formal features that these heads contain to drive the derivation. Once the relevant syntactic structure is completely built, specific lexical predicates are introduced inside it (76).

(76)



The term 'exo-skeletal' is justified by the step represented in (76): the skeleton determining how many argument positions there are is not copied or projected from the properties of the lexical predicate, which is not even present when they are built. Syntax produces a skeleton, using different heads, and only later the lexical predicate is added to the tree, which is external to it in any sense. The term 'Late Insertion' is used to refer to this timing between lexical selection and syntax: when syntax precedes lexical selection, it is said that the verb (more appropriately, a vocabulary item corresponding to the verb) has been late inserted. Its opposite, cases where the lexical item is chosen before syntax starts, is sometimes called 'Early Insertion', although in the proper sense items are not inserted in the tree in this story, as the structure grows from them by projection of their lexically-stored properties.

The main empirical domain where the advantages and disadvantages of endo-skeletal and exo-skeletal theories have been discussed is the case of argument structure alternations, cases where –without systematic differences in formal marking– one and the same lexical predicate exhibits two or more different argument structures. However, I will leave the discussion of this aspect of the theory for §8, and I will now start a discussion of the theoretical and empirical reasons that made the field move from mainly endo-skeletal accounts to mainly exo-skeletal accounts.

We will start this discussion with the empirical generalisation that set the stage for divorcing syntactic structure from lexical information in argument structure: the so-called UTAH.

3. The nature of argument structure (I): the UTAH and its problems

The theoretical construct that in practice opened the door for exo-skeletal explanations is Baker's (1988: 46) Uniformity of Theta Assignment Hypothesis (UTAH), which is stated in (77):

(77) Identical thematic relationships between items are represented buy identical structural relationships between those items at the level of D-structure.

Remember that D-structure is the syntactic level that deals with the projection of lexical categories, mainly argument-predicate relation. For the purposes of the illustration, let us assume this is equivalent to VP.

What the UTAH states is that each theta role ('thematic relationship') is assigned in one and only one syntactic position. If a predicate encodes an agent in its argument structure, then a designated position for 'agent' must be projected. If an argument receives an agent theta role, then it must occupy that position. If two different verbs both assign an agent theta role, then they must be identical at least in the chunk of structure where the agent theta role is assigned.

In this section, I will present and discuss the UTAH, starting with the way in which it was initially motivated by the distinction between unaccusative and unergative verbs (§3.1 and §3.2), which focus on the relative position between agents and non-agents. In §3.3 I will discuss how other theta roles are ordered according to the UTAH, which as we will see is more problematic. Finally, §3.4 will briefly discuss the position of experiencers to show how an approach that assumes the UTAH can address cases where the same theta role seems to project in different syntactic positions. A topic I will leave aside is different proposals that share the spirit of the UTAH but introduce other types of isomorphisms, such as Randall's (2010) Isomorphic Linking Hypothesis.

3.1. Unaccusative verbs

The UTAH was partially inspired by Perlmutters's (1978; see also Burzio 1981, 1986) Unaccusative hypothesis. We have already seen that unaccusative verbs are verbs whose argumental subject receives a patient theta role.

(78) María murió.
María died

Perlmutter noted that, even though projected as a subject, the argument of unaccusative verbs behaved in some respects like an object –specifically, like a direct object–. In some languages like French, Italian or Old Spanish the auxiliary used for unaccusative verbs in the perfective forms is the same one used in the passive, as expected if, in some sense, the unaccusative subject was a passive subject coming from an object position; in languages like Spanish, objects of transitive verbs and subjects of unaccusative verbs, but not subjects of transitive verbs, can be bare nominals in postverbal position.

(79) a. Juan trae manzanas.
Juan brings apples
b. *Traen niños unas manzanas.
bring children some apples
(80) a. Juan murió.
Juan died
b. Murieron soldados.
died.3pl soldiers

A frequently cited empirical test for the distinction is the absolute participle structure. Even though the absolute participle test has aspectual restrictions that complicate its applicability (Hernanz 1991), the generalisation is that it generally can combine in a subordinate non-finite structure a participle with a direct object, as in (81b), from (81a):

(81) a. Juan escribió la carta.
Juan wrote the letter
b. Escrita la carta, (Juan salió del despacho).
written the letter, (Juan exited from.the office)
'Once the letter had been written, Juan left the office'

The subject of some verbs –unaccusative verbs– can produce an absolute participle construction with its subject. From (78) above we can produce (82):

(82) Muerta María, (fue enterrada).

died María, (was buried)
'Once María died, she was buried'

In contrast, absolute participles cannot combine the participle with the subject of a transitive verb:

(83) a. Juan escribió la carta.
Juan wrote the letter
b. *Escrito Juan, (salió del despacho).
written Juan, (exited from.the office)
Intended: 'Once Juan had been written, he left the office'

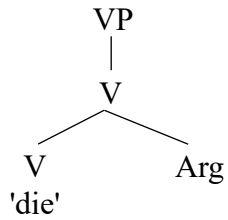
Similarly to this, the valence-1 verbs without a direct object that are called 'inergative' cannot make absolute participle constructions:

(84) a. Juan estornudó.
Juan sneezed
b. *Estornudado Juan, (fue al médico).
sneezed Juan, (went to.the doctor)
Intended: 'Once Juan sneezed, he went to the doctor'

Perlmutter's observation, which was later on formalised by Burzio (1981), is that the subject of unaccusative verbs was 'similar enough' to a direct object because of its semantic interpretation: the subject of an unaccusative is the entity that is affected by the event, which is the prototypical interpretation of direct objects. This similarity licensed them in the absolute participle structure. In contrast, the subject of unergative verbs is an agent, and agents are semantically very different from direct objects because they prototypically project as subjects.

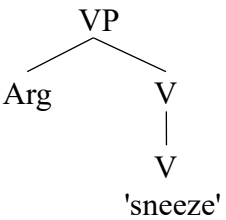
Burzio (1981) proposed that this was not simply a semantic difference, but should actually be codified in the syntax. The argument of unaccusative verbs that ends up as the subject in S-structure was projected in an object position at D-structure –by assumption at the time, this involved the complement of V–:

(85)



Any rule that targets the complement of V would put together direct objects in transitive verbs and subjects in unaccusative verbs. In contrast, the subject of inergative verbs would occupy the external argument position, at the time spec, VP:

(86)

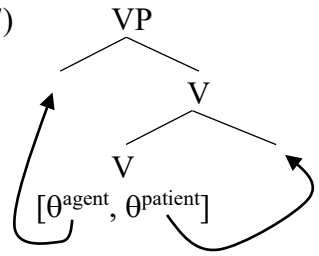


The UTAH explained the correlation between 'having the typical interpretation of a direct object' and 'occupying the base position of the direct object', which in Burzio was accidental and proposed only through the dicussion of a particular empirical case. The UTAH makes it inescapable that, if both transitive objects and unaccusative subjects are [patient], they must occupy the same position at D-structure. Also, if the subject of unergatives and the subject of transitives both get the theta role [agent], they must share one and the same position.

3.2. The UTAH and unaccusative verbs

More specifically, the UTAH ties together the two sides by proposing that at D-structure, verbs that have [patient] as part of their argument structure in the lexicon must project that theta role in the complement of V position. Verbs that have [agent] as part of their lexical entries must project this theta role in the spec, VP position –at the time, there were no more levels within VP for additional roles–.

(87)

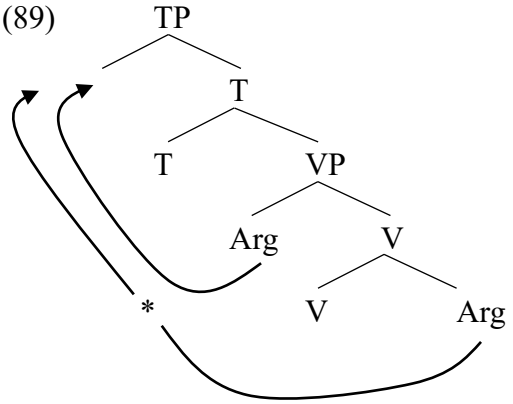


Baker provides different pieces of evidence for the UTAH. They all have the same guiding principle: syntax is inherently hierarchical, so any two positions can be differentiated by their hierarchical positions with respect to each other. If we identify than in predicate A the position of an argument with theta role 1 is higher (or lower) than the position of theta role 2, then the same hierarchical relation should be identified in all predicates assigning the same theta roles. For instance, given the behaviour of [agent, patient] verbs we can see that [agent] is syntactically higher than [patient]. There are two reasons for this, beyond obvious linear order: when an agent argument is present, patients do not reach the higher subject position:

(88) a. write(agent, patient)
b. Juan escribió dos novelas.
Juan wrote two novels
b. #Dos novelas escribieron a Juan.
two novels wrote.3pl DOM Juan

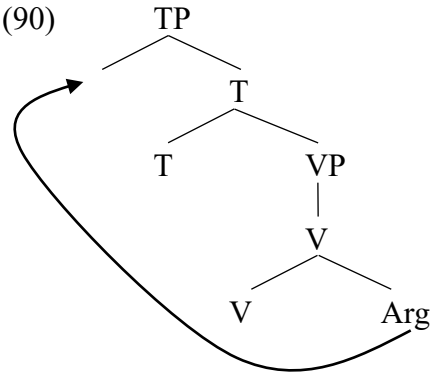
This is expected if [agent] is assigned higher than [patient], because this means that movement from the position of the agent to the subject position is shorter than movement from the position of the patient; if [agent] is present, in some way it will block movement of [patient].

(89)



However, in an unaccusative, where patient is present and agent is absent, movement is possible because no higher element intervenes:

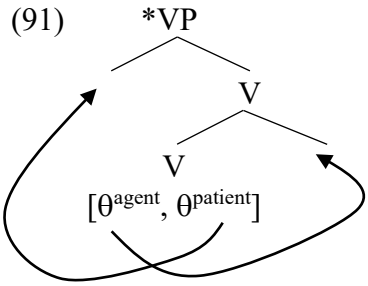
(90)



This explanation would suggest that passives –where patients end up in subject position– either remove agents or somehow reorder arguments at D-structure so that patient is higher than agents.

Then, agents are higher than patients. What the UTAH predicts is that there should be no verbs where the agent theta role is assigned below the patient theta role, then; in other words, no [agent, patient] verb should allow the patient to become the subject without additional operations, like passive. This prediction has turned out to be extremely solid.

(91)



Secondly, Principle A of Binding theory also diagnoses patients as lower than agents. Principle A, roughly speaking, states that the antecedent of an anaphoric expression must c-command the anaphor. In our diagrams, [agent] c-commands the [patient], and consequently we (correctly) expect patients to allow anaphors with agents as their antecedent, but not vice versa (see Baker 1988: 210-212):

(92) a. John saw [himself]^{patient}.
b. *[Himself]^{agent} saw John.

3.3. The ordering of other theta roles

How about other theta roles? Goals –participants towards which movement is directed– seem to be lower than patients according to the anaphor test. I reproduce an example in English (93) because in Spanish these examples are difficult to evaluate: given that direct objects in these configurations tend to be specific animates, Differential Object Marking makes themes and goals surface identical (cf. 94):

(93) a. Mistakenly, John introduced [the senator's wife]^{patient} to [herself]^{goal}.
b. *Mistakenly, John introduced [to the senator's wife]^{goal} [herself]^{patient}.
(94) Por error, Juan presentó [a la mujer del embajador]$^{??patient/*goal}$
by mistake, Juan introduced [DOM the wife of.the ambassador]
[a sí misma]$^{??goal / patient}$
DOM her self
Intended: 'Juan introduced the wife of the ambassador to herself'

While the evidence for agent > theme/patient is very clear, data are much less clear with respect to the relative ordering between goal and theme / patient. The following example reproduces the hierarchy of theta roles proposed in Larson (1988: 382), where he uses 'theme' as a cover term for 'patients' and 'themes'. See also Speas (1990).

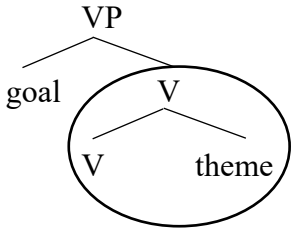
(95) agent > theme > goal > obliques (place, manner, time...)

Grimshaw (1990: 8) proposes a different hierarchy –also followed by Hale & Keyser (1993)–, with themes as the lowest theta-role and experiencer above goals (96a). She presents some evidence that may suggest that under certain conditions goals are higher than themes. Part of her argument is that themes can combine with V inside compounds (96b), but goals cannot (96c):

(96) a. agent > experiencer > goal / source / location > theme
b. gift-giving to children
b. *child-giving of gifts

Assuming that compounding is solved at the smallest structural level possible, Grimshaw's example may suggest that themes are contained within this structural level, but goals are not. If so, goals should be higher than themes:

(97)



<--- compounding level

However, there are at least three alternative analyses: Baker (1997: 106) suggests that what actually goes on in the above contrast is that goals are always introduced by prepositions, and prepositions must be outside compounds –for reasons that are unclear–. Secondly, one could simply give up the idea that compounds are necessarily built at the lowest structural level possible and derive the difference from the configuration. For instance, goals may occupy a specifier position and themes may be located in complement positions. If compounding requires some form of incorporation or head-movement between the members of the compound, and incorporation is restricted –as standardly assumed– to head-complement relations, the contrast follows irrespective of the internal ordering between the two theta roles. Finally, one could assume that goals are introduced by additional heads, called Applicatives, and for some reason the applicative head cannot be part of a compound (see Cuervo 2003 for discussion; we will leave the nature of applicatives for its own state of the art article).

3.4. Illustration: psych verbs and the UTAH

Before we end this section, let us illustrate the type of problems that the UTAH faces and what solutions have been proposed for them. I will do so through a particularly complex case, which is the position of the experiencer argument in psychological verbs. By hypothesis, psychological verbs always assign the theta role of [experiencer] to one of its arguments: a sentient being that holds the psychological state related to the eventuality. Following the spirit of the UTAH, that theta role should always be assigned in the same position. Note, however, that [experiencer] is not directly mentioned in the standard thematic hierarchy reproduced in (95). The main reason is that psychological verbs come at least in two distinct configurations (Belletti & Rizzi 1988):

(98) Dative experiencer
A Juan le gustamos nosotros.
to Juan him.dat like.1pl we
'Juan likes us'

In (98), the experiencer manifests as a dative –indirect object, in its traditional account–. Crucially, the subject is the entity that could be described as triggering that psychological state in Juan, 'we'. By the reasoning we presented above, then, experiencer should be lower than (at least) non-volitional causers.

If we use that test with a second family of psych predicates, however, the conclusion will have to be that experiencers are higher than this type of causer:

(99) Nominative experiencer
Juan nos ama a nosotros.
Juan us loves DOM us
'Juan loves us'

Here, the subject is the 3sg proper name *Juan*, and the 1pl participant is projected as an object –generally, a direct object– which does not trigger agreement with the verb. And, to make things worse, there is a third class of bona fide psychological verbs where the experiencer is an accusative object that and the causer is a subject:

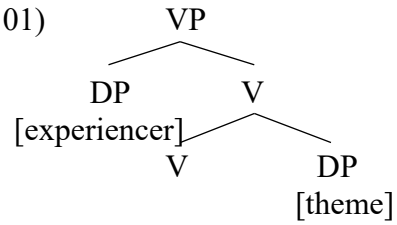
(100) Accusative experiencer
Nosotros preocupamos a Juan.
we worry.1pl DOM Juan
'We worry Juan'

This empirical pattern presents prima facie evidence against the UTAH. Thus, the existence of these two patterns involving experiencers could have taken to mean that the UTAH did not work, and perhaps even that individual verbs define their argument mapping differently (see §6.2 and §6.3 for why this proposal does not work). However, these facts have received two distinct sets of explanations in order to preserve the UTAH.

The first type of solution proposes that the experiencer and the causer arguments are initially introduced in exactly the same positions for the three types of verbs. The fact that experiencers become subjects in the first case, but not the second or third, derives from grammatical properties that are orthogonal to argument structure and the assignment of theta roles. Belletti & Rizzi (1988) propose that the difference in grammatical functions across the three verb types depends on case assignment.

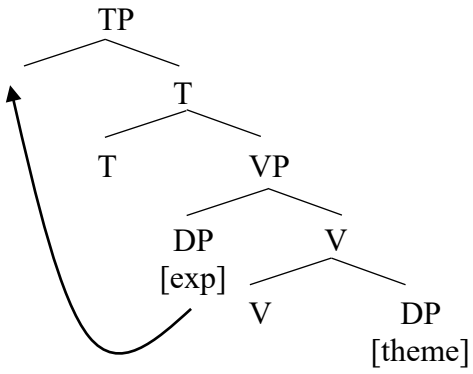
In the three cases, the experiencer theta role is assigned within the lexical verb projection, at a higher position than the theta role of the other argument –which Belletti & Rizzi (1988) label 'theme', not 'causer'–. Thus, somehow adapting the structure proposed by these authors, in the three verb types the VP structure involves a specifier-head-complement configuration where the complement is the theme argument and the experiencer is above it.

(101)



The UTAH is preserved because of this: at the level where theta roles are dealt with, the experiencer is always projected in the same position, and the same goes for the theme. If nothing else is added to (101), we expect that the experiencer argument will become the subject of the clause, because it is closer to the subject position than the theme. This automatically derives the case of subject-experiencer verbs like (99):

(102)



As it was standard at the time where Belletti & Rizzi made the proposal, this movement is triggered by the need of the argument to receive case: nominative is assigned in the subject position. By assumption, the theme argument receives accusative case by whichever procedure is used in any transitive verb.

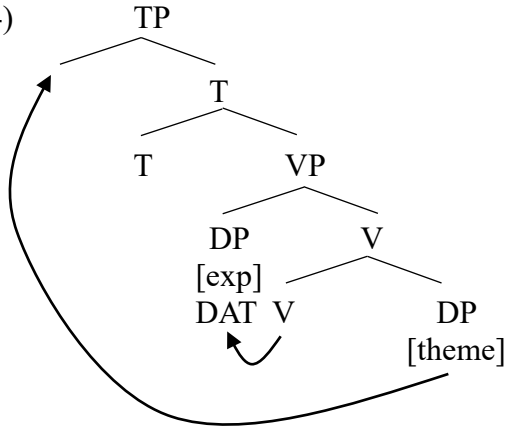
What is special in verbs whose experiencer becomes the accusative direct object or a dative is that these verbs lexically assign case to the experiencer, not to the theme. This case –inherent case, in the terminology of the 80s– basically makes movement of the experiencer to the subject position unnecessary. Under the assumption that a verb only assigns one case, verbs that assign case to the experiencer argument do not assign case to the theme, which will then have to move to the only other position available for case, the subject position.

Dative-experiencer verbs like (98) are verbs that assign inherent dative case to the experiencer (Belletti & Rizzi 1988: 344, example (121)):

(103) gustar theta-grid [Experiencer, Theme]
|
case-grid [Dative -]

Consequently, the experiencer has no reason to move to the subject position and leaves the position available for the theme:

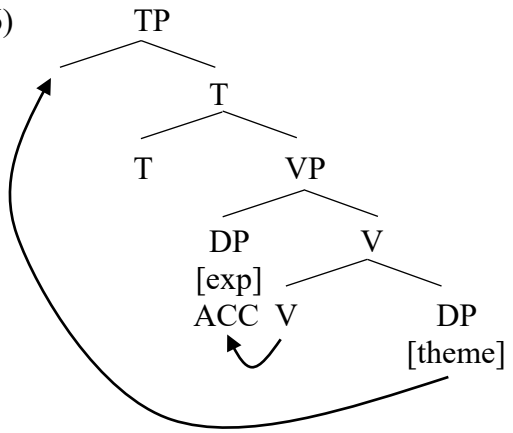
(104)



Accusative-experiencer verbs (100) assign inherent accusative case to the experiencer –that is, they do not follow the same operation that assigns accusative case to the internal argument in transitive verbs which do not specify a case grid–, as in (105), and give rise to the same situation as in (104), as represented in (106).

(105) preocupar theta-grid [Experiencer, Theme]
|
case-grid [Accusative -]

(106)



This is one way to save the UTAH: to explain the different grammatical functions of the same theta roles across verb classes as the output of an independent grammatical principle. The second option, of course, is to propose that the theta roles involved in each one of the three verb classes are not identical. The existence of nominative-experiencer, dative-experiencer and accusative experiencer verbs is problematic for the UTAH only to the extent that the rest of theta roles in the three verb classes are the same. Only in that case one can take the facts to mean that the two theta roles involved must be assigned at different places across verb classes.

In contrast, if for instance nominative-experiencer and dative-experiencer verbs involve different sets of theta roles, the problem may dissolve. For instance, one could propose that what seems to be a causer or theme in nominative-experiencer verbs has a theta role A which is lower than experiencer, and what has also been called a causer or theme in dative-experiencer verbs has a theta role B which is higher than experiencers. This would produce a refinement of the set of theta roles available in natural languages, and of the thematic hierarchy itself, but proposing something like (107):

(107) ...Theta role B > Experiencer > Theta role A

This option is made possible by the fact that the definition of thematic relations is largely an empirical problem where researchers must determine which semantic entailments actually define different theta roles and which ones are grammatically irrelevant (see §7 below). This is precisely the proposal done by Pesetsky (1995). After rejecting the case account through theoretical and empirical arguments (Pesetsky 1995: Chapter 2), he makes the proposal that what Belletti & Rizzi (1988) labelled 'themes' are actually three different theta roles.

First of all, he proposes that psych verbs may involve a Causer of Emotion or a Target of Emotion, whose differences he illustrates with the following two examples (1995: 56, example (30)):

(108) a. Bill was very angry at the article in the *Times*.
b. The article in the *Times* angered Bill.

In (108a), *the article in the Times* is a target of emotion. It is the entity towards which Bill directs his anger, but it may not be what caused it –Bill must have read the article and evaluated it as something worthy of anger–. The same NP, *article in the Times*, is the causer of emotion in (108b): Bill may like the article and find it worthy of praise, but its content causes him to be angry at someone else –for instance, the article reveals that French President Emmanuel Macron has ignored the results of the election–. This subtle difference in meaning involves different sets of semantic entailments, and Pesetsky's claim is that they are enough to define two distinct theta roles that are assigned in two distinct positions. Causer of emotion is assigned above experiencers, and target of emotion is assigned below experiencers.

A third theta role is proposed by Pesetsky: Subject Matter of emotion, which is the participant that corresponds to the entity that the experiencer evaluates through the emotion. In (109), *the article in the Times* is the subject matter.

(109) John worried about the article in the *Times*.

However, this third theta role does not project in a different position from the Target of emotion. Both targets of emotion and subject matters of emotion project in the same position, with the difference between them perhaps being merely conceptual.

With this proposal about how theta roles in psych predicates should be split, Pesetsky can propose that object-experiencer verbs are verbs whose other argument is a causer of emotion, not a target of emotion; as a causer, that argument projects higher than the experiencer and it is expected that the experiencer will not become the subject of the clause. For subject-experiencer verbs, on the other hand, the other argument is a target of emotion (or a subject matter), and targets of emotion project lower than experiencers. The expectation is that, all things being equal, in these cases the experiencer will project as a subject.

Pesetsky's proposal fares well in the comparison between accusative-experiencer and nominative-experiencer verbs:

(110) a. Las noticias preocuparon a Juan.
the news worried DOM Juan
'The news worried Juan'
b. Juan odió las noticias.
Juan hated the news
'Juan hated the news'

It is clear that in (110a) Juan may not be worried about the news, but about something else; learning what the news had to say about, for instance, COVID19 infections may make Juan worried about his brother, who recently got it. The news starts a chain of events that cause Juan to get worried. Consequently, the causer of emotion theta role works fine for this type of argument –but see Landau (2010), who argues that the subject in these verbs is simply a causer and there are no principled reasons to treat these verbs as different from other causative verbs of change–.

On the other hand, in (110b) it is clear that Juan hates some aspect of the news, and is directing his hatred towards that aspect; the news may not have caused that hatred, but the news may be reporting that COVID19 vaccines cause autism and Juan finds that claim dangerous and stupid –see also Ramchand (2008) and §7.5 below for the proposal that the causer in (110b) is Juan himself, through his internal properties–.

It is unclear, however, that Pesetsky can explain the third type of psych predicate, dative experiencer predicates, without any appeal to case assignment possibilities: in dative experiencer predicates, like (111), the theta role of the nominative argument has the properties of a target of emotion or subject matter:

(111) A Juan le gusta la música.
to Juan him.dat likes the music
'The music pleases Juan'

It is clear that the music is what Juan evaluates as likeable, and there is no sense in which the music causes that liking in Juan –again, one could argue that Juan's internal properties cause that liking–. However, at least in terms of case marking, *the music*, and not *Juan*, get nominative case –see Zaenen at al. (1986), however, for the possibility that the dative argument is in fact in a subject position, despite the case that it has received from the verb–.

This brief discussion is just intended as an illustration of how the UTAH addresses some empirical challenges, either by appealing to non-thematic grammatical relations or by splitting thematic relations into distinct roles that have distinct positions in the hierarchy. While the discussion of experiencers and psych verbs deserves its own state of the art, I hope that the illustration has made it clearer how the UTAH behaves in practice and how its predictions are dealt with.

Despite these problems –and in §6 we will see some stronger counterexamples–, the UTAH has become part of the standard account of argument structure. In fact, most theories assume some version of the UTAH in their analysis. An important outcome of the UTAH is that it opened the door to a non-lexicalist account of thematic structure: the UTAH proposes an isomorphism between syntactic positions and theta role interpretations, which is a precondition for an account where argument structure is defined in syntax and not in the lexicon.

In Baker's (1988) version of the UTAH, that isomorphism is explained by proposing that the obligatory projection of lexical properties in syntax follows strict hierarchical principles; other theories, like Hale & Keyser's (1993, 2002) L(exical)-syntax, treat syntactic structure as independent, and in fact derive the possible argument structures from configurational

principles. This puts at the center of the discussion the issue that argument structure is restricted to at most three participants per predicate, with a limited set of thematic relations. In the next section, we will revise the theories that from one perspective or the other have proposed syntactic means to derive the restrictions on number and types of arguments. These accounts, as we will see, frequently involve splitting lexical verbs into syntactic layers.

4. The nature of argument structure (II): delimiting the number of arguments through syntactic means

This section will introduce a second component which in many current approaches is combined with the claim that identical theta roles project in identical syntactic positions: the idea that the full syntactic projection of a lexical verb may involve more than one lexical head. These approaches, which split lexical predicates into layers, have been frequently proposed as ways to derive some effects of the UTAH or to explain the apparent limits on the number of arguments that one single predicate can introduce. At the same time, they also introduce another important idea that exo-skeletal approaches presuppose: the possible argument structures available in natural language are limited by syntax, not by the lexicon –because the lexicon could in principle describe situations with 4, 5 or 6 participants–.

§4.1 will present Hale & Keyser's (1993) L-syntax level, which proposes that argument positions co-define the grammatical category of predicates. In practice this system implies that lexical predicates involve two levels of structural complexity, so from there I will move to approaches which split lexical verbs into two layers (§4.2) and their subsequent elaborations (§4.3).

4.1. L-syntax

One unresolved issue that involved argument structure, and that we have introduced in §2.2 above, are the limits on the number of arguments and thematic relations that natural languages seem to cross-linguistically express. Even though there is no clear cognitive principle that restricts our conceptualisation of reality to situations involving three or four participants at most, lexical predicates are overwhelmingly restricted to three arguments. A purely lexical account of argument structure did not have an immediate answer for this problem. The closest answer that could be given within the Government and Binding system (Chomsky 1981) that was predominant on the years where the UTAH was developed was to blame an independent syntactic module, the Case Filter, for this limitation.

The case filter (Chomsky 1981: 49) is defined in (112):

(112) *NP if NP has phonetic content and has no Case.

In practice, this filter was restricted to NPs that acted as arguments. The way in which this filter could have explained that argument structure was restricted to three arguments, then, would have been by limiting the number of cases that syntax can assign within one same clause. This would be a purely linguistic principle that would act as a filter on cognitively valid situations: even if we can conceive of situations involving five participants, we would not be able to have a predicate with five arguments because syntactic structure is limited to only three case-marked NPs within the clause –for instance, one could have claimed that only three clausal heads, and no more, can assign case–. However, Case theory also allows prepositions to assign case –such as for in (113), Chomsky (1981: 66)–:

(113) [for [John to leave]] would be a mistake.

