The Embodied Basis of Discourse Coherence

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THE EMBODIED BASIS OF DISCOURSE COHERENCE

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PART I

PART I

1. INTRODUCTION

Discourse analysis has received a major boost over the last three decades prompted by an increasing concern for investigating the rhetorical structure of discourse across languages, cultures, and genres. This renewed interest in discourse studies is attributable to two principal factors: On the one hand, the desire to determine whether every language and culture has its own rhetorical system which manifests in different discourse organizational preferences, which, if true, would support the Sapir-Whorf hypothesis. On the other, the imperative need to provide the academic community with tools that can help them to get their articles accepted for publication, given the fact that scientists and academics tend to disseminate their findings in journals that are bound by very specific rhetorical conventions whose explicit command is crucial in publishing decisions.

These two aims have contributed to the emergence of a significant body of research that approaches the study of discourse as a product, that is, as a linguistic construct. The objective of these studies is to analyze the formal, stylistic, and rhetorical characteristics of a text in order to identify particular structural and linguistic patterns beyond the confines of the sentence, and explore whether these patterns can be associated with a given genre or topic (e.g., legal or medical discourse) or whether they may be linguistically and

culturally determined. This is the case of move analysis (Swales, 1981, 1990, 2004)[1] or contrastive rhetoric (Kaplan, 1996, 1967; Connor, 1996), among others.

The results obtained so far have been somewhat contradictory. Whereas some studies have found, for example, certain intercultural differences between French, German and English academic writing (Clyne, 1987; Régent, 1985, inter alia), others report no significant variation (Cook, 1988). In the case of research articles, contrastive studies point out that the overall structure of this type of texts, is basically similar across languages and cultures, as several studies of the characteristics of research articles in Arabic (Najjar, 1990), Chinese (Taylor & Tinguan, 1991), English, and Spanish (López, 1982), have found.

These results suggest that there is some factor, more powerful than language and culture, which is capable of unifying discourse patterns across languages. The purpose of the present thesis is to investigate whether this unifying factor is our metaphorical conceptualization of the abstract notion of discourse itself. To evaluate this possibility, discourse analysis is approached herein from an alternative perspective based on the Cognitive Theory of Metaphor (Lakoff & Johnson, 1980, 1999; Johnson, 1987, Lakoff, 1993, inter alia). Unlike other studies on text structure, the present thesis argues that our metaphorical conceptualization of discourse as a form of motion through space and time is one of its basic structuring devices. This means that the overall structure of discourse is metaphorically constrained and embodied in nature.

[1] For a complete account of Swales' method see appendix A.

This view is theoretically supported by one of the basic tenets of Conceptual Metaphor Theory: the idea that our embodied experience is compressed into skeletal mental representations (i.e., image schemas), which guide our understanding of abstract concepts by means of metaphorical mappings from concrete to abstract or less organized realms. If confirmed, this would have significant implications in explaining not only how discourse is formally organized but also how texts mean; in particular how global and local coherence relations, two basic ingredients of meaning directly linked to textual organization, are attained.

Traditionally, linguistic meaning has been characterized as the match between an expression and an (objective) situation in the world or possible worlds. Nowadays, however, a growing field within cognitive science, known as embodied cognition, suggests that meaning is actually the mapping from linguistic expressions to cognitive structures grounded in our sensorimotor experiences or bodily interactions with the world. In this context, words are pointers to concepts, many of which are clearly tied to kinesthetic experiences (Langacker, 1987, 1991). That is to say, linguistic expressions do not encode meaning themselves but are only 'prompts' for the construction of meaning, which is built at the conceptual level in particular contexts, with particular cultural models and cognitive resources (Evans & Green, 2006; Fauconnier, 2009).

Along these lines, cognitive approaches to discourse analysis argue that, just as words are not containers for meaning, texts themselves do not contain meaning; instead a text becomes meaningful to readers when they are able to build a coherent mental representation of its content using prior knowledge and experiences in the form of existing cognitive schemata. Therefore, "what is in fact comprehended is not sentences (i.e., the actual text), but conceptual content" (de Beaugrande, 1982:180). In this view, language comprehension exploits prompts for concepts, which are internalizations of prior interactions with the world, encyclopedic knowledge, and idealized cognitive models. This leads to the implication that meaning is inherently based on embodied experience (Glenberg, 1997; Gibbs, 2006; Lakoff & Johnson, 1999).

The main difference between the processing of isolated words and that of texts is that the units of language in a text must form a unified, coherent whole. This is why coherence becomes crucial to explain how texts mean. Discourse studies distinguish between global and local coherence. The former refers to the interrelatedness of large amounts of discourse and is associated with the overall organization of the text, whereas the latter focuses on the connections between adjacent segments of text, which act as a web of links that sustain text macrostructure (Louwerse & Graesser, 2005).

If, as argued here, conceptual metaphor shapes discourse organization, metaphor would become an important source of global coherence, which in turn would imply that our embodied experience also underlies global

coherence. This is why identifying the factors that model discourse structure and how they contribute to its overall coherence is crucial. Of course, this cannot be possible if text microstructure is not analyzed. Hence, it is crucial to take into account local coherence relations since they contribute to forging text macrostructure. The claim is that local coherence relations, specifically those which are encoded by means of cohesive devices (i.e., text connectives) are more thanmere instructions on how to understand a given propostion. Instead, it is argued that the meaning of these devices also has embodied conceptual bases because, like other abstract concepts, their semantic foundation is based on more concrete concepts.

In sum, the present thesis proposes that the search for global coherence is often guided by means of metaphorical mappings, particularly those having to do with the conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS. In the case of local coherence, the analysis presented herein focuses only on a subset of interclausal connections: cause-effect and cause-concession relations, when explicitly marked by means of discourse markers. The object of this study is to assess the hypothesis that Talmy's force-dynamic model, along with conceptual metaphor, may account for the semantic content and the type of inferences that said subset of connectives generate during language processing. More broadly, an important aim of this thesis is to provide evidence to support the premise that not only the

general structure of discourse, but also the coherence relations on which it relies, have corporeal bases.

In chapter 2, I begin by exploring the tenets of text meaning with special attention to the study of global and local coherence and the role of experience and world knowledge in their emergence. I then provide an overview of recent research concerning the impact that causal and concessive connectives have on discourse comprehension. Chapter 3 is devoted to the analysis of the embodiment hypothesis, and, hence, examines the thesis that our conceptual structure grounded by experience and the nature of our bodies. Special attention is paid to the theory of image schemas developed by Johnson (1987) and Lakoff (1987), inter alia. Moreover, their plausibility is analyzed through a detailed account of the evidence garnered from cognitive psychology, developmental psychology, psycholinguistics, neuroscience, artificial intelligence and spontaneous gesture studies. Chapters 4 to 6 examine conceptual-metaphor theory and the implication that it has for explaining how abstract notions are conceptualized. The metaphorical conceptualization of discourse as A FORM OF MOTION LONG A PATH INFLUENCED BY FORCE DYNAMICS is discused in depth. I then carry out a qualitative analysis of the macrostructure of research abstracts in biology, cognitive science, and literature studies in an attempt to examine the extent to which discourse structure is shaped and constrained by the above mentioned metaphor.

Chapters 7 to 9 discuss the embodied and metaphorical bases of local coherence, specifically of causal, consecutive and concessive relations, which I argue are to be considered members of the category of causation. Chapter 7 provides an overview of current evidence on how causation is perceived and conceptualized. Chapter 8 explores the way language codifies that conceptualization of causal relations by applying two basic constructs within cognitive semantics: conceptual metaphor and Talmy's force dynamics. Chapter 9 brings together the experimental work that I conducted to determine whether force dynamics and conceptual metaphor are able to predict the type of interactions that language users would classify as causal or non-causal. Finally, chapter 10 describes the main contributions of this thesis and suggests further lines of research.

2. THE TENETS OF TEXT MEANING

Nowadays, psychologists and cognitive linguists widely accept the notion that meaning is not encapsulated in the text itself. Rather, meaning is constructed by the reader in his or her encounter with the text by virtue of complex interactions among explicit features in the discourse itself, the reader's background world knowledge, and the reader's task or goals at hand (Kintsch, 1998; McNamara et al., 1996; Snow, 2002). In this view, understanding a text "involves the construction of a cognitive representation of the meaning of the text rather than of its surface form" (van den Broek & Gustafson, 1999: 17; see also Keenan et al., 1984; Meyer, 1984; Meyer & Rice, 1984; Murray, 1995; Sanders & Noordman, 2000). Several approaches to text comprehension based on these assumptions have appeared over the last three decades. Some examples include:

a) The construction integration model (Kintsch, 1988, 1998; Schmalhofer et al., 2002; Singer & Kintsch, 2001).

b) Constructionist theory (Graesser et al., 1994; Singer, et al.,, 1994).

c) The structure building framework (Gernsbacher, 1997).

d) The event-indexing model (Zwaan et al., 1995; Zwaan & Radvansky, 1998).

e) Memory-based resonance models (Lorch, 1998; O'Brien, et al., 1998).

f) The landscape model (van den Broek et al., 2002).

It is beyond the scope of this thesis to describe all these models but it is worth pointing out that, regardless of their differences, they coincide in arguing that

coherence is a crucial aspect of the cognitive representation constructed by the reader of a text. Textual coherence means that the mental representations of the segments that make up a discourse are linked to one another in a meaningful and organized manner (Hobbs, 1979; Sanders et al., 1993; Graesser et al., 2003).

To construct a coherent mental representation of discourse information, readers look for coherence relations (i.e., relational links) among sentences (local coherence) and larger discourse units such as paragraphs, sections and the whole text (global coherence).[2] If readers fail to establish connections between these various units, then they will not be able to understand the information in the text. This is why coherence is so crucial for understanding and comprehension: it is what makes a string of separate sentences into a meaningful discourse, or, in Graesser, McNamara and Louwerse's words (2003: 82) coherence is "the cornerstone of comprehension."

2.1 Global coherence: the outline of a journey

As mentioned above, discourse can be said to have two general levels of coherence: global and local. Global coherence "is mediated primarily by the overall structure or organization of the text which refers to the arrangement of ideas and the relations connecting the ideas in the text" (Anderson & Armbruster, 1986:154). This is why it is important to understand how speakers and writers construct the conceptual edifice that underlies a text, and, likewise,

[2] For a more detailed account of global and local coherence see section 2.1 and 2.2.

how listeners and readers are guided in accessing this conceptual edifice. In fact, comprehension is constrained by readers' ability to attribute structure to unfolding events given the fact that "to be able to understand and to store complex information from discourse, language users need to assign global structure to the complex semantic input"(Van Dijk, 1980:202). This tendency to impose structure on discourse for comprehension seems to be a general cognitive principle, not only restricted to language, but also present in perception or thought (Van Dijk, 1980), which has been attributed to an attempt to limit our potential perception of disorder (Marroquín 1976) and to the brain's capacity to order sensation in characteristic ways.

Gestalt psychology has tested this phenomenon in the field of visual perception and has found that subjects are more effective in recognizing configurations that can be interpreted as patterns than as random configurations. This suggests that people acquire meaning from the totality of a group of stimuli rather than from each individual stimulus, a fact that leads to a human preference to look for organization, structure, and patterns. As a result, upon viewing images such as the one below, subjects impose order and structure on what they perceive; what is initially seen as a jumble of splotches thus becomes a Dalmatian dog among leaves (see figure 1). In this case, subjects apply a basic principle of perceptual organization, which is separation of the figure and the ground, which involves the allocation of attention resources to certain parts of a scene. This principle reveals our perceptual tendency to assign

a contour or structure to certain areas of a scene and separate them from their backgrounds based on one or more possible variables, such as contrast, color, size, etc. (Goldenstein, 2007). The region to which a contour is assigned is the figure and this becomes the focus of attention, while the ground lies in the periphery of attention.

Figure 1: Dalmatian dog by R.C. James

Even though Gestalt theory has been essentially formulated at the level of sensory perception, under the assumption that language is just one part of human cognition that operates on the same principles as other cognitive faculties, cognitive linguistics has extended the principles of Gestalt theory to language. Here these principles have been shown to be relevant in the articulation of meaning and comprehension (see for example Talmy's work on figure and ground (1985, 2000a), Langacker's cognitive grammar framework (1991, 2008), or Lakoff's research on metaphor and gestalts (1980, 1987, 1993, 1999). It therefore seems natural that the human predisposition or preference for a gestalt perception, which explains why humans impose structure and

"sense" unity in a configuration of visual shapes (a complete object) or in a succession of sounds (a whole musical piece), can also be extended to language.

In the case of discourse, as stated above, research on reading comprehension has shown that the perception of unity or global coherence that readers seek is connected to the overall organization of the text and can be ensured by the way in which the text is structured (Richardson & Morgan, 2003). For this reason, it is crucial that we identify and understand the mechanisms that shape discourse structure and how they contribute to its overall meaning and coherence.

Classical discourse studies advocate an approach to the study of discourse structure that is similar to syntactic analysis, thusly: "in the same way as the form of sentence is described in terms of word order (syntax), we may decompose the form of the whole text and talk into a number of fixed conventional components or categories and formulate rules for their characteristic order and function […] much like when we analyse a sentence in terms of subject, object, etc" (van Dijk, 1998: 13). When this type of analysis is applied to discourse, it is immediately observed that texts are commonly organized around three major schematic categories (as van Dijk [1980] called them): the introduction, body, and conclusion, which are sequentially ordered and whose functions are, respectively, to present the topic, to provide details, and to draw conclusions. However, this formal analysis of discourse is incomplete (just as it is for a sentence analysis) because, even if it helps to

identify the structural parts of discourse, it makes no reference to the semantic value of discourse structure.

Over the last three decades, cognitive linguistics has provided evidence that the grammatical structure of sentences is meaningful; it is not just words that bring meaning to sentences but the grammatical properties of the sentence are also meaningful. Talmy (2000b) and Langacker (1987, 1991, 2008) argue that this is possible because grammar encodes schematic aspects of embodied experience, such as attention, which are not only fundamental to human perception, as discussed above, but also to grammatical organization.

> The claim made in cognitive linguistics is stronger than the claim that grammatical structure contributes to meaning via the structural identification of grammatical functions like subject and object. The cognitive claim is that grammatical constructions and grammatical functions are themselves inherently meaningful, independently of the content words that fill them. (Evans & Green, 2006:215)

Hence, when describing an event, as when perceiving it visually, we impose a certain construal on the scene by profiling some aspect of the event while other aspects are relegated to the background. In linguistic terms, this figure and ground separation is made on the basis of the grammatical function assigned to each element. In simple English sentences, for example, the figure and ground distinction is encoded as subject of the sentence and object of a preposition, respectively. So, in a sentence such as *The bicycle is next to the church*, *the bicycle* is singled out as a prominent figure with regard to the ground, *the church*. This configuration is a matter of focal attention: the subject of a

sentence is more prominent and encodes the figure of a profiled relationship whereas the complement (or to be more exact, the prepositional object in this case) is a secondary focal participant and encodes the ground (Talmy, 2000; Langacker, 2008). This can be seen if the order of the nominals is inverted: **The church is next to the bicycle*. Being relatively small and moveable, bicycles do make for very good figures with regard to churches, which are more groundlike in that they are large and offer a good stable reference point.The idea, then, is that the attribution of grammatical functions (such as subject and complement) is meaningful on its own right, independently of the specific words that we use. This is an illustration of how grammar encodes embodied experience; by selecting a specific grammatical configuration, grammar can mirror some aspects of our conceptual representation of a particular situation. In the example given above, conceptual prominence is mirrored by grammatical prominence on the basis of the subject and object attribution.