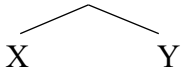
This extends to semantically stronger prepositions that may transmit a theta-role to the lexical predicate, which in principle means that nothing prevents a possible five argument predicate to express three or four of its arguments through PPs that solve case assignment irrespective of the clausal projections.

Thus, at the end of the 80s the question of why argument structure was limited to three elements was still unresolved. Hale & Keyser (1993) sketch a proposal mainly aimed at solving this issue.

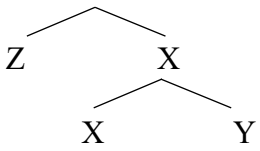
Their proposal, which they call 'prolegomenon to a theory of argument structure' in Hale & Keyser (2002), is that argument positions are syntactically restricted by the rules of structure building themselves. If one thinks about usual phrase structure building, there are only three conceivable possibilities, which correspond to no argument (114a), a complement (114b), a complement and a specifier (115) and a specifier (116).

(114) a. X No argument

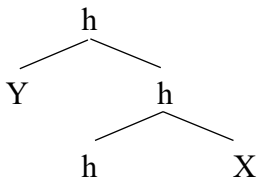
b. X One argument



(115) Two arguments

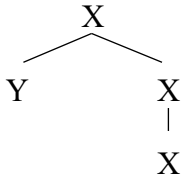


(116) One argument



In (114a), the head represented as X does not take any other constituents within its projection. In (114b), in contrast, the head takes one complement, projected as usual as a sister to the head. In (115) the projection of X hosts two constituents, a complement Y and a specifier Z. (116) requires some further explanation: Hale & Keyser (1993: 74-77) propose that a representation where a head associates to a specifier but no complement should be represented as (116), where the head that will be thematically linked to the specifier parasitically combines with another element, which in turn takes X as a complement. This representation, they argue, is to be preferred to the obvious alternative in (117):

(117)

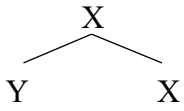


The representation of (117) implies treating phrase structure as some kind of template with two optional positions to be filled, so that the highest position (specifier) can be filled even if

the lower position (complement) has not been filled. In other words, a representation like (117) assumes that phrases are pre-ensembled objects.

The theoretical desideratum, however, is to fully derive the structure of a phrase from the elements that are syntactically present. From this perspective, there is no non-templatic way to build a phrase like (117): structurally, there is no difference between the X that is sister to Y and the X that depends from it: in both cases, we have the same element, which does not combine with another object. At the same time, Y is the only, and therefore first, element with which X combines: there are no structural reasons not to treat it as a complement to the head, which (*pace* linear order) is the result obtained when one conflates the non-ramified X levels, as in (118):

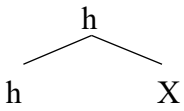
(118)



If we ignore linear ordering, which is perhaps irrelevant at this stage of syntax, (118) is equivalent to (114b): a head that takes a complement.

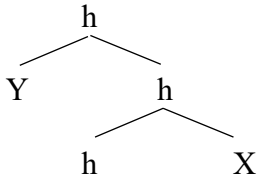
Following the same reasoning, the only way in which X can get a specifier and not a complement is by first becoming itself the complement of another head:

(119)



At this point, given that the head represented as 'h' has built structure and its first constituent has been introduced, combination with a second constituent semantically required by X will trigger a specifier configuration, as in (120), identical to (116):

(120)

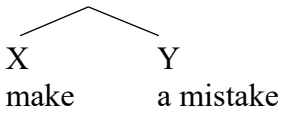


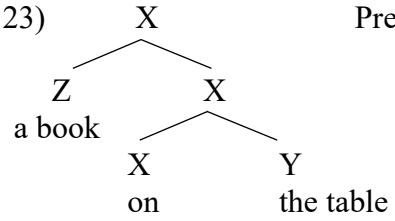
Hale & Keyser (1993) propose that these four configurations are the only possible ones in the syntactic level that deals with argument structure. As in Government and Binding and Baker's (1988) UTAH proposal, Hale & Keyser (1993) allow a syntactic level that deals with thematic relations prior to movement, and the introduction of functional structure. Instead of calling it D-structure, they label it L(exical) syntax.

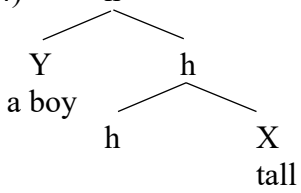
Moreover, they argue that each one of the only possible combinations listed in (114)-(116) above corresponds to a different lexical category, which are defined in L-syntax at the same time as argument structure. Nouns are manifestations of (114a), that is, heads which do not introduce any arguments. Verbs correspond to (114b), heads which take a complement and no specifier; Prepositions are equivalent to (115), as relational elements that connect two participants to each other through a spatial relation, or other types of relations; Adjectives are derived as in (116), taking a subject of predication but not complement.

(121) dog Noun; cf. (114a)

(122) X Verb; cf. (114b)



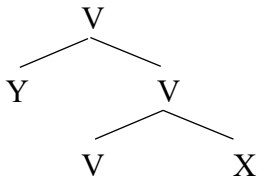
(123)  Preposition; cf. (115)

(124)  Adjective; cf. (116)

There are obvious empirical complications in this picture –all verbs should be underlyingly transitive in some sense, no noun should introduce argument structure per se, no adjective should introduce a complement...– which I will entirely leave aside. What I will focus on here is instead how this theory makes an attempt to restrict arguments to maximally three.

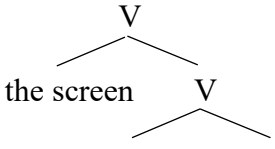
Let us try to build a lexical item with four arguments; we will see that given the premises above this will be impossible. A lexical item with four arguments will be one where there are at least three arguments projected inside the verbal structure, excluding for the time being the external argument –by hypothesis in the UTAH, an agent–.

Let us take a head that we will define as V. This head can maximally take two arguments, one in the complement position and one in the specifier position, as in (125).

(125) 

Note that for (125), however, the verb must correspond to a configuration that is uncharacteristic of it, because there is a specifier in addition to a complement, contra (114b). Hale & Keyser (1993: 63) propose that this structure is possible provided that it is an instance of (116), that is, that X is an adjective that semantically licenses the extra constituent for V.

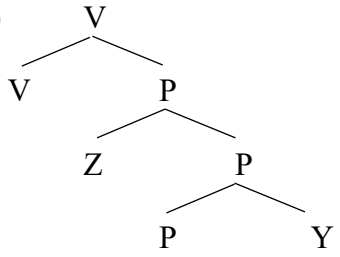
(126) the screen cleared



V A
clear

By the restrictions imposed on L-syntax, there are no additional positions to introduce the third participant as directly depending on V. Therefore, let us now try to make the complement of V itself complex: let us place a P structure as its complement, as in (127):

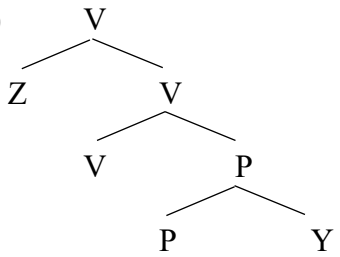
(127)



This structure, again, has been argued to exist and to correspond to verbs like *embotellar* 'to bottle', understood as 'to put something in bottles' (Mateu 2002). With the complement only, we have introduced two arguments. Can we now use the specifier of V to introduce the third internal argument?

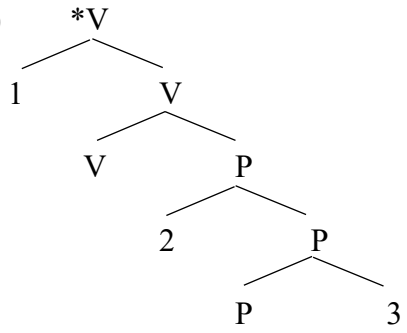
The answer is no; as the verb does not itself license a specifier, that specifier must be semantically introduced by the complement of V. However, in (127) that complement is semantically complete, because the two arguments of P are already introduced. The only way to project a specifier in (127) would be to leave one of the arguments of P unprojected in the complement (as in 128, which roughly corresponds to Hale & Keyser 1993: 62):

(128)



There is no way, given the premises in (113)-(116) above, to build a lexical predicate like (129), which has three internal arguments and then adds a fourth external argument.

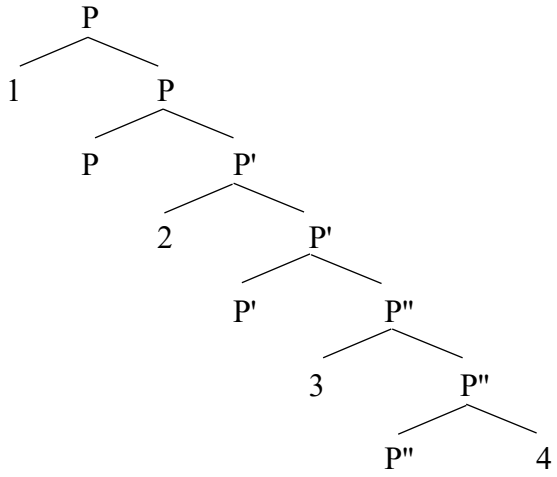
(129)



The attentive reader may have already noticed that this approach works provided that one establishes an additional rule: some lexical categories, and singularly prepositions, cannot combine with each other. If we let a preposition to be the argument of another preposition, it

becomes very easy to build lexical structures with an unbounded number of arguments. (130) shows a structure with four internal arguments, but of course adding another layer will produce +1 in each case (and the same is true if we use the specifier position to introduce another P structure).

(130)

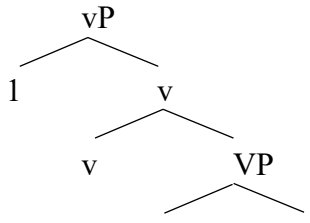


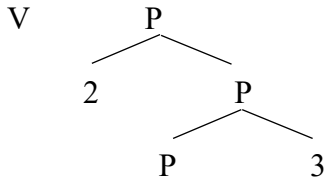
Thus, the theory needs to include statements about how lexical categories can combine with each other, crucially restricting the arguments of Ps to only nouns.

This is an example that let us see that the type of explanation for argument structure presented in Hale & Keyser (1993, 2002) moves the account of why argument structure is limited in the ways that it is from the nature of theta roles to the nature of the predicate heads that introduce those arguments. Combined with the consequences obtained from Baker's UTAH –that argument interpretations depends on the position within a syntactic structure where the argument is merged–, Hale & Keyser paved the way for a fully exo-skeletal account where the answer to how argument structure is built lies on an exploration of the ways in which lexical heads can combine with each other.

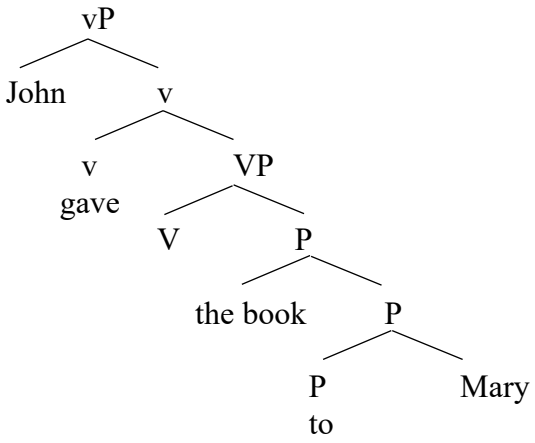
At this point, we must make a small clarification that will become more important in the next section and which directly relates to this problem: Hale & Keyser (1993) do not represent the external argument of verbs within their L-structure. The reason is that they assume the existence of two layers for verbs, following Larson (1988): a head labelled little v and a head labelled big V. While V is a fully lexical head that is built at the L-syntax level, following the restrictions that we have just detailed, the little v head had the status of a functional head which was involved in case assignment and other operations that defined not just the thematic structure of a predicate, but also the grammatical functions of some arguments. As L-syntax restricts the number of arguments to 2, the addition of a third argument in spec, vP creates verbs with three arguments from prepositional configurations (131).

(131)





(132) John gave the book to Mary.



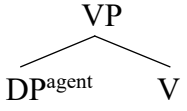
Let us then move to the discussion of approaches that split lexical predicates into different syntactic layers, which is the final piece to obtain an Exo-skeletal approach.

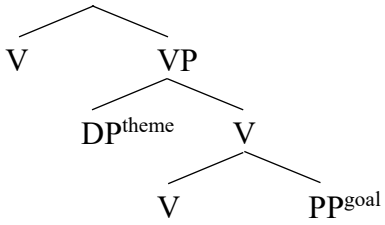
4.2. Two layers for lexical verbs

While endoskeletal approaches can also split the lexical predicate into primitives that are smaller than the immediately visible elements (see §4.3), decomposing a lexical predicate into syntactic layers is a characteristic property of exo-skeletal accounts. The reason for the decomposition of lexical predicates into smaller syntactic heads is that it presents an automatic account of Baker's UTAH: each one of those heads introduces a maximum of two arguments, and the theta role interpretation that they have directly follows from the nature of that head. Therefore, Baker's UTAH reduces to local selection: a theta role is assigned always in the same position because that position is always created by the same head. If one assumes that that head cannot appear in any position whatsoever in its syntactic domain, but is ordered with respect to other heads through selection or some other technical element, the result will always be that the relative ordering of theta roles in the syntactic structure will be invariable and directly conditioned by the syntactic heads present.

The first proposals that argued for a decomposition of the verb in syntax (see §6 and §7.3 for those approaches that argued for semantically splitting the verb into primitives) were based on the asymmetry between the agent argument, on the one hand, and the theme / patient and goal arguments, on the other hand. This lead to proposals where the arguments corresponding to the theme and goal formed one constituent to the exclusion of the argument corresponding to the agent. This, in practice, implied splitting the verb into two heads, one that introduced the two internal arguments and another one that introduced the external argument, as in (134):

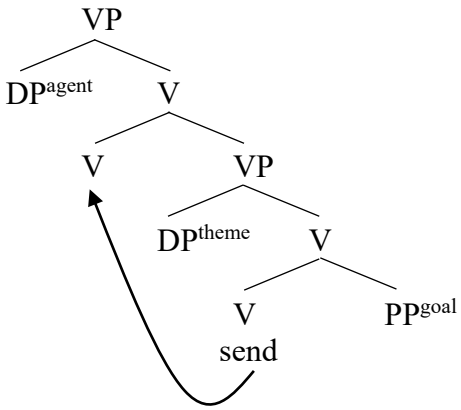
(134)





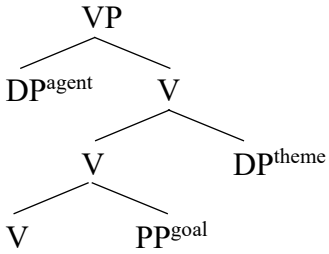
While the analysis where lexical verbs divide in two parts is generally credited to Larson (1988), and is sometimes called 'Larsonian shell', Larson himself acknowledges that his proposal derives from previous work by Bach (1979), Dowty (1979) and Jacobson (1983, 1987). In this account, a ditransitive verb is split into two components, both labelled as V in the diagram above: a higher structure that introduces the entity that causes or initiates the event, and a lower structure that introduces the participants that are related to the change that has been caused by the agent. One can base generate the lexical verb in the lower V head and move it to the higher one via head movement:

(135)



The structure was proposed initially to account for ditransitive verbs: from a theoretical perspective, the structure in (135) has the advantage that it accounts for why what seems to be one single predicate introduces three arguments without the need to propose syntactic positions beyond one complement and one specifier, which is done in (136), where the verb must allow for two complement positions.

(136)



The solution in (135) involves making the surface lexical verb a syntactically complex object, with two heads involved. The higher head takes the agent in its specifier, and the second verbal head in its complement, and the second verbal head projects the two remaining arguments.

Larson's (1988) initial puzzle that motivated this proposal was the double object construction. In a structure where the goal argument is a PP, the evidence –in accordance with the UTAH– is that the theme c-commands the goal (137a). However, some valence-3 English

verbs allow a construction known as 'double object', where the goal argument is not introduced by a P, and the goal argument both precedes and c-commands the theme argument (137b).

(137) a. John gave a letter^{theme} to Mary^{goal}.
b. John gave Mary^{goal} a letter^{theme}.

Barss & Lasnik (1986) note that in (137a) the goal is lower than the theme, while the opposite hierarchy is diagnosed in (137b). A possesive contained in the theme cannot be a bound variable controlled by an operator in the goal in (138a), but it can in (138b):

(138) a. *I denied his paycheck to each worker.
b. I denied each worker his paycheck.

This follows if in (138a) the theme is not under the c-command of the goal, but that is the case in (138b). In (139b), wh-movement of the theme causes a weak crossover effect that movement of the goal does not create:

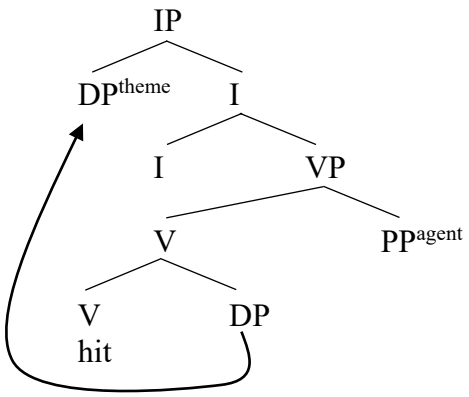
(139) a. Which worker did you deny his paychek?
b. *Which paycheck did you deny its worker?

This follows if the double object construction has the theme lower than the goal, because then wh-movement of the theme leaves a trace (or a copy) that will be coindexed with a hierarchically higher intervening possessive.

Therefore, while themes are higher than goals introduced as PPs, themes in the double object construction seem to be lower than goals. Of course, this variability would be prima facie counterevidence to the UTAH or any equivalent theory that claims that thematic structure maps into a stable set of argument structure positions.

Larson (1988) identified one way out: thematic relations remain stable unless an additional syntactic operation, like passive, is performed on the structure. As we saw, passive allows the theme argument to move to the subject position, somehow removing the agent argument as a competitor. Larson (1988) assumes that passive involves the demotion of the agent argument, which projects as an adjunct, and does not intervene between the subject position and the theme argument (140, Larson 1988: 351).

(140) Mary (was) hit by a snowball.

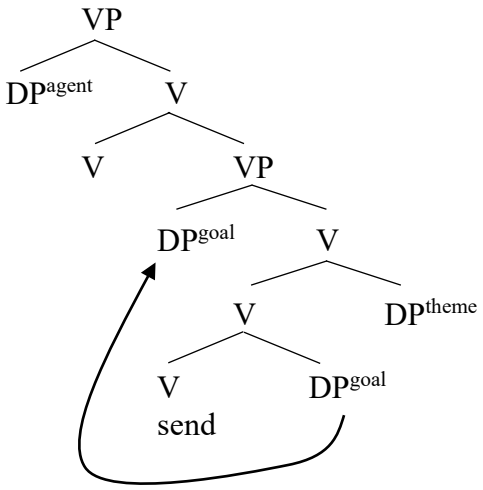


His proposal is that the double object construction involves a passive of the lower VP layer. Normal passives involve argument demotion where the specifier of the higher VP layer

becomes an adjunct and case of the theme is absorbed, and double objects are passives where the specifier of the lower VP layer (the theme) becomes an adjunct, and case of the goal is absorbed.

Demotion of the theme as an adjunct means that the specifier of the lower VP is free for the goal argument to occupy it –Larson assumes that the absence of the preposition involves case absorption, which implies that the preposition was a case marker rather than a lexical head–.

(141) Mary sent John a letter.



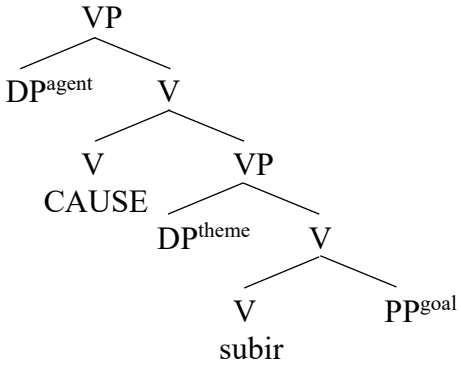
In this way, the thematic hierarchy does not become contravened, at the same time that the theme is now structurally lower than the goal, after movement.

The motivation for this split was to explain why two theta roles seemed to behave as a constituent to the exclusion of the agent one. At the same time, splitting the lexical verb into two layers had semantic appeal, precisely because the higher layer introduced the agent and therefore could be associated to a CAUSE semantic primitive that Dowty (1979) had actively used in his analysis of lexical aspect. Once the proposal of splitting the lexical verb in two had been made for the double object construction, the immediate expectation is that in some cases one of the layers would be missing. Specifically, verbs alternating between a causative and a non-causative structure, such as (142), were an immediate candidate to illustrate this case.

(142) a. Juan subió la ropa al altillo.
Juan raised the clothes to-the attic
'Juan took the clothes up to the attic'
b. Juan subió al altillo.
Juan rose to-the attic
'Juan went up to the attic'

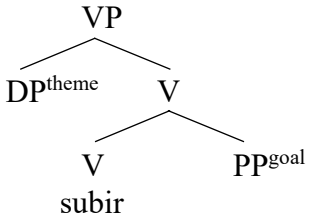
An approximate gloss of (142a) is that Juan cause the clothes to move up to the attic, while in (142b) the causing component is perhaps absent. The division of the lexical verb into these two layers could then be mapped to the semantics of the verb: while the lower VP structure corresponds to the 'the clothes move up to the attic' part, the higher VP structure introduces the 'Juan caused...' part that is present in (142a) and absent in (142b). Therefore, (142a) would correspond to a lexical verb with two layers:

(143)



(142b) would be a truncated lexical verb structure where the higher layer is missing:

(144)



The proposal could easily be extended to verbs with valence-2, which alternate with non causative versions of valence-1. Consider the following pair:

(145) a. La desgracia cambió a María.
the misfortune changed DOM María
'Misfortune made María change'
b. María cambió.
María changed
'María changed'

In (145a) the gloss 'Misfortune caused something to happen', where what happens is that María undergoes some change suggests that we can treat this type of verb as projecting the two layers, while (145b) only projects the lower layer.

The association of different verbal heads to portions of the verb's structural meaning opened for new possibilities in the analysis of thematic structure. On later work, the higher V layer was relabelled as little v, and it was associated to a diversity of meanings (Harley 1995, Folli & Harley 2007), but the idea that the 'standard' or 'complete' version of little v had a core causative semantics that allowed for the introduction of the agent argument influenced some proposals that argued, as in Chomsky (2000, 2001), that the version of little v that assigned an agent theta role is also responsible for making a verb syntactically transitive. This, and the fact that little v is associated to an abstract semantics, where the nature of the change caused by the agent has to be lexically specified by the lower VP, is among the reasons that Hale & Keyser (1993) had to propose that little v, and therefore agents, are built outside the level of syntax that they called L-syntax (see also Kratzer 1996).

Leaving technical details aside, which are more relevant for specific discussions about the relation between case and structure, what the Larsonian shell proposal meant is that it was in principle possible to split the verb in as many syntactic layers as components of meaning of an eventuality. The Larsonian shell approach provided an elegant explanation of the UTAH: (i) lexical verbs can be composed of two heads; (ii) each one of those heads introduces the arguments needed for the portion of meaning that it denoted, and consequently assigns the corrresponding theta role; (iii) heads are syntactically ordered in a semantically compositional way, so the head that denotes the causation must take as an argument the VP that denotes the change that the agent leads to.

In this way, having a theta role necessarily means to be in the same local syntactic position: specifier or complement of the designated verbal head, for instance specifier of little v or complement of V. The theta role cannot be assigned in the structure by any other head, so absence of v necessarily implies that no verbal argument will have the agent theta role. Moreover, little v is higher than V, when both are present, so it follows that arguments interpreted as agents will always c-command the rest of the arguments of the same verbal complex.

4.3. Extensions of the two layered system

Most current accounts that decompose the lexical verb into layers assume a two-layered system, with the equivalents of little v and V as the two heads that project the structure (and potential presence of other optional heads like the Applicative, which we will leave outside this discussion; see Cuervo 2003). The central reasons for this binary division, next to the theory-internal arguments in favour of the UTAH, are the maximal number of arguments that one single predicate can introduce given the four options presented by Hale & Keyser (1993), the isomorphism with the semantic decomposition of eventualities, argument alternations like the double object construction and the causative - non causative alternations, and the interpretation of some verbal modifiers. For instance, a frequently noted fact is that a two-layered system predicts that modifiers like *casi* 'almost' should trigger two distinct meanings, depending on whether they modify the CAUSE component of little v or the change component of V.

The two readings can easily be obtained in (146):

(146) Juan casi leyó *Don Quijote*.
Juan almost read Don Quixote

(146) can be interpreted in two ways: in the first reading, Juan started reading the book and almost completed it, but left it before reaching the last chapter. In this reading, 'almost' modifies the change component, saying that it was almost fully developed. In a second reading, Juan never opens the book, but considers reading it and eventually decides not to start the reading. Here, 'almost' modifies the causative component, saying that Juan was in a state where he almost initiated the change.

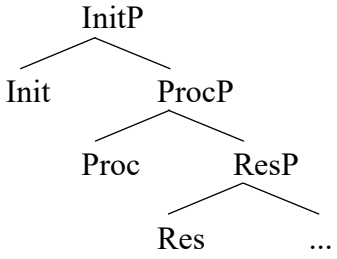
It is important to note that the layering of lexical verbs makes it easier to move to an exo-skeletal approach, but it does not force one to abandon an endo-skeletal one. The reason is that, to the extent that individual verbal heads will introduce specific theta roles, one could still design an endoskeletal system where the verb's argument structure specifies the heads that should be projected, indirectly determining which arguments the verb requires –and we will see in a minute that Ramchand (2008) is an example of this type of theory–. What the layering approach does imply is that theta roles are associated to subcompoonents of the lexical verb, with theta roles depending on the semantic contribution of those heads.

For this reason, this type of approach treats as an empirical question the issue of how many layers there should be in the internal decomposition of a lexical verb. One unsatisfactory

property of the account above is that the types of meanings conveyed by lexical verbs greatly exceed the semantic distinctions that a simple split in CAUSE and a change denoted by V predict. Approaches that want to obtain a close isomorphism between syntax and semantics by exploiting Larson's idea that verbal layers introduce specific arguments frequently propose additional layers, splitting the lexical verb in more than two heads.

Ramchand (2008, 2018) is an example of a theory which uses the identifiable primitives of eventualities to determine the number and ordering of heads that can introduce arguments (see also Champolion 2010, who argues that each single argument is introduced by a different syntactic head). In her approach, verbs are maximally decomposed into three layers, as in (147), which does not represent yet the positions where arguments can be introduced.

(147)



Starting from the bottom, the lowest verbal head is labelled Res(ult), and as the name suggests it denotes the result state that follows the culmination of the dynamic part of an eventuality.

The next head up is Proc(ess). In Ramchand (2008) this is the only eventive head –as opposed to stative head– in the system. It is therefore only present in dynamic verbs, and it is only excluded in stative verbs. This head must be responsible for introducing any internal change in the event, or any type of action that is developed as part of the verb's denotation.

The highest head is Init(iation), a term that is more general than causation (see §7.5 for discussion). This head is also stative in nature, and when Proc is present as its complement it gets interpreted as the relation between the event and the entity that starts it, triggers it or, more abstractly, sets the conditions that allow the event to happen.

Note that, from one perspective, Ramchand is splitting in two the role of the VP layer in Larson (1988), by dividing change in at least the dynamic part that is required for something to happen and the result obtained when change has happened; in contrast, InitP is quite close to vP in Ramchand (2008).

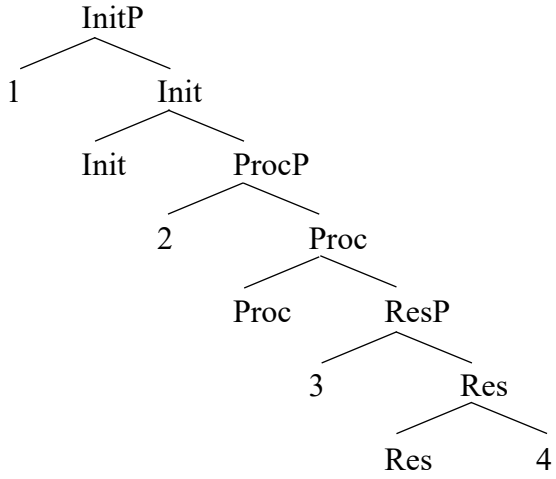
In Ramchand (2008), Init and Res are featurally identical and they are only differentiated by their relative position with respect to Proc, when present: assuming that logical precedence at LF matches the hierarchical ordering of heads in syntax, a stative head that takes Proc as its complement is interpreted as leading to the process, that is, as causing it. The same stative head taken as complement of Proc is interpreted as what the process leads to, hence the result state. In this system, both Res and Init behave in the same way, and have the same configuration – Ramchand (2018) decides to treat each as a separate head, precisely through argument structure–.

This system allows for many different combinations of the heads, predicting the existence of several verb classes: some verbs will just be Init (more appropriately, State), while other verbs will be just Proc –dynamic events, telic or atelic–; other verbs will be Init, Proc –causative dynamic events, telic or atelic–, or Proc, Res –telic events with a result state–. Maximally, verbs will be Init, Proc, Res –causative telic events with a result state–. If Res and Init are indeed the same head, we predict that no stative verb will be Res (because that would be interpreted identically to Init alone, as State) or Init, Res without Proc (because the two labels can only be different in the presence of Proc). The same configurational distinction makes it impossible

that any verb will be Proc, Init or Res, Proc –or the more complex but equally impossible Res, Proc, Init–.

As in Larson (1988) each one of these three layers can introduce arguments with specific theta roles associated to them. In fact, there are four possible argument positions within the same verbal structure: three specifier positions and an extra complement position.

(148)



Init will assign an agent-like theta role (see §7.5 for discussion) that Ramchand labels 'Initiator', defined as the entity that is responsible for the event's coming up.

(149) Mary broke the window.

In (148) the complement of Init is occupied by another event constituent, ProcP. When the verb is stative and therefore there is no Proc, the thematic interpretation of that complement is one that Ramchand calls 'rheme', which is a sort of theta-role by default: rhemes are arguments that do not act as the subject of any subevent –starting it or being affected by it– but are properly part of the description of the subevent. As states do not involve any internal change, only stative-compatible constituents can be integrated as rhemes of Init.

(150) Mary owns a house.

With respect to Proc, its complement position can also host a rheme. The difference with the rheme of Init is that Proc is dynamic, which means that any rheme integrated with Proc as part of its description must be conceivable as an internally complex object with mereological properties that allow mapping to portions of the event. For this reason, rhemes of Proc are interpreted as paths: structures containing parts which are ordered in a way that they can be matched with the process and delimit it. In other words: paths will measure the progression of the event, and they will contribute to defining the telicity or atelicity of the event, which entirely depends on the complement of Proc.

DPs interpreted as paths will be affected objects which, when mass, will not delimit the event (151a), triggering an atelic predicate, and will delimit the event and build a telic predicate when count (151b):

(151) a. Mary reads poetry.
b. Mary reads a poem.

Paths can also be projected as spatial PP structures which denote a trajectory of movement; when the trajectory is bounded and specifies an endpoint, the event will be defined as telic (152a), and when the trajectory is unbounded, the event will be atelic (152b):

(152) a. Peter runs <u>to the shop</u>.
b. Peter runs <u>around the shop</u>.

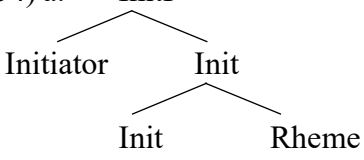
Therefore, Proc defines a dynamic subevent whose development may be specified and measured by a rheme path in its complement. The specifier of Proc, in contrast, gets the theta role that Ramchand calls 'undergoer', the entity that travels along the temporal progression of the process without being part of its description. For instance, in (151) above Mary gets (as well as the role of Initiator) the role of undergoer, because she is the entity that consciously travels along the process of reading the poem, obtaining the information contained in it, while she herself does not measure or decide the extent of that progression –which the poem, with its length, does–. In (152), Peter does not measure the running event (the extension of the perimeter of the shop or the trajectory that ends there does), but is quite literally the entity that travels along that spatial trajectory.

Finally moving to Res, its rheme in this case with be identified with the description of the result state where an entity is located, and the theta role Resultee will be assigned to the specifier, as the entity that is located in that state. (153a) underlines the rheme of result, and (153b) underlines the resultee:

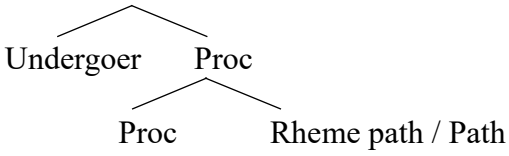
(153) a. John put the book <u>on the table</u>.
b. John put <u>the book</u> on the table.

(154) summarises the names of the arguments introduced by each one of these heads.

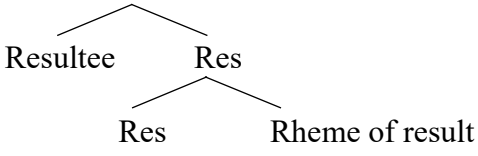
(154) a.



b.



c.

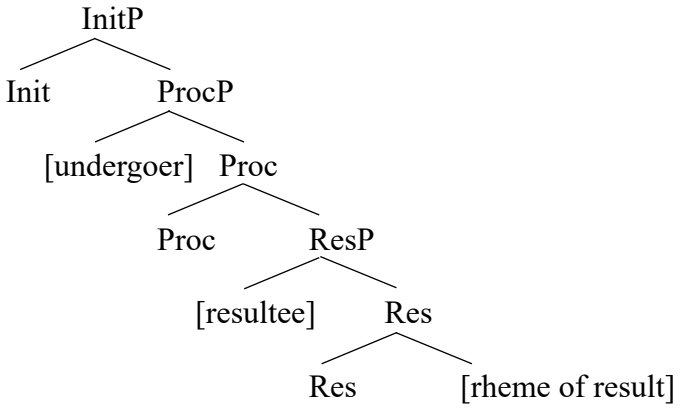


As the reader has noticed, splitting the verbal head in three heads predicts that there should be verbs with valence-4, which we have seen is not empirically clear –and even in the cases where one could argue for verbs with four arguments, it is not obvious that each argument would match the predicted theta roles Initiator, Undergoer, Resultee and Rheme of Result–. This weakens the theory, because it is forced to claim that the restriction of arguments to only

three for one single predicate must follow from independent reasons, perhaps case theory – although nothing in the theory forbids any of these arguments from projecting as PPs, in which case P could directly satisfy case–.

In Ramchand (2018), a technical change is introduced in the theory that is relevant for argument structure: she proposes that Init introduces a causative-like component, but that it does not project a specifier that receives an initiator theta-role (155).

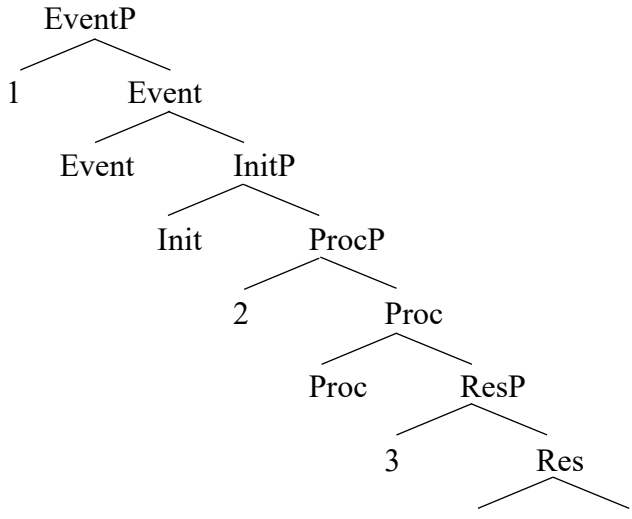
(155)



The immediate consequence of this decision is that Init and Res cannot be identical heads, solely differentiated by their relative position with respect to Proc: one of them, Res, is a relational head that associates the holder of a stative set of properties with the rheme that defines that set of properties, and the other is a purely eventuality-related head that semantically introduces a theta-role but does not provide the syntactic space to host a participant that receives it. Hence, now the theory is less restrictive in that it predicts that Init, Res verbs – something like agentive stative verbs– are possible; a different question is whether semantic compositionality still restricts Res to the complement of Proc, and bans it from appearing above Proc, and whether Init must be above Proc or it could be syntactically merged as a complement of Proc.

The syntactic position for the external argument is provided by a different kind of head that Ramchand (2018) labels 'Event'. Event is a voice-like head that does not introduce any theta role, but builds enough structure for an argument to be projected. Ramchand also associates this head to the introduction of the time and world parameters that allow the lexical verb to be integrated in a clause with T, Mood and Asp, as the descriptor of the situation that the proposition conveys.

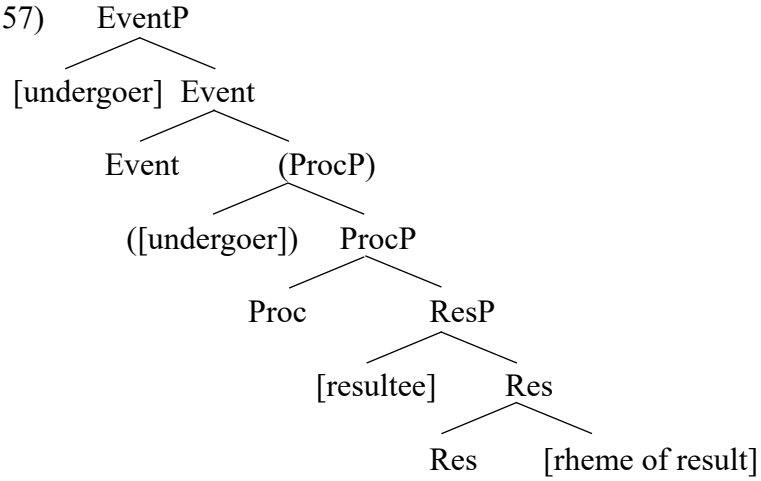
(156)



Res 4

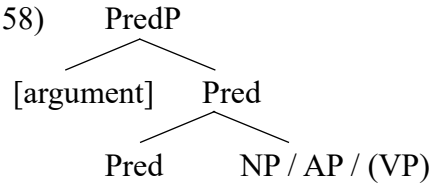
The theta-role that the argument in spec, EventP will receive corresponds to any semantic relation expressed by the complement of Event and not yet assigned to a participant in their spec positions. In (156), as the complement of Event is Init, which introduces a causative semantics, that theta role will be [initiator], but other possibilities are available. For instance, in (157) one would expect that the external argument should be interpreted as [undergoer] –it is unclear in the proposal whether that argument is introduced directly in spec, EventP or whether movement from spec, ProcP is required, and perhaps natural languages allow both options–.

(157)



This move, which in the case of Init clearly implies dissociating the syntactic positions from the theta roles, is another step towards an exo-skeletal theory. In this approach, syntax solely introduces syntactic positions, but it is not required that thematic interpretations are always syntactically projected within the XP corresponding to the head that introduces the theta role: provided that the role is semantically unassigned yet, the argument that will receive that interpretation may be introduced at a higher position. This dissociation had also been previously proposed in Bowers (1993) for all lexical predicates and in Baker (2003) for non-verbal categories: in both cases the proposal is that predication requires the introduction of an argument position through a designated head Pred(ication) that does not introduce its own argument structure, but creates syntactic space for the predicate properties of its complement.

(158)



Ramchand's (2018) is closer to Bowers than to Baker, because it proposes that the complement of Event –which is similar to Pred, except that Event introduces time and world parameters and is therefore a verbal projection– can be a lexical verbal projection.

We must insist, however, that proposals where the verbal predicate is split into layers and argument positions can be dissociated from thematic structure only make an exo-skeletal system easier, but they by no means enforce an exo-skeletal system. Obviously, an exo-skeletal system requires argument structure to be a mainly syntactic phenomenon, and that requires a rich syntactic structure. Also, an exo-skeletal system requires theta roles to be mainly a

semantic notion that at best is derived by interpreting the syntactic structure at LF, and that again means that theta roles cannot be lexically-specified objects that must be projected within the XP headed by the predicate. However, an endoskeletal system is still possible if one adopts both technical solutions, because all that it takes to be endoskeletal is to say that the lexical item used contains enough information in its lexical entry to enforce or filter that specific syntactic heads must be present in the structure where the item is introduced.

Ramchand (2008) in fact shows that this is possible. Ramchand's theory does not claim that lexical items are present in the derivation at the initial stage, and therefore her theory does not claim that lexical items project their lexical information in the syntactic tree. Ramchand's theory proposes a particular form of Late Insertion, in fact.

However, the lexical items that are late inserted –which Ramchand, mainly working on English, directly correlates with the root of a verb– do contain non-trivial information about the specific heads that must be present in the syntactic tree for the item to be compatible with it. For instance, the verb *push* specifies in its lexical entry the information in (159; Ramchand 2008: 70):

(159) push [init, proc]

The verbal exponent specifies which subeventive heads should be present in a structure (and also, in which order) for the item to be used. Even though the lexical information does not directly determine which arguments must be introduced, as the subeventive heads are directly related to theta roles, (159) is an indirect representation of the argument structure of the verb, and could as well have been defined as (160) keeping the same meaning:

(160) push [initiator, undergoer, rheme path]

Ramchand's theory is, therefore, strictly non-projectionist because the information that *push* requires init, proc is not known to syntax at the point where the structure is being built. However, the lexical information of *push* still acts as a filter that blocks the derivation: if the structure is for instance proc, res, the lexical item *push* will not be usable there –inserting it would create ungrammaticality–. A pure exo-skeletal approach would say that in a proc, res context the meaning of *push* would be accommodated to whichever configuration (and interpretation) the syntactic structure imposes.

5. Argument structure (III): abandoning the theta criterion and moving to an exo-skeletal account

So far we have discussed two main technical innovations: the idea that theta roles project into designated positions and the proposal that lexical verbs are actually syntactically complex objects composed of more than one syntactic head. These two proposals do not enforce an exo-skeletal account, but are necessary components of this type of approaches. This section will discuss the final technical innovation that makes exo-skeletal accounts: rejecting the Theta Criterion (§5.1). At that point it becomes possible to define non-projectionist approaches and a purely exo-skeletal system; exo-skeletal systems are discussed in §5.2.

5.1. Removing the Theta Criterion from the set of grammatical principles

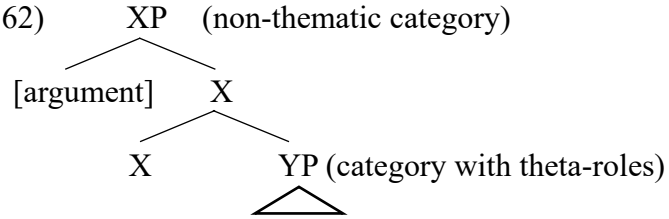
Before we arrive to a pure exo-skeletal account, there is another technical modification that the traditional theory needs to make: the theta criterion. We repeat in (161) its initial formulation, which was assumed by Baker (1988), Larson (1988) and many of the theories decomposing predicates –but, crucially, not works like Ramchand (2008)–.

(161) Each argument bears one and only one θ-role, and each θ-role is assigned to one and only one argument (Chomsky 1981: 35)

The theta criterion was stated as a condition on D-structure, which was still part of the framework where Larson and Baker worked during the 80s; however, D-structure disappears from the theory (unless transformed into Hale & Keyser's L-syntax, understood as the initial stages of syntactic composition) in the early 90s.

At the same time, proposals where thematic structure did not need to be assigned within the lexical projection of the category acting predicate started appearing: Bowers (1993), as we have already mentioned, proposed that, even if a predicate is semantically incomplete and needs to saturate an argument position, an additional syntactic projection had to introduce the argument that would eventually build that position. Abstractly, these approaches proposed a structure like (162), where the semantically strong projection did not (always) host the argument.

(162)



Argument positions, then, where simply syntactic positions on a par with other specifiers of functional categories, like TP and CP. All that made them different was the broader configuration where they where placed, and specifically that their complement was semantically a predicate that had some semantic variable to be filled.

It was known that movement could cyclically target multiple specifier positions; for instance, in the traditional analysis of wh-movement from subordinate clauses, nothing prevented a wh-element from passing through multiple spec, CP positions –as well as potentially other positions–, as in (163).

(163) [What$_i$ did Mary say [that John believes [that the teacher has told you [to read _]]]]?

From this perspective, the theta criterion was arbitrarily limiting the possible movement landing sites. The part of the theta criterion that bans one single argument to receive more than one theta role in practice bans a constituent from passing through multiple positions where theta roles are assigned. The theta criterion could not be considered a syntactic principle, because it affected a level of syntax which had stopped having a separate status, so at best it could be taken to be a semantic principle saying something like (164):

(164) An argument cannot be interpreted as having multiple relations with one and the same eventuality

However, (164) is obviously wrong. Consider the semantic role that the subject has in the eventuality in the sentence in (165):

(165) John runs through the park.

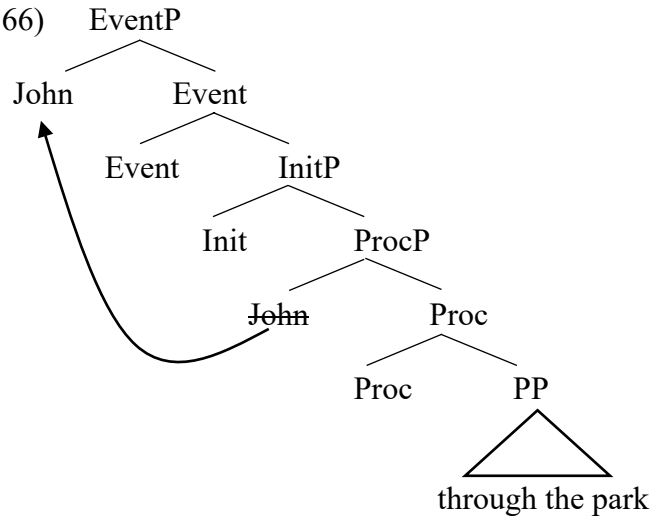
The entailments associated to the verb tell us that *John* must be an agent (an initiator, in Ramchand's terminology), because it must be the entity that controls the running event. If, say, John is drugged and unconscious and a machine moves him along the park, (165) is perceived

as a lie. However, at the same time, *John* must be the entity that moves along the park (patient, undergoer, depending on the terminology). If John sits on a bench and moves a robot representing him through the park, again (165) is a misleading at best. It seems, then, that in a sentence like (165) one and the same argument must be interpreted as both initiator and undergoer, in Ramchand's terminology.

Therefore, the theta criterion is impossible to state as a syntactic principle and empirically false as a semantic principle. This means that there are no reasons to ban movement from a position where a theta role is interpreted to a position where a different theta role is interpreted, with one and the same argument accumulating the entailments of both theta roles, as in (165).

The easiest way, then, to account for the double entailments of *John* is to allow the DP to be introduced in the position where it gets interpreted as undergoer, and move it from there to the position where it gets the initiator reading. In Ramchand (2018) that movement would be as in (166):

(166)

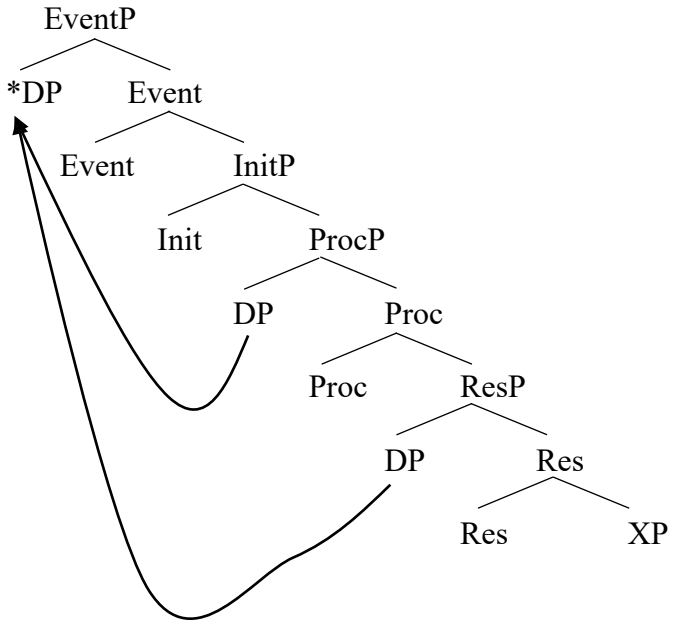


Thus, in spec, ProcP the DP spelled out as *John* receives the entailments of an undergoer –it moves along the spatial path defined by *through the park*–; movement to spec, EventP when the complement is InitP adds to it the entailments of an initiator –he defines the conditions that are required for the running event to happen–.

The second part of the theta criterion –the same theta role cannot be assigned to two arguments– is still valid, but note that it does not need to be stated as an independent principle. This part of the theta criterion directly derives from usual assumptions about structure building once one has concluded that theta roles are assigned in specific syntactic configurations.

Specifically, think about the initiator theta role. It is associated to a participant in spec, EventP when InitP is the complement of Event. There are two options: either XPs can have multiple specifiers, or they cannot. If XPs cannot have multiple specifiers, then it follows that only one argument will be interpreted as initiator because only one constituent can be a specifier of EventP –something like (167) is an impossible structure building operation, and it is identically impossible that a specifier contains both a moved item and a base-merged item that are both the only specifier of XP–:

(167)



Imagine now that multiple specifiers are possible. It will still be impossible to assign the same theta role to the two specifiers, because LF is looking for a participant that fills the open variable position of the predicate. Whichever of the two participants is read first by LF will fill the semantic position, so it will be unavailable for the participant that comes next; perhaps the predicate will have another empty position for another thematic relation, and that second participant will fill it, but the already filled position is not available. Either way, two distinct DPs will not be able to be interpreted as satisfying the same theta role.

5.2. Pure exo-skeletal theories: syntactic context determines the interpretation of the predicate

We arrive now, finally, to full exo-skeletal accounts. In the previous sections we have seen how different ingredients that are needed for an exo-skeletal account were introduced:

i) thematic interpretations are defined in syntax, autonomously, which presupposes that the empirical facts are compatible with the UTAH or a UTAH-like principle

ii) hence, limits on argument structure must be only those imposed by syntax (number of possible arguments, positions for individual theta roles...)

iii) hence, predicates must be built in syntax and not be pre-ensambled in the lexicon (decomposition of lexical verbs in distinct heads)

iv) hence, positions where thematic interpretations emerge should not have special properties that other syntactic positions lack (the theta criterion is abandoned)

However, as we have seen, these are necessary but not sufficient conditions for a pure exo-skeletal approach, and Ramchand (2008, 2018) is an example of a system that satisfies all the conditions above but is still endo-skeletal. The reason is that in her system lexical items –roots– convey information about the syntactic structure that is enough to make them only compatible with specific argument structures.

A pure exo-skeletal system must in addition to (i)-(iv) above comply with (v):

v) The argument structure of a lexical item is imposed by syntax, and any mismatch must be solved by accommodating the interpretation of the lexical item to the interpretation obtained from syntax

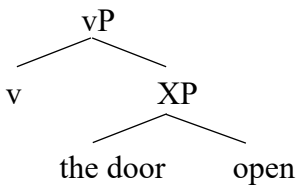
Being exo-skeletal, then, involves not only that arguments are projected by syntax, but also the claim that the verbal event is interpreted according to the elements that share syntactic space with it.

There are two ways to obtain this: the first one is that lexical items –roots, in Ramchand's account– contain information about which heads must be present in syntax for the lexical item to be licensed there, but those heads are not directly associated to specific argument structures (and eventuality interpretations). The second one is, obviously, that the lexical item does not contain any reference to the specific syntactic structure where it can be introduced.

An illustration of the first type of answer –items refer to syntactic heads, but those syntactic heads do not impose a single argument structure– is Harley (1995, 1999). In this approach the central idea is that little v's primary function is to define a predicate as verbal. Given this premise, the obvious fact that non causative verbs exist must necessarily mean that little v is not always causative, and therefore that the argument structure (and thematic interpretation) of little v is variable.

Harley (1995, 1999) and Folli & Harley (2007) illustrate this type of approach. In their system, little v is not associated with a stable and rigid interpretation. For instance, Harley (1999) proposes that the interpretation of little v varies with respect to at least boundedness and the selectional restrictions of the head. In Harley (1999: 10) she proposes at least four interpretations of little v. When little v does not introduce an agent and combines with a state-denoting object, a BECOME reading emerges:

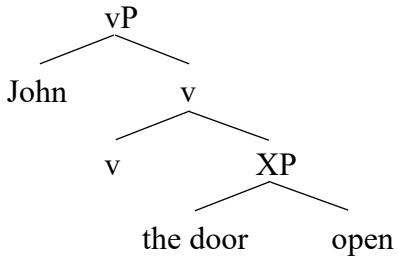
(168)



'The door opened'

If (168) projects an agent, a CAUSE reading emerges (169):

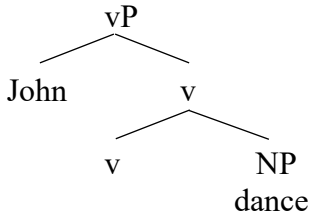
(169)



'John opened the door' ('John caused the door to open')

When little v projects an agent and its complement denotes an event –as a noun, for instance–, the interpretation proposed is DO.

(170)



Harley (1999) notes that in these cases one could argue that little v is stable and the differences in interpretation follow from its syntactic environment, the type of complement taken and the presence or absence of an agent. However, she leaves the door open for additional cases where little v must indeed be featurally different, and she preliminarily suggests that other common semantic primitives used to describe lexical verbs and their argument structure (like GO, Applicative, Experiencer, etc.) may be alternative instances of such heads.

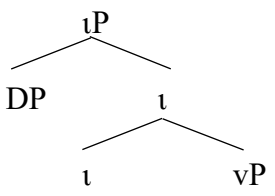
Note that at this point we have fully arrived to an exo-skeletal account: what Harley claims is not only that theta roles are introduced by designated syntactic heads. She goes further and proposes that the types of arguments introduced in the syntactic environment of one and the same head condition the interpretation of the eventuality. If a lexical item's (a root) lexical entry makes reference that it is introduced in the context of little v, that statement will only make the item be verbal, but it will not say anything about the argument structure of that verb. If the insertion information is underspecified so that it is neutral with respect to the possible flavours of little v, such as GO, BE, etc., then the verb will have an even broader compatibility with different argument structures.

(171) push <vP_____>

(171) illustrates this point: if an item like 'push' contains only the statement in (171) to deal with its context of insertion, we predict that 'push' will always emerge as a verb, but we do not say anything about whether that verb will encode a change of state with agent and patient, a directed motion event with agent, undergoer and path, a stative verb, a transference verb, etc. Of course, verbs typically are more rigid than this, so the problem in this approach is how to restrict the combination of verbs with argument structure (see §8.3), but we leave this part aside for the moment.

Another example of this type of exo-skeletal account is Wood & Marantz (2017). Their approach goes even further than Harley's (1999) in that they even treat the category label of some elements as entirely derived from the syntactic context and only relevant at LF and PF. They propose the existence of a iota head (ι) which is inherently relational, and which will receive a verbal, prepositional or other interpretation depending on its syntactic position. For instance, what Harley defines as a little v that projects a specifier corresponds in actuality to a configuration like (172).

(172)



hold the purse

Thematic interpretation emerge only after syntax, where LF has statements like the one in (173), which assign an interpretation to the specifier of ιP in the context of other elements (defined in a semantic way relevant for LF; Wood & Marantz 2017: 259):

(173) [[ι]] <–––> λxλe. Agent (x,e) /_____ (agentive e)

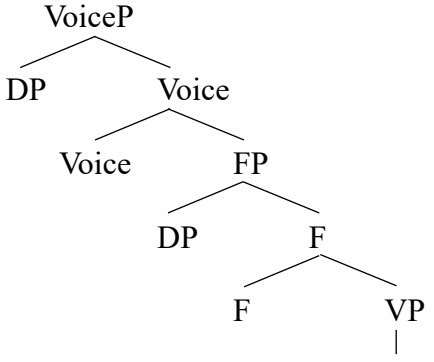
Therefore, Wood & Marantz (2017) propose that the only syntactically relevant distinction in argument structure is whether there is a specifier or not in the ιP projection –whereas for Harley (1999) the same head can choose to have a specifier or not–. Little v with a specifier will be, at the relevant syntactic level, identical to some prepositions that also introduce a (figure) argument.