If discourse structure is equated to sentence structure, and if we agree that the grammatical form of a sentence has its own schematic meaning that remains constant regardless of its actual content, then it would be logical to argue that discourse macrostructure is inherently meaningful too, regardless of the specific content of the text. Just as grammar reflects our particular conceptualization of an event by linguistically organizing the scene in a specific way, so discourse organization might also reflect our conceptualization of the notion of discourse in the way ideas are sequenced. Texts are commonly

conceived as the material expression of a reasoning process that contains three major parts: the introduction, body, and conclusion. In this view, a text is a sort of "journey" that takes us from premises to conclusions by means of logical arguments since, as Johnson argues:

> When we reason, we understand ourselves as starting at some point (a proposition or set of premises), from which we proceed in a series of steps to a conclusion (a goal, or stopping point). Metaphorically, we understand the process of reasoning as a form of motion along a path—propositions are the locations (or bounded areas) that we start out from, proceed through, and wind up at. (Johnson, 1987:38-39)

As a consequence, the topological macrostructure of discourse rests on the main metaphor: DISCOURSE IS A FORM OF MOTION ALONG A PATH where the structural components of discourse (introduction, development, and conclusion) correlate with the three major stages of a journey: source, path, and goal. The pairing between the source domain (i.e., motion along a path) and the target domain (discourse) is determined by the experiential correlation between the source and target domains (Lakoff, 1987); thus, the common purpose of a journey, which is to arrive at a particular place, correlates with the purpose of discourse, which is to reach a particular logical conclusion. This implies that conceptual metaphor plays an important role in determining the organization and sequencing of ideas in a text and, for this reason, it is an important source of coherence that facilitates comprehension. Moreover, conceptual metaphor suggests that text structure is inherently meaningful because, just as the subject and object of a sentence have an intrinsic schematic meaning (figure and

ground respectively), so too does the introduction, body and conclusion of a text, which serve to encode the source, path, and goal of a reasoning process by imposing a certain construal on the events described in the text.

At the content level, current evidence confirms that conceptual metaphor is an important source of coherence that facilitates comprehension. Ponterotto's work on the role of conceptual metaphor in oral discourse has shown that metaphor is crucial in the structuring of conversation since "it contributes in a decisive manner to the cohesive force upon which the text representation depends in order to emerge and be sustained in conversation" (Ponterotto, 2000:287). This is possible because, as Barcelona argues, "a major metaphor normally provides the heuristic frame for the conversation which then calls up a complex web of thematically related conceptual metaphors that are used to elaborate the major metaphor […], these networks often constitute the backbone of conversation and give it coherence and cohesion" (Barcelona, 2000:24).

In the case of written discourse, the effect of metaphor on the elaboration that readers make of the mental representation of a text has been analyzed by Albrintton et al. (1995) These authors have shown that texts written around a main conceptual metaphor provide a schema-like structure that can be used during reading to organize information and link pieces of information in a text representation. Their findings point to "a role for metaphor in fostering coherence within readers' text representations" (Albrintton et al., 1995: 619). Likewise, Kimmel (2005a, 2005b) attributes a prominent role to conceptual

metaphor and its underlying image schemas as narrative structuring devices used to scaffold the story macrostructure. In his analysis of *Heart of Darkness*, for instance, he shows how the text is organized around a main metaphor, SELF-TRANSFORMATION IS A JOURNEY, which presents the transformation that the protagonist undergoes in terms of a physical journey. As a consequence, the events are sequenced according to a journey-based structure. Such evidence, therefore, seems to strengthen the idea that our metaphorical conceptualization of a topic can, by acting as a source of coherence that facilitates comprehension, provide a schema-like structure for organizing information.

To our knowledge, however, the impact that the metaphorical conceptualization of discourse itself may exert on its general organization and global coherence has still not been considered. There are reasons to think that this metaphorical conceptualization might be a determining factor on discourse, particularly because the major structural parts identified by formal discourse analysis (i.e., introduction, body and conclusion) correspond to the main stages of a metaphorical journey: a starting point, trajectory, and destination. This is not surprising if we consider how conventional metaphors often impose structure on everyday life (Lakoff, 2003). So, in the same way that the conceptual metaphor MORE IS UP is made "real" in a thermometer oriented vertically, our metaphorical conceptualization of discourse can materialize in the way the text is structured. This metaphor may impose its structure on the text design, which is why the first part of this thesis will be devoted to

exploring the extent to which text macrostructure is shaped by our metaphorical conceptualization of discourse, and how this might contribute to developing a gestalt perception of the text content and, in turn, to enhancing global coherence in reading comprehension.

2.2 Local coherence: the scaffolding of text macrostructure

To be meaningful, texts must not only cohere globally but also locally, at the micro-level, by relating the different information units in the text to each other (Sanders & Noordman, 2000). Quite often these links are established through connectives or other lexical cues (i.e., cohesive devices) that profile the type of relation that exists between adjacent sentences. However, a distinction must be made between coherence (i.e., the meaning relations underlying a text), and cohesion (i.e., the linguistic devices used to make these relations explicit). It is generally accepted that coherence, like meaning, does not lie within the text; coherence is not a property of the text itself, but rather a characteristic of the cognitive representation that writers and readers construct on the basis of the text (Garnham & Oakhill, 1996, Zwann & Radvansky, 1998, Sanders et al., 1993). In other words, coherence is a cognitive construct, whereas cohesion is a textual construct in the sense that it implies the presence of specific linguistic cues (Louwerse, 2002; Louwerse & Graesser, 2005).

Therefore, a text can be coherent even without the presence of overt linguistic signs that relate a segment of text to another. For example, the

sentences *Mary never goes to Marcello's. She hates pasta*, do not contain any explicit cohesive device but their components are connected by means of implicit links between concepts. On the one hand, part of the connectedness of this sentence stems from a metonymic part-whole relation: "Marcello's," the name of an Italian restaurant, and "pasta," food typically served in Italian restaurants. On the other hand, the information in the second sentence can be interpreted as an explanation for the fact that Mary never goes to Marcello's. In other words, the two sentences can be understood to be connected by a causative relation, even though this link is not overtly indicated by any linguistic device, such as the connective *because*, which could have been used to make the relation explicit: *Mary never goes to Marcello's because she hates pasta*. In any case, coherence and cohesion are intimately related, since, even if coherence phenomena are of a cognitive nature, their emergence and reconstruction is often based on linguistic cues (i.e., connectives) present in the text itself (Sanders & Pander Maat, 2006). In other words, the actual text acts as a prompt for the construction of meaning relations that go beyond the text.

2.2.1 Meaning beyond the text: the unsaid information that coherence reveals

Coherence relations are meaning relations that connect two text segments giving way to an interpretation of the text that provides more information than the sum of the segments in isolation (Sanders & Pander Maat, 2006). This happens because explicit textual information is interconnected and

integrated with background knowledge by means of inference generation, which aids comprehension. The relevance of coherence relations in discourse production and understanding has led researchers to focus their efforts on the identification and classification of these relations, and to investigate their psychological reality and linguistic coding (See Halliday & Hasan, 1976; Mann & Thompson; 1986, Sanders et al., 1992, 1993, Louwerse, 2001 inter alia). Out of the many taxonomies that have been developed, we will focus on Sanders' classification for several reasons: his taxonomy is a clear illustration of how cognitive approaches to coherence relations operate, it distinguishes between the explicit linguistic indicators of text structure (cohesion) and the underlying meaning relations between segments (coherence); and because its validity has been empirically tested (Sanders et al., 1992, 1993) and confirmed by complementary studies, such as that carried out by Louwerse (2001).

2.2.2. Coherence relations: a cognitive account

Sanders et al. (1992, 1993) present taxonomy based on four cognitive primitives whose combination, they argue, account for the different types of coherence relations that can appear between the information units of a text.

The first cognitive primitive is the Basic Operation (denominated "Type" in Louwerse's classification). Basic Operation "concerns the operation that is to be carried out on the discourse segments" (Sanders et al., 1993). According to this model, there are two types of Basic Operations: causal and additive. The

relation between two segments is causal (1) if an implication relation (P> Q) can be deduced. The Basic Operation, however, is additive (2) if a conjunction (P & Q) can be deduced.

1. *Thick fog enveloped the city. Flights were cancelled.*

2. The *room was nicely decorated and the temperature was pleasant.*

The second primitive is called the "Source of Coherence." It can be semantic (3) or pragmatic (4), depending on whether the link that is established between the textual segments expresses a relation between events in the world or a epistemic conclusion.

3. *The street is blocked: it has been snowing for hours.*

4. *John must be at home: it is half past nine.*

The third primitive is the "Order of the Segments." It refers to the order in which the events appear in the sentences. If the order of the information matches the cause-consequence pattern (P>Q), then the basic or canonical order applies (5); otherwise, the order is non-basic (6). This distinction parallels Louwerse's division between forward and backward order. The former retains the iconic sequence of events in the world whereas the latter changes the order of the related events.

5. *The central heating stopped working yesterday, so it is very cold here.*

6. *It is very cold here because the central heating stopped working yesterday.*

Finally, the last cognitive primitive is denominated "Polarity." As in Louwerse's taxonomy, this can be positive (7) or negative (8), depending on whether the events described in the sentences show continuity (i.e., function in the basic operation) or discontinuity (i.e., if the negation of one of the information units functions in the basic operation: *x* and the negation of *y*).

7. *John got up very early. He was really tired.*

8. *Although John got up very early, he was not tired at all.*

According to Sanders, the combination of these four primitives seems to account for all types of coherence relations. So, for example, a cause-consequence relation, such as the one connecting the information units in the sentence: *The singer was sick* (segment1)*; the concert was cancelled* (segment2), would rest on the following arrangement:

A. Basic operation: causal

B. Source of coherence: semantic

C. Order: basic

D. Polarity: positive

The relation is causal because an implication can be deduced between the sentence segments in which segment 1 (S1) is the antecedent and segment 2 (S2) is the consequent. Its source of coherence is semantic because it refers to the locutionary meaning of the segments. The order in which the states of affairs described by this sentence appear is basic because S1 implies S2 and its polarity

is positive because the two segments function as antecedent and consequent, respectively.

2.2.3 The role of experience in coherence relations

As stated above, coherence relations may have clear linguistic indicators (i.e., connectives), which are understood as "processing instructors" (Sanders & Spooren, 2001:12) that help readers to connect two or more information units. However, in the absence of those indications, subjects can also infer the type of relation that exists between them. The question then is: how are coherence relations inferred? It is widely acknowledged that coherence relations are "the product of knowledge-based bridging inferences that establish conceptual links between the concepts derived from the text" (Mudler, 2008:39). In other words, coherence relations emerge from our world knowledge, since inferences are pieces of information that are not explicitly given in the text but result from our experience and which we incorporate into our mental representation of the content of a text.

It is beyond the scope of this thesis to introduce and clarify all the theories and debates surrounding coherence relations and inference research, but is worth pointing out that a major issue that many text researchers are interested in resolving is to clarify the kind of inferences people usually make in the course of comprehending a text, as well as when, why, and how these

inferences are made. The answer to these questions is still unclear. Nonetheless, researchers seem to agree that the kinds of inferences made online are those that are necessary to maintain the coherence of the text representation (e.g., Graesser et al., 1994; Just & Carpenter, 1980; Lea, 1995; Singer, 1988), and that readers spontaneously generate causal bridging inferences [3] when reading narrative texts (e.g., Suh & Trabasso, 1993; van den Broek, 1990)[4] . Moreover, it is also assumed that "knowledge-based inferences are constructed by activating and recruiting world knowledge" and "not by logical truth tables, predicate calculus, propositional calculus, Bayes' theorem, and statistical algorithms that many researchers and scholars have traditionally associated with inferences" (Graesser et al, 2007 :291).

In short, to form a unified representation of a given text, subjects must be able to link the information presented in the text with their background world knowledge to construe the meaning, which may not be explicitly stated. In this process, coherence relations (overtly expressed through the use of connectives or not) play a prominent role helping to create conceptual links among textual units that otherwise would remain unconnected.

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[3] Bridging inferences are those inferences that *must* be made to maintain coherence in a text (i.e., to understand a text as one reads through it. This involves making connections between adjacent sentences. These inferences are assumed to be obligatory, as discourse coherence is interrupted if they cannot be drawn. Elaborative inferences, on the other hand, are not immediately necessary, and might not be drawn. They "refine or embellish the text representation" (Long et al., 1990).

[4] For a review of developmental trends in inference generation during event comprehension, see van den Broek, 1997, and van den Broek et al., 2005)

2.2.4 The special status of causal relations

Studies on discourse comprehension have pointed out that causal relations seem to have a special status among the various types of coherence relations identified by researchers. These relations are considered especially important in discourse studies for two primary reasons. First, they show better results in verification and recall tasks than other types of relations, such as additive relations (Sanders & Noordman, 2000; Mulder & Sanders, 2005). Second, they speed processing and facilitate understanding (Trabasso & Sperry, 1985). As a result, a significant number of studies have analyzed the role of causal relations in narrative text comprehension (Golding et al., 1995; Keenan et al., 1984; Myers et al., 1987; Trabasso et al., 1984; Trabasso & Sperry, 1985) and expository text (Noordman, Vonk & Kempf, 1992; Millis & Graesser, 1994; Singer & Gagnon, 1999; Singer, Harkness & Stewart, 1997).

These studies have shown that readers, during the process of constructing a coherent mental representation of a given text, expect to identify the causes and consequences of the events described in texts "a process that is analogous to the strategy that they use to understand and organize the world around them" (Trabasso et al., 1984:93). Various studies have also confirmed that causally related information is processed faster (Halldorson & Singer, 2002; Singer, Halldorson, Lear & Andrusiak, 1992; Sanders & Noordman, 2000) and is better remembered than noncausally related information (Sanders &

Noordman, 2000; Trabasso & Sperry, 1985; Trabasso, van den Broek, 1985; Trabasso, Secco & Van den Broek, 1984).

This tendency seems to be consistent across age groups, since a similar effect has been found in children. In fact, reading comprehension research has revealed that children better remember units with many causal relations and also consider this type of information to be more important; as a result, children tend to include information with causal relations in their summaries of text content more often than they do for other pieces of information (Goldman & Varnhagen, 1986; Lynch & van den Broek, 2007; van den Broek, 1989a, 1989b). Similar patterns have been found in preschool and kindergarten children, whose comprehension of narrative events has been tested using acoustic and visual stimuli. Research has also shown that, when four-year-old children watch television programs, they remember events with many causal connections better than events with few connections (van den Broek et al.1996; Trabasso & Nickels, 1992). Even two year old children have been shown to have the ability to identify causal relations between events when presented with event sequences that are either arbitrarily ordered or organized by enabling relations. In this context, children reliably recall the enabling sequences, but their ability to recall arbitrarily ordered sequences improves only when they are 20 months or older (Wenner & Bauer, 2001). This evidence proves that both children and adults are particularly sensitive to causal relations and rely on them when making sense of the events that they experience.

Two explanations might account for these findings. The first explanation is the "CAUSALITY-BY-DEFAULT hypothesis, which assumes that readers by default try to connect statements by means of a causal relation and will only arrive at a different interpretation when a causal relation is not possible" (Mulder, 2008: 134). The second explanation argues that readers create certain schematic expectations about the text structure, such as the expectation that events will be presented in the following sequence: introduction, body, and conclusion. Similarly, when a text introduces a problem, the readers' schematic knowledge of the Problem-Solution structure is triggered.

> "The reader expects that a solution will be presented. If this expectation is substantiated by the text, the integration of the solution sentence in the developing representation requires less processing resources" (Mulder, 2008: 134).

Likewise, concessive or adversative relations, which only differ from causal relations in in their continuity —i.e., in concessive relations, the events do not show continuity because the outcome of the action is not the intended or expected one—also show a processing advantage, but only when overtly signaled by means of connectives (Louwerse, 2001; Murray, 1997; Sanders et al., 1992; 1993; Morera & de Vega., 2010). This advantage, as stated above, has been attributed to the fact that concessive and adversative connectives indicate to the reader that a discontinuity or disruption in the events described in the text is going to appear. This enables readers to construct a logical relation between two clauses that, in the absence of this discontinuity marker, would remain

incoherent. The facilitative effect triggered by these types of connectors (as opposed to causal or additive markers, which do not manifest a similar facilitative effect) is thus explained because readers have less of a need for explicit signaling of continuity since they expect a linear unfolding of events (Murray, 1995, 1997).

From these results, we can deduce that coherence relations, specifically causal relations (including their negative counterparts, concessive relations), play a significant role in the construction of conceptual links between two or more textual units. This fact has led to the development of numerous studies that have tested the influence that overtly marked (i.e., by connectives) coherence relations have on text comprehension. The following section provides a general overview of this research.