In practice, the move of making the syntactic heads that an item refers to in its lexical information turns upside down the traditional account of argument structure, which was clearly endocentric: verbs do not project their argument structure according to their interpretation, but verbs are interpreted in particular ways according to the syntactic elements projected in their environment, that will be read as the arguments involved in the situation it describes. To the extent that the same little v head can get different readings determined by its surrounding context, it is impossible to associate a lexical item to the little v head in the hope that this will indirectly determine its argument structure.

The second exo-skeletal solution, and in fact the one that gave name to this type of approach, is to propose that roots lack any lexical information. Borer (2005a, 2005b, 2013) was the first one to make this claim: roots are syntactically inert objects that never introduce any complement or specifier, and act as purely phonological indices that refer to a particular entry in the set of exponents that a language has. An item like 'push' would correspond to a root with a particular index (say, 143, as in $\sqrt{}^{143}$). There is no reference to any argument structure, category or set of theta roles in that item, and the interpretation that it will receive will entirely depend on the syntactic context where it is inserted.

An application of this set of ideas to the specific case of argument structure is Lohndal (2014). His proposal uses spell out domains in order to enforce that lexical predicates will not be able to make reference to any argument structure. He follows Borer (2005b) in the claim that the chunk of structure that can be labelled VP (which is itself complex) does not introduce any argument. All arguments, be them internal or external, are introduced by independent heads above VP (Lohndal 2014: 27-43; see Marantz 1984: 22 for a similar idea, where head verb only assigns one theta role in unmarked cases). (174) presents a simplified structure where F introduces the internal argument and Voice introduces the external argument:

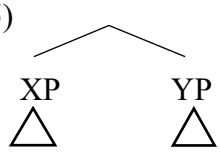
(174)



(verb)

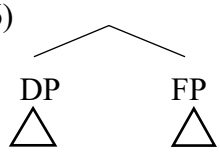
Importantly, the full structure in (174) is never together in the syntax. Specifically, Lohndal (2014) proposes that structures where two full phrases merge, as in (175) are not derivationally tolerated because they cannot be created by merge in one single space:

(175)



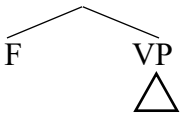
Note that, if VP stays as complement of F in a structure like (174) by the time the DP is introduced, we would have a situation like (175) –F is at that derivational point an FP because it contains both the head and a complement–:

(176)

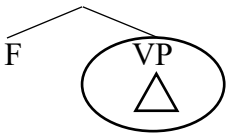


The proposal is that, in order to merge DP with F without F having an XP status is that, prior to that merge operation, the complement of F is transferred and abandons the syntactic derivation. Hence, at the point where VP combines with F (177a), VP gets transferred (177b) and F becomes again a head (177c) that can be merged with the DP (177d):

(177) a.



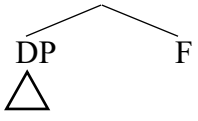
b.



⟹ Transfer

c.

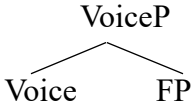
d.



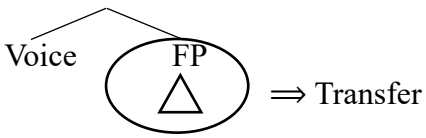
(linear order irrelevant)

The same logic will require the FP in (177d) to be transferred prior to the introduction of the DP when it combines with VoiceP:

(178) a.



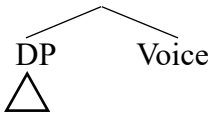
b. VoiceP



⟹ Transfer

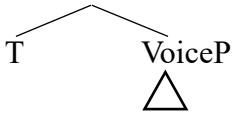
c. Voice

d. VoiceP (linear order irrelevant)

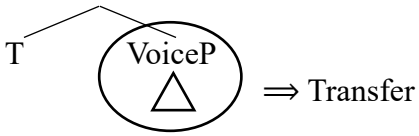


And again, when VoiceP combines with the next specifier projecting head (for instance, TP), the sequence will have to be repeated.

(179) a. TP



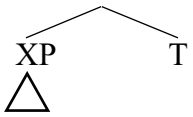
b. TP



⟹ Transfer

c. T

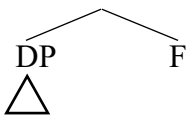
d. TP (linear order irrelevant)



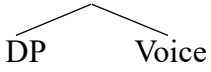
This is the syntactic derivation part of the verbal structure, but the relevant level at which the argument structure and thematic relations are defined is LF. LF gets the portions of the tree as they are transferred from syntax, and consequently in our example it will get three separate chunks:

(180) a. VP

b. FP (linear order irrelevant)



c. VoiceP (linear order irrelevant)



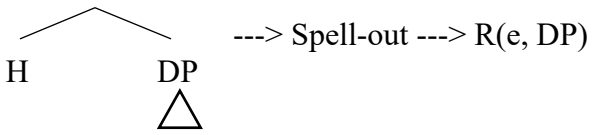
Lohndal (2014: 98) proposes that the interpretation of (180a) is directly an eventuality named by the verb:

(181) VP ⟹ blah'(e)

Crucially, there is no argument structure in (181), and moreover there is no way in which the VP can define or impose any argument structure, because it is transferred to the exclusion of any argument –or the heads that introduce them–. In fact, to the extent that arguments will have to be DPs, and hence XPs, it is derivationally impossible to transfer the verb together with any argument.

Arguments are linked to the eventuality indirectly; Lohndal (2014: 108) proposes that after transference the following interpretation principle is applied:

(182) Thematic integration



In (182), H corresponds to whichever heads have been identified to introduce arguments, at least F and Voice, and R is whichever thematic relations have been proposed (agent, patient...). The spell out rule will associate types of H with types of R, in practice making each argument to be introduced by a distinct head. The following set of rules are tentatively proposed (2014: 124):

(183) a. An agent is the sister of a Voice head.
b. A theme is the sister of an F head.
c. A benefactive is the sister of an Appl head.
d. A goal, path or location is the sister of a G [=roughly, P] head.

Importantly, these thematic relations are solely determined by the interpretation of H at spell out, and the verb and these argument introducing structures are never transferred together. Consequently, theta roles are defined by syntax (when interpreted) and whatever lexical item names the event (VP, cf. example 181) will have to accommodate its meaning to match that interpretation.

In this account, the UTAH could then follow directly from a principle of syntactic hierarchy –as in Ramchand (2008)–, that simply treats the hierarchy as reflecting the independent ordering of the H elements in the syntax.

At this point, we have arrived to purely exo-skeletal approaches where argument structure is fully derived by syntax and the lexical information does not intervene, either because it is underspecified with respect to argument structure or because argument structure cannot be encoded in it. However, this does not mean that endo-skeletal approaches have disappeared. In fact there are a number of empirical issues that are still potential reasons to adopt an endo-skeletal approach. We will discuss them, and the solutions proposed involving the notion of linking, in the next section.

6. The nature of argument structure (IV): projectionist accounts and theories of linking

We saw in §2 and §3.1 above that the first formal accounts of argument structure proposed that lexical predicates are stored in the lexicon with a particular argument structure, and the initial stages of syntactic structure dealt with the projection of this structure. We have also seen that, in contrast, exoskeletal approaches propose that syntactic structure is built without access to any lexical information, so that syntax imposes particular argument structures to individual predicates depending on the syntactic context where they are inserted.

Exo-skeletal approaches, or approaches that incorporate exo-skeletal properties, treat the mapping of arguments into participants of the event as an output product of syntax, that may be filtered by lexical information or not. In contrast, approaches where the argument structure of a verb is codified as part of the verb's semantics needs to develop a principled theory that explains how the semantic information of the predicate maps into an argument structure that, ultimately, is projected in syntax.

In §6.1 I will provide a first approximation to the notion of linking, whose main justification as a concept comes from (apparent or real) counterexamples to the UTAH in its strict form, some of which are discussed in §6.2. In §6.3, I will show why an alternative to the UTAH that does not use linking will not work.

In subsections §6.4 to §6.5 I will discuss different linking theories proposed. §6.4 presents the initial approaches where linking intermediates between lexical semantics and grammatical functions. Some approaches to linking compare the relative dominance of any two given theta roles, and other approaches treat the absolute value of theta roles as the determinant of how a given argument will map to syntax; the two theories are presented in, respectively, §6.5 and §6.6. Finally, §6.7 discusses linking theories which use aspectual notions, and not theta roles, to determine grammatical function.

6.1. Linking (1): introduction and definitions

Broadly understood, the mapping of theta roles into grammatical functions involves the notion of 'linking', whose details differ across proposals but which can be preliminarily defined as (184):

(184) Linking maps the semantic information of a lexical predicate into syntactic structures

From the perspective of thematic structure, a proposal involving linking –and hence projection of arguments in the strict sense– contrast with exo-skeletal approaches, and any syntactic-heavy version of argument structure where designated heads introduce them with no intervention of the lexical predicate, in how it addresses the following set of questions:

i) determining the syntactic position of each argument
ii) dealing with predicate flexibility, when verbs undergo argument structure alternations
iii) dealing with predicate rigidity, when verbs reject certain argument structures

As an introduction to what linking means, let us go back to Baker's (1988) UTAH. As we mentioned already several times, the UTAH established a framework where exo-skeletal theories could be proposed, but was by no means exo-skeletal in nature. In fact, Baker (1988) himself conceived of this proposal as a restriction on linking, that is, the way in which the semantic objects within a verb's description in the lexicon are projected in the syntax. Although it was in principle logically possible that each verb defined a different linking relation between agents and syntactic positions, the UTAH implied that linking followed a set of well-defined rules, and therefore linking was not defined in a case-by-case basis for each lexical predicate.

These linking rules are clearly stated in Baker (1997: 120-121):

(185) a. An agent is the specifier of the higher VP of a Larsonian structure.
b. A theme is a specifier of a lower VP.
c. A goal, path or location is the complement of the lower VP.

In essence, (185a) associates the highest head of the lexical verb complex with the theta role of agent. This head, as we can see, could be V, little v, Event or Voice. Assuming only two verbal heads –as most theories do–, (185b) associates themes (including patients under this label) with the lower head, as its specifier –the subject of that change– and (185c) associates the complement of V to a variety of roles, which share some locative properties (see §6.4). Note, incidentally, that Baker (1997) maintains a thematic hierarchy where themes are higher than goals (see Levin & Rappaport Hovav 1995: chapter 4 for a proposal involving a different set of linking rules).

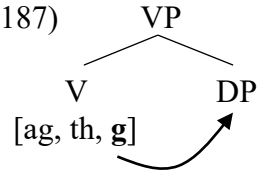
What (185) states, ultimately, is that linking cannot be performed in just any way. In this type of endo-skeletal, projectionist theory, a verb that takes an agent, a patient and a goal, like *send*, does it because its lexical entry contains information like (186):

(186) [agent, theme, goal]

Linking follows the rules of (185), meaning that it is not necessary to state in the specific lexical entry of (186) the information that [agent] will have to project as spec, vP (or equivalent). Being constrained by (185), these rules enforce that a verb with an argument structure like (186) will not be licensed unless syntax builds a two-layered verbal complex, and makes available a specifier in the highest layer.

Going step by step, the verb with the argument structure in (186) will first project as a V, and makes available a complement where the goal theta role is linked –we assume for the time being, as Larson did, that *to* is part of the formal marking of this theta role, so the presence of that P does not need to be lexically stipulated in the entry.

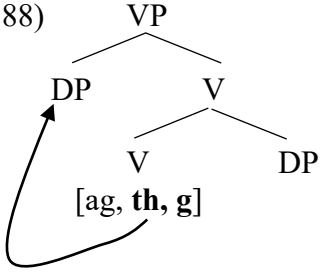
(187)



The complement of V links to the theta role [goal], which is at that point discharged from the verb. No other theta role can be projected in that position, given the constraint in (185c).

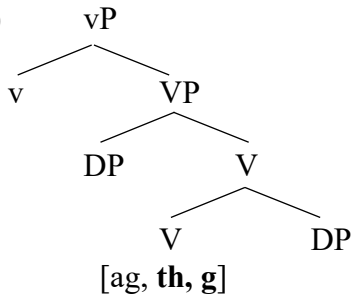
At a second step, VP projects again, introducing a specifier. That specifier, by (185b), is the projection of the [theme] role.

(188)



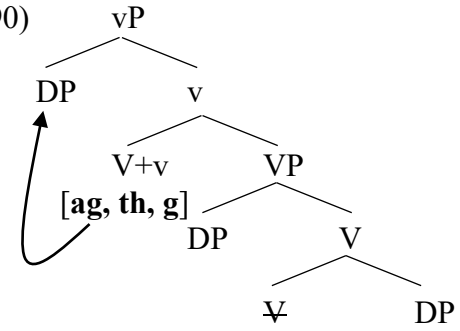
The second layer of the Larsonian shell is at this point introduced –I will use the little v notation, but nothing follows from it–. The little v projects, taking the VP as its complement. No theta role is projected here, because (185) does not associate any role to the complement of the higher verbal head.

(189)



By (185a), the specifier that vP projects links to the [agent] theta role (190) –assuming head movement from V to v here, so that the V head is in a local relation with the domain where the theta role links, but it is technically possible to link prior to head movement or irrespective of it–.

(190)



This is a simple illustration of linking where linking follows systematic rules, which account for the UTAH as an empirical generalisation. However, as we will see now, there are reasons to adopt more complex linking theories.

6.2. Empirical problems for the UTAH

Even if the UTAH was not exo-skeletal, the reason why it paved the way for modern exo-skeletal theories is that it proposed that linking between lexical representations and argument positions was driven by rules. Rules, after all, are what syntax works with, so a rule-based system of linking is always susceptible to be reframed as a syntactic explanation.

For this reason, a lot of support for linking theories of argument structure came from apparent exceptions to the UTAH.

For instance, consider (185c) above, which I repeat here as (191):

(191) A goal, path or location is the complement of the lower VP.

(191) predicts, among other things, that no verbs should project the goal as the specifier of the higher projection. In fact, it predicts that goals should not be subjects of verbs that contain a theme –unless some form of passive is performed–. However, it is easy to find verbs with goals and themes where the goal is the subject –without any apparent passive–.

(192) a. Pedro recibió una carta.

Pedro received a letter
b. Luisa obtuvo un premio.
Luis obtained a prize
c. Carlos percibe un buen salario por su trabajo.
Carlos gets a good salary for his job

Note that the subject of these sentences does not have any agent entailment. It is perfectly possible that Pedro receives a letter without doing anything to start the event in motion; the subject does not control the event, or needs to even be conscious of it.

These facts are not easily accounted for in a way that they are directly compatible with (191). Note that (191), and also the UTAH, is not a bi-directional statement: it sets a condition on where a given theta role must project, but it does not force a particular position to always have that theta role. Given (191), external arguments can have theta roles that are not [agent], but goals can only project as the complement of the lower VP. This means that, for the goal to end up as the subject, the lower VP projection becomes passive; however, applying passive –which by assumption is a syntactic operation– weakens the projectionist account, where argument structure should be projected as the starting point of syntax: even if after projection of arguments the passive is applied, the verbs *recibir* 'receive', *obtener* 'obtain' and *percibir* 'get' should be associated to passive VP projections, and therefore their lexical entry would reflect the output, not the input, of a syntactic operation. That is in principle possible in an account where verbs do not project their arguments –an exo-skeletal account– but not on an endo-skeletal one (see Cuervo 2003 for how Applicative heads can solve this).

Another option would be to redefine the thematic hierarchy, changing the rules in (185) above so that goals are above themes. However, again, it is easy to find verbs with [theme, goal] where the theme –as a displaced object– is the subject, so this decision would actually just move the problem from one set of data to another.

(193) La carta le llegó a Pedro.
the letter him arrived to Pedro
'The letter arrived to Pedro'

Also, given that Baker (1997) links the complement of VP to locations, the verbs in (194) are also problematic for the solution that involves moving goals to a higher position than themes.

(194) El premio recayó en Luisa.
the prize fell on Luisa
'The prize was assigned to Luisa'

The problem stays irrespective of how abstractly defined theta roles are; in fact, a more abstract definition of theta roles may worsen the problem. Levin & Rappaport Hovav (1995: 135) propose an Immediate Cause Linking rule (195) that simply associates the highest argument position (external argument) to the participant that somehow sets the event into motion:

(195) The argument of a verb that denotes the immediate cause of the eventuality described by that verb is its external argument.

Following this linking rule would predict that in (196) the person that sends the letter to Pedro, which is actually syntactically expressed as a source preposition in Spanish or English, should be the external argument –and not the goal–.

(196) Pedro recibió de María una carta.
Pedro received from María a letter
'Pedro received a letter from María'

Jackendoff (1990: 259) in fact notices that one cannot keep a simple version of the UTAH with the type of theta roles that Baker (1988) assumes. He identifies at least five types of intransitive verbs according to the entailments of the predicate, and sixteen types of transitive verbs –not counting additional oblique arguments–. Even a non bi-conditional statement of the UTAH seems to run into immediate trouble when trying to make it compatible with this lexical diversity.

6.3. Idiosyncratic mappings on a one-by-one basis

At this point, an immediate solution that emerges –but as we will see, does not work– is to completely give up any type of linking rules and claim that each individual predicate lists its theta roles, and states how the arguments corresponding to those theta roles should be projected into the syntax. This account implies accepting that UTAH does not work, but also that any version of the UTAH that makes reference to more abstract notions than theta roles, such as the aspectual involvement of the participant in the eventuality, would also fail.

To the best of my knowledge nobody actually advocates for this type of account, even within non-compositional models like Construction Grammar (Goldberg 1995)–, but the system that Dowty (1989: 72-78) sketches (and does not ultimately prefer) comes close to it, as it allows individual semantic predicates to order arguments and theta roles in arbitrary ways. In this one-by-one system, the lexical entry of an item lists theta roles with am explicit statement of which position in the syntactic tree they must be projected into. For instance, for our example with *obtain* verbs:

(197) obtain <goal, theme, source>
a.- project source as a PP headed by *from* in the complement position of V
b.- project theme as an NP in the specifier position of V
c.- project goal as an NP in the specifier position of little v

Other notations can be used to abbreviate that information, like a convention that says that the order of arguments corresponds to the order in which they are cited in the first line, but not much would change in terms of analytical power and predictions.

Obviously, this account would provide a technical solution to integrate *obtain* verbs in the grammar. The account is not immediately incompatible with more general linking rules that treat, for instance, agents as externalising by default as specifiers of little v: the linking rules could be ordered in the usual Panini way, with more specific rules being applied first –and any lexical rule, by definition applicable to one single item, will be more specific than the general rules– and therefore blocking the application of the general linking rules.

The problem of this approach, simple as it may seem at first glance, is that it overgenerates. For instance, this solution makes it conceivable that we have a verb with the argument structure information in (198):

(198) blah <agent, goal, theme>
a.- project agent as a PP headed with *from* in the complement of V

b.- project goal as an NP in the specifier of V
c.- project theme as an NP in the specifier of little v

In practice, this would be a transitive verb whose external argument is a theme and with an agent that is projected as an oblique. We can obtain a similar result in syntax with a passive, but as far as we know there are no languages with items that follow this description, as in (199):

(199) *La conferencia blable-ó al público del ministro.
the conference blah-ed DOM-the audience from.the minister
Intended: 'The minister gave a conference to the audience'

See Jackendoff (1990: 245) for another illustration of this same observation. Therefore, there must be some type of linking rules that at least block that, in the presence of both an agent and a theme, no language stores a lexical item where the theme is the external argument and the agent is an internal argument –although we know that there are syntactic operations that reverse the hierarchy through some means–.

As I have already said, no current theory admits a system that literally defines argument structure on a case-by-case basis for each lexical items, but there are aspects of some theories that do make this in principle possible. An often cited example is parts of Jackendoff's Correspondence Theory, that in the absence of an Action Tier may map spatial-related theta roles to syntactic functions arbitrarily.

Another set of theories with aspects that make it possible to have a mapping like (198) are those that essentially treat the lexicon as the repository of associations between levels of representation, like Marantz (1984) –see in particular page 53 and following–, and also Anderson (1977), Ostler (1979), Grimshaw (1987, 1990). In all these cases provisos are introduced that ultimately block or make it very unlikely that an agent would map as an internal argument, but this has to be independently blocked. These accounts are often called 'hierarchical' because they propose that lexical items hierarchically order their participants through the eventuality description and then that hierarchy has to be matched to a hierarchy of grammatical functions which determines the syntactic position of each element (see for instance Marantz 1984: 56). Essentially, if one allows the verb to describe any situation, and therefore to order thematic roles in different ways, one can only indirectly block a lexical item that profiles the theme over the agent and therefore projects as (199). Let me insist that each one of these approaches introduces one device or another that blocks that type of situation, but that those devices must be added to the core of the theory, that in principle allows it.

In conclusion: an item-by-item definition of thematic structure is not a good technical solution. Linking rules are necessary to block any chance that a lexical item can behave as in (199). The general strategy used in projectionist accounts in order to incorporate the broader diversity of mappings without overgeneration of unattested mappings has been to propose linking theories that make reference to structures that are more abstract than the usual theta roles, sometimes allowing multiple co-definitions in different levels which equally contribute to the mapping, and always splitting argument structure into a set of levels or tiers that filters the meaning of the verb. We will now move to a discussion of some influential examples of these types of theories.

6.4. Meaning does not directly map to syntax

Leaving aside cases where linking can compare sets of entailments rather than assign a mapping through the presence of absolute notions, the way in which projectionist theories have reframed linking rules despite exceptions to the UTAH generally involve making those rules refer to notions, or sets of notions, which are distinct from the traditional theta roles recognised

in the literature. In practice, this means that a theory like Baker's (1988), or more generally any approach accepting any form of the D-structure projection of argument structure, is viewed as an oversimplification that glosses over intermediate steps that can influence mapping in a non-trivial way.

Rappaport (1983) was among the first researchers to point out that a linking theory where argument structure directly mapped into syntax was empirically untenable. If argument structure was directly projected into the syntax, the immediate expectation would be that, given identical predicate-participant relations the syntactic mapping would remain stable. Rappaport (1983) shows, instead, that the same lexical item may involve different mapping principles when it is used as a verb and when it projects as a noun. The example that she provides is illustrated in (200): (200a) shows the verbal projection of command, and (200b), the nominal projection:

(200) a. The general commanded the troops to leave.
b. The general's command to the troops to leave.

As can be seen, in (200a) the goal argument (*the troops*) is manifested as an NP, and in (200b) it must manifest with a preposition *to*. Using the preposition with the verb, or not using the preposition *to* with the noun, leads to ungrammaticality.

(201) a. *The general commanded to the troops to leave.
b. *The general commanded to leave to the troops.
(202) a. *The general's command of the troops to leave.
b. *The general's command the troops to leave.

This is an immediate counterexample to any theory where theta roles are directly projected from argument structure: if the projection is not intermediated by any additional level of representation, the only conclusion must be that each lexical item defines its own projection, not following any rule in linking. Moreover, at some level of abstraction we have the same lexical item in both cases, because one denotes the same situation with *command* as a noun and as a verb. Assuming that both categorial instantiations of *command* describe the same situation –which is reasonable–, the conclusion must be that despite their similarities there is an entry for the noun, with a parochial mapping to syntax, which cannot be derived by rules, and another entry to the verb, which just by chance describes the same type of situation, has the same phonological interpretation, etc. This is an obviously unwanted result.

Rappaport's (1983) own solution is to split the representation of argument structure in different levels. The situation described by the verb and the noun is the same, because the semantic representation of both is identical in number of participants and their relation with the eventuality, which one can consider the argument structure in the narrow sense. Both the noun and the verb share the same representation at this level:

(203) command: agent, goal, theme

What makes the noun and the verb different is that these theta roles, in order to project in the syntax, must be differently linked to grammatical functions and to syntactic expressions. In the case of the verbal instantiation, the theta roles are linked to the set of grammatical functions in (204a), and to the syntactic instantiations in (204b), which declare that the goal argument will not take a preposition.

(204) agent goal theme

a.	SUBJECT	OBJECT	X-COMPLEMENT
b.	NP	NP	VP

In the case of the noun, the same argument structure is linked to a different set of grammatical functions (205a) and syntactic expressions (205b).

(205)	agent	goal	theme
a.	POSSESSOR	OBLIQUE	X-COMPLEMENT
b.	NP	PP_{TO}	VP

A different question is how much of this mapping can be covered by independent linking rules –which, for instance, could state that an agent projects as a possessor in an NP unless something else is declared–, but the point here is that argument structure will never directly link to the syntactic expression: the set of grammatical functions (at least) intermediates between the two sides, and grammatical function is an important level of representation which determines crucial aspects of the projection of arguments. For instance, the reason why the goal must come introduced by a P in the noun but not in the verb is determined by linking that role to an oblique grammatical function in the noun.

Notice that, already, this opens a solution for *obtain*-type verbs where the goal projects as a subject. Even if one decides to associate the verb to an agent and wants to declare that in this case the agent projects as a source PP, one could give a representation like (206) –which I want to make it very clear that Rappaport never does–:

(206)	obtain	agent	theme	goal
		OBLIQUE	OBJECT	SUBJECT
		PP_{from}	NP	NP

Of course, in any case the theory aims to maximise the aspects of linking that can be defined by rule, even if individual lexical items may have lexical information that prevails over the general rules.

6.5. Linking (II): linking rules that compare relative dominance

Perhaps more influentially, Jackendoff (1990) treats the problem of how the number of participants maps into syntax as the lexical manifestation of a general problem which he calls the Problem of Correspondence. Jackendoff assumes that the architecture of language involves three different representation levels –syntax, semantics and phonology– that are unordered: in this view syntactic structure, semantic structure and phonological structure are defined in parallel, without any of them being the input of the other. Given this type of model, the syntactic equivalent of a semantic representation must be determined by some form of correspondence between the two models. Jackendoff (1990) in fact calls this the Problem of Correspondence: in which way do speakers know how a syntactic structure relates to a semantic structure, or either of them to a phonological structure (and vice versa)? The mapping of semantic participants into argument positions in the syntax, and therefore grammatical functions, is a particular instantiation of the Problem of Correspondence.

Given the existence of these three parallel levels, the lexical entry of an item must contain information about the three of them, as in (207), for the verb *enter* (Jackendoff 1990: 46).

(207)
$$\left[\begin{array}{l}\text{enter}\\ \text{V}\\ \text{\_\_\_\_\_}\langle \text{NP}_j\rangle\\ \\ [_{\text{event}}\ \text{GO}\ ([_{\text{thing}}\ \ ]_i,\ [_{\text{path}}\ \text{TO}\ ([_{\text{place}}\ \text{IN}\ ([_{\text{thing}}\ \ ]_j)])])]\end{array}\right]$$

This lexical entry has information about the phonological representation (the first line, where Jackendoff does not use phonological signs merely for the sake of simplicity), the syntactic representation (grammatical category, the frame that indicates that the verb may take an optional direct object, as in *enter the room*), and the semantic representation, which is in the last line (see §7.3 below for an explanation of the meaning of GO, TO, IN and the rules to produce these structures). We want to highlight two properties here: first, note that the number of semantic arguments that the meaning of the verb involves is represented through empty slots in the last line. This verb, semantically, takes two participants, one the first argument of a movement predicate and the other the argument of a place concept. Second, note that there are diacritics <i>, <j> present in the semantic representation, and that the <j> diacritic that tags the location in the semantic structure is also present marking the optional direct object in the syntactic representation. This is intended as a convention that says that in this lexical predicate the end location after movement projects as a direct object.

Given this machinery, where the lexical entry has the power to state for each individual item how theta roles map into syntactic functions, one could think that Jackendoff's theory suffers from the problem that we introduced above, namely that the mapping is entirely arbitrary. Jackendoff is very conscious of this problem (see 1990: chapter 11), and for this reason he proposes a set of linking rules that make the tagging unnecessary in most cases, and specifically block the possibility that a verb maps the agent as a complement and the theme as a subject.

As we have advanced, the main strategy is to treat the representation of argument structure as a representation that has several levels which interact with each other. The semantic representation in Jackendoff's theory receives the name of Conceptual Structure (CS); when one analyses the portion of conceptual structure that is part of the representation of a lexical item, the name given is Lexical Conceptual Structure or LCS.