2.3 Coherence relations and discourse comprehension: an overview of recent studies on connectives

A quick review of studies on connectives conducted over the last two decades reveals that their main focus has been on the cognitive processes that are put in motion by connectives and their effect of connectives on discourse comprehension (Millis & Just, 1994; Millis et al., 1995; Murray, 1995, 1997; Sanders & Noordman, 2000). The conclusions of these studies (most of which compared recall performance and reading time for connective-present vs. connective-absent versions of sentences or short texts) seem to converge on a

similar conclusion: that connectors favor the integration of the text content by generating inferences and expectations that profile the type of relation that can be established between two clauses.

Millis and Just (1994), for example, conducted a series of experiments on the function of the connectors *and*, *because* and *although* that led them to conclude that connectives favor interclause integration into a unified and coherent representation by facilitating the reactivation of the first clause and triggering connector-specific inferences. Their initial hypothesis was that interclausal integration takes place in a series of steps: first of all, readers construct a representation of the first clause which is stored in the working memory until it is reactivated when the second clause is processed, and then integrated with it. This process can be boosted by the presence of connectives whose meaning guides the reader in knowing how to interpret the relation that exists between both sentences. The absence of connectives, however, does not necessarily prevent reactivation or interclause integration, which can still be achieved through inferences drawn from the content of the sentences (Millis & Just, 1994). This hypothesis was confirmed by faster response time to a probe-word verification task as well as by shorter reading times for the second clause in connective-present sentence pairs compared with connective-absent sentence pairs. Moreover, in a second experiment, Millis and Just proved that connectives not only contribute to content integration, but also trigger inferences that are connector specific. Contrary to Trabasso and the hypothesis

of causality by default, Millis and Just (1994) found that sentences with the causal connective *because* triggered cause-effect inferences with a greater frequency than the additive marker *and*, and that in the absence of connectives causal inferences were not triggered by default. In sum, Millis et al. (1994, 1995) provid evidence that supports the theory that connectors are "modulating devices" that favor interclausal integration by "explicitly signaling the reader to integrate two clauses together and form a representation which encompasses the representation of each individual clause" (Millis & Just, 1994:128).

Murray (1995) also found that connectives not only signal the reader that two clauses are interconnected but also constrain the way readers integrate adjacent sentences. According to Murray, connectors trigger expectations about the information that is going to come and help interclause integration. In other words, the presence of a particular connective in the text invokes an "expectancy of the content of the post-connective sentence" (Murray, 1995:120). In the particular case of adversative markers, specifically *although*, his study showed that the connective meaning facilitated interclause integration, as shown by the fact that reading times decreased in sentences linked by this connector, which were also judged to be more comprehensible in connective-present sentences than in the no-connective condition. From this result it was deduced that adversatives are highly constrained and limit the relationship between two sentences to contrasting propositions. Murray argued that adversative connectives show a greater facilitative effect than causal and

additive ones because they inform of possible content discontinuities or disruptions in the continuous sequence of events that readers expect by default. In short, according to Murray's proposal, connectives have a procedural meaning that limits the range of possible relations to be construed between two clauses; and informs of continuity disruptions, which thereby facilitates the integration of two units into a coherent whole.

Finally, Sanders and Noordman (2000) argue that connectives serve as surface cues that guide the construction of text representation. As in the case of Millis et al. (1995), Sanders claims that the absence of such linguistic cues does not prevent the reader's construction of a text representation, but doing so may entail more time and effort. Consequently, an online representation may be constructed faster with the support of connectives, but this may not necessarily improve recall, as their experiments subsequently confirmed.

All these studies show that connectives, as coherence indicators, undoubtedly favor discourse comprehension, since they play a prominent role in the integration of text content by instructing readers on how to connect two pieces of information. We argue, however, that to consider coherence relations as simple modulator devices or processing instructions is not enough to describe the complexities of constructing a coherent message; to provide a complete psychological description of how a coherent message is built necessarily requires an analysis of the world knowledge that is activated in the reading process. In other words, as Graesser et al. (2001:264) point out, what

"ultimately is needed is a theory that explains how meaning representations are constructed on the basis of the mappings among surface linguistics cues [in this case connectives], world knowledge structures and cognitive processes."

In this respect, cognitive semantics is a perfect point of departure, since it equates the meanings that words are conventionally assigned with concepts that exist in the mind of the reader and arise from the language user's embodied interaction with the world. In other words, cognitive semantics attributes the emergence of meaning to the links established between words, conceptual structure and world knowledge. These links are sometimes reliant on cognitive processes such as conceptual metaphor. Our objective in adopting this perspective is to shed light on the conceptual basis of causal and concessive coherence relations and their nature. This can be achieved by indentifying the type of world knowledge that is recruited when causal and concessive links are established, as well as, the inferences and restrictions that these coherence relations may trigger and impose.

Such an approach to the study of coherence relations implies the denial of a radical distinction between words that encode concepts (i.e., open-class words) and those that encode procedures (i.e., close-class words such as connectives). In fact, this approach requires us to acknowledge that the distinction between conceptual and procedural meanings is artificial (despite the arguments of relevance theory; Blakemore, 1992) since the semantic characterization of both open and close-class words is conceptual. Cognitive

linguistics has claimed that there is no need to posit a strict boundary between open-class and closed-class units, instead they must be seen as the poles of a continuum that only vary in the level of specificity of their meaning: open-class words tend to possess rich and specific conceptual content whereas closed-class words usually provide more schematic conceptual content (Evans & Green, 2006). This means that connectives can be semantically typified along the same lines as nouns or verbs and are equally meaningful, even though their meaning is much more schematic.

The assertion that connectives have a schematic conceptual content goes beyond their traditional interpretation as relational features, and implies to determine how connectives come to mean and in what sense their meaning is similar to that of open class words. To clarify these questions, we first need an integral characterization of the emergence of meaning. For this reason, the following section provides an analysis of how meaning is thought to be grounded and how the links between language, cognition and embodied experience seem to be set.

3. GROUNDING LANGUAGE IN BODILY EXPERIENCE: THE EMBODIMENT HYPOTHESIS

How language conveys meaning continues to be an open question. The traditional answer to this query in cognitive science has been that language conveys meaning through the syntactic combination of abstract symbols, a conception of meaning that emerges from the thesis that cognition is computational in nature. The symbol-processing view of cognition holds that human cognitive functions consist in manipulating strings of mental symbols, which are supposed to be the format in which the mind represents concepts. These symbols are often seen as constituting a sort of innate language that is distinct from all spoken languages and are subject to combinatory rules, which allow for the construction of any of the propositions that humans can think, express or understand given a finite stock of symbols (see, for example, Fodor, 1975).

This conception of cognition relies on the computer metaphor, which has been used as an essential paradigm to account for human cognitive processes since the 1950s. According to the computer metaphor, the brain is the hardware, and the mind is the software run by the brain, and meaning is the output that comes about after a series of abstract symbols are arranged according to syntactic rules. In metaphorical terms, therefore, meaning would be the result of "translating" a set of arbitrary symbols, i.e. words, into a mental language consisting of equally arbitrary symbols and establishing relations among them.

As de Vega (2005) argues, this proposal is insufficient, since it would be akin to translating a sentence from Russian into Finnish for a person who does not know any of those languages even if this person knows the rules to combine their symbols.

A crucial problem of this conceptualization of semantics is that syntax does not guarantee access to meaning. As Searle's Chinese room argument shows, (digital) computers merely use syntactic rules to manipulate symbol strings without any awareness of their meaning (Searle, 1980, 1999). Meaning cannot be grounded in syntactic relations among abstract symbols because, if in order to determine the meaning of one abstract symbol, we only have at our disposal more abstract symbols and syntactic rules to combine these symbols, then words would be meaningless to us (Glenberg & Kaschak, 2002).

One proposed solution to the symbol grounding problem is the idea that words obtain their meaning through arbitrary mappings onto specific real-world referents. However, even if this explanation could partially solve the grounding problem, it seems unsatisfactory since symbols can be mapped onto a wide variety of referents and "if one has only abstract symbols at one's disposal, determination of the correct mapping is impossible" (Glenberg & Kaschak, 2002:558). Moreover, under such an objectivist conception of meaning, semantics is believed to be purely referential and the purpose of language the objective description of the world. Language is more than the objective description of states of affairs in the real world: it is the description of human

perception and understanding, which is always mediated by our particular bodily characteristics and conceptual abilities.

Cognitive linguistics strongly supports the principle that meaning is embodied. Put another way, meaning is grounded in experience and perceptuomotor processes are the principal way by which we learn the meaning of things. This approach to meaning puts an end to the classical conception of mind as a separate, nonphysical substance that exists independently of the biological and neurological characteristics of the human body. Likewise, the cognition as computation metaphor is also unsound according to this approach. To view thought and language in terms of the computer metaphor is to ignore the basic assumption that "the relationship between language and other areas of cognition is very intimate" and that "the body and its perceptual processes serve as an important source of grounding for concept formation and imaginative reasoning" (Hilferty, 2001:1). In the embodied-cognition framework, cognitive processes such as thought, reasoning, understanding, and meaning are based on our embodied interactions with the environment and therefore they are constrained by our physical characteristics and the limitations of our attentional system.

> The best biology, psychology, cognitive neuroscience and phenomenology available today teach us that our human forms of experience, consciousness, thought and communication would not exist without our brains operating as an organic part of our functioning bodies, which, in turn, are actively engaged with the specific kind of physical, social and cultural

> environments that humans dwell in. Change your brain, your body or your environments in nontrivial ways, and you will change how you experience your world, what things are meaningful to you and even who you are. (Jonhson, 2007:1)

Our interaction with the environment manifests a wide range of recurrent patterns that are schematized by our cognitive ability to compare two experiences, register their similarities or discrepancies and make abstractions from those experiences (Langacker, 1999:3–4). These skeletal mental representations, known as image schemas, capture commonalities among recurrent spatial configurations, object manipulation, and perceptual processes, which are thought to be essential to structure our conceptual system.[5] For example, if we think of fragments of our everyday experience, we immediately realize how certain conceptual notions arise in a ubiquitous fashion. Every day we go in or out of rooms and put things into and out of containers, our pockets, bags, etc, and these repeated actions make possible for us to learn and understand the concept of containment. In the same way, our movements through space lead us to learn about trajectories and when we apply or receive force the notion of force becomes clear to us (Johnson, 2007). Embodied experience, then, manifests itself at the cognitive level in terms of image

[5] For a preliminary sketch of its terminological history, and a revision of a range of studies illustrating the application of image schemas, see Oakley, T. (2007) "Image Schemas" in *Handbook of Cognitive Linguistics*.

schemas (Lakoff & Johnson, 1999) and other conceptual representations such as radial categories [6] or idealized cognitive models. [7] These elementary representations, which are meaningful because they derive from and are linked to human experience, serve in part as the foundation for conceptual structure (Lakoff, 1987), which is understood as "the cognitive system that represents and organizes experience in a form that can serve as the input for processes like reasoning and expression in language" (Evans & Green, 200:201). This implies that language (i.e., semantic structure) reflects conceptual structure, which in turn reflects embodied experience.

[6] A radial category is a structured relationship between a prototype and other subcategories that bear a family resemblance to the prototype. The prototype is of the most representative member a category and serves to motivate extensions to other subcategories via cognitive mechanisms such as metaphor and metonymy. Unlike classical categories, a radial category is not defined in terms of a set of necessary and sufficient conditions, all subcategories are motivated directly or indirectly by the prototype, but there need not be any one characteristic that all of them share (Rosch, 1978 ; Lakoff, 1987; Croft & Cruse, 2004).

[7] ICMs are complex knowledge structures, rich in details, which abstract across a range of similar experiences rather than representing specific instances of a given experience. They are idealized because they represent an idealized version of the world that does not include all possible real-world situations. See Fillmore's conceptual analysis of *Bachelor* for an illustration (Fillmore, 1975) within frame semantics.

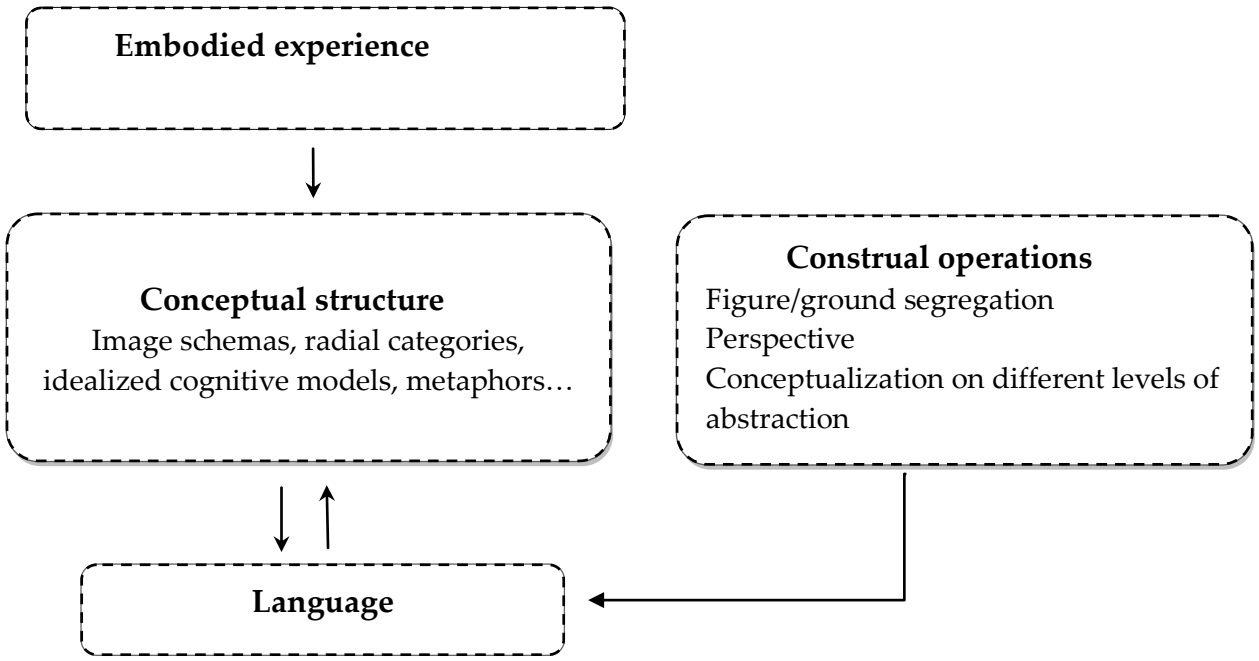

Figure 2: Cognitive semantics view of the interrelation between embodiment, meaning and language (adapted from Evans & Green, 2006). A complete account of meaning must take into account how language can help to structure our conceptual system and experience as held by the principle of linguistic relativity or Whorfian effects.

According to conceptual embodiment, therefore, linguistic meanings emerg from the pairing between signs or sounds with concepts. Concepts are not abstract symbols but representations that are reliant on recurrent patterns of perceptuomotor interactions with the world From this statement it can be deduced that, the embodiment hypothesis provides a plausible solution to the symbol-grounding problem—as formulated by Harnad (1990)—by emphasizing the role of our embodied experience in structuring word meaning. Perhaps even more interestingly, the embodiment hypothesis is one of the few theories that explicitly deals with the representation of abstract concepts by

arguing that they are actually grounded in more concrete concepts via conceptual metaphor. Thus, in the case of domains that do not have a clear embodied basis, such as the domain of abstract concepts, conceptual embodiment argues that the cognitive process of conceptual metaphor operates by mapping from concrete concepts onto abstract ones, which also explains the bodily basis of abstract concepts.

The argument posited by Conceptual Metaphor Theory suggests that our understanding of abstract concepts is based on our knowledge and experience of the world, which is metaphorically extended to less tangible domains because we typically conceptualize the nonphysical in terms of the physical. Thefore it builds on above mentioned view of conceptualization. The pattern of directionality from concrete to abstract relies on the embodied grounding of our conceptual system and is guided by image schemas, which provide the basis to make those projections possible while also constraining them; in this way, our spatial system is often involved in the representation of abstracts realms and nonspatial language (Lakoff & Johnson, 1980; Lakoff & Johnson, 1999; Gibbs, 2005). This is especially relevant to us, since the objective of this thesis is to clarify the conceptual nature of causal and concessive connectives, completely abstract domains, which are understood herein as prompts for coherence relations. To undertake this task, we first examine the notion of image schema as introduced by Lakoff and Johnson (1987), then we analyze the psychological status of this schema by reviewing the empirical

evidence found in cognitive sciences, and finally introduce and illustrate the theory of conceptual metaphor.