Argument structure is the part of the LCS that specifically deals with the number and nature of participants involves in the portion of reality that a lexical item describes. In contrast with approaches like Marantz (1984), Jackendoff proposes that argument structure within an LCS should actually be divided into two different tiers or levels that intersect in the lexical item: the first, called thematic tier, uses primitive notions from spatial cognition –location and movement– to abstractly define those theta roles directly codifiable as participants in a literal or metaphorical spatial configuration: goal, source, theme (understood as the entity that undergoes change in space or in some property that can be conceptualised using a movement metaphor). For instance, in the following sentences with the verb *hit* (Jackendoff 1990: 126), on that tier the subject and the object have different thematic tier values:

(208)
a.	Sue	hit	Fred.	
	Theme		Goal	
b.	Peter	threw	the ball.	
	Source		Theme	
c.	Peter	hit	the ball	into the field.

Causer Theme Goal

In (208a), the subject is the entity that moves –or at least, a relevant part of her body moves–, and the object is not a theme because it is not necessarily displaced: it is the goal of that movement. In (208b), the subject acts as a source –note that no part of Peter travels along the trajectory that the ball defines–, and the ball is the theme that changes location across that trajectory. In (208c), the subject causes some movement on the object, which is the theme that moves, and the goal is projected as a PP. From the perspective of the thematic tier, our example with *obtain* verbs has a similar thematic representation as in (208b):

(209) Bill received the letter.
Goal Theme

A second tier contributes to argument structure: the so-called Action Tier, which encodes –in combination with the thematic tier– the distinction between actor (similar to agent, §7.5) and patient, understood as an entity affected by the event. The roles of the action tier are not predictable by the role assigned in the thematic tier, essentially because both are mutually autonomous representations.

(210) represents the same sentences as in (208), but now representing the action tier and not the thematic tier:

(210) a. Sue hit Fred.
Actor Patient
b. Peter threw the ball.
Actor Patient
c. Peter hit the ball into the field.
Actor Patient

Note that 'actor' is different from 'agent': at the very least, it does not involve any notion of consciousness or volitionality, and it is compatible with the same participant undergoing some change or moving along a literal space. The division of argument structure in at least two tiers means that, contra the Theta Criterion, one and the same argument can receive more than one theta role: at the very least, one can be patient and goal at the same time.

The action tier opens for new additional possibilities to define other verb classes and other mappings. The function AFF(ect) is the central building block in the action tier: it relates the actor –entity that is interpreted as affecting another– with the patient –the entity that is affected–, as in (211):

(211) AFF([ACTOR], [PATIENT])

Jackendoff (1990) associates [actor] entailments with accepting a gloss like '[Actor] did something', and [patient] with a gloss like 'This happened to [patient]': we can answer *She hit Fred* to the question *What did Sue do?* (but not *Sue died*), and we can answer *Fred was hit by Sue* to the question *What happened to Fred?* (but not *Fred threw the ball*). This means that in *Sue hit Fred*, Sue is the actor in the action tier and Fred is the patient, irrespective of their spatial interpretation in the thematic tier; additionally, *Sue* is patient is *Sue died* and *Fred* is actor in *Fred threw the ball*. Other, more complex, AFF functions are proposed, codifying volitionality or beneficiaries, but let us first discuss the simplest manifestation of AFF.

Even though many transitive verbs –involving caused change or caused movement– have an actior tier like the one in (211), not each verb has that representation. There are six other

possibilities. First, a lexical predicate may have an actor tier like (212), where an actor is present but no patient is –for instance, any event where one intends to affect something or has entailments of doing something but there is nothing affected–:

(212) AFF([ACTOR],)
a. What did Mary do?
b. She sneezed at the party / She searched John for the whole night.

The opposite is also possible, for instance with verbs whose only argument is affected but there is no specification of any actor:

(213) AFF(, [PATIENT])
a. What happened to Mary?
b. Mary disappeared.

(212) and (213) introduce only one of the two members of the affect relation; it is also possible to introduce both but not letting one of them be filled, and forcing it to be implicit, which is conventionally represented by introducing square brackets that are left empty.

(214) AFF([ ], [PATIENT]) (implicit agent)
a. What happened to the table?
b. It burnt.

In (214) it is not possible to conceive of the table burning spontaneously, but the predicate does not specify who or what was the actor. (215) corresponds to the action tier of a verb with an implicit patient, for instance *John drinks* –meaning 'John drinks alcohol'–.

(215) AFF([ACTOR], [ ])

The fifth option is (216), where the same argument is at the same time interpreted as the affected entity and the one that affects, which Jackendoff (1990: 127) associates to arguments that pass both the actor and the patient test:

(216) AFF([ACTOR+PATIENT])

An example of such verb is *roll*: in *Bill rolled down the hill*, we can both ask *What did Bill do?* and *What happened to Bill?*

Finally, the last option is that, simply, there is no actor or patient defined in the structure of the verb. Jackendoff proposes that this is in fact what happens with *receive*: both *What did Bill do?* and *What happened to Bill?* cannot be naturally answered with *Bill received a letter*, according to Jackendoff (1990: 127, cf. example (8)), which leads Jackendoff (1990) to propose that there is no actor or patient defined in the action tier of this verb.

The AFF function that defines the action tier has different values, which Jackendoff (1990) uses to deconstruct the notion of agent (see also §7.5) and make semantically relevant distinctions such as the difference between arguments that are affected in a negative way and arguments that are affected in a positive way, as beneficiaries. Specifically, Jackendoff (1990: 134) proposes that beneficiaries are the second argument of a function that he notates AFF+, and which for instance *helping* verbs have. (217) represents the action tier of a helping verb:

(217) John helped Mary

AFF+([John], [Mary])

Moreover, Jackendoff (1990: 136) proposes that the subject of a verb like *obtain*, which is a goal in the thematic tier, is a beneficiary in the action tier:

(218)
receive

thematic tier: [GO ([ ], [TO ([ ])])]
action tier: [AFF+ (, [ ])

Therefore: the thematic tier does not define any causative relation –in fact, the proposal is that *receive* is the non-causative version of the verb *give*–, but only a theme that moves and a goal; in the action tier, the goal is a beneficiary, and no other participant is defined.

Next, Jackendoff (1990) defines a linking principle that privileges the action tier by making reference to entailments defined in this tier, and only in the absence of those elements the thematic tier is referred. The principle in (219) states that dominant theta roles must be matched with dominant grammatical functions (Hierarchical Argument Linking; Jackendoff 1990: 248)

(219) Following the thematic hierarchy, order the dominant θ-roles in the LCS of a verb from first to *n*th. To derive the syntactic argument structure of V, map this ordering of θ-roles into the first through *n*th roles in the syntactic hierarchy.

That is: the rule states that the LCS of the verb is scanned to identify the theta roles present. From those contained in the LCS, the one that is hierarchically highest is picked, and it must be matched to whichever syntactic function is highest in the syntactic level; the second highest will be mapped into the second highest syntactic function available, and so on until all arguments of the verb have been satisfied.

What makes (219) different from a mapping principle like the ones that were criticised in §6.3 is that individual verbs do not directly decide which theta role is higher in their lexical entry. The hierarchy of theta roles is independently established, universally, as (220), and individual verbs cannot contradict it.

(220) Thematic hierarchy
a. Actor
b. Patient or Beneficiary
c. Theme
d. Location, source or goal

[Jackendoff 1990: 258]

As can be seen in (220), the hierarchy starts ordering within the action tier (and inside it, first the first argument of AFF, then the second argument) and only then does it make reference to relations defined in the thematic tier.

That is: irrespective of idiosyncrasies of a lexical entry, the linking principle will always treat an actor as the highest ranked argument; if an LCS has an actor, that will be the dominant argument that will be mapped to the highest syntactic function position, as defined by the syntactic hierarchy, which reproduces standard assumptions about the markedness of grammatical functions and Jackendoff (1990: 258) treats as basic, pending further study:

(221) Syntactic hierarchy
a. subject

b. (direct) object
c. other non-direct objects

Thus, the only way to have a patient or a beneficiary project as the subject of a verb is that the verb does not define an actor, which is the case in *receive*. If the verb does have an actor, this will be mapped as subject, and then the second highest theta role will be identified: if there is a patient, it will be mapped as the direct object –and if there is no patient, as in *enter*, the direct object may correspond to a goal–. If this linking procedure is universal, as Jackendoff intends, it becomes impossible to have any lexical item in any language where the agent is a direct object and the patient is a subject.

6.6. Linking (III): linking rules sensitive to absolute thematic values

Sharing some assumptions with Jackendoff, Levin and Rappaport-Hovav's (1995) proposal has some important differences with the approach that we have just presented. In their view, like in Jackendoff's (1990), linking must be a matter of rules rather than a matter of individual lexical items. Among other reasons, Levin & Rappaport-Hovav cite the empirical fact that it is possible to identify grammatically relevant verb classes where a core semantics matches a core set of syntactic properties (see Levin 1993), something that would be very surprising if each lexical item was free to define its own mapping. Also like Jackendoff (1990), the solution to these regularities cannot be the UTAH, because the range of attested mappings cannot be predicted by this elegant principle.

The main difference with Jackendoff –beyond some irrelevant terminological choices– is that Levin & Rappaport-Hovav do not propose one single linking principle that assumes two distinct hierarchies and maps theta roles to positions given their relative ordering. Instead, they propose a set of rules that make direct reference to individual thematic roles, and state that, when present, they must project in designated positions in the tree. A second difference with Jackendoff (1990) is that the mapping is not to grammatical functions, but to syntactic positions within the lexical verb projection, as will be become clear in the case of unaccusative verbs.

Let us present these rules one by one. The first one is presented in (222):

(222) Immediate cause linking rule
The argument that denotes the immediate cause of the eventuality described by the verb is its external argument.

(222) does not refer to 'the highest grammatical function' among a set, but simply determines that the entity that is responsible for causing the event will be an external argument. Notice that the rule does not make reference to whether that cause is internal –that is, the causer typically coincides with the patient that is affected– or external, so it predicts mapping to subject for *Mary* both in (223a) –where she is assumed to be an internal causer, as Levin & Rappaport-Hovav treat posture verbs as unergative and not unaccusative– and (223b):

(223) a. Mary sat on the chair.
b. Mary sat the child on the chair.

It does not make any reference either to animacy, volitionality or other properties that one may want to associate to agenthood. Verbs of emission, like *ring*, define the entity that emits something as the internal causer –the internal properties of the entity are what causes the sound, the light or whichever substance comes from it–, and therefore those verbs will project their argument as an external argument:

(224) a. The telephone rang.
b. Peter cried.

The second linking rule is the Directed Change Linking rule (1995: 145-146):

(225) The argument that corresponds to the entity undergoing the directed change described by a verb is its direct internal argument.

Assuming that unaccusatives project their sole argument as an internal argument (see §3.1), this explains that valence-1 verbs whose participant is a patient become unaccusatives: the entity suffering the change projects as an internal argument, and when no causer is additionally introduced that argument will become a subject, as in (226) –but will become an object when in a causative version, as in (227):

(226) The car broke.
(227) The snow broke the car.

Note that the two notions above presuppose that the verb is dynamic, that is, that it involves some type of change. Given that linking directly refers to theta roles in this theory, and not to a hierarchy that orders them universally, this means that stative verbs will need distinct linking rules. The Existence Linking rule determines the mapping for stative verbs denoting existence or spatial location, and also for dynamic verbs that assert that something comes to exist, like *appear* or *happen* (228; Levin & Rappaport-Hovav 1995: 153):

(228) The argument of a verb whose existence is asserted or denied is its direct internal argument.

Some examples of verbs falling into this class, with the relevant argument underlined, are given in (229); note that the claim is that when these verbs are intransitive they are unaccusative.

(229) a. Mary <u>stayed</u> home.
b. <u>Something new</u> happened.
c. <u>John</u> appeared.

Finally, the last linking rule is a default rule that maps arguments of the verb not falling into any of the previous descriptions:

(230) Default linking rule
An argument that does not fall under the scope of any of the other linking rules is its direct internal argument.

The reader may wonder why the linking rules proposed only refer to external and direct internal argument positions. The reason is that Levin & Rappaport (1995: 21) assume that arguments projected as oblique get their theta role assigned by the preposition –or equivalent device that expresses obliqueness, like some case markings or a postposition–. A verb like put has the argument structure in (231):

(231) x (causer)
y (patient)

$P_{locative}$

(232) John^{x} put the book^{y} on^{P} the table

Hence, *the table* is not an argument of the verb, but an argument of the preposition –and we can say at most that the verb takes a locative predicate–.

6.7. Linking (IV): linking through aspectual notions

So far we have seen only theories where linking makes reference to theta roles, in two versions: one where linking scans theta roles and maps them by their relative prominence, and one which does not need to compare theta roles to each other. Other linking theories combine thematic roles with aspectual notions or with other types of information.

In a sense, within syntactic models, Ramchand (2008) is an example of a theory where theta roles depend on the aspectual nature of the heads that provide argument positions. However, within endo-skeletal, projectionist models the most influential linking theory referring to aspectual notions is Tenny (1987, 1994) –see also Travis (2010)–.

Tenny's proposal is that, rather than the specific theta role that an argument receives, what ultimately determines the mapping to external or internal argument positions is the role of the participant within the Lexical Aspect of the predicate. Remember that Lexical Aspect or Aktionsart (Vendler 1957) refers to the temporal properties of the situation that a lexical predicate describes, depending on its dynamicity or stativity, whether it denotes a punctual or temporally extended situation and whether the predicate involves a culmination or not –among other potential parameters–. It is a well-attested fact of human languages that in many cases participants in the event control some of these parameters, in particular with respect to the possible culmination and the possible duration. For instance, in (233) the two predicates contrast in telicity: (233a) is telic and (233b) is atelic.

(233) a. John wrote a poem (in one hour).
b. John wrote poetry (for several years).

The lexical verb and its subject are identical, and the only difference is in the nature of the participant that projects as a direct object, which is the count noun *poem* in (233a) and the mass noun *poetry* in (233b). Hence, the count noun denotes a bounded entity –with clear limits, although its exact extension can be contextually established–, and the creation of that entity is also itself temporally bound –although, again, the exact temporal extension can vary–; the mass noun is unbounded, without defined limits, and the creation event is also unbounded. One can claim that the object in these predicates measures or co-defines the event, so that the boundedness of the object correlates with the boundedness of the event –Ramchand (2008) calls these objects 'paths', as we have seen in §4.3–.

Tenny's proposal uses this type of notions to determine the mapping of participants into external and internal argument positions. Tenny proposes that lexical predicates contain information not only about theta roles, but also about the aspectual contribution that each argument makes to the predicate (Event Structure, Tenny 1994: 131-182).

Specifically, Tenny proposes three linking rules, all defined within Event Structure. She (1994: 10) states the Measuring-Out Constraint on Direct Internal arguments –that is, internal arguments that are directly introduced by V without intermediate predicate Ps–.

(234) Direct internal arguments are the only overt arguments which can measure out the event.

This is not a bi-conditional: the principle just says that any argument which measures out the event in the semantics must project as a direct internal argument in the syntax. Tenny (1987, 1994) points out that in other cases, the internal argument projected does not measure out the event, but this is essentially because no other participant measures it out. This is the case of stative verbs (235), whose lack of dynamicity makes it contradictory to define an element that measures change, and some non-statives (236) (Tenny 1994: 13).

(235) a. John likes Bill.
b. The candle grows.
c. Mary knows calculus.
(236) a. Dan pounded the wall.
b. Susan shook the tree.
c. Bill pushed the cart.

The immediate prediction, of course, is that when none of the arguments measures out the event, one can expect that the projection of arguments is more arbitrary and not directed by linking rules, which has been argued to be the case with experiencer verbs (see §3.4 above).

The reader may wonder what happens with prepositionally-introduced arguments that seem to measure the event, as the *to* PP in (237), which is a version of (236c):

(237) Bill pushed the cart to the entrance.

Indeed, intuitively it seems that the bounded path denoted by *to the entrance* delimits the movement of the cart and therefore measures out the event. In that case, then, we may expect that (234) incorrectly predicts that (237) should be wrong, and the obviously ungrammatical (238) –or any alternative where the moved object is introduced by a P– should be right.

(238) *Bill pushed the entrance with the cart.

The reason why (234) does not predict that (238) should be grammatical and (237) should be ungrammatical is that Tenny differentiates between measuring out and delimiting. Delimiting is the broader notion, which simply states that there is a terminus or final point in the event. Measuring-out is the more restrictive notion which presupposes delimitedness but additionally requires that the relevant argument is associated to a measuring scale –an ordered set of values in some dimension– which can define a temporal bound by reaching and end value.

To wit, in *John wrote a poem* one establishes some kind of scale of completion of the poem, where each verse cumulatively reaches a higher value of the scale, until the poem is totally written. This participant does measure out the event. In contrast, *to the entrance* is not associated to a scale of values (of what? proximity to the entrance?), even though there is a limit on the movement event set by the preposition. Hence, one can delimit without measuring out, but one cannot measure out without delimiting.

Tenny (1994: 68) states the linking principle that she calls The Terminus Constraint for arguments that delimit but not measure out. The constraint determines how arguments that delimit but not measure out the event must project in the syntax, and its first part restricts how an indirect argument can be involved in aspectual structure at all:

(239) An indirect internal argument [= internal argument introduced by P or equivalent] can only participate in aspectual structure by providing a terminus for the event described by the verb. The terminus causes the event to be delimited.

The next part of the principle ties the notion of terminus –as delimitation without measuring-out– to the notion of spatial path. In her terminology, Tenny treats as path the object that moves across a spatial trajectory:

(240) If the event has a terminus, it also has a path, either implicit or overt.

Therefore, the Measuring-out principle and the Terminus Principle together predict that the measuring out argument, if present, will be a direct object, and that an internal argument introduced by P will be able to delimit, but not to measure out. Consequently, the grammaticality of (237) is predicted –but not so clearly the ungrammaticality of (238), because none of the principles forces the PP argument to delimit or the object to measure-out–. Notice, additionally, that the explanation depends on one accepting the premise that scales and spatial trajectories are ontologically different; Ramchand (2008) does not accept this premise, and treats both as rheme paths because in either case one has a series of ordered elements across a dimension, which may be spatial points, values within a property, or mereological parts of an object.

Additionally, Tenny (1994: 13, 68) proposes the following principles, that associates the measuring out of the event and the delimitation to only one participant.

(241) a. There can be no more than one measuring-out for any event described by a verb.
b. An event as described by a verb can have only one terminus.

These principles not only block the possibility that a verb projects two measuring-out events: as measuring-out involves delimitation, it also blocks the possibility that the same verb has one measuring-out argument and one path. Ramchand (2008) does not need this type of constraint, because the impossibility of having both a path and a measuring-out object follows from her proposal that both would occupy the same position, the complement of Proc.

Combining (234) with (237) also automatically predicts that any external argument, if there is one, cannot be able to measure-out the event, but note that the Terminus constraint does not force delimitors to project as indirect internal arguments. Therefore Tenny (1994: 83) states a third and final linking principle, the Non-Measuring constraint on external arguments:

(242) An external argument cannot participate in measuring out or delimiting the event described by a verb. An external argument cannot be a measure, a path or a terminus.

The difference between unergative and unaccusative verbs in many cases can be partially derived from this aspectual distinction. Unergatives will be verbs whose arguments have no aspectual roles (Tenny 1994: 106), and hence would naturally project as external arguments. Remember, however, that no linking principle forces a direct internal argument to measure-out or delimit, which means that aspectual information does not block an agent from projecting as an internal argument. In contrast, the theory clearly predicts that some valence-1 events –specifically those where the only argument undergoes change across a set of values (243)– will be unaccusative, as the linking principles clearly state that only direct internal arguments can have this role (Tenny 1994: 107).

(243) a. The bananas ripened.
b. The lake froze.
c. The window cracked.

In contrast, inherently directional verbs like *enter* (which Tenny 1994 does not discuss) are not predicted to be unaccusative (or unergative): all that the linking principles state is that the participant introducing the terminus cannot be an external argument, blocking (244a). The mappings in (244b) and (244c) are both (correctly) allowed, because the terminus can but does not have to project as an indirect internal argument.

(244) a. *The room entered John.
b. John entered the room.
c. John entered into the room.

The linking principles cannot force this type of verb to be unaccusative instead of unergative, though: the moved entity has the aspectual role that Tenny calls 'path', and there is no principle that bans paths from being external arguments or that forces them to be direct internal arguments. This is only a shortcoming of the theory to the extent that inherently directional verbs turn out to be always unaccusative, of course.

In contrast, the theory is not able to predict that agents will never be objects in the presence of some affected argument. As moved objects must be possible as external arguments –the external argument rule does not block paths–, and as direct objects do not have to make an aspectual contribution, both (245a) and the universally ungrammatical (245b) should be possible:

(245) a. John^{agent} put the book^{path} on the table.
b. *The book^{path} put John^{agent} on the table.

This does not exhaust the existing linking theories (see Butt 2006: 91-153, Levin & Rappaport-Hovav 2005, for other cases). However, we will end their specific presentation here, noting a few common properties to all theories: in all cases, the proposed linking rules explain part of the attested mappings within a language, and leave some undecided areas. In Jackendoff (1990), nothing is said about whether some internal arguments will be introduced by prepositions or not; in Levin & Rappaport-Hovav (1995), nothing is said about cases where verbs lack clear causers or patients, and in Tenny (1994) delimiting arguments can project anywhere, and internal arguments can be occupied by any type of object with the sole exception that measuring-out must project as a direct object. The reason is empirical: with perhaps the only exception of agent-theme verbs where themes are external arguments and agents are internal, it seems that verb classes illustrate virtually any other combination of roles.

7. The nature of theta roles

So far we have concentrated on argument positions and the different theories about how they connect with the lexical predicate semantics. In this discussion we have assumed that theta roles are the interpretations that arguments get when they integrate with a particular predicate. We have, however, not said anything about how theta roles are defined or what type of entities they are, which are also important issues in linguistic research. This section will complete the discussion about thematic structure with an exploration of the main proposals about the semantic objects that we call theta roles.

Within the research on thematic roles, irrespective of argumenthood, there are three central issues that we will revise in this section.

i) How semantically specific a theta role is
ii) Whether theta roles are primitive elements or should be themselves decomposed into smaller primitives

iii) How many theta roles should be defined, and how they are distinguished from each other

The first question directly connects with the problem of why theta roles are much more restricted than the types of participants that we can cognitively associate to situations in the extralinguistic reality. The second question connects with approaches to argument structure where lexical predicates are decomposed into different primitive components, specialising in that way the semantic contribution of each one of them, but focuses on how this decomposition affects the understanding of what a theta role is. Although both questions can be related to each other, in this section, we will dedicate §7.1 and §7.2 mainly to the first problem, and §7.3 and §7.4 to the second problem. These proposals are in principle orthogonal to the distinction between endo-skeletal and exo-skeletal properties, but we will see that some of the arguments are also relevant for this other distinction across theories.

The third question presupposes the first two, and refers to how particular theta roles should be defined and differentiated from each other. As I said in §1 above, this question is too complex to discuss it in a general way, and different (families of) theta roles will be individually discussed in future issues, but as an illustration of the types of problems that the third question addresses, §7.5 presents a less-than-exhaustive discussion of agenthood.

7.1. Conceptual semantics and its limits

As we saw in §1, human cognition allows us to identify ways of participating in an event that no natural language seems to include in its grammar. This creates an initial problem with theta roles, because they were introduced in linguistics from predicate logic. As predicate logic treats arguments as participants, and theta roles as the relations between eventualities and those participants, in principle the number and nature of theta roles could be expected to directly derive from the properties of the situations that we name through predicates.

The solutions to this problem have not always been explicit. Within exo-skeletal approaches of the type that we revised in §4 and §5 above, the general strategy has been to separate meaning into two aspects (Marantz 1995, 2013; Pensalfini 2000, Mateu 2002): some aspects of meaning directly derive from the syntactic features and their configurations, as read from syntax at LF, and some aspects of meaning are not computational and are associated to individual lexical items.

The first, called structural semantics, refers to the meaning imposed by the heads that build argument structure, or by the configurations that they form. This would be the only linguistically relevant aspect of thematic structure, therefore restricting the types of relations between participants and eventualities that are grammaticalised to those that are encoded into the relevant syntactic heads. For instance, the absence of a theta role 'spectator' in Spanish, where participants that witness an event do not receive a special case marking, agreement, designated prepositions, etc., would follow from the absence of a syntactic head that introduces a spectator within the syntactic area where the lexical predicate is built.

The second receives more different names: conceptual semantics, encyclopedic semantics, or even world-knowledge. This aspect of meaning is not codified in the grammar of a language through formal features or configurations, and rather corresponds to the portions of extralinguistic reality that a particular individual lexical item encodes. For instance, while 'spectator' is not a grammatically active notion in Spanish, there are individual lexical items that describe situations where there must be a spectator present, as in the verbs in (246), roughly meaning 'perform':

(246) a. La compañía actuó (para las tropas).
the company performed for the troops
b. Los niños representaron Hamlet (ante sus padres).

the children performed Hamlet in.front.of their parents

Individual nouns may also describe someone as a spectator, like *testigo* 'witness', *notario* 'notary', *asistente* 'attendant', *verificador* 'verificator'. The point is that these meanings are not computationally calculated, because they are not obtained through the combination of features in the syntax. Instead, they enrich the abstract semantic template built by structural semantics with specific descriptions of extralinguistic reality, and are inert for the syntactic computation. For this reason, grammatically identical elements may radically differ from each other in terms of their conceptual semantics, as in *cat* vs. *diplodocus*.

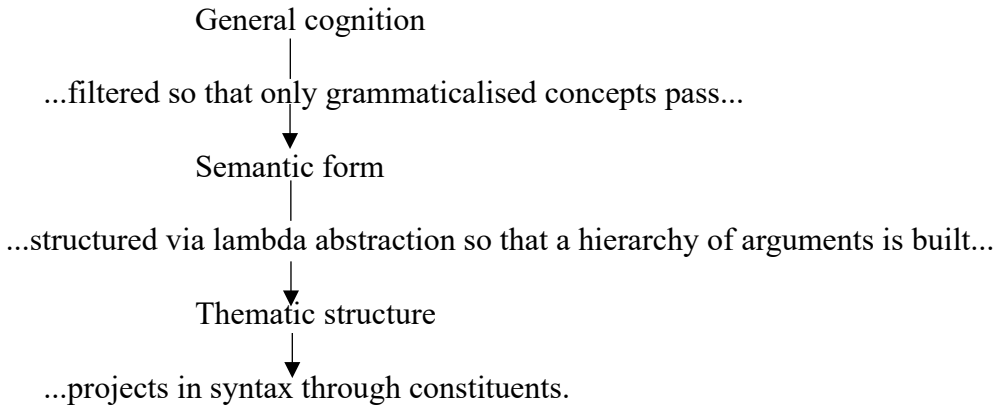
The general strategy that an exo-skeletal approach adopts to explain why linguistic theta roles are more restricted than participant relations in cognition is very clear: only distinctions encoded through syntactic heads are part of the proper definition of a theta role, while distinctions that are solely contained in the conceptual semantics of the individual items that are Late Inserted in the structure reflect cognitively important notions that have not been grammaticalised. However, in practice exo-skeletal approaches have rarely provided specific discussions about these issues.

In exo-skeletal approaches, the question of which distinctions are made by theta roles reduces to the question of which aspect of participant-eventuality relations are grammaticalised in the relevant heads. The answer to this question determines, among other things, how many theta roles there should be. A clear example of this is to be found in how 'agent' should be defined, which we will specifically discuss in §7.5 below.

The second conceivable way to approach the problem of how semantically specific theta roles are is by allowing the argument structure of a lexical item be fully defined, but introducing restrictions to the types of information that it can encode. This solution is typical for endo-skeletal accounts, which directly address the question of how lexical items encode portions of reality within their semantics. A prime example of this theory, that puts the relation between conceptual semantics and the grammaticalisation of meaning in the center, is Bierwisch (1983, 1986) proposal.

In Bierwisch' proposal, the argument structure of a lexical item is the end result of a complex operation involving at least two different steps. Seen from the perspective of cognition, not any cognitively salient property can be part of the argument structure (or other types of lexical information) of a predicate. A level called Semantic Form takes cognitive information and only encodes those aspects of it that can be part of the grammatical system. Therefore, the Semantic Form will act as a filter on cognition that contains several concepts, and only lets pass to the following level the aspects of cognition that can be encoded through those concepts. A second level, Thematic structure, picks from Semantic Form only the concepts that in that particular language interact with the syntax –in the familiar way, by defining the number and nature of arguments–. Technically, thematic structure is built through lambda abstraction from the concepts encoded in Semantic form, and it determines the syntactic projection of arguments receiving the theta role in particular grammatical functions.