3.1 The bodily basis of language and thought: Image schemas

As we have seen so far, in both cognitive science and linguistics, there has been significant interest in understanding the relationship between language and thought on the one hand, and perception and action systems on the other (Barsalou, 1999; Glenberg, 1997; Wilson, 2002). In this context, Lakoff (1987) and Johnson (1987) introduced the notion of image schema: basic conceptual structures that arise from recurrent perceptual and motor interactions with the environment that cut across vision, hearing, haptic perception, kinesthetic movement, and so on, and are mediated and structured by the characteristics of the human body (Johnson, 1987; Lakoff, 1987; Lakoff & Johnson, 1999; Talmy, 1988, 2000a). Experimental work on perception makes plausible the existence of these types of structures, which are fundamental to an embodied perspective on cognition and language, because it demonstrates that we are capable of making cross-modal, or cross-sensory, connections that enable us to understand important aspects of objects and events in the world. "Yet these cross-modal connections also form the bases of image schemas that underlie many concrete and abstract concepts" (Gibbs, 2005:231).

In the following section, I will review the evidence that supports the relevance of cross-modal sensory interactions and prior experience in perceptual processes and how these may be compressed into image schemas.

3.1.1 The cross-sensory character of perception: the example of vision

Vision has been traditionally viewed as a passive window on the world that captures everything before us in detail and creates a picturelike mental representation of it by sending the information captured by the retina to specific areas of the brain. Under this premise, perception has been considered to be a modular function that operates independently from the other sensory modalities and cannot receive top-down influences; in other words, perception is considered impervious to higher cognitive processes, such as the perceiver's knowledge, beliefs and expectations (Noë & Thompson, 2002).

This traditional view of vision has been abandoned by most cognitive scientists who reject both modularity and the traditional separation between perception, action, and thought. This rejection is based on the argument that stimulation of the retina by light is not sufficient for vision, as retinal images can only give us a pattern of light without supplying enough information to determine how things are in the environment. This suggests that perception is not exempt from cross-modal influences and implies the interaction of bottom-up and top-down processes (Vilarroya, 2001).

The discovery of cross-modal influences on vision is not new, and many studies have shown that vision can be radically altered by touch and hearing, even when there is no ambiguity in the visual stimulus. The visual and tactile systems, for example, frequently interact during the manipulation and identification of objects (Cohen & Andersen, 2002; Haggard, 2001). Moreover, recent studies have also shown that the coupling of these sensory systems is not only involved in processing the physical properties of graspable objects, but also in the disambiguation of visual object motion. Blake et al. (2004), for example, evaluated the effect of tactile input on observers' visual perception by using a two-dimensional projection of dots onto the surface of a virtual globe that rotated about its vertical axis either in a clockwise or counterclockwise direction; as subjects watched the rotating globe, they simultaneously touched a styrofoam tactile globe, which also rotated about its vertical axis, either in the same or the opposite direction of the virtual globe. Blake found "that tactile input tended to bias visual perception of the direction of rotation", although it did not completely determine the viewer's perception of direction (Blake et al., 2004:201).

In the case of audiovisual integration, sound-induced illusory flash, for example, has shown that when observers are presented with a single brief visual flash accompanied by multiple auditory beeps, the single flash is erroneously perceived as multiple flashes due to the influence of the auditory stimulus (Shams, Kamitani & Shimojo, 2000, 2002). Another study (Meyer &

Wuerger, 2001) has also reported the influence of auditory motion on visual motion perception. In this case, the experimental subjects saw a visual display in which a series of dots moved about randomly while, simultaneously, a tone that simulated horizontal motion from left to right (or vice versa) was played. Results showed that auditory motion predisposed the subjects to perceive visual motion in a direction consistent with the auditory motion when the visual and the auditory stimuli mismatched.

In light of findings such as these, it seems clear that vision functions cooperatively with the other senses to identify objects and events correctly. This is not the only source of influence on visual perception, however. Higher cognitive processes such as attention are also actively involved in this process.

The existence of figure and ground relations in perception shows that vision is not direct but is influenced by basic attentional principles. Well-known examples of this fact are Necker's cube and Rubin's goblet/face illusions (see Figure 3). Necker's cube is a drawing consisting of a set of lines with no inherent front or back. The cube can thus induce two perceptions: either a three-dimensional cube oriented upward or a three-dimensional cube oriented downward. This illusion is motivated by our attentional system, which imposes a figure and ground distinction on it, so that one set of lines is perceived as the nearer side of the cube and considered to be the front of the cube, while the rest of the lines are relegated to the ground. In Rubin's goblet/face illusion, the image fluctuates between two possibilities, even though it remains constant in

the retina; as a result, it can be perceived either as two black faces looking at each other in front of a white background, or as a white vase on a black background. We can never see the two images simultaneously, when we see one of the perceptions, the other region forms a background, so to see both percepts requires switching back and forth.

These illusions show that perception is not solely determined by an image formed on the retina. The spontaneous reversal observed illustrates how our brain organizes its visual environment on the basis of attention.

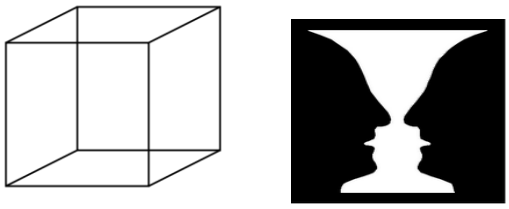

Figure 3: Necker's cube and Rubin's vase/profile illusions.

Other evidence supporting the attention-dependent character of perception are change blindness and inattentional blindness, that is, the failure to detect changes in parts of a scene. O'Regan, Rensink and Clark (1997, 1999, 2000) proved that observers do not experience everything in the visual field at the same time, but only those parts they are attending to. Therefore, they are not able to identify changes in a scene unless their attention focuses on these changes. This assumption was tested in a series of experiments in which observers were shown displays of natural scenes and asked to detect cyclically repeated changes, such as an object changing color or location, or appearing

and disappearing. The results of the experiments showed that in many cases observers did not see the changes, even though they were very large and occur in full view (Rensink, O'Regan & Clark, 1997; O'Regan et al., 2000; O'Regan, Rensink & Clark, 1999).

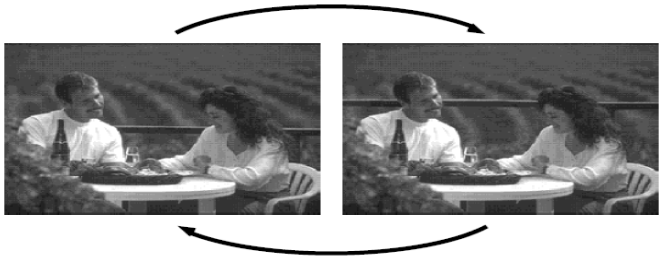

Figure 4: Example of changes in a scene. Change in a marginal interest area, the railing behind the couple is moved (Rensink; O'Regan & Clark, 1997).

Mack and Rock (1998) have also described another related effect known as inattentional blindness. In this case, changes are not detected because subjects are engaged in an attention-intensive task. In this particular situation, subjects were asked to judge which arm of a cross was longer. After a number of trials, an unexpected stimulus, a rectangle, appeared on the screen along with the cross but subjects did not notice it, even when it appeared in the center of their visual field, because they were concentrated on the cross. However, when participants' attention was not distracted by the cross, they easily noticed the intrusive object.

The above described phenomena clearly show that attention plays a central role in visual perception; however, perception also implies other top-

down processes in which we apply our previous experience and expectations to interpret information more rapidly and to make sense of the world. Among those processes is the ability of human vision to compensate for missing or ambiguous visual information. Our previous experience, prior knowledge, and the data resulting from other cognitive processes are used in these situations to build a coherent whole. The image in Figure 5, for instance, when seen out of context, might be ambiguous and interpreted as either a seal or a donkey. However, in the scenario of a beach it is more likely that perceivers will identify it as a seal because they rely on information from their past experiences, as well as on the expectations triggered by the context.

Figure 5: Ambiguous stimulus subject to contextual interpretation.

The role of prior knowledge and experience is not only important in perceptually ambiguous situations but also in general perception. Cross-cultural research has allowed us to understand that even when perceivers are exposed to exactly the same visual information, their individual and cultural experiences can influence their interpretation of what they see. For example, we apply pictorial-depth principles when observing a picture to estimate depth and height. Large objects are perceived as being near, and small ones as being

far. Similarly, objects that are closer to the horizon are perceived as being further away from the rest of the objects in the scene. However, people who are not used to interpreting flat images, like photographs or drawings, would construe a different interpretation of the same picture.

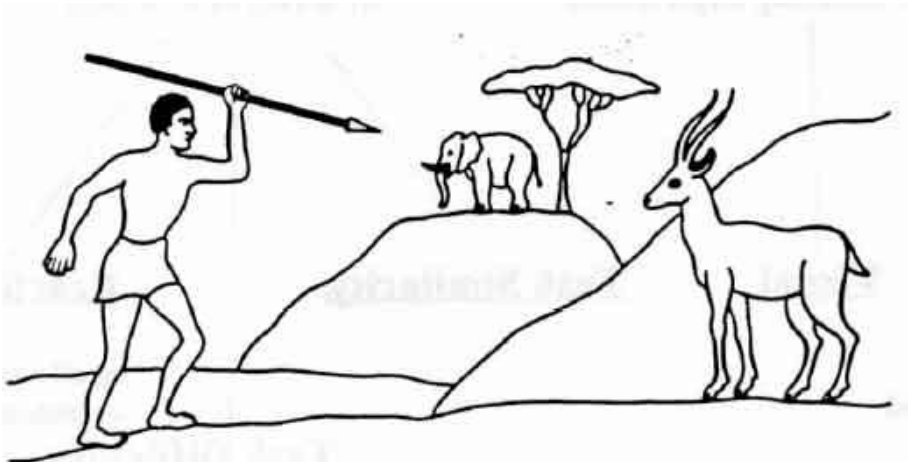

Figure 6: An example of how depth and height cues are applied to interpret an image.

A clear example of this is Hudson's (1960) pictorial depth perception test (Figure 6), which showed that experienced perceivers, who base their perception on the size and position of the objects, interpreted that the hunter was attempting to kill an antelope with an elephant in the distance; in contrast, nonexperienced subjects, in this case a group of African children, described the picture as that of a hunter attempting to kill a very small elephant. Hudson's results showed that African children experienced great difficulties in perceiving depth since they did not respond to any of the clues which placed the elephant at a greater distance from the hunter than the antelope (Rookes & Willson, 2000).

In sum, studies on visual perception have confirmed that the brain does not operate like a camera, which takes a whole picture of a scene. "Our perceptions are not direct records of the world around us; rather they are constructed internally according to constraints imposed by the architecture of the nervous system and its fundamental abilities" (Gardner & Martin, 2000:412). From this standpoint, perception must be conceived as a process of coordination between bottom-up and top-down processes in which sensory receptors receive information from the environment, which is used as a cue for activating higher cognitive activities, overall conceptualizations and contextually relevant information about the world provided by our experience. Consequently, each and every perception depends not only on the information available in the stimulus itself, but also on the perceiver's expectations and previous experience. This would be the case, for instance, of the sensory and perceptual experience, which gives rise to image schemas, skeletal mental representations that compress recurrent patterns of embodied expreince and arise in conjunction with our physical and psychological development.

3.1.2 Some examples of bodily-derived image schemas

In this section we shall analyze the nature of some of the most common image schemas to examine how they emerge, to describe their internal logic, and to exemplify their role in conceptualization and meaning.

a. Scale image schema

The scale image schema is one of the most recurrent schemas since it serves as a basis for the characterization of a wide range of domains that include "numbers, properties, relations, geometric structures, entities in economic models, etc." Johnson (1987: 23). The scale image schema emerges from the common experience of seeing the level of a pile increase or decrease as objects are added or taken away from the pile. "Our world is experienced partly in terms of *more*, *less* and *the same*" (Johnson, 1987:122), patterns of orientation that guide us in our interaction with the environment. This fact is only possible because we have certain accepted standards that constrain what we consider a normal average amount in each particular situation. These standards become norms of amount and help us to gauge the quantity of something, its strength, intensity or speed. The scale schema is applied not only to quantitative features but also to qualitative aspects such as color, taste, or feelings

The structural elements that make up this schema are a closed or open-ended progression of amount, a position in the progression of amount, a calibration of amount and one or more norms of amount.

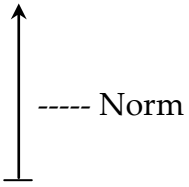

Figure 7: Scale image schema.

The scale image schema is a basic constituent in the conceptualization of notions such as *height* (1) or *feelings* (2 and 3), as in the metaphor HAPPINESS IS UP/SADNESS IS DOWN, which clearly shows how we perceive qualitative aspects as having varying degrees of intensity, the amount of which can be measured.

1. *The average height for men in the U.S. is 5'10".*

2. *I feel like being on top of the world.*

3. *To pick yourself up when you feel down; you should smile more.*

Happiness and sadness are abstract entities, feelings that cannot be mathematically measured (as opposed to height), but we conceptualize them as having different degrees of intensity that can be quantified using a vertical scale in which euphoric states are at the top and depressive states are at the bottom.

b. Containment image schema

The containment image schemas results from the fact that we experience our bodies both as containers and as things in containers. On the one hand, our bodies are conceived as bounded areas into which we put substances such as food, water, or air. Moreover, they are also entities that move in and out clothes, rooms or any bounded space, which are seen as having aninterior, an exterior (Lakoff, 1987 & Johnson, 1987). From a structural point of view, this schema is comprised of a physical or metaphorical boundary, an interior and an exterior. From this structure a basic logic can be inferred: something is either inside a container or outside of it. Moreover, the containment schema has some other additional properties, such as transitivity of enclosure (if one object is enclosed

by a second, and that by a third, the first is also enclosed by the third), protectiveness of an enclosed object and a relatively fixed position of the bounded object (Lakoff, 1987 & Johnson, 1987).

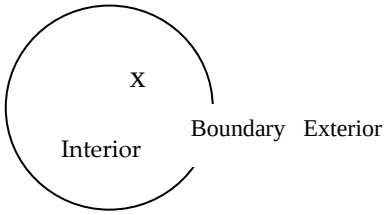

Figure 8: Containment

On the basis of this image schema, not only concrete (4) but also abstract concepts like *time* get their meaning (5 and 6). Our experience with containers is projected onto the abstract domain of *time* by the conceptual metaphor TIME IS A CONTAINER, which is shaped and constrained by the structure described above, as the following metaphorical expressions manifest.

4. *Get in the car right now!*

5. *In 1979 the Soviet Union invaded Afghanistan*

6. *He's like something out of the last century*.

Vehicles and *time* are, as can be observed, conceived herein as a bounded area because we impose on them a container structure; as a result, we can identify its limits and determine our position in or out of that enclosed area.

c. Center-periphery image schema.

The center-periphery image schema is a direct consequence of considering our bodies as the center around which our world is organized. "Our bodies are perceptual centers from which we see, hear, touch, taste and smell our world"

and the objects, people or events that surround us are located at varying distances depending on their closeness or importance to us (Johnson, 1987:124). The most relevant aspects of our environment and lives occupy a central position, whereas less important features are relegated to the periphery.

As an experiential gestalt, three interdependent structural parts form the center-periphery schema: an entity, a center, and a periphery that is dependent on the center.

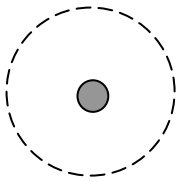

Figure 9: Center-periphery schema

The center-periphery image schema underlies our conceptualization of concepts such as *centeredness* (7) or *importance* (8 and 9) by means of mapping

IMPORTANCE IS CENTRALITY

7. *They drove around the city for hours*.

8. *The core of the problem is about choosing the best option.*

9. *These considerations are peripheral to the debate, they move away from the root of the problem.*

The center-periphery schema tends to be combined with other image schemas that help to define our spatial orientation, such as scale, near-far, and container schemas (Johnson, 1989). The scale schema is crucial to determine the nearness or remoteness of an entity relative to the center. The container image schema helps us to mark a boundary between the center and the periphery, and

this boundary is the limit between being inside the container (at the center), or outside it (at the periphery).