Figure 1. Bierwisch two-tiered system for argument structure



The approach treats as an empirical question which aspects of cognition pass to Semantic Form and what possibilities there are in turning the Semantic Form aspects into thematic roles that will require a specific syntactic projection, which is not different from what happens with exo-skeletal approaches in determining which syntactic heads there are and what their denotation is. However, this approach provides an explicit architecture that separates cognitive participant-eventuality relations from theta roles.

The third conceivable solution to the problem of how theta roles are defined and how they map to cognitive categories is by proposing that the interpretation of theta roles is not absolute, but comparative: given a particular situation, speakers compare the participants in order to see which semantic entailments they have, and determine given those entailments how they should be treated in argument structure. Given the influence that this approach has, I will dedicate the next section to the discussion of this specific solution.

7.2. Strong and weak theories of theta roles

The question of semantic specificity can be viewed under the lens of how much conceptual information is grammaticalised by theta roles, as we have just seen, but it can also be addressed from a different perspective: are there necessary and sufficient properties that speakers use to identify theta roles?

Dowty's (1989) goal is to offer an explicit formal semantic theory of theta roles that overcomes the problems that an intuitive definition of agent as 'whoever does something' and similar claims has when trying to identify instances of each theta role. In doing so, he opposes theories of theta roles that he calls 'strong' (1989: 74) to those that he calls 'weaker' (1989: 114).

Strong theories of theta roles always propose that there is a set of properties, either entailed by the predicate or entailed by the predicate that relates the eventuality to the participant, that are sufficient and necessary to assign a particular theta-role.

He sketches two such strong theories in Dowty (1989). In the first, the predicate directly declares a set of entailments for each argument, and the entailments received by the argument define its theta role. He first defines the individual thematic role as follows:

(247) Given an n-place predicate δ and a particular argument x_i, the individual thematic role $<\delta, i>$ is the set of all properties a such that the following entailment holds:

$\Box[\delta (x_1, ..., x_i, ...x_n) \text{ --> } a(xi)]$

That is, the individual theta role of a participant is the set of entailments that the lexical predicate assigns to it; those entailments are sets of properties that must hold of the participant. However, not all entailments will be equally relevant in determining theta roles: for instance,

it is trivially true that in the sentence *John built the house*, *the house* is interpreted as the x such that x is built, and it is also trivially true that this is a necessary entailment of the verb *build*.

Once these trivial entailments are removed, this opens the door for a theory of theta roles where there are as many theta roles as lexical predicates, because in principle any two predicates may codify different entailments –at least whenever they are not logically interchangeable–. For some linguists, like van Riemsdijk & Williams (1986), this is a welcome result, but (247) above does not provide a definition of what we normally understand as a theta role. In this view, our standard theta roles are types of thematic relations. Thematic role types are defined by only considering the entailments which remain invariable across sets of predicates and arguments with a similar set of grammatical and semantic properties (1989: 77):

(248) Given a set T of pairs $<\delta, i_\delta>$ where δ is an n-place predicate and i_δ is the index of one of its arguments (possibly a different i for each verb), a thematic role type τ is the intersection of all the individual thematic roles determined by T.

Consequently, and assuming a strong definition of [agent] as a thematic role type, an entity that receives that role must have whichever properties verbs one of whose arguments behaves as an agent satisfies. For instance, *murder* adds a volitionality entailment to its subject, and *kill* does not. If both subjects behave similarly enough to each other in other ways, volitionality will not be a property of the thematic role type [agent], and hence we may call non-volitional participants [agent]. Obviously, it is an empirical question –to some extent, also of some theoretical desiderata– which predicates should form the set, which properties are used to determine whether two arguments behave the same, and which label one assigns to the type.

The second strong theory of theta roles that Dowty (1989) offers makes it explicit that the theta role is a set of properties that relate the event to the participant; Dowty calls it 'Neo-Davidsonian', because the formalism used takes advantage of Davidson's (1967) proposal that verbs have an event argument. This approach treats theta roles as predicates relating the event that the predicate describes, not as entailments directly encoded into the verb. The representation in (249) is perhaps already familiar to the reader, as it has become the most standard way to represent theta roles in formal semantics:

(249) $\lambda y \lambda x \lambda e$[predicate'(e) & Agent (x, e) & Patient (y, e)]

In contrast to the previous approach, now the theta role cannot be directly defined through the entailments of the predicate, because –note– the predicate never directly takes the arguments as open positions –Lohndal's (2014) approach, revised in §5.2, makes this semantic proposal syntactically explicit. It can still be true that the predicate's entailments determine which relations must be specified, but in either case this approach presupposes that theta role types are primitive objects. In the previous approach, individual verbs assigned individual sets of entailments and theta role types are derived by intersection; in this approach, theta role types are pre-defined and they add their entailments to whichever entailments the predicate may introduce.

Now, both approaches are strong because through one road or through another one has a set of properties that an argument must satisfy if the theta role is assigned to it. In Dowty (1989), the claim is that there is a lot of evidence that makes a strong theory of theta roles preferrable, in addition to the methodological logic that a strong theory contributes to clearer predictions about the behaviour of items.

In contrast, in Dowty (1991) a version of the weaker theta role theory is presented, and argued for. The crucial difference is that a theta roles are clusters of entailments where none of

them is strictly speaking necessary or sufficient to identify the individual theta role of an item within a predicate.

This move from a strong set of entailments to a weak cluster of entailments is accompanied by a reduction of the natural families of properties that form a cluster; Dowty (1991: 572) proposes only two clusters. The cluster that describes the possible entailments of an agent is called 'agent proto-role' or 'proto-agent' for short, where *proto-* corresponds to *prototypical* to make it clear that only prototypical, textbook examples of agent will satisfy all entailments:

(250) Entailments for the agent proto-role
a. volitional involvement in the event or state
b. sent[i]ence (and/or perception)
c. causing an event or change of state in another participant
d. movement (relative to the position of another participant)
(e. exists independently of the event named by the verb)

(250a) does not need comment: it is the entailment that the participant decides to initiate an event. (250b) automatically excludes any non-animate entity from being a proto-agent, because it requires that the entity is able to have mental states, feel and perceive. (250c) does not only entail that the entity initiates the event, but also that the event should affect some other participant; (250d) is satisfied simply if the entity moves, and (250e) sets the even weaker condition that the entity exists without the event.

(250e) is satisfied by the underlined arguments in (251), but not by those in (252) either because they are created by the event or because they have virtual existence only in the mind of the agent.

(251) a. John has a child.
b. The unicorn is eating grass.
c. Lucas reads a book.
(252) a. John wants a child.
b. Mary imagined a unicorn.
c. Lucas writes a book.

The other cluster of entailments describe a proto-patient –that is, whoever has them all is a prototypical patient–.

(253) Entailments for the patient proto-role
a. undergoes change of state
b. incremental theme
c. causally affected by another participant
d. stationary relative to movement of another participant
(e. does not exist independently of the event, or at all)

(253a) states that the participant changes some of its properties in the course of the event –for instance, it is destroyed, it is damaged, it is healed, it grows, it changes colour...–. (253b) adds the property that the entity delimits the event, and (253c) introduces the notion of affectedness, which means that somehow what another participant does influences it in some way. (253d) makes the entity not only unable to move by itself, but also unmoved, and (253e) declares that the entity is created somehow as part of the eventuality.

Importantly, Dowty (1991: 573) treats these entailments as contributing properties for one of the two proto-roles. None of them, alone, is sufficient to determine whether the role would

be agent or patient, and in fact, 'agent' and 'patient' are gross simplifications that should be substituted by 'more agent-like' and 'more patient-like' in most cases.

In practice, the theta roles of a predicate simply include a subset (proper or not) of these entailments. Dowty, who assumes a projectionist model, proposes that determining which one of the two arguments is dominant and projects as subject always involves comparing the sets of entailments associated to each participant and determining which one of the two has more agent properties and which one has more patient properties. This procedure is stated as an Argument Selection Principle (254, Dowty 1991: 576):

(254) In predicates with grammatical subject and object, the argument for which the predicate entails the greatest number of Proto-Agent properties will be lexicalised as the subject of the predicate; the argument having the greatest number of proto-patient entailments will be lexicalised as the direct object.

This is ultimately a linking principle, but as can be seen, a partial one that determines the relative mapping of the two arguments that act as subject and direct object, and does not extend to other cases. According to this principle, it is correctly predicted that when a participant is interpreted as the actor of an event (the entity that causes something to happen) and another one undergoes some change (the entity that something happens to) it can never be the case that the first projects as object and the second, as subject –which is roughly the type of mapping that one wants to avoid cross-linguistically.

The principle has two corollaries that Dowty (1991) highlights. The first one is that the principle predicts that predicates that assign roughly the same amount of entailments of proto-agent or proto-patient to both arguments will not determine mapping to subject or object in one single clear way.

(255) If two arguments of a relation have approximately equal numbers of entailed Proto-agent and Proto-patient properties, then either or both may be lexicalised as the subject (and similarly for objects).

Therefore, verbs that fall into this class may lexicalise in an arbitrary way, with one member of the class projecting one argument as subject and the other projecting the same argument as object. Dowty (1991) cites the contrast between *like* and *please* in this respect: the experiencer of the mental state is subject in the first, and object in the second.

(256) a. I^{exp} like this song.
b. This song pleases me^{exp}.

In contrast with a verb like *write*, where the subject is a clear proto-agent and the object is a clear proto-patient, the two arguments of these psychological verbs are quite similar in terms of the cluster of properties. The experiencer argument –the human that holds the mental state– exists independently of the eventuality, like the other argument –the song–. None of the two is volitionally involved in the state –one does not willingly like something, something does not willingly please you–. Both are stationary with respect to each other, there is no movement, and none of them undergoes a change of state or measures the state. If anything, the experiencer must have sentience –and the other argument does not–, and the song can be argued to be the cause of the feeling experienced by the sentient being. Therefore, each one of the two arguments have exactly one proto-agent entailment; according to the theory, this is what explains that two similar verbs apparently selecting the same participants choose the opposite mapping in this case.

While the Argument Selection Principle is a partial mapping principle, the second corollary makes a prediction about three-place predicates:

(257) With a three-place predicate, the nonsubject argument having the greater number of entailed proto-patient properties will be lexicalised as the direct object and the nonsubject argument having fewer entailed proto-patient properties will be lexicalised as an oblique or prepositional object (and if two nonsubject arguments have approximately equal number of entailed P-patient properties, either or both may be lexicalised as direct object).

A relevant example illustrating cases where the two internal arguments are differentiated is a transfer verb, like *give*.

(258) Mary gave a book to the child.

Note that in these verbs, the indirect object must be human or interpreted as human (*John gave a book to the tree* is odd, in contrast to *John threw a book to the tree*, which is not a transfer verb). The subject clearly has more proto-agent properties than the direct object: the subject is typically volitional and conscious, and causes some location change on the given entity. The book, in turn, has more patient properties than the child: it undergoes a change, it is causally affected by another participant –although of course we need to exclude that receiving the book does not affect the child, and that is difficult without a clear definition of affectedness (which perhaps we do not have, see Beavers 2011)–. The only clear proto-patient properties of the indirect object here are that it is stationary with respect to movement; both direct and indirect objects have one proto-agent property, as the direct object moves relative to other entities and the indirect object must be sentient.

An example where entailments of proto-patient do not differentiate between direct object and an oblique argument is (259), which illustrates the so-called locative alternation: some directed motion verbs, like *load*, can express a location as both direct object (259a) and a PP (259b):

(259) a. John loaded the truck with hay.
b. John loaded hay in the truck.

The explanation from the perspective of Dowty's (1991) principles is that both the truck and the hay have a similar number of proto-patient properties: the physical extension of the truck measures the loading event, is causally affected by another individual and is stationary relative to movement; the hay also measures the loading event (which finishes once the hay to load is in the truck) and is causally affected by the agent, which moves it. Both of them exist independently of the event. The entailments do not really allow a clear distinction between the two.

Dowty's (1991) theory in fact proposes that agent and patient are the only two relevant notions, as clusters, but that each property that composes the cluster, alone, is not informative enough to assign a clear theta role. He states this as the principle of Nondiscreteness:

(260) Proto-roles do not classify arguments exhaustively –some arguments have neither role– or uniquely –some arguments may share the same role– or discretely –some arguments could qualify partially but equally for both proto-roles.

A clear illustration of these cases is symmetric stative verbs like (261):

(261) a. Spain limits with France.
b. John lives with Mary.
c. Anna resembles her mother.

It would be very difficult to assign patient or agent to either argument in these examples –or for that matter, to assign any theta role that differentiates the two arguments–, at least in terms of semantic entailments. Dowty's theory, contra other proposals that we have already seen, correctly predicts that natural languages should also allow verbs like this.

Before concluding this section, a few notes are necessary about the shortcomings of this approach. The main difficulty, as the reader can easily imagine, is that a non-discrete system where entailments are not ranked faces difficulties when trying to apply the procedure to specific cases, because the procedure itself is very flexible. It does not help, either, that the first and second corollaries introduce the adverb *approximately* when comparing number of entailments.

Let us go back, as an illustration, to *obtain* verbs.

(262) John received a letter from Mary.

To what extent can the proto-role theory predict that this type of verb, with a goal subject, exists? Let us examine how many entailments the subject has from the agent and patient clusters; we will immediately see that it is unclear how to apply these entailments, and that it might be the case that the principle predicts that this class of verbs should not exist.

Starting with the clear properties, both subject and direct object exist independently of the receiving event. The letter moves –which is an agent entailment– while the subject is stationary –which is a patient entailment–. Neither the letter nor John cause anything on another –Mary, introduced as a source, does cause the letter to move–. Neither John nor the letter undergo a change of state, or measure the event, and neither of them is volitionally involved in the event.

The question reduces, then, to whether John must be sentient to receive the letter. I would contend that it is not necessary: it is not only that John may receive the letter when he is in a coma from which he will never awake, but also that the verb *receive* admits non-animate subjects with ease (eg., *This painting received a prize at the exhibition*). If so, the subject is not sentient either with this type of verb. The subject has exactly zero agent entailments, then, and the object has one agent entailment; the subject has one patient entailment and the object has one patient entailment too.

It seems that it is difficult to interpret the principle in a way that does not predict that *obtain* verbs should be ungrammatical cross-linguistically. This is not a case where both object and subject have roughly the same amount of agent entailments: the subject has no agent entailments, and the object has one. Either additional entailments are added (which ones?) that make the receptor of something a better agent or one accepts that some verbs lexicalise mapping statements that completely disregard the linking principle, at the cost of not having an explanation for the absence of agent-object verbs, which was the main purpose of the principle to start with.

7.3. Theta roles and the decomposition of predicate primitives

Let us now move to the second question, namely whether theta roles are primitive relations or they can be decomposed into smaller semantic notions that, by combinations, produce what we call [agent], [patient], [goal], and so on.

Every theory that explicitly discusses theta roles acknowledges that some theta roles that are generally understood as distinct display similar behaviour under certain circumstances. For

instance, recipients and prototypical agents share the property that they must be animate, or interpreted as such. Many verbs allow construals where the second internal argument can be introduced with a locative preposition to be interpreted as an endpoint or a source, or, alternatively, they can become a dative with the appropriate preposition, which both in English and Spanish happens to be the same. One such example where the second internal argument can be a locative source PP or a dative is (263):

(263) a. Juan tomó prestadas de María cien coronas.
Juan took loaned from María hundred crowns
'Juan loaned one hundred crowns from María'
b. Juan le tomó prestadas a María cien coronas.
Juan her took loaned to María hundred crowns
'Juan loaned one hundred crowns from María'

An example of a verb that either takes a locative directional goal or a dative animate goal depending on animacy is in (264):

(264) a. Juan lanzó la pelota al tejado.
Juan threw the ball to.the roof
'Juan threw the ball to the roof'
b. Juan le lanzó la pelota al gato.
Juan him threw the ball to.the cat
'Juan threw the ball to the cat'

An immediate possibility to explain these relations across theta roles is to decompose [agent], [patient], [goal] and so on into smaller entailments; one entailment may be shared by two or more theta roles, and a rule like the one that determines whether something can project as a dative may be sensitive to an entailment that is contained in two or more theta roles.

In some sense, Dowty (1991) is already a theory where theta roles are not monolithic sets of entailements that a participant either absolutely lacks or absolutely holds. The difference between Dowty (1991) and the approaches that we will review in this section and the next is that here the decomposition may still argue for a strong theta role theory where the presence of one entailment is enough to discard other theta role interpretations, something that Dowty (1991) explicitly denies.

There are two strategies to achieve a result where traditional theta roles are decomposed into smaller primitives. The first one is to propose that the predicates that introduce them are themselves semantically decomposable: this strategy will be discussed in this section, and it shares some properties with the ones discussed in §4.2 and §4.3, which proposed a decomposition within syntax. The second strategy is to decompose theta roles into features that codify different types of entailment, so that any argument that is used to match with those features will get those entailments. The second strategy will be discussed in the next section.

While the idea that lexical predicates should be decomposed into smaller primitives goes back to Gruber (1965) and arguably was presupposed by Generative Semantics, Jackendoff (1983, 1990) is the most influential example of a theory that argues in favour of decomposing predicates into semantic primitives. Specifically, his proposal about the thematic tier (in contrast to the action tier, cf. §6.4 above) involves proposing a number of primitives that are more abstract than the lexical meaning that an item denotes, and make them combine as functions and arguments of each other. The empty slots made available by the primitive predicates, but not filled by another primitive predicate, will correspond to the open argument positions where theta roles will be interpreted.

An example of structure for the thematic tier is provided in (265), for *give* (Jackendoff 1990: 97):

(265) [CAUSE ([ ], [GO ([ ], [TO [ ]])])]

Remember that this is only a partial representation of the argument structure of the verb within the Lexical Conceptual Structure of *give*. (265) declares that the verb should be decomposed into three semantic predicates, CAUSE, GO and TO. The first argument of CAUSE is an entity that will be interpreted as doing something; the first argument of GO is an entity that will change its location, and the only argument of TO is an entity that will define an endpoint.

The investigation of which semantic primitives are available in a given language, perhaps universally, is an open issue, but Jackendoff (1990) offers some candidates for them. He proposes that the semantic structure manipulates several conceptual categories, such as THING, (stative) PLACE, PATH, EVENT, STATE, AMOUNT, or PROPERTY (1990: 22). Each one of these categories contains a set of primitive functions (predicates, in fact) that take arguments. Complex structures can be built compositionally by combining a function with another as an argument; some functions have one argument, some have two. Some of the specific semantic functions proposed by Jackendoff (1990) in his book are listed in (266):

(266) a. PLACE: ON; IN, ON-TOP-OF...
b. PATH: FROM, TO, VIA...
c. EVENT: CAUSE, GO, STAY, ORIENT...
d. STATE: BE

Jackendoff's (1990) proposal is that the thematic tier has a structure that is mainly based on spatial configurations, due to the apparent relevance of the spatial domain in human cognition. For instance, following previous work, GO is a basic spatial notion that can be also used to express changes of possession, temporal advancement or changes in properties; in all these cases it is the same notion, basically localistic, but applied to a different semantic field (1990: 26).

At this point, some of the immediate advantages of the decomposition become apparent. Dowty (1991) proposed a weaker theory of theta roles, among other things, because in some cases the traditional theta roles proposed in Gruber (1965) and others are not appropriate for some participants, as the two ones in the symmetric stative predicate *John resembles his mother*. Jackendoff's answer is that the real theta roles are assigned by the primitives, and some of them may assign an entailment that is not part of the established list of theta roles (1990: 47). In *John passed the house*, the house is an argument of the PLACE function VIA or VIA-NEAR, and gets the entailments from that primitive, which is a particular type of location that had not been studied. Automatically, the set of entailments related to theta roles becomes richer and highly specific, depending always on the set of semantic functions that one identifies in a language. Our difficulty to make arguments match the traditional theta roles does not come from a non-discrete nature of the notion, as Dowty (1991) had argued, but from not having identified the real semantic functions that assign the entailments. The decomposition automatically makes it possible to redefine theta roles in terms of the basic semantic functions.

Another way in which the decomposition makes it possible to define theta roles in a semantically more concrete way is that, given a conceptual structure, now arguments may share theta roles within the same lexical predicate. All we need is for the same semantic functions to appear twice, which is precisely what Jackendoff (1990: 61) argues for the verb *buy*. This verb, conceptually, requires an exchange: the subject gives money to the source, and the source gives

something in exchange. If that aspect is not there, we have other transfer verbs (*say*, *give, send*, etc.). Thus, in a sense both the subject and the PP in (267) are at the same time goals and sources.

(267) John bought a car from Mary.

The solution is to propose that the thematic tier of this verb involves two GO functions, which define source and goal inverting the participants, as in (268):

(268) [GO ([ ], [FROM [ ]$_i$ TO [ ]$_j$)])]
[EXCH [GO ([ ], [FROM [ ]$_j$ TO [ ]$_k$)])]]

Finally, the third advantage –at least in practice, not so much in terms of restricting the theory– is that the list of semantic functions that are needed is treated as an empirical issue. Jackendoff never offers what he takes to be an exhaustive list of all available functions, which in practice means that whenever a participant has entailments which do not fit with the available functions, it is possible to propose an additional one instead of claiming that arguments may lack any clear entailments, or that those entailments are non-discrete. This is an advantage only to the extent that it allows a procedure to maintain the theoretical desiderata that all arguments get clear, discrete entailments even in more complex cases, but notice that any new semantic function proposed should be identifiable in at least a whole class of verbs in order to be a plausible candidate.

This approach coincides with the syntactic decomposition of lexical verbs started in Larson (1988) and which we revised in §4.2. However, there are several important differences. The first one is that, depending on independent assumptions about how syntax and semantics interact, one could propose different decompositions for syntax and semantics. Ramchand (2008) explicitly argues that her syntactic decomposition can be directly mapped to semantics in the sense that she never splits one single semantic primitive across two distinct syntactic heads, or that she never proposes syntactic heads that lack a semantic correlate –hence, her decompositions roughly ascribe CAUSE to Init, PROC to GO and other event functions, and RES to state functions. However, an approach where syntax and semantics are independent levels whose correspondence must be stated does not make this type of assumption and in principle could map an Event function into two distinct syntactic heads, or leave a syntactic head without a direct correlate in semantics.

Secondly, it is never presupposed that syntactic heads will not contain more than one syntactic function. For instance, think of Larson's (1988) VP constituent (the lower one that is still today notated VP in many approaches): in his analysis, this constituent introduces both theme and goal, and codifies the change component. However, in semantic terms change involves more than one semantic function.

Third, the approach is compatible with a semantic analysis where some important function-argument structures in the semantic component lack a syntactic correspondence –and Jackendoff (1990) actually argues in favour of such analyses–. For instance, the following partial LCS of the verb *drink* famously makes reference to putting the theme inside the mouth of the causer as part of the event (1990: 53) even though this semantic participant is never manifested in the syntax –in other words, the verb *drink* does not behave as a verb of directed motion, like *put* or *drag*.

(269) [$_{event}$ CAUSE ([$_{thing}$]$_i$, [$_{event}$ GO ([$_{thing}$ LIQUID], [$_{path}$ TO ([$_{place}$ IN ([$_{thing}$ MOUTH-OF ([$_{thing}$]$_i$)])])])])]

Additionally, note that in the example above the syntactic subject receives two entailments, one as an argument of CAUSE and another one as an argument of the semantic function MOUTH-OF, which specifies that the liquid must end inside the agent's own mouth to qualify as drinking.

7.4. Feature-based accounts of theta roles

It is not impossible to think about the previous approach in terms of features, where each primitive introduces features that must be checked or matched by the arguments; however, Jackendoff (1990: 32) explicitly rejects a feature account of his system.

The goal of a feature system for theta roles is, again, to allow rules that group theta roles into natural classes, instead of rules that only can refer to notions like agent or patient directly. The most influential approach with this format is Reinhart (2000, 2002).

Reinhart calls 'the theta system' the aspects of grammar which enable the interface between the system of concepts and syntax. The elements within the theta system, in practice, make it possible that some of the aspects of our cognitive experience of eventualities become grammaticalised as entailments in semantics, and as instructions to the computational system that builds syntactic structures. The components of the theta system in Reinhart (2002: 230) are summarised as follows:

(270) a. Lexical entries, which are coded concepts, with formal features defining the theta relations of verb entries

b. A set of arity operations on lexical entries, which may generate new entries, or just new options of realization

c. Marking procedures which prepare a verb entry for syntactic derivations: assign an accusative feature to the verb in the relevant cases, and determine merging properties of arguments (technically obtained by indices)

(270b) is relevant for the question of how one and the same verb –or at least, what seems to be one and the same verb– can allow distinct argument structures, which we will revise in §8 below; (270c) is essentially a particular linking procedure, as Reinhart presents a projectionist view of argument structure where something must determine the syntactic properties of each semantic participant.

Here we will be concerned with the details of (270a). Reinhart's (1996) motivation to deconstruct theta roles is that the empirical properties of verbs force us either to adopt a variable system in the fashion of Dowty (1991) or to substitute the traditional labels for much more abstract discrete notions. For instance, a notion of agent in the sense of Gruber (1965) only works for a few verbs, like *murder*, while many other verbs allow in what seems to be the same syntactic position agents, instruments and causers –see §7.5 for the problems relating to the definition of causer: it is not obvious that *the storm* is a causer in (271b), but this is the terminological choice adopted by Reinhart–:

(271) a. {John / *The knife / #Cancer} murdered the professor.
b. {John / The key / The storm} opened the window.

The crucial idea is that, in order to give account of (271b) and any verbs that allow the three types of conceptual interpretations for external arguments, some common property to agents, instruments and causers must be identified; at the same time, as some verbs take only agents, something must differentiate agents from the other two.

Reinhart's proposal is that –with the exception of paths that measure the event, which she argues should be accounted for within the aspectual system– the available theta roles that turn out to be grammatically relevant can be dealt with through a system of binary features.

Specifically, the main features are [c], for 'cause change', and [m], for 'mental state'; the first involves triggering a change on an entity; the second involves having a relevant mental state for the event.

Given this, an agent that initiates some change in a conscious way will be characterised as [+c, +m]. An experiencer theta role involves [-c, +m]. Both instruments and causers share the property that they are [+c, (-m)], that is, they cause a change but not in a conscious way. Finally, an internal argument, irrespective of it is an affected entity –a patient– or not –which Reinhart calls 'theme'– will be characterised as [-c,-m]. As the system is binary, the minus feature is significant: it can be reinterpreted as being affected by the change.

Given that the features used are binary, they actually allow for three options: beyond the positive and the negative values, the absence of the feature allows to define additional distinctions. Reinhart (2002) proposes that what one takes to be a goal is defined as simply [-c], without any [m] feature, and conversely that sources are [-m], without a [c] feature. Additionally, an argument can be defined by the empty set of features, as [ ], which Reinhart proposes to use for arbitrary cases where no other entailments can be made, suggesting that some middle voice arguments may correspond to this case (Marelj 2002).

With respect to the earlier work, Reinhart (2000) proposes that instruments and causers should be characterised as [+c], without a [-m] feature, given that there does not seem possible to find predicates that only allow instruments or causers as subjects, blocking agents: if an argument position is defined as [+c,-m], that should correspond precisely to verbs allowing instruments / causers but never agents, while defining a position as [+c] predicts that agents, instruments and causers are possible, in contrast to those verbs that only allow agents, which would define the position as [+c,+m].

Some of the possible feature matrixes allowed in this system are not clearly defined; for instance, Reinhart (2002) comments that an [+m] position would predict that some arguments must be sentient, but the position should be compatible both with causing and being affected by the event. Reinhart suggests that perhaps the experiencer subject arguments of verbs like *love* may associate to this matrix, given the different linking of these arguments with respect to other experiencer manifestations.

Again, the specific decomposition adopted is a matter of empirical research, but the idea is clear: the features proposed must be able to make generalisations that treat sets of theta roles as natural classes, as [+c] for the verbs that do not specifically select agents. Ideally, also, the features proposed should combine freely and in all cases produce attested differences across verb classes –which, as we can see, is not clearly the case here, because some logical possibilities, like [+c, -m], blocking agents but accepting instruments / causers, do not seem to be attested–.