All in all, as can be observed from the previous examples, image schemas seem to have a prominent role in conceptualization and reasoning. However, their empirical validation, their psychological status and specific cognitive functions are yet to be determined. Many studies within the field of cognitive linguistics have been conducted to trace the role of image schemas in abstract reasoning and thought; however, these studies are largely based on the introspective analysis of linguistic data and have therefore been received with great skepticism. As Gibbs (2006, 2007) observed, introspection and intuition can be valuable sources for constructing hypotheses but they do not constitute the kind of objective, replicable data that can be used to make generalizations about human cognitive and linguistic processing. In other words, intuition is not enough to assert the psychological reality of image schemas or to account for their function in language.

Because pure linguistic analyses cannot prove the existence of image schemas, we must look to other disciplines to find evidence to determine the cognitive reality and function of these schemas. For this reason, a wide range of studies have been conducted in an attempt to shed light on this topic. Studies have been carried out from a variety of perspectives, as follows: psycholinguistics (Gibbs, 1994), cognitive and developmental psychology (e.g., Gibbs & Coulson, 1995; Mandler, 1992, 1996, 2000), robotics and artificial

intelligence (Spranger & Loetzsch, 2009), neurosciences (Gallese & Lakoff, 2005), and new fields of enquiry such as gesture studies (Cienki, 2005; Nobe, 2000). The experimental evidence from these studies suggests that image schemas are cognitively real, even though they are still considered hypothetical constructs.

3.2. The psychological status of image schemas

More than twenty years have passed since the notion of image schema first emerged and rather than becoming more clearly defined, the meaning of this notion has become more diffuse.[8] For some scholars, image schemas are abstract mental representations of embodied experience stored in long term memory, while for others they are "a kind of 'structural coupling' between brain, body and world interaction" (Gibbs, 2008: 236) and their activation involves constructing an embodied simulation of experience. In general terms, both interpretations share a common understanding of the origin of image schemas (i.e., as body-world interactions), but their conceptions of embodiment are different. Gibbs states the problem in these terms: "Under the [first]view perceptual processes give input to forming conceptual representations, but higher-order concepts are disembodied representations stripped of their embodied roots"(Gibbs, 2008: 231). Thus, bodily experience would be relevant only in an initial stage, when image schemas are generated. An alternative view

[8] See Hampe, 2005 for an account of the versatility of the notion.

is that "bodily experience has an enduring role in early conceptual development and throughout the lifespan, with image schemas being continually tied to ongoing perceptual and kinesthetic actions" and activated via simulation (Gibbs, 2008: 231). The temporal or enduring role of bodily experiences seems then strongly linked to what authors understand as embodiment.[9]

Generally speaking, the use of the concept ranges from the classical interpretation that emerged under the influence of experientialism—our cognition is dependent on the nature of our world and the type of bodies that we have—to what is known as "full embodiment" (Lindsay, 2008), which emphasizes the physiological and neurological basis of our conceptual system and asserts that image schematic reasoning recruits part of the same sensorimotor programs used in actual performance. Under this perspective, our perceptuomotor experiences are stored in perceptuomotor areas of the brain and are activated by simulation in conceptual processing (Barsalou, 1999; Damasio, 1989).

This interpretative variability of just what constitutes an image schema is important, since the studies conducted to clarify the psychological status and function of image schemas are shaped by the definition of image schema and

[9] Rohrer has identified twelve senses in which the term can be used with respect to cognition. See Rohrer (2007) for a review.

embodiment adopted by researchers. Likewise interpretation of the findings of these studies will depend on the definitions used.

3.2.1 Image schemas in cognitive psychology

Cognitive psychology has been very influential in the study of the cognitive plausibility of image schemas and their role in cognitive processes. When the notion first appeared, it was claimed that "image schemas motivate important aspect of how we think, reason and imagine" (Gibbs & Coulson, 2006:241), but this claim was based only on the introspective analysis of linguistic data. Cognitive psychology, particularly through studies on mental imagery, has provided an opportunity to assess this hypothesis. Such studies have shown that, despite the differences between mental images and image schemas (mainly based on their level of specificity), image schemas can be plausible mental representations. The fact that we recruit multimodal information when we generate mental images, both visual and spatial, seems to support our ability to entertain cross-modal mental representations, which in the case of image schemas stem from our bodily experience. Moreover, if, as Gibbs and Coulson assert (2006), we are constrained by our kinesthetic knowledge when manipulating mental images, it can be deduced that the internal logic of image schemas is projected onto this type of mental activities. If true, this would support the claim that image schemas play a crucial role in how we reason and conceptualize. To illustrate this point, we will review some

classical studies on mental imagery that reveal the multimodal character of mental imagery and the influence of the topological structure of image schemas on cognitive tasks.

Shepard and his colleagues (Shepard & Metzler, 1971; Shepard & Cooper, 1986) presented subjects with two drawings that portrayed a three-dimensional shape in very different orientations and with variable angular disparities. Next, subjects were asked to determine whether the two drawings depicted the same object or different ones. To successfully perform this task, subjects had to mentally rotate the drawings. The result of these experiments demonstrated that the time taken to mentally rotate objects was directly proportional to the angular disparity between the objects, a finding that many cognitive scientists accept as evidence that mental imagery also encodes spatial information. Kosslyn (Kosslyn et al., 1978) also provided evidence to support the idea that mental images preserve spatial (specifically, geometric) information. Their study showed that scanning time between distant points on an imagined object (a map that subjects first have to memorize) was affected by the actual distance between them. The conclusion of these studies is that the time needed to mentally scan or rotate an object is directly proportional to the distance covered or the degree of rotation.

These results are easily understood if we think of the source-path-goal image schema and how its internal logic is projected onto the scanning and rotation tasks. Our embodied experience with paths tells us that if you travel

along a path from a starting point to a destination, the further along the path we are, the more time will have elapsed since starting (Lakoff 1987). Scanning a path from one point to another or mentally rotating an object require that we trace a trajectory with a source and goal; as a consequence, the time taken to reach the goal must be proportional to the length of the trajectory. This is consistent with the idea that there are mental representations that are not symbolic descriptions that have been stripped of percetuomotor information, but rather multimodal representations that are at once visual, auditory, kinesthetic, and tactile, and which also constrain certain aspect of our cognitive processes. As Bryant (1998) claimed, the internal worlds that we create do not form maps of external space per se, but of perceptual and behavioral affordances within space.

In this respect, Richardson et al. (2001) presented evidence that mental images generated purely from linguistic descriptions activate motor affordances. The authors designed an experiment based on the stimulus-response compatibility paradigm. In that experiment, subjects listened to a story containing sentences in which the location and orientation of an afforded object, for example a jug with a handle on the left, was indirectly described by reference to other objects. Subjects responded to a question about the location of the object (e.g., in the center of the table, was there a milk jug?) by pressing a yes/no key. Richardson and his colleagues showed that the imaginary orientation of the object, indirectly and verbally described, influenced which

hand the respondent used to answer. They showed that the mental representation of graspable objects activates a potential motor interaction with the object resulting in quicker reaction times in the matching condition (i.e when the jug had a handle on the left and the left hand was used to answer). This finding, considered in the light of full embodiment, seem to support the idea that motor activation is part of conceptual processing and understanding.

The advent of neuroimaging techniques has also allowed researchers to shed light on the issue. In a study that used functional magnetic resonance imaging (fMRI), Olivetti Belardinelli et al. (2009) investigated imagery for seven different sensory modalities (visual, auditory, kinesthetic, olfactory, gustatory, tactile and somatic). In the case at hand, subjects were instructed to create a mental image after stimulation with auditory input. Subjects listened to short sentences describing different sensory experiences (e.g., visual: "to see a candle"; auditory: ''to hear a shot"; tactile: ''to touch something, etc), and the results showed modality-specific activation, thus suggesting that "some of the neural processes underlying modality-specific perception may also be used in imagery when people are able to evoke vivid images" (Olivetti Belardinelli et al., 2009:199)

Given such data, it seems logical to argue that reasoning, conceptualization and understanding are mediated by image schemas and recruit part of the same sensorimotor programs used in actual performance.

3.2.2 Image schemas in developmental psychology

The role of image schemas in language acquisition and conceptual understanding has also been explored by developmental psychology. In her series of papers on "how to build a baby", Mandler lays out the evidence for the presence of preverbal concepts in infancy and explores how image schemas can structure the preverbal conceptual system and the role of these schemas in learning and understanding grammatical forms, regardless of the language being learned. According to Mandler (2005: 137), "infants come equipped with a concept-creating mechanism [called perceptual-meaning analysis] that analyzes perceptual information and redescribes it into simpler and reduced form." Infants not only see but also analyze what they see and extract simple descriptions of that perceptual information in the form of image schemas, which comprise "schematic versions of spatial information and movements in space." Children observe that some objects start themselves and follow unpredictable paths and interact with other objects while other objects only move when they are acted upon by another object, only follow direct paths, and do not interact with other objects from a distance.

According to Mandler, this analysis of how objects move and interact with each other results in image schemas such as *animate motion*, *inanimate motion*, *self motion*, *caused motion*, *end-of path* and *link* from which the concepts of *animate or inanimate thing* and *agency* emerge. Containment and support are also

conceptualized at the preverbal stage, and these concepts, together with path notions, represent many of the important concepts that undergo grammaticalization in the majority of languages. In fact, Mandler, following Brown (1973), shows that the first six grammatical markings and prepositions acquired by English speakers "rely on notions describable in terms of image schemas" (Mandler, 2005:151). The order of acquisition established by Brown is as follows:

> The present progressive (*-ing*), expressing an ongoing path, 2) the preposition *in*, expressing containment, 3) *on*, expressing support, 4) plural – *s*, expressing individuation of objects, 5) the irregular past, exemplified by verbs such as *broke* and **ran** [marking end- of -path] and 6) the possessive *-s* (Mandler, 2005:151).

Similar studies show that the earliest verbs used by children are verbs of motion, which describe different kinds of paths. In languages such as English, in which motion verbs include the manner of movement but not the path (which is expressed by prepositions), children only use prepositions during the one-word stage. Infants do not say *go in* or *go out* but *in* and *out.* This fact can be understood as a manifestation of the first preverbal concepts developed from motion image schemas in the first year of life. The findings therefore indicate that image schemas and the preverbal concepts that enable children to learn spatial relations play a key role in language processing and understanding.

As we pointed out before, this conception of image schemas emphasizes the role of perceptual processes as a source of input used to form conceptual

representation, which, once created, become detached from their perceptual or kinesthetic roots (Gibbs, 2008).

3.2.3. Image schemas in psycholinguistics

Psycholinguistics studies have investigated the role of image schemas in language processing. To do this, some researchers have focused on assessing subjects' intuition about the image schema meaning of certain verbs and metaphoric expressions (Gibbs, 1994, Richardson et al., 2001). These studies have demonstrated substantial agreement across participants in their judgments of the spatial and bodily basis of image schemas.

In 1994, Gibbs et al. carried out four experiments whose objective was to empirically validate the idea that sense extensions within a word, including metaphorical extension, are not arbitrary but constrained by image schemas. Their analysis of the polysemous word *stand* showed that the meanings of this word are not arbitrary but motivated by a set of image schemas that arise from our bodily experience of standing. Experimental subjects confirmed this point since they consistently agreed that BALANCE, VERTICALITY, CENTER-PERIPHERY, RESISTANCE and LINKAGE, were primary to their experience of standing. This study also demonstrated that subjects did not separate the physical senses of the term *stand* from the metaphorical ones (e.g. "To stand at attention" vs. "To stand the test of time).

In 2001, Richardson et al. used a similar paradigm to show that participants in offline tasks display a high level of agreement when asked to choose or draw schematic representations of concrete and abstract verbs. In a forced-choice task, subjects were presented with a series of sentences and were asked to select the skeletal image that best depicted the event described by the sentence. Four schematic pictures containing a circle and a square aligned along a vertical or horizontal axis and connected by an arrow pointing up, down, left or right were provided as possible options. In a second experiment, this time an open ended response task, participants were asked to draw their own image schematic representation of the sentence. The results demonstrated that participants tended to ascribe a horizontal image schema to verbs such as *push* or *argue with*, and a vertical image schema to *lift* or *respect*. This consistency has been presented as "evidence that language [literal and metaphorical language] invokes spatial forms of representation" (Richardson, 2001:767).

In a second study, Richardson et al. (2003) lend support to the idea that image schemas are activated in online language comprehension. In addition, these authors provide evidence in favor of an embodied account of language processing. The study showed that the underlying horizontal or vertical orientation of verbs can interfere with perception in visual discrimination tasks, thus indicating that language representation has a perceptuomotor component and shares cognitive resources with other perceptual processes (visual perception in this case). To confirm this, the authors used a dual task to see if

performance on one task was affected by performance on another. Participants listened to and tried to memorize short sentences while engaged either in a visual discrimination task (Experiment 1) or in a picture memory task (Experiment 2). In the first case, participants had to indentify visual stimuli (a circle or square) that were briefly flashed in the top, bottom, left. or right of the screen. In the second task, subjects listened to a set of sentences whose verb had an intrinsic vertical or horizontal orientation while they memorized pairs of pictures depicting the agent and the object of those sentences. Afterwards, the participants judged whether they saw two pictures presented together or not. In both cases, reaction times showed an interaction between the horizontal/vertical nature of the verb and the horizontal/vertical position of the visual stimuli "interfering with performance on a visual discrimination task, and facilitating performance in the encoding of a visual memory" (Richardson et al., 2003: 776). These results provide behavioral evidence that converges with linguistic theory, thus supporting the hypothesis that certain notions evoke specific spatial orientations that are basic for their conceptualization and understanding, even if those spatial inferences are not explicitly mentioned in the linguistic utterance.

Research on language comprehension has gone a step further to demonstrate that understanding the events described in a sentence means constructing a situational or mental model. Stanfield and Zwaan (2001) developed a study designed to test this assumption. They posit that, as part of

the process of understanding the linguistic meaning of a sentence, we create an image-schematic construal of events. During the experiment, participants were presented with pairs of sentences such as *He hammered the nail into the wall* and *He hammered the nail into the floor*. After reading one of the two sentences they were shown a picture depicting the object in the sentence either in a horizontal or vertical orientation, creating a match or mismatch with the orientation implied by the sentence. The researchers found that comprehension was faster when the object orientation implied by the sentence matched the orientation depicted by the picture; when orientation was mismatched, comprehension was slower. This finding supports the theory that we "create an image schematic understanding of the verticality or horizontal nature of an event, even if these inferences are not explicitly mentioned in the linguistic statement" (Gibbs, 2005: 120).

Several recent findings further suggest that language comprehension involves not only the construction of a mental model of the narrated events but also stimulates activation of areas of the brain involved in actual perception and action. For example, an eyetracking experiment conducted by Spivey et al. (2000) studied eye movements during language comprehension. In that study, the authors found that participants who constructed mental models of a narrative text without any visual information available (staring at a blank white screen or with their eyes closed) had a tendency to move their eyes in the direction of the scene being described. Their eye movements, in other words,

were similar to the movements that would be made when viewing the actual scene. These results point to an embodied cognitive system that as Spivey argues "naturally activates 'lower level' motor actions to accompany 'higher level' cognitive processes because motor actions are fundamental components of the mental state." (Spivey et al., 2000: 492)

If, as previous results seem to suggest, language comprehension relies on representations and processes that are similar to perception and action, it would be logical to think that language comprehension, perception, and action are likely to interact when performed simultaneously since they must compete for similar resources. Using this hypothesis as a starting point, Lindsay (2008) investigated (in a series of nine experiments) how perceptuomotor simulation in language processing can interact with the execution of actions with similar spatial axes. He designed a set of lexical decision tasks in which participants had to press the top or bottom keys of a vertically-oriented keyboard in order to indicate whether stimuli presented to them were real or nonsense words. Among these words were verbs that encode upwards and downwards directions, such as *rise* and *fall,* and spatial items that encode location on the vertical dimension, such as the prepositions *up* and *down.* Lindsay found that congruency with underlying image schemas had a facilitatory effect and incongruence with image schemas caused slower reaction times. These results were consistent in the comprehension of both literal and metaphorical expressions.