7.5. Agenthood: a preliminar discussion

While the discussion of individual theta roles will be left for future states of the art, in this section we will briefly discuss the notion of agent as a way to illustrate the complications that one encounters when trying to delimit one thematic relation from another by choosing specific entailments that define each one of the roles.

The central problem when defining the notion of agent has been to which degree the notions of consciousness and volition are required for an argument to display the properties of an external argument of a caused motion or change event. As we have seen, volition is one of the criteria used in some textbook definitions of agenthood, but it faced quite early an important

problem: unergative verbs, whose subjects behaved as external arguments, do not assign volition entailments to their subjects in, for instance, emission verbs like *cough* or *sneeze*.

(272) a. Juan tosió.
Juan coughed
b. Juan estornudó.
Juan sneezed

It is of course possible to cough willingly –for instance, to signal to someone that you are there–, but this is clearly not an entailment imposed by the lexical predicate because most instances of coughing do not involve any volition on the part of the external argument; sneezing willingly is even more difficult to conceive.

There are also problems with the consciousness requirement, which in practice restricted agenthood to only animate beings. The main empirical problem is that, strictly speaking, the external argument of a verb expressing caused motion or change does not need to be conscious of the change that it triggers, even when it is an animate, human entity. For instance, in (273) below it can very well be the case that Juan is unaware of what he has done.

(273) a. Juan tiró el libro de la mesa.
Juan dropped the book from the table
b. Juan ensució el suelo.
Juan dirty-ed the floor
'Juan made the floor dirty'
c. Juan pulsó el botón.
Juan pushed the button

In all these cases we can follow, without contradiction, with *...without noticing*. If the predicates imposed the entailment –not an implicature– that the external argument is conscious, then adding that continuation should be felt as a contradiction, as in *#Juan made the floor dirty, but the floor stayed clean*.

These problems have prompted different types of solutions. The first one is to restrict the label 'agent' to animate and conscious entities that initiate an event in a volitional way, so that other labels are used when some entity causes something but volition and consciousness are missing. This solution works to the extent that one can show that being volitional and conscious plays a role in grammatically differentiating between external arguments. We will now show that those possible differences are not uncontroversial.

There are in fact some verbs that impose the restriction, such as *asesinar* 'murder', *disimular* 'pretend' and *entrenar* 'train', which can only be performed by animate beings that are conscious of the eventuality and do it willingly. Notice that these verbs reject non-animate subjects:

(274) a. #El frío asesinó a Pedro. (cf. *matar* 'kill')
the cold murdered DOM Pedro
b. #El olor disimuló ante los invitados.
the smell pretended before the guests
c. #La impresora entrenó unas horas.
the printer trained some hours

However, most verbs with a causative component lack this animacy restriction. Even a verb like *leer* 'read', that in its common-sense understanding describes a conscious and willing activity can take non-animate subjects.

(275) a. El escáner leyó la tarjeta.
the scanner read the card
b. El ordenador analizó el sistema.
the computer analysed the system

Unless we invoke semantic extensions of the verb –which raises the question of when and how can those be obtained–, these verbs do not impose a consciousness or volition requirement on their subjects because one does not interpret the subjects as personified.

So far we have only shown that volition and consciousness can be part of the meaning of some verbs, but this may be a lexical fact that does not directly interact with syntactic or morphological structures. Volition and consciousness has been invoked as a grammatically relevant feature, for instance, in final clauses (Manzini 1983). As a final clause denotes a purpose, and purposes can only be related to conscious entities that want to obtain them as results, it has been claimed that only main predicates with willing and conscious subjects can license purpose clauses. That is the explanation of (276) in these approaches:

(276) a. Juan hundió el barco para cobrar el seguro.
Juan sank the boat to collect the insurance
b. #El barco se hundió para cobrar el seguro.
the boat SE sank to collect the insurance
(in the reading 'The boat sank to collect the insurance', not 'The boat was sank to collect the insurance')

However, the generalisation is not perfect. (277) shows an instance of a purpose clause where no being has that purpose, or (if there is one) the purpose-holder is not part of the main clause:

(277) El plumaje del pavo real es colorido para atraer a las hembras.
the plumage of the turkey royal is colourful to attract the females
'The peacock's plumage is colourful to attract females'

The distinction reflects, however, on the entailments of individual verbs, where some require a conscious and willing subject. Depending on the theory, this may just be a lexical fact that is not part of the meaning aspects that syntax projects or defines, or it may be a grammatically active notion in the semantic level.

However, there is something about verbs like *leer* 'read' that would not be automatically solved by not calling their subjects 'agents': these verbs entail that the external arguments must have some capacity or internal properties that allows them to initiate and control the reading event during all its development. The absence of those capacities explain the oddness of (278), given usual assumptions about the external reality.

(278) #La mesa lee el libro.
the table reads the book

This has prompted a second type of solution: redefining agents in ways which do not involve consciousness or volition. This is the solution that Folli & Harley (2008) and Ramchand (2008) independently adopt. In Folli & Harley (2008) agenthood is defined through the notion of teleological capability (Higginbotham 1997), which is defined as the inherent qualities and abilities of an entity to participate in the eventuality. When an entity is what they call a

teleological agent, it is the entity whose qualities or abilities allow it to set the event in motion. The machine that reads cards has, due to its internal mechanisms, the ability to initiate the reading event, applied to a card. When an entity coughs, it is because its qualities and abilities, even the state in which the subject is at the moment, make it possible and set into motion the coughing event.

Ramchand (2008) also adopts a definition of agenthood along these lines, although she avoids this term and instead uses 'initiator', for reasons that we will immediately see. In her approach, an initiator is the individuated entity that possesses the property which leads to the event coming into being.

According to both approaches, then, non-animates can easily be agents / initiators because they can have the relevant properties to set the event into motion without being willing or conscious. The main difference between Folli & Harley (2008) and Ramchand (2008) comes when other external argument roles are considered. For Ramchand (2008) the roles that are usually called agent, causer and instrument are simply conceptual semantic interpretations of only one grammatically defined role, initiator. Therefore, there are no differences between the three sentences in (279) from a grammatical perspective, because the semantic differences are not part of the grammatical definition of each subject:

(279) a. Juan abrió la puerta. (agent)
Juan opened the door
b. El viento abrió la puerta. (causer)
the wind opened the door
c. La llave abrió la puerta. (instrument)
the key opened the door

In Ramchand (2008), subject experiencer verbs project the experiencer as an external argument simply because their experiencer is actually an initiator which is interpreted as such given the conceptual meaning of the verb (§4.3).

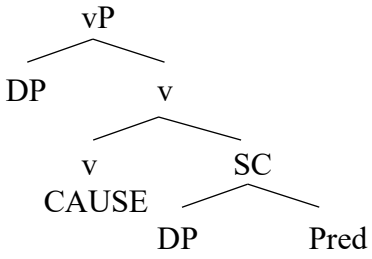
(280) Juan odia las acelgas.
Juan hates the chards
'Juan hates chards'

In her view, the hating-state is made possible and initiated not by any property of chards –because, after all, some people like them– but because of some property of Juan. This view of initiators as 'any type of entity that somehow starts the event' is similar to Jackendoff's (1990) notion of ACTOR within the action tier, although the thematic tier may further specify its entailments in ways that Jackendoff's theory considers grammatically relevant –but Ramchand's theory puts outside any structure-building operation– (remember §4.3).

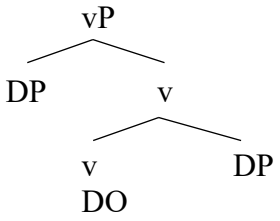
In contrast, Folli & Harley (2008) propose that being a teleological agent is grammatically different from being other types of external arguments. They specifically define causer as the entity that sets the event into motion without having the internal properties or qualities that naturally make it possible. Revisiting contrasts from Folli & Harley (2005), they propose that causers and teleological agents are interpreted in two different grammatical configurations.

In their theory (see also Harley 1999), causers are introduced in configurations where little v takes a small clause as complement and is interpreted as CAUSE, as in (281), while agents are introduced as specifiers of little v interpreted as DO, with a single complement, as in (282):

(281)

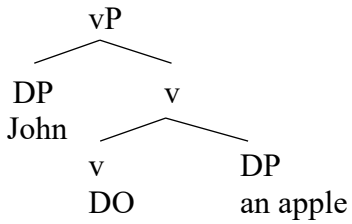


(282)



Being strongly exo-skeletal, they show that when the external argument is a teleological agent the structure of the predicate does not require a small clause, because the verb is interpreted as what they call DO:

(283) John ate an apple.

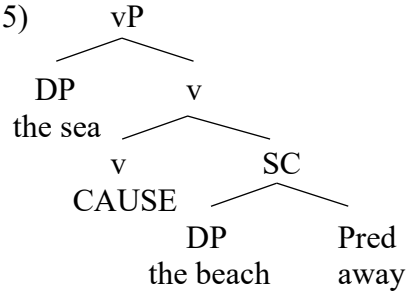


In contrast, when the subject is not a teleological agent for that event, the small clause is needed, because otherwise it cannot be interpreted as a causer. For instance: John has the capability to set in motion an eating event, but the sea does not:

(284) a. *The sea ate the beach.
b. The sea ate the beach away.

(284b) corresponds to the structure in (285), where the little v is interpreted as 'cause':

(285)



In fact, most current theories differentiate in the realm of external arguments between causers and agents, be it through the syntactic configuration or through distinct set of entailments. In many cases, no other theta role is differentiated, and clearly a teleological

definition of agent automatically accounts for most cases where instrument subjects have been proposed; see for instance Alexiadou & Schäfer (2006), who argue that subjects are never instruments, and instrument-objects used as subjects are either agents or causers, depending on whether they have capacity to set the event into motion or not. Like this, *The key opened the door* is a case of an agent –interpreted as instrument given our conceptual knowledge– and *The falling axe broke the window* is a causer.

However, the distribution of roles is not identical in each theory. Pinker (1989) and Baker (1992) also do so, only that they do not make the difference through the complement structure directly. Their proposal is that agents and causers are differentiated by their involvement in the eventive aspectual structure of the verb. Specifically, agents (related to a DO predicate) involve a continuous imparting of force to keep the event in motion, accompanied by control of the event. Causers set the event into motion but do not keep imparting force to it during its development. A straightforward illustration of the contrast is in (286):

(286) a. Pedro arrastró la silla por la habitación.
Pedro dragged the chair across the window
b. Pedro lanzó la silla contra la pared.
Pedro threw the chair against the wall

In (286a) the subject must control the whole motion of the chair across the room; if Pedro pushes the chair and lets it roll to the other side, that is not dragging it. In (286b), in contrast, Pedro sets the chair into motion at the beginning of the event, but loses control of its movement while it develops. In this view, (286a) introduces an agent and (286b) introduces a causer. While the participant that this division identifies as causer does not have all the properties that Folli & Harley (2008) predict –there does not seem to be needed a small clause in (286a) to a greater extent than in (286b)–, the two notions overlap to the point that only entities with teleological capability can be the external argument of a dragging event, while those that lack teleological capability can combine with *throw*.

(287) a. #La explosión arrastró la silla por la habitación.
the explosion dragged the chair across the window
b. La explosión lanzó la silla contra la pared.
the explosion threw the chair against the wall

Thus, to conclude: clearly a narrow definition of agents as willing and conscious entities leaves outside a great number of external arguments, and does not clearly introduce a grammatically relevant distinction between external arguments. The most extended distinction in external arguments is between agents (defined by their capabilities, not their consciousness) and causers, which reflects either in the rest of the predicate configuration or aspectual definition. It is also standard to not use the instrument theta role for tools and machines used as external arguments, but it is less clear whether some experiencers are in fact also some type of agent or not.

8. The Rigidity / Flexibility Tension and theories of argument structure

In this section I will compare the projectionist, endo-skeletal approaches involving linking with non-projectionist approaches that treat at least some properties of the syntactic structure as independent of lexical information, including approaches that are strongly exo-skeletal.

As the discussion in §3 emphasised, a stronger reliance on syntactic structure over lexical information may involve several independent claims. However, it is possible to group approaches in three big families:

i) Argument structure and theta roles are fully defined in the lexicon, and project in the syntax following one single principle (Baker 1988) or a set of linking rules (Marantz 1984, Jackendoff 1990, Levin & Rappaport-Hovav 1995).

ii) Argument structure and theta roles are syntactically defined, through designated heads that compose with each other (Larson 1988) and lexical items must at least match the syntactic information (Ramchand 2008, 2018)

iii) Argument structure is fully syntactic, theta roles are interpreted after syntax, and lexical items must adapt their meaning to the interpretation imposed by syntax at the semantics component (Harley 1999, Borer 2005, Lohndal 2014).

The comparison between approaches will concentrate on two facts that are attested across languages: first, many verbs allow two or more different argument structures in their use. This variability generally follows a number of distinct patterns, which are called Argument Structure alternations. Among them, the best studied ones are the causative-inchoative alternation (Fillmore 1966, Lakoff & Ross 1972, Vendler 1972, Dowty 1979, Dixon 1982, Abusch 1985, Burzio 1986, Hale & Keyser 1992, 1993; Levin 1993, to name just some of the classics), illustrated in (288), and the locative alternation (Anderson 1977, Bhatt 1977, Postal 1982, Dixon 1989, Jackendoff 1990, Larson 1990, Tenny 1992, again just to mention some fundamental early work), illustrated in (288).

(288) a. Luis puso al bebé encima de la silla.
Luis put the baby on.top of the chair
'Luis put the baby on the chair'
b. El bebé se puso encima de la silla.
the baby SE put on.top of the chair
'The baby got on top of the chair'

(289) a. Carlos cargó el camión con oro.
Carlos loaded the truck with gold
b. Carlos cargó oro en el camión.
Carlos loaded gold on the truck

These two alternations nicely illustrate the two main versions of flexibility. In (288), the alternation involves a change in the valence of the verb. While (288a) is built with three arguments –roughly, agent, theme of movement and locative goal–, (288b) contains only the last two, and the agent is not projected. Correlatively, while the verb in (288a) denotes a directed motion event, (288b) denotes an internally caused event where the theme of movement displaces without external forces that drive her. A common intuition underlying the causative-inchoative alternation is that the inchoative involves argument suppression, removing the agent, or that the causative involves argument addition, defining a causative relation on top of whichever event the inchoative represents. Both approaches have solid pieces of evidence in favour of them, and problems –which we will not revise here, see Koontz-Garboden (2009), Schäfer (2008, 2009), Horvath & Siloni (2011), Beavers & Koontz-Garboden (2013) and Fábregas (2021) for discussion–.

In contrast, there is no valence change between (289a) and (289b): in both cases there is an agent, *Carlos*, a displaced object and a locative. The difference between them refers to the grammatical function that the arguments are mapped into: the location (*the truck*) is a direct object in (289a), and an oblique argument in (289b). The theme of movement is (289b) is the direct object, while in (289a) it is introduced as an oblique argument, with a preposition typical for instruments. As in (288), it is difficult to know which one of the two mappings is more

basic, if any, and another option suggests itself: none of the two structures is derived from the other, that is, each one of them represents a different mapping without either being 'more basic' or 'simpler'.

Note that there are two main theoretical options to start analysing argument structure alternations: by deriving one from the other through some rule, and by proposing two alternative and independent argument structures which some verbs happen to accept. While logically possible, using the second solution for the causative-inchoative alternation has often been dispreferred, given that at an intuitive level the causative contains the inchoative (Gruber 1965, Dowty 1979).

Next to possible alternations (and see Levin 1993 for an introduction to some of the other attested types of alternation), we have the problem of rigidity. It is by no means true that every single verbal predicate accepts any type of argument alternation. Far from it, verbs that one could expect to undergo an alternation may only be acceptable in one of the two uses. For instance, a verb that one could expect to be a near synonym to *cargar* 'load', like *llenar* 'fill', does not undergo the alternation and is fixed in the mapping illustrated by (289a), with the end location of the moved entity projected only as a direct object.

(290) a. Carlos llenó el camión con oro.
Carlos filled the truck with gold
b. *Carlos llenó oro en el camión.
Carlos filled gold on the truck

It is also easy to find verbs that only appear in the causative or the inchoative versions, despite apparently expressing changes of state. An example of a change of state verb that only appears in a causative version is (291), where (291b) must be interpreted as a passive, at best.

(291) a. Pedro abrillantó el espejo.
Pedro polished the mirror.
b. #El espejo se abrillantó.
the mirror SE polished
Intended: 'The mirror got shinier by itself'

It is equally easy to find cases of change verbs which must be inchoative. This is the case of (292), and many other verbs that have been considered unaccusative –note, by the way, that unlike *matar* 'kill' ~ *morir* 'die', there is no clear lexically causative verb in Spanish that may block (292b).

(292) a. Juan se personó en la oficina.
Juan SE appeared in the office
'Juan appeared in person in the office'.
b. *Miguel personó a Juan en la oficina.
Miguel appeared DOM Juan in the office
Intended: 'Miguel made Juan appear in person in the office'

In what follows, we will use these two main phenomena to compare the endo- and exo-skeletal approaches that we have discussed in the previous sections. We will see that endo-skeletal approaches very nicely predict rigidity, but need additional principles in order to explain flexibility; in contrast, exo-skeletal approaches predict maximal flexibility without any additional machinery and must propose other devices for the cases where any form of rigidity appears.

Sections §8.1 and §8.2 will discuss flexibility in exoskeletal and endoskeletal accounts, respectively. Section §8.3 discusses rigidity in exoskeletal accounts –rigidity is a given in an endoskeletal account–. The conclusion that we will reach is that both approaches automatically explain one of the two sides of the phenomenon, but need to introduce additional rules, levels or constraints to explain the other.

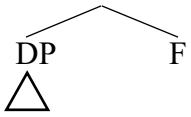
8.1. Argument structure alternations in exo-skeletal accounts

Exo-skeletal accounts have no problem with flexibility, because they in fact predict maximal flexibility for each predicate. The main reason is that they do not treat argument structure –or other properties which we will not discuss, such as grammatical category– as pre-codified in the lexical entry used, and projected or matched in syntax.

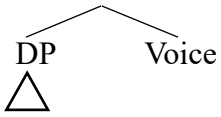
Starting with the pure exo-skeletal accounts, there are two ways in which flexibility is predicted. The first one, characteristic of Lohndal (2014) and other accounts where the lexical verb identifies an event but never introduces arguments in its projection, is by never allowing the verb projection get transferred to LF together with an argument. Remember the chunks of structure that are dispatched to LF in this theory (cf. 180 above, repeated here as 293):

(293) a. VP

b. FP (linear order irrelevant)



c. VoiceP (linear order irrelevant)



This ensures that argument structures will be defined solely by the (functional) heads that introduce them, and that the lexical predicate, which was the first one to be transferred (alone), will have to accommodate its meaning to whichever information those heads –F, Voice...– have defined in the rest of the derivation.

The second way in which an exo-skeletal can ensure that flexibility is expected, without additional machinery, is the solution that Harley (1999) or Wood & Marantz (2017) illustrate, where the syntactic heads and configurations that define argument structure are underspecified enough that, even if a verb tried to make reference to these notions in its lexical entry, that would be clearly insufficient to force a particular set of arguments and theta roles. For instance, if one defines an agent as the specifier of little v when its complement receives an event denotation, and an experiencer when the complement denotes a psychological state, it is clear that no verb will be able to enforce that only agents or only experiencers will be compatible with it, because even a direct reference to the presence of little v will be insufficient to deduce the type of argument that will be projected. Moreover, if the reference that the verb makes does not even declare whether little v will introduce a specifier or not, one does not even force the verb to be causative or inchoative.

When it comes to differences in the grammatical function, the ideas will be very similar – leaving aside the option, which is common to endo-skeletal approaches, where the difference in grammatical function actually involves less obvious differences in theta-roles–: if the verb is interpreted without any arguments, or if the heads involved in introducing those arguments

are underspecified enough, it follows that any structural layer that determines whether an argument is marked as accusative, oblique or any other way will not be part of what the lexical verb can pre-determine, no matter how the grammatical functions are defined.

Either way, the exo-skeletal system is designed in a way that flexibility is expected for each one of the verbs. Explaining rigidity cases, on the other hand, is a problem in this type of approaches.

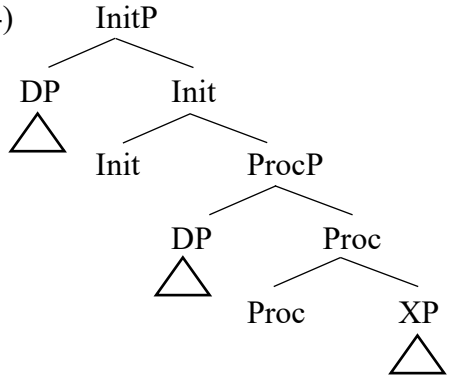
8.2. Argument structure alternations in endo-skeletal accounts

Flexibility is not obviously expected in an endo-skeletal account. The reason is that its core proposal involves verbs projecting their information from a rich lexicon into syntax; from this perspective, there are no obvious solutions for instances where one and the same lexical verb seems to project in two or more different ways. Some additional device, that ultimately complicates the number of levels and operations necessary, must be proposed in this type of system.

It is easy to show that those additional devices are necessary given the assumption that argument structure projects. Ramchand (2008), in contrast, can solve the problem of flexibility in a relatively simple way without these additional devices, that is, solely through the format of lexical entries. Remember that Ramchand (2008) is not projectionist because her system does not map lexical information into syntactic structures, but she is not exo-skeletal because –once built in syntax– the configurations must match some aspects of the lexical entry of whichever verb is late inserted. Specifically, the lexical entry must match the Init, Proc, Res heads used to build argument structure and event structure.

For instance, assume that syntax builds a structure like (294) –represented with Ramchand's (2008) technical solution for the location of external arguments, in spec, InitP:

(294)



This structure has three argument positions, two within Proc and one within Init. Res has not been used to build a result state in this predicate. Given this, the lexical entry must match the syntactic structure in two senses: first, the lexical entry must have all heads that are used in the syntax. A verbal lexical item like (295a) can be used as the sole exponent for the structure in (294), but not one like (295b) or (295c) because it does not match the two heads present –under some conditions, one could imagine cases where (295b) and (295c) are both used, each for one of the two heads, but that is assumed to be impossible in Spanish or English–:

(295) a. blah <Init, Proc>
b. bleh <Init>
c. blih <Proc>

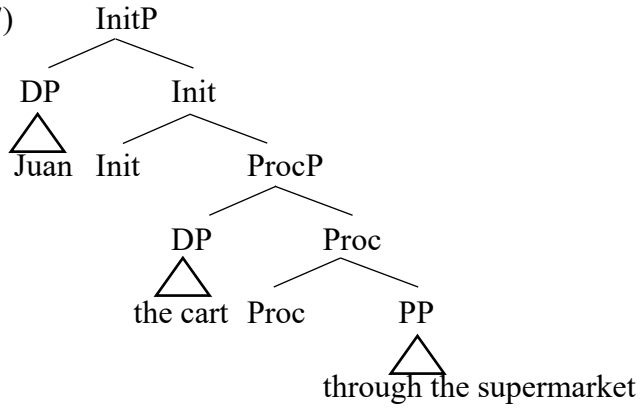
Secondly, the entry must match also whether the heads share the same specifier or not. Remember that, once the Theta Criterion is given up (§5.1), movement can happen between

one position where the DP gets argument entailments to another position where a different set of argument entailments appears. In a verb like *empujar* 'push', the three arguments are associated to three different constituents:

(296) Juan empujó el carrito por el supermercado.
Juan pushed the cart by the supermarket
'Juan pushed the cart through the supermarket'

Clearly, *Juan* is an agent, and *the cart* is an undergoer that travels along the rheme path defined by the PP, which within Ramchand's system means that the internal structure of the lexical verb is as follows:

(297)

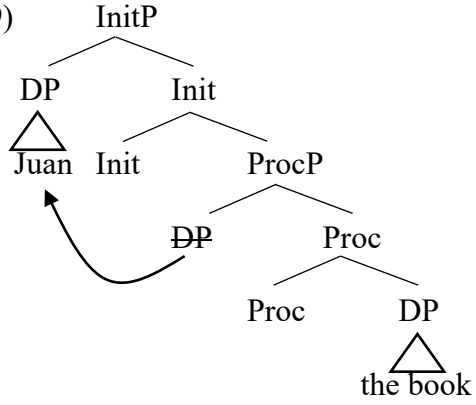


None of the arguments moves within the lexical verb structure to get two distinct sets of entailments. In contrast, in the verb *leer* 'read', the subject is both agent and undergoer, and the object is rheme path.

(298) Juan leyó este libro.
Juan read this book

The book functions as rheme path because its extension measures the duration of the reading event, and makes it bounded (telic) given that the noun is count. The book, however, is not an undergoer that figuratively travels along this path: Juan is, because it is him that moves line after line and page after page throughout the reading event. At the same time, Juan is clearly the agent. This means that the representation within Ramchand's (2008) theory is the one in (299):

(299)



Here, *Juan* is initially merged as the undergoer in spec, ProcP –where it gets the undergoer entailments, and from here it moves to spec, InitP, where it adds agent-like entailments.

This type of movement to an argument position from an argument position underlies some alternations, at least potentially: importantly, the verb *empujar* is causative –to make something move along some path– and cannot have an inchoative version. In this theory it is a property of lexical items (and not syntactic structures, as in exo-skeletal approaches) whether the specifiers of any two heads can be shared or not.

The technical way in which Ramchand (2008) adds this type of information is through subindexes in the Init, Proc, Res heads within the exponent's lexical entry: when the specifiers of two heads must correspond to the same participant –and hence, movement is required–, the two heads get the same subindex. *Comer* 'to eat' would be represented as in (300):

(300) comer <Init$_i$, Proc$_i$>

Given this, the late inserted verb does not only have to match the specific heads involved, but also whether their specifier is shared or not. When the specifiers must be necessarily distinct, in contrast, it is conceivable to use the formalism of adding distinct indexes, as we seem to need in *empujar* 'to push':

(301) empujar <Init$_i$, Proc$_j$>

Thus, it is conceivable –although to the best of my knowledge, this option has not been exploited by Ramchand– that a lexical entry where the heads do not carry any subindex should be interpreted as an underspecified entry which matches the syntactic structure irrespective of whether the specifiers are shared or not.

(302) bluh <Init, Proc>

In that case, one would be giving account of flexibility at least in terms of valence: with the convention that I have just sketched, one can build verbs that have separate agent / undergoer pairs in some cases, when in other the same argument receives both theta roles –this is not the solution that Ramchand ultimately uses for causative-inchoative alternations, though; cf. (2008: 84-89), where she proposes that the inchoative member lacks Init and verbs that undergo it do not identify an Init head in their lexical entry–.

Then, just through the lexical entry and the information contained in it, this system goes a long way in allowing some flexibility without having to introduce extra machinery: diacritics are used, but they are still part of lexical entries, which the system anyways uses to match exponents to syntactic structures. This does not solve all alternations, however: diacritics only give account of alternations involving specifier arguments, never arguments projected as rhemes in the complement position. For alternations involving those other elements, Ramchand (2008: 98) does need to complicate her theory by proposing a principle that allows restricted exceptions to matching ('Underassociation') in some cases where the verb does not match all the heads within its lexical entry. I will leave the discussion aside in this overview, and concentrate only on what is directly essential for all argument structure alternations.

Approaches which are purely projectionist must propose something else in addition to lexical information in order to explain flexibility. Let us understand, step by step, why: consider again a causative-inchoative pair like (303):

(303) a. Juan hirvió la sopa.
Juan boiled the soup.

b. La sopa hirvió.
the soup boiled

Imagine that one postulates that the basic argument structure for *hervir* 'boil' is the one in (303b), with one single argument that acts as a patient. Such structure would be as in (304):

(304) hervir <Patient>

The problem is where the second argument (and the causative component) comes in (303a), which requires a structure like (305):

(305) hervir <Agent, Patient>

Projectionism claims that argument structure reflects the projection of arguments from the lexical entry into syntax, and that syntax follows the indications presented by the lexicon. Therefore, the option of simply projecting in the syntax a 'cause' predicate that the verb does not lexically encode does not exist. It is possible, in contrast, to propose that (303a) involves a second verb 'make' and, despite appearances, the structure is equivalent to 'Juan made the soup boil', as in (306) –where, to make the proposal more palatable, the verb can be phonologically null.