Finally there is a set of studies that have shown how actual performance of an embodied action can act as a prime in language processing, a fact that also support the interaction between language comprehension and perceptuomotor activation. Klatzky, Pellegrino, McCloskey and Doherty (1989), for example, studied this effect in an experiment where participants were taught to make different hand shapes such as *pinch* or *clench* before they judged whether or not a set of sentences that described actions performed with objects (e.g., *Insert a coin* or *Hold an apple*) made sense. When the hand shape prime matched the action described in the sentence, response times were faster than when there was a mismatch.

In sum, the studies previously described, show how on-line comprehension appears to be attached to be dependent on simulation and how our perceptual and motor systems are involved in the process.

3.2.4 Image schemas in neuroscience

The convergence of results from behavioral studies, functional neuroimaging, and neuropsychology all support the prominent role of sensory-motor processes and structures in higher-order cognitive processes such as conceptual representation and understanding. This implies that "conceptual content is reducible sensory-motor content" (Mahon & Caramazza, 2005: 480) and understanding is based on the reactivation of sensory-motor information via simulation (Barsalou et al., 2003; Lakoff & Johson, 1999). In other words,

understanding is imagining and "imagining is a form of simulation, a mental simulation of action or perception, using many of the same neurons as actually acting or perceiving" (Gallese & Lakoff, 2005:3). Gallese and Lakoff (2005) exemplify this point in their analysis of the concept of *grasping*. In that study, the authors conclude that our ability to imagine *grasping* makes use of the same neural substrate as performing and perceiving this action.

This idea is consistent with the discovery of the mirror neuron system in macaque monkeys and in humans, a system that is active during both the performance and observation of actions (Gallese, Fadiga, Fogassi & Rizzolatti, 1996; Rizzolatti, Fogassi & Gallese, 2001). In humans, there is growing evidence, mainly based on fMRI studies, that the mirror neuron system is located in the ventral premotor cortex and plays an important role in action recognition and understanding. Buccino et al. (2001) developed a study where subjects were scanned while they observed a set of videotaped actions involving the mouth, arm, hand, or feet (e.g., biting and chewing an apple; reaching for and grasping a cup; kicking a ball; or making gestures that mimic these actions without the object.). Results supported "the view that during action observation there is a recruitment of the same neural structures which would be normally involved in the actual execution of the observed action" (Buccino et al, 2001:404). Aziz-Zadeh et al. (2006) has extended these findings by showing how the premotor cortex of the left hemisphere was activated not only when subjects were confronted with visually-presented actions but also when they read sentences

describing foot, hand, or mouth actions. "These results suggest a key role of mirror neuron areas in the re-enactment of sensory-motor representations during conceptual processing of actions invoked by linguistic stimuli" (Aziz-Zadeh et al., 2006:4988).

In general terms, these results appear to indicate that, compared to monkeys, the mirror-neuron system in humans is less dependent on specific, visually-accessible action information. Consequently, mirror neurons may be of value to better understand the relationship between language, simulation, and comprehension. In this respect, fMRI neuroimaging studies have been used to explore whether the same brain areas known to be involved in sensorimotor activity would also be activated in literal and metaphoric language comprehension. Rohrer compared activation induced by tactile stimulation to activation triggered by a set of literal sentences describing hand actions and metaphorical expressions derived from the conceptual metaphor IDEAS ARE OBJECTS. This metaphor was chosen because the source domain (object manipulation), licenses many metaphorical expressions that imply hand reaching movements (e.g. "I grasp the idea"). Results showed that "reading both metaphoric and literal hand sentences activated many of the same sensorimotor areas as tactile stimulation of the hand did, as would be predicted by the image schemata hypothesis" (Rohrer, 2005: 185). These findings from neuroimaging experiments are the strongest evidence to date in support of

conceptual metaphor; it appears that action and language understanding both share neural substrates even when language is metaphorical.

In sum, it can be concluded that a growing body of neuroscience research suggests that comprehending verbal descriptions of actions, even in metaphorical terms, relies on an internal simulation of the described action, thus reinforcing the interrelation between body and language.

3.2.5 Image schemas in artificial intelligence

Embodiment theory and image schemas have also been brought into artificial intelligence in an attempt to connect embodiment, language and cognition. A ground-breaking experiment on image schemas has shown how robotic agents can construct image schematic categories from sensorimotor data and extend them to other objects (Spranger & Loetzsch, 2009). The experiment, which focused on the development and extension of three concepts (stand, lie and sit) was inspired by a linguistic phenomenon that has been widely studied in theoretical terms: the locational use that speakers of Germanic languages make of posture verbs. As Spranger and Loetzsch assert, sentences in English such as *the jacket is lying on the bed* are prototypical. In languages such as Dutch, however, "it is more or less obligatory to use a posture verb for describing the location or posture of the clothes." and "these locational uses are considered to be "extensions of the anthropocentric perceptual schemas" (Spranger &

Loetzsch, 2009: 2546), which transform visual and motor information into locational information.

To test how this projection takes place, a group of humanoid robots were first taught to perform a series of body actions involving some aspect of standing, lying and sitting (e.g. walking; making arm gestures while standing or lying; getting up after falling; and performing various sitting motions). The robots learned these body postures both by performing the actions themselves (thus accumulating 'sensorimotor' data from their internal sensors during the learning process), and by watching other robots perform these movements. Once the humanoid robots had acquired the intended body postures (stand, lie, and sit), they were engaged in two types of language games. They were first shown a robot in a specific posture that they had to name, and then they were confronted to objects with different shapes (i.e., objects that either have a strong verticality or horizontality component). As expected, they were able to extend the body posture verbs they had learned previously to describe the position of the object: when confronted with objects in vertical position, they tended to use the verb *stand*. By contrast, when the object was horizontally placed, the robots tended to use *lie*. These results show that embodied agents, in this case robots, can construct conceptual representations from their sensorimotor interaction with the environment and can metaphorically project them onto objects; this new evidence lends additional support to the existence of image schemas (Spranger & Loetzsch, 2009).

3.2.6 Image schemas in spontaneous gestures

In recent years the relation between speech and spontaneous gestures has attracted the attention of researchers in cognitive sciences who argue that "spontaneous gestures along with the speech they accompany are a window into the nature of speakers' mental representations and processes" (Nobe, 2000: 186). Because, from this point of view, gesture and speech are thought to be different expressions of the same conceptual content, gesture analysis can provide insights into the cognitive processes underlying language and eliminate the circularity inherent to the use of linguistic data as a primary source for the study of language processing. Several studies have demonstrated how gestures interfere with speech fluency and content (Rausher et al., 1996 and Rimé et al, 1984): the inhibition of gesturing reduces fluency and decreases the number of utterances that describe movement.

Having proven the influence of gesture on language, gesture studies have now focused on assessing how image schemas may motivate the spontaneous gestures that accompany language, especially those attached to abstract concepts and discourse structuring elements. The underlying assumption is that gestures are suitable for depicting spatial properties of conceptual structures and processes; in other words, "they can bring to light visual and sesorimotor aspects of mental models" (Cienki, 2008: 144). Experiments seem to confirm this claim. Cienki (2005), for example, found

consistent agreement between his experimental subjects on the use of six image schemas as descriptors of a set of videotaped conversations. In subsequent experiments (Mittelberg, 2007; Cienki, 2008), analysis of a series of recorded speeches showed that speakers systematically used gestures that tended to evoke image-schematic patterns (e.g., object, container, path, balance, support, rotation) attached to abstract concepts and discourse structural devices. For instance, the path schema was associated with the concept of *sentence* and was materialized in gestures that traced a horizontal line from left to right; in this way, speakers represented a complete sentence from its beginning to its end (Cienki, 2008). The use of these gestures is understood as the surface manifestation of the spatial basis that literal and metaphoric language have.

Gesture studies, therefore, appear to provide additional, independent evidence of how our conceptual system is grounded and organized. This evidence supports the idea that space plays a fundamental role in the structure of language.

3.3 What experimental evidence tells us about image schemas

The studies described above strongly suggest that image schemas are not just a theoretical construct, but are actually cognitively plausible. Unfortunately, no clear set of criteria has yet been identified to definitively characterize image schemas, and it is still unclear whether bodily experience

has a temporal or enduring role in concept formation and activation. However, some commonalities of image schemas can be distilled:[10]

1. Image schemas are highly schematic and flexible mental representations of embodied experience that emerge from our sensorimotor interaction with the environment.

2. As experiential gestalts, image schemas are more basic than their integrating parts and have their own internal topology which is necessary for drawing inferences.

3. They are one of the main principles by which humans organize their knowledge of the world and are recruited to structure not only concrete concepts but also abstract ones.

In sum, the cumulative evidence supports the idea that significant aspects of thought and language arise from, and are grounded in, embodiment and there is a general consensus (despite some minor discrepancies) about the important role that image schemas have in the interplay between perception and higher cognitive processes such as producing and understanding linguistic communication. In this respect, image schematic structures are thought to be "central in the organization of meaning and in the formation of inferences based on that meaning" (Yü, 1998: 24) even in domains of knowledge (i.e., abstract concepts) that do not have a clear perceptuomotor basis.

[10] For a review of the original notion of image schemas and definitional discrepancies see Grady (2005).

Cognitive linguistics has paid special attention to these types of concepts in an attempt to clarify their embodied nature. In this respect, the explanatory constructs of image schemas and conceptual metaphor have played a crucial role, since they support the argument that abstract notions are grounded in more concrete ones (Johnson, 1987, Lakoff & Johnson, 1980, 1999). In order to better understand how abstract notions get their meaning, the next section will provide a description of the basic tenets of conceptual metaphor theory and its connection with image schemas and embodiment.

4. THE COGNTIVE THEORY OF METAPHOR

The Cognitive Theory of Metaphor has been extremely influential and has stimulated a line of research based on embodied approaches to cognition. According to this theory, metaphor is not a matter of language but of conceptualization and reasoning that are constrained by our embodied nature: "The locus of metaphor is not in language at all, but in the way we conceptualize one mental domain in terms of another [...] metaphor is the main mechanism through which we comprehend abstract concepts and perform abstract reasoning" (Lakoff 1993: 203). This view of metaphor departs drastically from classical theories in which metaphor is considered a deviation from literal language and is used for special rhetorical effect. Thus, whereas noncognitive approaches to metaphor account for linguistic expressions such as kennings (metaphorical two-word compounds originally used in Norse and Anglo-Saxon poetry) as rhetorical devices used to embellish poetic lines, a close analysis of these compounds shows that they are more than literary tropes. So, for example, the use of the kenning *bān-hūs*, literally 'bone-house', to make reference to the 'human body' in the Beowulf poem, clearly refers to the conceptual metaphor THE BODY IS A CONTAINER FOR THE SELF where our body is conceived of as a container.

(1) *…let her heathen soul out of its bone-house.*

(Beowulf, 1000 A.D.)

This metaphorical expression reflects a common way of conceptualizing the human body, and explains why there is continuity between this body metaphor used in 1000 A.D. and the metaphorical expressions that speakers of modern English use today in everyday language:

2. He's a woman trapped in man's body.

3. Don't let her hard exterior fool you: she is beautiful person inside.

Consequently, what for centuries has been taken to be a figure of speech—a matter of language rather than of thought—is actually, according to cognitive linguistics, a common cognitive process used to understand and reason about abstract concepts. CMT defines metaphor as the cognitive mechanism whereby one experiential domain (the source domain) is partially mapped (i.e., projected) onto a different experiential domain (the target domain) so that the latter domain is partially understood in terms of the former (Barcelona, 2000).

Conceptual metaphors can be conceived of as cognitive templates that license an open-ended number of metaphorical expressions, "words, phrases or sentences that are the surface realization of a cross-domain mapping" (Lakoff 1993:203). It is therefore crucial to distinguish between conceptual metaphors and their linguistic manifestations.

4. *They are at a crossroads in their relationship.*

5. *This relationship isn't going anywhere.*

6. *They're in a dead-end relationship.*

The expressions above represent love in terms of a journey. This manner of conceptualizing love is realized in many different linguistic expressions that cannot be considered different metaphors but rather different linguistic manifestations of the same conceptual metaphor: LOVE IS JOURNEY.

Conceptual metaphors are conventionally represented through the formula A IS B (i.e., LOVE IS JOURNEY) in small capital letters where A is the target domain and B is the source domain. "It is a common mistake to confuse the name of the mapping for the mapping itself" (Lakoff 1993: 207). The name of the mapping is just a mnemonic device for a set of ontological correspondences; metaphors are merely "a set of conceptual correspondences" between domains (Lakoff ibid.). The internal structure of conceptual metaphor is, therefore, based on a series of source to target domain mappings called ontological correspondences according to which entities in the source domain correspond systematically to entities in the target domain (Lakoff, 1993).

Conceptual metaphor: LOVE IS JOURNEY

Target: love / Source: journey

Ontological correspondences

Source domain		Target domain
The travelers	>	The lovers
The vehicle	>	The relationship
Obstacles	>	Their difficulties
The goal	>	Common purposes

Table 1: Ontological correspondences of the metaphor LOVE IS A JOURNEY

Such sets of ontological correspondences allow us to import inferences, that is, it is via such mappings that we apply the knowledge of the source domain to the target domain and use it to reason about the target domain (Lakoff, 1993). Such inferences are called epistemic correspondences.

Conceptual metaphor: LOVE IS A JOURNEY

Target: love / Source: journey

Epistemic correspondences

Source domain		Target domain
On a trip, travelers have a common destination.	>	In a relationship, lovers have common goals.
Travelers use a vehicle to get to their destination.	>	Lovers forge a relationship that leads them to get their common goals.
On a trip, travelers can find difficulties or obstacles.	>	In a relationship lovers can face problems.

Table 2: Epistemic correspondences of the metaphor LOVE IS A JOURNEY

Therefore, each conceptual metaphor has a source domain, a target domain and a series of source to target mappings, these mappings allow us to reason about the target-domain concepts in term of those of the source-domain. It is important to understand that these mappings are partial: only part of the structure of the source domain is mapped onto the target domain. In fact, only those attributes that are relevant to the interpretation are mapped (Lakoff & Johnson, 1980).

Target domains tend to be more abstract and difficult to understand than source domains. According to Lakoff (1993: 205), "as soon as we get away

from concrete physical experience and start talking about abstractions or emotions, metaphorical understanding is the norm. We typically conceptualize the nonphysical in terms of the physical." Metaphor allows us to understand relatively abstract or intangible notions in terms of a more concrete or at least more highly structured ones. This pattern of directionality from concrete to abstract is completely normal in metaphor. This explains why we often conceptualize time in terms of space or difficulties in terms of obstacles (Cuenca & Hilferty, 1999).

Metaphors are definitely not mere words; they are not a matter of language but of thought and reason that permit the understanding of one kind of experience in terms of another, creating coherence by imposing gestalts that are structured by experience (Johnson, 1987). Metaphors are part of our everyday life and they determine not only our understanding of abstract concepts but also the way in which we experience them. This is the assumption underlying this thesis, and we shall explore it in greater detail in the following section.

4.1 The metaphorical conceptualization of discourse

Discourse is conceived herein as the material expression of a rational process, which in turn is metaphorically conceptualized as a form of motion through space that leads from premises to conclusions by means of logical arguments: the underlying (or initial) premises and presuppositions represent a

starting point and the arguments that we forge correspond to paths to a solution; explanation difficulties are obstacles to be overcome; and, finally, the persuading evidence is the force that leads to a conclusion. All this is compressed into words and conveyed through discourse. As a consequence, discourse has the topological structure of the rational process that underlies its organization which shapes the logical and rhetorical structure of discourse.

Taking this premise into account, the claim of this thesis is that, as Covarrubias asserted in 1611, discourse can be understood as "la corrida que se hace de una parte a otra" (literally: 'The running that is done from place to another,' Santos Dominguez& Espinosa Elorza, 1996:161) or in metaphorical terms, DISCOURSE IS A FORM OF MOTION ALONG A PATH. The pairing between the source domain (i.e., motion along a path) and the target domain (i.e., discourse) is not random; rather, it is determined by the experiential correlation between the source domain and the target domain (Lakoff 1987), which is simply the common purpose of getting to a particular location correlates with the purpose of reaching a conclusion. In this respect, the ideas developed in a text are conceived as successive locations or points along a linear path that connect the source with the goal, and, in our progress to a conclusion, we move forward by passing from one idea to another, until we reach a logical conclusion/ destination. This textual configuration acts as a sort idealized pattern for writers and readers, although it is flexible enough to allow for other possible elaborations. This idealized pattern acts as a structural baseline from which

other configurations are developed in accordance with the function of the text (i.e., informative or argumentative, etc.). In the case we will be dealing with (i.e., abstracts that accompany research articles), such texts perform a double function: they are both informative and argumentative texts. That is, the abstract provides the reader with information about the process that led the researcher to achieve certain results while also trying to persuade the reader of the relevance and validity of their findings. This last characteristic (persuasion) leads us to conceive this type of discourse as a process often influenced by force dynamics, which, as Talmy asserts, is crucial for argumentation.

> Force dynamics functions extensively in the domain of discourse and preeminently in the process of argumentation. This is the rhetoric of persuasion and includes efforts to exhort, to convince, and to logically demonstrate (Talmy, 2000a: 452).

The arguments or evidence that a discourse uses to support a thesis can oppose or reinforce other ideas and overcome or be overcome by other arguments. In Talmy's words "Each successive resultant of these encounters can move the current argument state closer to or further from one of the opposing conclusions"(Talmy 2000: 452). Thus, incorporating Talmy's idea into the present thesis, I shall argue that the conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS, together with the image schemas that structure this metaphor (i.e., source-path-goal, force dynamics and link image schemas), play a prominent role in shaping the formal

and logical structure of discourse whenever it combines descriptive and argumentative information.

4.2 An insight into source-path-goal, force-dynamics and link image schemas

As stated previously, metaphor is not based on random associations, nor is it arbitrary or unstructured; metaphor is, instead, motivated. According to Lakoff (1987) and Johnson (1987), many of the conventional metaphors we have are based on our interaction with the environment and our kinetic experiences and sensorial perceptions. Indeed, these experiences explain why our conceptual system contains one set of metaphorical mappings rather than another. For example, the co-occurrence in real life of an "increase in quantity" and "an increase in verticality" gives rise to the metaphor MORE IS UP. Our everyday experience, therefore, constrains metaphor in two ways: "it constrains the choice of source and target domains" and it determines "which elements of the source domain get mapped onto which elements of the target domain" (Lakoff 1987: 277–278). Consequently, in this view, image schemas play a crucial role in metaphor, since they are skeletal mental representations of recurrent patterns of embodied experience. (e.g., schematizations of movement through space, object manipulation, and perceptual processes). [11]

[11] For a preliminary sketch of its terminological history, and a revision of a range of studies illustrating the application of image schemas, see Oakley, T. (2007b) "Image Schemas" in *Handbook of Cognitive Linguistics*.

In the case of the conceptual metaphor under examination: DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS source-path-goal, force dynamics and link image schemas seem to be the skeletal mental representations that structure the abstract domain of discourse via metaphor, constrain the mappings between the source and target domains, and allow us to draw inferences about discourses using the knowledge acquired from our experience with spatial paths, physical forces, and links.

Source-path-goal and force-dynamics image schemas can either act independently or overlap since they are coherent both individually and when they interact. According to Peña Cervel (1999: 188-190), force-dynamics image schema requires the source-path-goal schema for its development and understanding: force possesses a source, directionality, and a destination or goal, all of which are basic components of the source-path-goal schema. Therefore, it can be said that the source-path-goal schema functions as a "guideline for the orderly activation of the force image schema." Both image schemas operate as the basic primitives that allow an embodied account of the concept of discourse and constrain the mappings between the source and target domains by using the information provided by our bodily and perceptual experience.

Our knowledge of the world also gives rise to certain mappings, which are guided by the link image schema. Experience tells us that paths are not always straight and that sometimes they merge onto others before they arrive at

their destination. This basic experience is also extended to discourse domain by means of the link image schema.

In sum, source-path-goal, force dynamics, and link image schemas seem to be the skeletal mental representations that structure the abstract domain of discourse via metaphor. For this reason, in the next section we will analyze the bodily experience that instantiates these image schemas, their structural components, and the basic logic that holds them together as a result of their configuration as gestalts.

a. The Source-path-goal Schema

a. *Bodily experience*

"Our lives are filled with paths that connect up our spatial world. There is the path from your bed to the bathroom or from San Francisco to Los Angeles […] , in all these cases there is a single recurring image schema pattern with a definite internal structure."(Johnson, 1987: 113)

b. *Structural elements*

According to Johnson and Lakoff, the structural elements of the path image schema are as follows: a source (starting point), a destination (end point), a path (sequence of contiguous locations connecting the source and the destination), and a direction (toward the destination).

c. *Basic logic*

Basic logic tells us that if you go from a source to a destination along a path, then you must pass through each point on the path and that the further along the path you are, the more time has gone by since starting (Lakoff 1987).

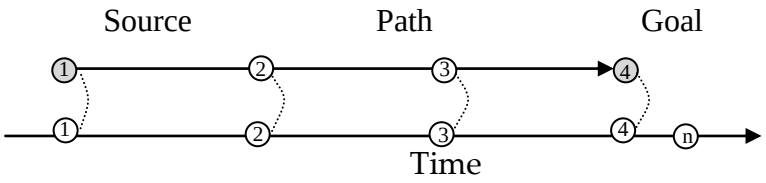

Figure 10: Source-path-goal image schema

b. The force dynamics image schema

a. *Bodily experience*

This schema emerges from our forceful interaction in our world. "We must interact with our environment and such causal interactions require the exertion of force, either as we act upon other objects, or as we are acted upon by them" (Johnson, 1987: 42).

b. *Structural elements*

Johnson distinguishes seven structures of force: compulsion, blockage, counterforce, removal of restraint, enablement, diversion, attraction, and repulsion. Although each of these has its own characteristics, we can state in general that the structural elements include a source and target of the force, a direction and intensity of the force, a path of motion, and a sequence of causation.

c. *Basic logic*

In general terms, an entity or force can be compelled to motion or can be blocked. In this last case, after colliding face to face with another force, it will be impelled to stop or deviate from its initial path towards a new destination. On other occasions, the entity can move freely because there are no obstacles in its trajectory (or they have been removed) and, as a result, the entity can reach its intended destination without difficulties.

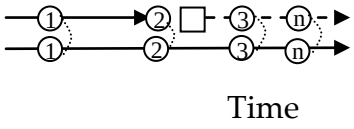

Figure 11: Compulsion

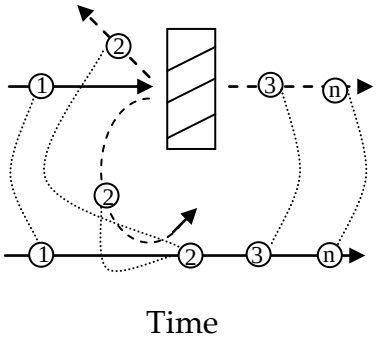

Figure 12: Blockage

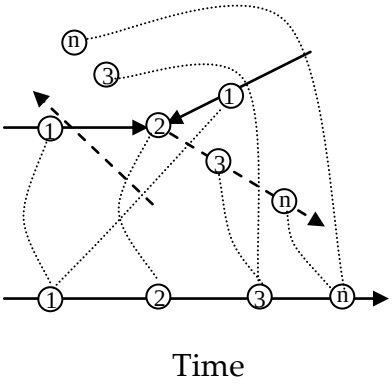

Figure 13: Diversion

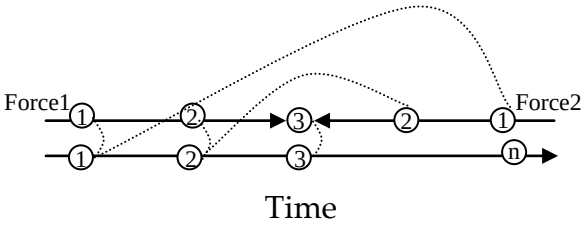

Figure 14: Counterforce

c. The link image schema

a. *Bodily experience*

"Our first linking is the umbilical cord" (Lakoff 1987:274), but throughout our lives many other physical links are forged; when we hold someone's hand, or

when we nail two pieces of wood together, we are forming physical links (Johnson, 1987).

b. *Structural elements*

According to Lakoff and Johnson, the structural elements of the link image schema are: two or more entities, connected physically or metaphorically, and the bond between them.

c. *Basic logic*

The topological structure of this schema tells us that if A is linked to B, then A is constrained by and dependent upon B, and that if A is linked to B, then B is linked to A (Lakoff 1987).

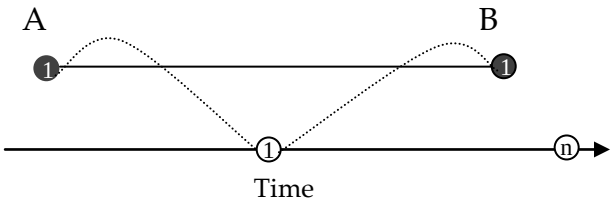

Figure 15: Link image schema

4.3. Discourse is a form of motion along a path influenced by force dynamics: ontological and epistemic correspondences

Having described the image schemas that structure the source domain and guide the mappings between domains, in the next section we will analyze the ontological and epistemic correspondences in the conceptual metaphor A DISCOURSE IS A FORM OF MOTION A LONG A PATH INFLUENCED BY FORCE DYNAMICS.

Ontological correspondences

Source domain Trajectories/ Force dynamics		Target domain Discourse
Source/ source of effect	>	Previous research or premises
Locations	>	Ideas, arguments
Trajectory	>	Ideas, arguments set up in spatial configuration
Path along which motion occurs	>	Means for achieving an explanation or testing hypotheses
Obstacles/ counter forces	>	Opposing theories or evidence, questions without answer
Changes in direction	>	Dismissal of arguments and presentation of new ones
Setting an intended target	>	Presenting a problem and commitment to solve it
Forces that lead to the goal	>	Evidence and findings
Goal	>	Conclusions

Table 3: Ontological correspondences of DISCOURSE IS A FORM OF MOTION

Epistemic correspondences
Source domain: when an entity moves along a path, there is always a starting point.
Target domain: in a discourse, as expression of a rational process, premises or previous research serve as starting point.
Source domain: a destination is arrived at by traversing contiguous points along a path.
Target domain: a conclusion is arrived at by following a series of interconnected ideas, arguments, and evidence.
Source domain: paths often contain obstacles that should be overcome to reach the destination. Furthermore, a trajectory can be tortuous or it can lead us straight to the destination.
Target domain: arguments can meet opposing evidence that must be overcome in order to reach a conclusion. Furthermore, arguments can be difficult or easy to follow.
Source Domain: If the mover finds an obstacle on its way to the destination, it can stop or redirect its route.
Target domain: If evidence contradicts the research hypothesis, the discourse can be blocked or it can redirect its line of research.
Source domain: When two entities or forces collide face to face on their way toward an intended goal, they can block each other with the result that neither of them can reach its destination or they can take separate ways to reach different destinations.
Target domain: When two theories or arguments collide face to face in their way toward an intended conclusion, they can block each other with the result that neither of them can be proved or they can take separate ways to reach different conclusions.

Table 4: Epistemic correspondences of DISCOURSE IS A FORM OF MOTION

As can be observed, ontological and epistemic correspondences enable us to project our knowledge of the physical world to a more abstract event involving complex non-physical motion and force (i.e., discourse). As a result the formal structure and internal logic of discourse relies on the metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INLFUENCED BY FORCE DYNAMICS and its underlying image schemas, which act as a structural scaffold.

It is the aim of this thesis to shed light on the metaphorical basis of discourse structure and, in turn, of coherence relations, which are the pillars on which it relies. Thus, we need to explore the embodied roots of discourse organization and coherence, as well as, the role that experience plays in their conceptualization. To achieve this goal, we take as a starting point the hypothesis and methodology described in the next section.

PART II

5. CASE STUDIES

The following chapters 6–9 contain qualitative and empirical analyses based on the argument outlined above, namely that global and local coherence are grounded in experiential factors. With regard to global coherence, I argue that the way we conceptualize the notion of discourse both shapes and constrains its structure. Likewise, I claim that local coherence is guided by the same principles as global coherence. Thus, connectives (i.e., explicit markers of coherence relations) are more than procedural instructions on propositions; rather, they act as prompts for embodied concepts that help to guide readers when constructing a mental representation of a text.

A detailed description of the main hypotheses and methodology used to conduct this research is provided in the following section.

5.1 Hypotheses and methodology

Discourse scholars have always suggested the need to study the role of cognition in discourse organization, and how text representations are related to conceptual structure (Barcelona, 2000). In this respect, it is crucial to understand how we construct the conceptual scaffolding that underlies text production as well as what guides us in accessing it when we construct a mental representation of the text.

The alliance between cognitive linguistics and discourse analysis to better understand the construction of this conceptual edifice seems to be a natural development, particularly given that cognitive linguistics focuses on the study of language as a window to cognition and language users communicate through discourse rather than through isolated words or sentences (Sanders & Spooren, 2007). Furthermore, any suitable explanation of how discourse becomes meaningful to both the writer and the reader must take as a starting point the evidence produced by the cognitive sciences over time; at the same time, this explanation must include the understanding of language as an integrated part of human cognition that interacts with other cognitive faculties and which is governed by the same principles. For this reason, the present research provides an alternative approach to discourse analysis based on the Cognitive Theory of Metaphor (Lakoff & Johnson, 1980). Unlike other studies on text structure, this paper argues that our metaphorical conceptualization of discourse as a form of motion through space and time is one of the basic structuring devices that shape the internal architecture of a text.

The Cognitive Theory of Metaphor is not explicitly included among the branches of cognitive linguistics that study discourse. However, its central role in the structuring of discourse and conversation has led some authors, such as Dianne Ponterotto (2000) and Elena Semino (2008), to suggest that conceptual metaphor should be regarded as a fundamental part of the cognitive theories of discourse. In fact, Semino (2008:31) argues that metaphors in discourse can be

used “to persuade, reason, evaluate, explain, theorize, or offer new conceptualizations of reality” and “to construct texts as coherent units of language. Thus, according to Semino (2008:32), a metaphor can provide the "backbone" of a text as a whole; the use of this backbone metaphor then requires the use of related metaphorical expressions at different points in the text to further “contribute to the internal structuring and coherence of the text.” At the content level, therefore, current evidence points to metaphor as a conceptual device that guarantees information management and integration (Barcelona, 2000). This is obviously relevant for the present paper, since it strengthens the hypothesis that conceptual metaphor helps to conform a gestalt perception of the whole text, that is, to integrate information coherently.

To my knowledge, the role of conceptual metaphor as a coherence device at the structural level has not yet been considered. The purpose of this thesis is to explore this dimension of conceptual metaphor. In other words, the main aim of this research is to determine to what extent the organizational structure of texts is a direct consequence of our metaphorical conceptualization of discourse and how this metaphorical notion can contribute to enhancing textual coherence and, in turn, reading comprehension. I believe that a better understanding of this issue has both cognitive and functional significance, as it can help to improve text design to better meet readers’ needs. Readers, especially those of technical documents, read texts to satisfy an immediate need. Consequently, they want to be able to understand the content easily,

without undue effort. In other words, they expect to find a text that is sufficiently clear so that neither time nor effort is wasted on trying to comprehend the text.

By applying the Cognitive Theory of Metaphor to discourse analysis we face the following objectives:

1. At the macrostructural level, we shall explore the extent to which the way we conceptualize discourse via metaphor determines the organizational structure and global coherence of the discourse. If "the essence of metaphor is understanding and experiencing one kind of thing in terms of another," and if "we act according to the way we conceive of things," (Lakoff & Johnson, 1980:5), then it is logical to assume that the source domain affects how the target domain is represented. In this particular case, it might guide us in the way we structure texts. To confirm this, the present thesis formulates, and will try to verify, the following hypotheses:

a. The conceptual metaphor DISCOURSE IS A FORM OF MOTION INFLUENCED BY FORCE DYNAMICS and its underlying image schemas govern the structural patterns and internal logic of discourse, which emerge through lexical cues to help to establish global coherence.

b. Depending on the discipline and its degree of empiricism, discourse can adopt different realizations of the same conceptual metaphor. In empirical sciences, the structure will be more stable and rigid whereas in disciplines that

combine experimental and theoretical research, or those that are mainly based on qualitative and introspective analysis, the organizational structure of the text will be more flexible, as a result of the variety of realizations that the conceptual metaphor can adopt.