(306) Juan <CAUSE> hirvió la sopa.
Juan <CAUSE> boiled the soup
'Juan made the soup boil'.

However, this solution is clearly empirically wrong. First, it cannot be used to explain the causative member of the verb because the independent causative predicate can combine with the overt causation verb, as in (307):

(307) Marta hizo a Juan hervir la sopa.
Marta made DOM Juan boil the soup
'Marta made Juan boil the soup'

In (307), the additional verb can appear with the causative version of *hervir*. As the two can co-occur, it follows that each one of them has a different role, and therefore that the additional verb does not explain the causative pair in causative-inchoative verbs.

The solution also makes other wrong empirical predictions: as noted by Fodor (1975), the two verbs in (307) make it possible for each one of them to have a different temporal denotation. Marta can have decided yesterday that Juan will be the one boiling the soup today, which is reflected in (308):

(308) Marta hizo ayer a Juan hervir la sopa hoy.
Marta made yesterday DOM Juan boil the soup today

Thus, projecting a new verb for free is not possible in a projectionist account, and adding a second verb meaning CAUSE makes the wrong empirical predictions. A projectionist theory seems forced, then, to propose that there are two different lexical entries for (303a) and (303b), as in (309):

(309) a. hervir <Agent, Patient>

b. hervir <Patient>

This is a lexical solution, and therefore a one-by-one solution. This proposal is too powerful because now we have two homophonous entries. Having two distinct entries makes it at least possible that the two verbs are entirely different in their meaning: (309a) may correspond to a change of state meaning 'to become red', or 'to grow', or 'to become invisible', etc. One automatically loses the strong generalisation that the meaning of (309a) is whichever change (309b) denotes, only that adding to it an external agent that starts the process. The two lexical entries do not ensure either that when one of the two verbs is irregular, the other tends to be irregular too, or that in a language with conjugation classes like Spanish the two members of the causative-inchoative pair also keep their conjugation class. Because (309a) and (309b) are two distinct entries, nothing preserves these generalisations; the problem multiplies for each new verb that one identifies as having a causative-inchoative pair, and once again for each other verb that allows any other argument structure alternation.

Clearly, what one needs in a projectionist theory in order to keep the generalisations is a solution that is not performed on a one-by-one basis, by adding more and more individual lexical entries. In other words, one needs some form of rule, a rule that can act over the argument structure as it is represented in the lexical entry of the verb. These rules are known as Lexical Alternation Rules, and are the main device used in projectionist theories to account for flexibility.

Lexical rules state generalisations over lexical entries, which in endo-skeletal approaches are prior to the syntactic derivation. In practice, adding Lexical Rules to the repertoire of elements contained in grammar involves having two different systems of rules, one prior to syntax and one within syntax.

Lexical rules come in two different formats. The first one to be proposed is the Redundancy Lexical Rule, proposed by Jackendoff (1975) and Oehrle (1976), and later on used by Lieber (1981) in her analysis of conversion processes. In this type of rule, which is non-directional and is not used to alter or derive one lexical entry, there are indeed two distinct entries for *hervir* as a causative and as a non-causative verb, but the two entries are related through a rule that states that the phonology, semantics and other properties not related to the argument structure alternation are shared across the entries. (310) is one possible representation of the Redundancy Lexical Rule that underlies the causative-inchoative alternation; note that the only information provided in it is the one affecting the argument structure:

(310)
$$\left[\begin{array}{l}\text{phonology}\\ \text{semantics}\\ \text{(morphology)}\\ \text{<Agent, Patient>}\end{array}\right] \longleftrightarrow \left[\begin{array}{l}\text{phonology}\\ \text{semantics}\\ \text{(morphology)}\\ \text{<Patient>}\end{array}\right]$$

This type of Redundancy Rule was first proposed as a way to relate verbal nominalisations to their base verbs, assuming Chomsky's (1970) proposal that the relation between the verb and its nominalisation should be stated in the lexicon, not through a syntactic rule. Wasow (1977) is cited as the first to extend them also to argument structure alternations, for instance those involving a verb and its participle used as an adjective (not as an inflectional verbal form).

In the second format for Lexical Rules, only one entry is posited and the rule operates over the relevant dimension of lexical information that needs to be altered. Bresnan (1982), for instance, proposes Lexical Rules like the ones in (311). Note that the arrow now goes in one single direction:

(311) Grammatical function 1 ⟼ Grammatical function 2

For instance, Bresnan (1982) discusses the Dative Alternation in English, which we discussed in the context of the UTAH and repeat in (312).

(312) a. John gave a book to Mary.
b. John gave Mary a book.

Within a Lexical Functional Grammar framework, Bresnan proposes that (312b) is derived from (312a) –as Larson (1988) did, with his syntactic passive analysis–, but as a Lexical Rule that operates on the part of the lexical entry of *give* which specifies the grammatical projection of arguments. The format proposed by her is (313):

(313) [Object] ⟼ [Object2]
[To Object] ⟼ [Object]

To the left of the arrows, we have the mapping in (312a), which Bresnan (1982) takes as basic; to the right, once the Lexical Rule has been applied, we get the mapping in (312b). Exactly the same format of rules with the sole innovation of allowing a symbol ø that stands for an empty set makes it possible that new constituents are introduced, or that some constituents are suppressed.

The format and type of the two types of Lexical Rules largely depends on the assumptions that each theory makes about which information is contained within the lexical entry. Within the system that Bresnan uses (see also Kiparsky 1997), grammatical functions must be defined on an independent tier from theta roles and therefore it makes sense that Lexical Rules may directly refer to grammatical functions. Reinhart & Siloni (2005), for instance, propose Lexical Rules that directly operate on theta roles, assuming some version of linking. They propose that some anticausative predicates involve an operation that reduces the valence of the predicate by bundling two lexical roles ('Reflexivisation bundling'), as in (314):

(314) $[\theta_i]\ [\theta_j] \rightarrow [\theta_i - \theta_j]$, where θ_i is an external theta role.

Levin & Rappaport, who differentiate the semantic representation of a verb from its syntactic manifestation, allow Lexical Rules to operate on either level, essentially within the same set of assumptions.

Both types of rules, directional and non-directional, have the initial advantage that they are fit to incorporate rigidity to argument structure alternations: as the rule is lexical, it has access to non-syntactic idiosyncrasies of each individual form, and as such it makes it easier to include arbitrary gaps in the alternation, cases of verbs which could be predicted to participate in an alternation but don't. The reason is that one states the rule within the lexicon, level where one has access to each individual entry and the idiosyncrasies contained in those entries that do not project into syntax, semantics or phonology.

Redundancy rules have one initial analytical advantage over rules that transform the argument structure: they are non-directional in the sense that the redundancy rule goes both ways, relating one entry to another without implying that any of the two is more basic or is used as the input for the operation. In contrast, they always imply a multiplication of the lexical entries in the speaker's lexicon, even if they guarantee that the two entries related by the rule will not differ in their meaning or phonological form.

On the other hand, directional rules do not strictly need to propose distinct entries, but must always take a decision with respect to which one of the two structures is more basic. In all cases

the choice is informed by other assumptions made in the system –for instance, whether causers are licensed by a higher verbal layer, whether patients in anticausatives are indeed interpreted as internal causers or whether patients are indeed expected to map as direct objects as their default linking–. See in this respect Schäfer (2008) about whether inchoative members should be treated as basic, derived or neither, and in which languages each one of the analyses fares better.

8.3. Argument structure rigidity in exo-skeletal accounts

Thus, flexibility can be formalised in a projectionist account, although by accepting the existence of two distinct sets of rules. In contrast, rigidity directly follows in a projectionist framework. In order to explain why a verb must project in a particular syntactic structure, a projectionist account only needs to make the following set of assumptions, which needed to be made anyways irrespective of the phenomenon of rigidity:

i) Verbal entries include an argument structure representation (with possibly several tiers)
ii) Linking principles always provide a univocal mapping for each argument structure
iii) The mapping determines, directly or indirectly, the grammatical function of each argument

The problem of rigidity emerges in exo-skeletal accounts, in contrast, and it is in such cases that these approaches need to posit additional devices, extralinguistic or not. The main problem is the following: in a purely exo-skeletal approach, the idea is that the lexical predicate, interpreted as the description of an eventuality, will adapt its meaning to whichever argument structure the syntactic configuration has defined.

In some cases, where the verb allows several structures, this is unproblematic; there are also some borderline cases where we can adapt the meaning of the verb, even if the result is incompatible with our standard assumptions about external reality. For instance, a structure with agent subject, an object defined as theme of movement and an animate goal is associated to a transfer verb, literal or metaphorical:

(315) a. John send a package to Mary.
b. John shot the ball to Mary.
c. John told the secret to Mary.

Some verb classes, involving for instance verbs of thinking, can be adapted to this construal. In order to interpret (316) we just must assume a world (in fiction or not) where telepathy exists:

(316) John remembered the joke to Mary.

However, in other cases the adaptation does not seem possible, and the crucial question in such situations is what blocks the adaptation. In some cases, like (317), one could imagine conceptual semantic reasons:

(317) ??John swam the joke to Mary.

One could posit that our encyclopedic information about swimming is not compatible with a transfer construal. In such case, an exo-skeletal account could be able to argue that our experience of extralinguistic reality is what makes us find it more difficult, or even impossible, to adapt the conceptual meaning of a predicate to the argument structure in its context. The idea

is excellent, but at this stage of research we have not identified clear cognitive principles that make the hypothesis testable: even if swimming was the description of an external reality situation where an entity moves in a particular manner through water (or another liquid), we would need to somehow make it impossible that (317) cannot be interpreted as meaning that John communicated the joke to Mary by writing it on a trained fish that would swim to her. It is clearly not that we cannot conceive of a situation where the agent communicates the joke to the recipient by swimming either –they may have developed some kind of code together where swimming movements represent letters–. It is true that, once this context is provided, speakers may find it easier to combine the swimming description with the requisites that the argument structure imposes, but the methodological problem still stays: how do we identify the concepts coming from extralinguistic knowledge that play a role in licensing flexibility, at the same time that they explain cases of rigidity?

In other words: if Mary and John can agree on a swimming code that translates into letters, they may also have agreed on a cooking code of the same type, where each one of the ingredients represents a letter –or something similar–. Still, this does not seem of much help to make (318) acceptable.

(318) *John cooked the joke to Mary.

It seems that world knowledge, or any type of extralinguistic meaning about (our assumptions for) the external reality is insufficient, at our current state of knowledge, to provide a full predictive theory of verb rigidity in an exo-skeletal framework, then.

A second option that already involves some degree of linguistic encoding is to propose that lexical verbs describe eventualities through some core meaning, which cannot be modified. For instance, *cook* could have a core meaning of a verb of creation in such a way that any attempt to adapt it to a transfer event would fail; the speakers feel that the verb is used in the wrong context. It would be an empirical question to identify core meanings that precisely account for the right degrees of flexibility and rigidity, and the task would be complicated by the possibility that different speakers may have slightly different core meanings encoded in each one of the items –after all, that encoding would be part of conceptual semantics, which can vary from speaker to speaker–.

However, irrespective of whether this task can be completed and which methodology is used to arrive to testable conclusions, the crucial point is that this would in practice mean that the lexical entry of each item would need to be tagged somehow to codify the core meaning that it encodes. That is, this solution implies complicating the system through an additional device that sets some kind of restriction on the inherent flexibility that the whole system predicts.

There are several conceivable technical solutions for this implementation, all of them involving tagging the lexical verb with information that acts as a filter on the representation, blocking some logically possible meaning combinations. For instance, Harley & Noyer (2000) propose that vocabulary items corresponding to roots –which in their system connect with conceptual meaning– can come tagged with licensing environments which can be defined positively or negatively. The root of a verb that can appear both in a causative and an inchoative environment, like *sink* (319), has a licensing environment like the one in (320):

(319) a. The captain sank the boat.
b. The boat sank.

(320) [+DP] [±cause]

The [+DP] convention states that this exponent names an event that can only be licensed in a structure with (at least) one argument. The [±cause] convention means that the verb is both licensed in a context where a causative meaning has been defined (319a) and one where there is no causative meaning (319b).

A verb that only allows a causative construal (321) would have an entry that includes the licensing environment in (322):

(321) a. John destroyed the documents.
b. *The documents destroyed.
(322) [+DP] [+cause]

Hence, the licensing environment states that this verb can only be licensed when the structure has defined a cause. It is easy to deduce that a verb which cannot be licensed in a causative environment, like (323) would have a licensing environment specified as [-cause]:

(323) a. *John arrived Mary to the party.
b. Mary arrived to the party.

Again, which components can be referred to in the licensing environment is an empirical question that depends on which syntactic heads are identified, which LF interpretations for those heads are necessary, and which alternations are (un)attested (see Harley & Noyer 2000: footnote 10). One can assume that, if these elements are exhaustively identified, the licensing environment will successfully account for rigidity while preserving the necessary flexibility in the right cases through the [±] convention.

Irrespective of this, this licensing environment that acts as a filter can be viewed as a retraction from the strong exo-skeletal view. Items will be filtered through licensing environments, which are necessarily intralinguistic notions, just in the same way as other endo-skeletal theories, like Ramchand (2008), propose that exponents must match syntactic heads and even whether distinct specifiers are used or not. To the best of my understanding, presenting these restrictions as filters or as a condition on lexical insertion does not make any difference in terms of explanatory power or predictions.

As can be seen, then, exo-skeletal approaches must explain rigidity by enriching their systems with devices that are close to some endo-skeletal solutions. Still, it is important to differentiate this device from a projectionist account. First of all, in a projectionist account a notation like [±] has no meaning, because it would be equivalent to an underspecified argument structure. The [-] sign does not have the same effect: as a filter, [-] means that the exponent is not licensed in an environment where that feature is somewhere, while a projectionist account cannot state this –at best, it can tag the opposite value as part of the lexical entry that should project in the structure, but it cannot tag the lexical entry in a way that it blocks the projection of that property somewhere else in the context–.

9. Conclusions

This article has concentrated on the format options for argument structure, distinguishing between approaches where argument structure is contained within the lexical entry of individual items and those where argument structure is autonomously defined in syntax, with the potential consequence that lexical items may have to adapt their meaning to whichever arguments syntax has defined. In doing so, we have explored the different technical solutions that have been proposed to deal with the relation between individual predicates and their arguments.

We have therefore left aside questions relating to specific arguments and specific classes of predicates, including the different types of patients and themes, the different proposals about how to introduce goals and the nature of experiencer arguments within psychological predicates. We have also left aside the discussion of specific argument structure alternations, and every reference during the discussion to these types of phenomena should be interpreted as an illustration of the analytical problems that some of the theories face, and not as a complete discussion of these issues. Future states of the art will deal with each one of these problems, individually.

This section highlights the main issues that have been revised in this discussion, in order to make a brief assessment of where the field stands with respect to each one of them.

9.1. The flexibility / rigidity tension

One common thread during this long state of the art has been the observation that, frequently, more than one argument structure is available for one predicate, while at the same time not every argument structure is available for each predicate. We have seen, for instance, that many change of state or location verbs allow a causative-inchoative alternation between a transitive construal where the patient is the direct object and an intransitive structure where the subject has patient entailments (324, 325):

(324) a. Juan despertó al bebé. Causative
Juan awoke DOM-the baby
'Juan woke the baby up'
b. El bebé despertó. Inchoative
the baby woke
'The baby woke up'

(325) a. Juan bajó la persiana. Causative
Juan lowered the blind
'Juan lowered the blind'
b. La persiana bajó. Inchoative
the blind lowered
'The blind lowered'

This type of fact seems to support a syntactically based approach where the lexical entry of a predicate does not directly determine the number and type of arguments that the predicate combines with. The reason is quite simple: these predicates are equally grammatical in either of the two argument structures, and crucially the inchoative one does not entail the existence of an external argument –the baby can wake up by himself, and the blind may lower by itself–. If the presence of these arguments directly depends on the lexical entry of the predicate, we must somehow posit two distinct argument structure representations for each verb that allows this alternation.

We have seen that approaches where lexical entries determine argument structure need to enrich the technical toolbox so that, somehow, groups of verbs can be associated to two or more lexical entries. Some of these approaches are directional, through lexical rules that operate on one of the two argument structures and produce the other, and other approaches are non-directional and propose some redundancy lexical rule that associates a causative and an inchoative entry in a way that, leaving argument structure aside, the morphological, phonological and semantic properties of the two members of the pair remain invariable.

We have seen also that approaches where the lexical verb is split into additional heads do not solve the problem, but rather recast the problem in terms of the availability or not of whichever heads introduce the agent and the patient with these verbs. A semantic or syntactic

decomposition of the causative member of each pair into a causative component and a change of state component simply rephrases the problem: how do we account for the fact that some verbs optionally allow a causative head that introduces another argument?

These facts support a non-lexical view of argument structure alternations, but situations where specific verbs strongly reject a particular alternation support, in fact, the lexical approach. (326) and (327) show instances of verbs that are either fixed in a causative or in an inchoative reading.

(326) a. Juan demolió la casa. Causative
Juan demolished the house
'Juan demolished the house'
b. *La casa (#se) demolió. Inchoative
the house (SE) demolished
Intended: 'The house self-destroyed'

(327) a. *Juan ardió los papeles. Causative
Juan burnt the papers
Intended: 'Juan burnt the papers'
b. Los papeles ardieron. Inchoative
the papers burnt
'The papers burnt'

(326b) is ungrammatical, with or without the reflexive clitic that often marks inchoativity in Spanish –the version with it can be interpreted as a passive, but not as an anticausative–, and (327a) is equally ungrammatical.

In these cases, a theory where predicates project their argument structure from the lexicon has the winning hand: nothing has to be added to the proposal to explain the rigidity, as the default option should be that a predicate has one single argument structure either with or without an agent. The syntactic theory has to explain why these particular lexical items cannot adapt their meaning to the structure imposed by syntax with or without a causative component. Again, any approach that splits the lexical verb into layers fails to solve the issue and simply recasts the question as a problem of whether the causative head is compulsory or impossible with some individual verbs.

As we have seen, syntactic approaches must enrich their explanations with additional technical objects to explain rigidity: for instance, idiosyncratic licensing conditions over specific items which state that they must appear in the context where a particular head is merged –or the opposite, cannot appear in such contexts, even though that would be formulating a negative constraint that makes the technical solution look like a filter rather than a real licensing condition–.

Other solutions are conceivable, but to the best of my knowledge have not been explored in full yet, in some cases understandably so. One solution that syntactic approaches frequently mention, although they do not illustrate how it would work, is to explore the non-structural meaning of the lexical item involved to identify meaning components that may explain why some predicates are more flexible than others. Notice that this solution is not identical to identifying a semantic type for the verbal root, because the semantic type is, in principle, rigid, and any approach allowing a flexible use of type shifting operations would face, again, the problem of rigidity in some cases –now recasting the question as which predicates allow type shifting and which predicates do not allow type shifting–. Obviously, an exploration of the conceptual semantics that have some chances to address the tension between flexibility and rigidity would have to identify some aspects of meaning as fixed for a predicate and some other aspects of meaning as underspecified or allowing adaptation from context.

In practice, this means allowing some degree of underspecification of the predicate meaning which can vary from one item to the other. The underspecification solution can also be adopted by the lexical account, and involves letting the verbs in (324) and (325) be mute about the presence or absence of a causative component, while (326) will specify in its meaning that the event must be externally caused, and (327), that it must be internally caused. The solution seems initially simple. For instance Ramchand's (2008) system of lexical entries, with the possible coindexation of the Init, Proc, Res heads with each other can be viewed as a way to formalise it. Remember that Ramchand's system determines whether verbs must have two or more distinct arguments or not through coindexation of the heads in the lexical entry, with (328a) meaning that the specifiers of Init and Proc must correspond to the same argument, while (328b), without coindexation, could be interpreted as not imposing any shared argument –or rejecting it–. An extension of the formalism to something like (328c) could be used for those cases where the two specifiers must necessarily be distinct.

(328) a. [Init$_i$, Proc$_i$] Same specifier
b. [Init, Proc] Same or different specifier (underspecified)
c. [Init$_i$, Proc$_j$] Different specifiers

The type of piece-by-piece underspecification that I have in mind is what this revised formalism states: the lexical entry, be it pre-syntactic or post-syntactic, would specify some aspects of meaning and leave others mute; rigidity follows from the first part and flexibility is a natural consequence of instances where the lexical information does not make any claim about the type of structure that the predicate integrates in. Additionally, one could imagine some formalism that differentiates predicates between those that must include a particular head, those that reject that head and those that do not care, something that Ramchand's (2008, 2018) formalism does not allow.

In summary, I believe that the flexibility-rigidity debate should be treated as orthogonal to the problem of whether lexical predicates should be decomposed or not, and even to the question of whether syntax precedes access to lexical entries or not. In essence, the problem refers to the matching between lexical entries and syntactic structures, which is common to both approaches. Exploring the conditions that allow underspecification of lexical information, similar to the one that phonology frequently uses for lexical entries, seems to be the most promising line of research at this point.

9.2. The definition of thematic relations

I believe that the second most important analytical issue that we have encountered in this review is the problem of how to determine the entailments that should be invoked to differentiate between thematic relations. Dowty (1989), as we saw, noted that ultimately one could claim that each different lexical predicate assigns different entailments to its arguments, but research cannot stop there: we aim to identifying the grammatically relevant sets of entailments that differentiate a (bona fide) agent from a (bona fide) goal or experiencer. This task is not simple, but solving it is crucial because many analytical proposals within the study of argument structure presuppose that we have a solid enough definition of what counts as theta role A and what counts as theta role B: argument structure alternations, the number of semantic primitives and their role, the number and position of different syntactic heads introducing arguments, among other central problems in argument structure, would be approached differently depending on how many theta roles we identify and which arguments are assigned which theta roles.

This central problem manifests itself in at least three different types of questions. First, identifying the specific entailments that are grammatically relevant is crucial to determine

which verbs relate to which theta roles: if I diagnose the subject of *attack* as an agent, I need to know which aspects of its semantic relation with the event define it as an agent, so that I know whether I can also treat as an agent the subject of *hit, arrive* or *break*.

Second, identifying the entailments that define each single theta role is crucial to know how many different theta roles should be posed: as we have seen, a definition of agenthood as control of the event allows a treatment of agents and instruments as essentially structurally identical with some verbs, while any claim that agenthood implies some form of consciousness would immediately force a separate treatment of instruments and agents as different participants, possibly different enough that they could be introduced by different heads or semantic primitives even when they are both used as subjects. This problem is more acute in theories that advocate for some form of the UTAH, or establish linking principles that directly refer to specific thematic entailments, because in these theories one predicts that the syntactic position and function of arguments with distinct theta roles must be systematically different. In these theories, if instrument and agent are different theta roles (and not just different names given to the same theta role in different predicates) they must have different syntactic positions and grammatical functions, all things being equal; if agent and instrument are the same theta role and the difference is just terminological, they should behave the same in syntactic function and grammatical properties.

Another side of the same problem is whether some semantically distinct property should be considered part of the definition of a theta role or not; we saw in §1.3 above that Bosque & Rexach (2009) consider denoting a quantity (as opposed to denoting a referential entity) part of the definition of some thematic relations, like temporal period. Without a definite set of entailments that are definitely diagnosed as determining the relevant thematic relations it seems to me impossible to assess whether 'quantity' should or should not be a criterion to differentiate theta roles.

Third, identifying the specific entailments that are required for each thematic relation is crucial to determine the (hopefully finite) list of possible theta roles that human language allows. We know that at least specific languages lack some conceptually conceivable thematic relations, as we saw for the case of the 'witness' relation in §1, but the desideratum is of course to have an exhaustive list of thematic relations and entailments that allows us to determine whether 'witness' is universally impossible or a language has a 'witness' thematic relation, and in either case why such a role is possible or impossible. Ultimately, this step is a necessary precondition to understand the differences between general cognition and the aspects of cognition that become part of grammar.

Notice that weaker theta roles theories like Dowty (1991) do not solve these problems; their advantage is that they allow for a more permeable definition of theta roles which opens the gate for more fine-grained relations between different levels of agenthood or patienthood, but they still raise the issue of which entailments are part of a proto-agent definition, why only those and which other sets of entailments can be identified. Are there languages, for instance, that add 'witnessing an event' as one of the entailment set to assign a particular theta-role?

One potential strategy to address these problems may be to set as a requisite for some relation to be categorised as a thematic relation that within the language one can identify a clear class of predicates that specifically select for that thematic relation. If we find verbs that must select for sentient entities that experience a psychological state, or we find prepositions that must select for spatial goals, we can conclude that 'experiencer' and 'goal' are grammatically relevant thematic relations, as opposed to 'witness', that at least in Spanish are not introduced by a semantically specialised preposition or a set of verbs. This might be the first step, followed by a detailed exploration of the compulsory and non-compulsory aspects of meaning that associate to that type of semantic relation.

9.3. Rules and representations

I think that the third problem in importance in this overview is the observation that the projection of some argument relations can be defined by specific lexical entries while other relations must be the reflection of a general rule of the language. We have seen that verbs may take external arguments that act as agents, as patients or as goals, with possibly experiencers and instruments also being able to play this role. It is therefore possible to build a predicate whose subject is a patient or a goal even if an instrument appears somewhere else in the predicate structure:

(329) a. Juan recibió una mala noticia con la carta.
Juan received a bad news with the letter
'Juan got bad news through the letter'
b. Pedro enfermó con las pastillas.
Pedro got.sick with the pills
'Pedro got sick with the pills'

In contrast, there are no known cases of predicates which take an agent and a patient and project the patient as the external argument. Syntactic theories try to explain this by making agents be introduced by a head that necessarily 'closes' the building of a lexical verb, and lexical theories propose linking principles that, in one way or the other, block patients from becoming subjects unless no agent is present.

The immediate question is, then, how the rule component interacts with the stored component. Is it possible to lexically define a verb with agent and patient, that defines the patient as the lexical argument, even if it will never emerge as such because linking would revert the relation between arguments, or should one take those linking principles as pre-lexical rules that restrict what types of lexical entries one can have? From the syntactic perspective, we could rephrase the question as why should the head that introduces agents close the lexical verb structure. Phase approaches like Chomsky (2001) propose that the little v head that introduces agents 'closes' the verbal structure because it forces its complement to be dispatched to the semantic and phonological component, forcing it to be interpreted as a predicate; however, we have seen in Lohndal (2014) that there are ways to compose predicates even when their pieces have been transferred as separate chunks, so nothing should in practice prevent syntax from building additional argument structure above an agent participant.

Part of the problem is that we still lack exhaustive studies about all types of argument structure relations attested in one single language (see however Levin 1993 for English). Such exhaustive description would give us some empirical base to start discussing the possible and impossible hierarchical relations between different theta roles, beyond the usual agent-patient relation that seems to be solidly established cross-linguistically. Of course, such exhaustive study would also help us address the previous two questions.

9.4. The limits of argument structure

Let me conclude with the most basic questions that I also used to open the discussion: why are natural language predicates so strongly restricted to three participants (with a few potential exceptions that may involve four)? Throughout this discussion we have seen that conceptual cognitive principles do not seem to explain this restriction, and we have seen a variety of potential explanations. The explanation that comes closer to provide a strict account of the restriction to three elements is Hale & Keyser's (1993) L-structure, which only allows the simultaneous projection of a head and a specifier when the predicate is prepositional or the complement is an adjective introduced by a verb, which provides it the specifier position. This account is successful at explaining why the maximal number of arguments within L-syntax is

two, with the third argument coming from a little v head that combines with the lexical verb at a later stage.

Of course, the success of the explanation crucially depends on little v being unable to introduce more than one argument, and it being the head that closes the structure for a lexical verb: if in addition to little v other argument-introducing heads are merged above the L-syntax level, the whole explanation dissolves. That is the reason why these approaches generally had to combine the explanation with some claim about the hierarchy of verbal projections that can be introduce in a structure, or with case-theoretic approaches.

I consider, then, that we still lack a principled and complete explanation of why predicates are restricted to three arguments, but perhaps a more detailed and exhaustive exam of verb classes in the attested languages may provide us enough information about the types of heads that one must identify in verbal structures, and their ordering restrictions, to lead us to a principled account.

With this promisory note, I finish this long state of the art about the theoretical options available to define argument structure.

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