To test these two hypotheses, the present study centers on the qualitative analysis of 15 abstracts collected from recent publications in three periodicals: *Journal of Cell Biology, Trends in Cognitive Science,* and *Journal of Modern Literature*. The abstracts have been selected from these three disciplines (biology, cognitive-science, and literature) in an attempt to include texts from the spectrum of empiricism (ranging from highly empirical to mostly theoretical) found in research articles. Thus, we have include a highly empirical subject (biology), a subject that combine theoretical and empirical research (cognitive sciences) and a highly theoretical subject characterized by its deliberate openness to interpretation (literature).

The academic genre of journal abstracts was selected because there is a clear interdependence between abstracts and the primary discourse from which they derive. In fact, as Mendiluce Cabrera (2004) asserts, these two types of discourse share the same logical structure. This will allow us to examine abstracts as a type of secondary texts governed by the same topology as its source. Moreover, abstracts, as summarized versions of the research that they accompany, give access to a skeletal and more approachable representation of

the whole process of reasoning that underlies the text. This facilitates their analysis and the identification of the constituent parts.

2. At the microstructural level, this thesis attempts to provide empirical evidence to support the embodied roots of coherence relations, specifically of causal and concessive relations, which are herein hypothesized to be abstract notions with a corporeal basis.

To evaluate this premise, four experiments that test two of the metaphorical conceptualizations of cause (CAUSES ARE FORCES and CAUSES ARE SOURCES) were conducted. These experiments were designed to assess the extent to which the image schemas (i.e., source-path-goal and force dynamics image schemas) underlying these two conceptualizations of cause might predict when language users classify a situation as causal or non-causal— as consecutive or concessive— and how this situation is codified in linguistic terms.

6. A QUALITATIVE ANALYSIS OF THE MACROSTRUCTURE OF RESEARCH ABSTRACT

Some caveats related to the present analysis must be made before we proceed:

First, the conceptual metaphor used as the basis for this analysis cannot give a complete account of all the aspects that define discourse because at least two other conceptual metaphors can be used to conceptualize the notion of discourse and its constituent parts. In this respect, discourse can also be conceived of as a container or as a building. However, we concentrate on the conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS because it profiles the form, direction, progress, and goal of the discourse--all of which are aspects that are consistent with our understanding of discourse as the expression of a rational process.

Second, the alternative conceptualizations of discourse mentioned above (i.e., DISCOURSE IS A CONTAINER and ARGUMENTS ARE BUILDINGS) are not incompatible with the metaphor explored here. In fact, they are complementary, since these two different metaphors account for different aspects of discourse. However, such a conceptualization mainly focuses on the content of discourse, whereas the conception of discourse presented here—that is, as a form of motion—concentrates on its structure.

Third, this thesis focuses on research abstracts, which are conceived to be condensed and compressed versions of longer texts. Despite their reduced

length, these abstracts still contain and provide information on the content and organisation of the longer texts. In Sinclair's words, abstracts are discourse on discourse (Sinclair, 1988): as a consequence, abstracts are governed by the same kind of structural patterns as the main discourse.

Finally, this study represents an exploratory attempt to apply the findings of cognitive linguistics to discourse analysis. Consequently, although any conclusions reached here must be considered preliminary, it is important to keep in mind that this is the first time that such an approach has been used in discourse analysis.

6.1 SCIENTIFIC ABSTRACTS. Research articles on biology.

Biology is a branch of natural science that studies living organisms and how they react to their environment. As a science, biology shares the same aims as other sciences: to pursue truth and look for a rational explanation of our physical world and its phenomena (Mendiluce Cabrera, 2004.). This is an important consideration because, as we shall see, the empirical nature of biology both influences, and is reflected by, the structure and internal logic of texts.

Scientific research and the dissemination of its findings are crucial for the development of science. Each new confirmed (or disconfirmed) hypothesis contributes to the body of scientific knowledge and can be used as a source for new research. This fact provides some clues about the inflexibility that governs

the structure and style of a genre that calls for precision, concision and clarity in its aim for objectivity. On the other hand, as Atkinson states, research articles face the problem of "how to convince those not directly privy to the events under study that one's findings are accurate and meaningful" (as cited in Mendiluce Cabrera, 2004:79). This statement implies that, even in the case of scientific research, discourses are not purely descriptive, as they also have the rhetorical function of justifying the validity of the research.

English has been widely adopted as the language of international scientific communication, and the style and the structure of scientific discourse are governed by certain conventions, the most important of which is the four-part I-M-R-A-C (introduction, methods, results, and conclusion) structure of research articles. Abstracts, *qua* summarized versions of a research article, usually follow the same four-part I-M-R-A-C structure (Cross. & Oppenheim, 2006). Salaguer-Meyer (1990) postulates that a well-structured science abstract should contain these four components, which are considered fundamental and obligatory in scientific inquiry and patterns of thought in logical order. Each of these structural units is further subdivided into a series of moves and steps that are present in both the full text and in the abstract, although in a summarized version[12]

[12] For a complete account of Swales' model of analysis for the introductory section of research articles, see Appendix A.

The present paper argues that the I-M-R-A-C structure is preferred because it fits our conceptualization of the reasoning process that precedes and underlies discourse production. The I-M-R-A-C pattern follows a path that leads the reader to a conclusion. The introduction acts as the source, or starting point, of the trajectory, the method is the path over which motion occurs, and the result is the evidence (force) that takes the reader to a destination (the conclusion). As a result, discourse can be understood as MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS.

Having said this, some remarks must be made before we proceed with the analysis:

a. All the examples analyzed in this section share the same basic structure with only minor variations. Therefore, for the sake of brevity, we shall analyze them together.

b. Italics are used when quoting from the abstracts.

Our first analysis focuses on abstracts from the *Journal of Cell Biology*, in which source-path-goal and force image schemas overlap to shape the organizational structure of the texts. These abstracts begin by describing some aspect of current knowledge about the field under research. This acts as a location, a source from which the discourse should proceed to a final location-goal. In some cases, however, progress has been hindered or blocked by a theoretical obstacle, a gap in our understanding of a given biological process. In terms of the logic of force dynamics, a blockage exists.

According to Johnson (1987), the internal logic of blockage image schema tells us that two alternatives are possible in this situation:

1. To stop and cease the exertion of force.
2. To redirect the force by going over the obstacle, around, or through it.

In the case of the abstracts analyzed, we find that discourse redirects its force toward a new intended goal, expressed in the article as the purpose of the study. In order to reach the new destination, the means/methods are crucial, since they are the paths along which motion occurs. The next stage is to report the main results obtained. Findings act as a sum of forces with a vector quality, a direction that lead to a conclusion-goal, which normally coincides with the intended goal described at the beginning of the abstract.

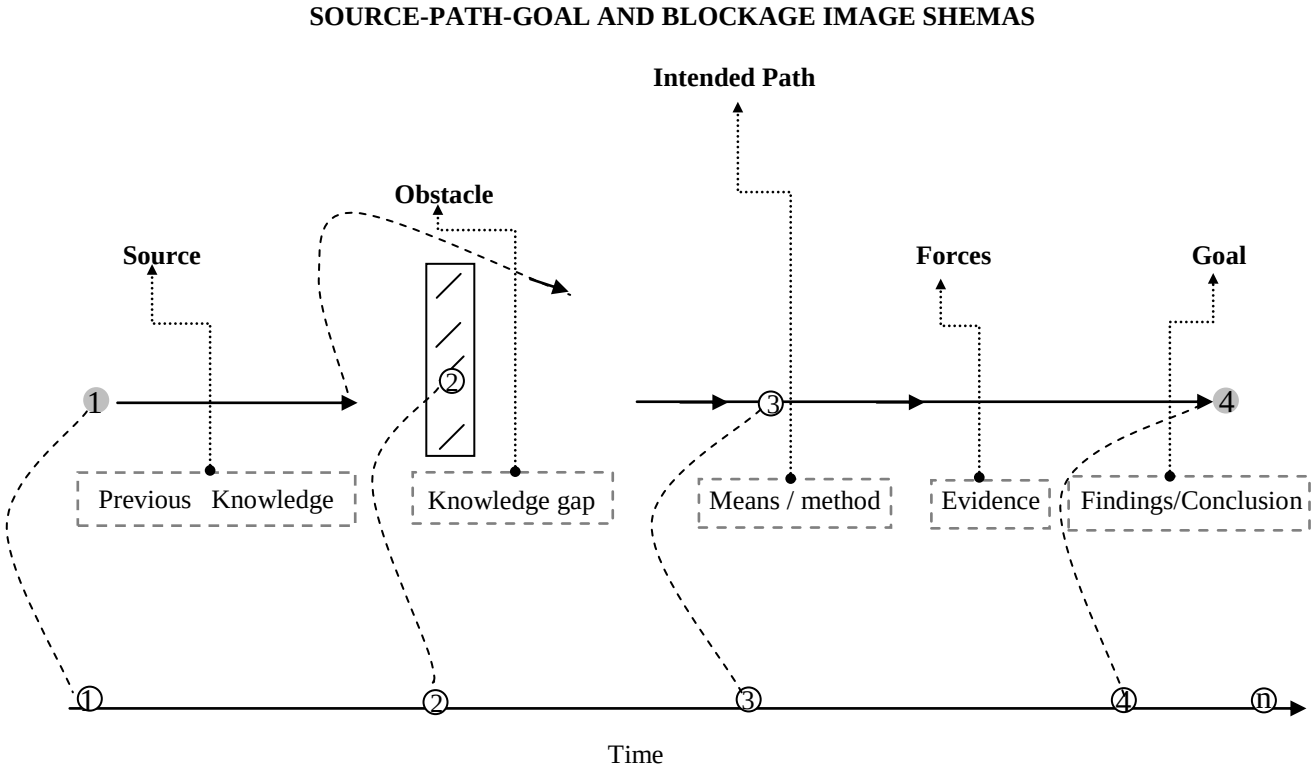

Figure 16: The metaphorical macrostructure of scientific abstracts

Our analysis of the abstracts in this corpus can be described as follows: discourse is a form of motion along a path influenced by force dynamics. As a result, the internal logic of the abstracts under consideration is governed by the topological structure of trajectories and forces. Hence, the following structural elements must be present: a source, a path, a force that blocks the progress from the source, and a goal.

a. Source / introduction unit

The sample of six abstracts analyzed provides evidence that confirms our hypothesis: previous research is used as a starting point—a source from which the discourse is intended to proceed. The abstract may make explicit reference to previous research by citing key authors (example 1). However, this is not the only option, since the author may chose to start by making general references to previous findings (examples 2–4) or by stating standard assumptions (example 5) about the field of study.

1) *The members of the Toc159 family of GTPases act as the primary receptors for the import of nucleus-encoded preproteins into plastids.[…] and is used for chloroplast biogenesis (Bauer et al. 2000) and has been shown to covalently cross-link to bound preproteins at the chloroplast surface (Ma et al., 1994).* [13]

[13] Smith, M.D., Rounds, C.M., Wang, F., Chen, K., Afitlhile, M. & Schnell D.J. (2004). atToc159 is a Selective Transit Peptide Receptor for the Import of Nucleus-encoded Chloroplast Proteins. *J. Cell Biol.* 165, pp. 323–334.

2) *Transport intermediates (TIs) have a central role in intracellular traffic, and much effort has been directed towards defining their molecular organization.* [14]

3) *In higher eukaryotic cells, the nucleolus is a nuclear compartment assembled at the beginning of interphase, maintained during interphase, and disorganized during mitosis.* [15]

4) *Many analyses have examined subnucleolar structures in eukaryotic cells.*[16]

5) *It is generally assumed that the functional consequences of stimulation with Ca^{2+} mobilizing agonists are derived exclusively from the second messenger action of intracellular Ca^{2+}, acting on targets inside the cells.*[17]

These examples show that the authors know their field and the previous work that has been done in the area, and this fact provides the discourse with a series of premises that serve as a starting location from which to move on.

b. Obstacle/ gap in the knowledge on the field under study

In an ideal situation, a discourse should move from premises to conclusion along a straight path. However, most of the examples examined prove that the route is often cut off by an obstacle, which normally takes the form of a gap in the knowledge of the field under study that prevents its full understanding. The

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[14] Polishchuk, R. S., Polishchuk, E. V., Marra, P., Alberti, S., Buccione, R., Luini, A. & Mironov, A. (2000). Correlative Light-electron Microscopy Reveals the Tubular-saccular Ultrastructure of Carriers Operating Between Golgi Apparatus and Plasma Membrane. *J. Cell Biol.* 148, pp. 45-58.

[15] Sirri, V., Hernandez-Verdun, D. & Roussel, P. (2002). Cyclin-dependent Kinases Govern Formation and Maintenance of the Nucleolus. *J. Cell Biol.*156, pp. 969–981.

[16] Gadal, O., Strauss, D., Petfalski, E., Gleizes, PE., Gas, N., Tollervey, D. & Hurt, E. (2002). Rlp7p is Associated with 60S Preribosomes, Restricted to the Granular Component of the Nucleolus, and Required for prerRNA Processing. *J. Cell Biol.* 157, pp. 941–951.

[17] Caroppo, R., Gerbino, A., Fistetto, G., Colella, M., Debellis, L., Hofer, A. M. & Curci, S. (2004). Extracellular Calcium Acts as a 'Third Messenger' to Regulate Enzyme and Alkaline Secretion. *J. Cell Biol.* 166, pp. 111-119.

obstacle that blocks progress makes the need for new research explicit; moreover, this obstacle also makes it clear that new paths must be explored to find a satisfactory answer to the problem. The obstacle can also be described as a piece of evidence that highlights the shortcomings of previous studies on a certain topic and the importance of offering a new perspective on the issue being covered by redirecting the current line of research.

The data in our analysis show that blockage image schemas are revealed by various lexical cues. Contrastive markers, such as the conjunction *but* or the adverbs *however* or *even if,* are often used. Talmy (2000: 452) defined this expression as "logic gaters", crucial elements to the process of force dynamics in discourse. They are "a particular class of expressions and constructions that limn out the rhetorical framework, to direct the illocutory flow, and to specify the logical tissue."

Cues such as *but* and *however* introduce a problem that contrasts with the *situation* presented in earlier sentences, as the following examples show:

6) *Many analyses have examined subnucleolar structures in eukaryotic cells,* ***but*** *the relationship between morphological structures, pre-rRNA processing, and ribosomal particle assembly has* ***remained unclear***.[18]

Previous analyses of subnucleolar structure failed to answer a key question: what is the relationship between morphological structures, pre-rRNA

[18] Gadal, O., Strauss, D., Petfalski, E., Gleizes, PE., Gas, N., Tollervey, D. & Hurt, E. (2002). Rlp7p is Associated with 60S Preribosomes, Restricted to the Granular Component of the Nucleolus, and Required for prerRNA Processing. *J. Cell Biol* 157, pp. 941–951.

processing, and ribosomal particle assembly? This situation represents a gap in our knowledge, and the aim of the research article is to fill that gap.

7) *It is generally assumed that the functional consequences of stimulation with Ca^{2+}-mobilizing agonists are derived exclusively from the second messenger action of intracellular Ca^{2+}, acting on targets inside the cells.* ***However****, during Ca^{2+} signaling events, Ca^{2+} moves in and out of the cell, causing changes not only in intracellular Ca^{2+}, but also in local extracellular Ca^{2+}. The Fact that numerous cell types possess an extracellular Ca^{2+} sensor raises the question […]* [19]

In this case, a piece of evidence, *Ca^{2+} moves in and out of the cell, causing changes not only in intracellular Ca^{2+}, but also in local extracellular Ca^{2} during Ca^{2+} signaling events* $^{+}$, is used as an argument, counter-claim against the general assumption: during *Ca^{2+}* signaling events, *Ca^{2+}* moves exclusively inside the cell acting on targets inside it. This reveals the weak points of previous work and, when added to another result (numerous cell types possess an extra cellular *Ca^{2+}* sensor), leads to a new path of research.

Even if blocks the validity of a logical expectation by emphasizing that although something may be true, another situation remains the same.

8) ***Even if*** *its structural organization [the organization of the nucleolus] appears to be indissociable from its function in ribosome biogenesis, the mechanisms that govern the formation and maintenance of the nucleolus* ***are not elucidated.***[20]

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[19] Caroppo, R., Gerbino, A., Fistetto, G., Colella, M., Debellis, L., Hofer, A. M. & Curci, S. (2004). Extracellular Calcium Acts as a 'Third Messenger' to Regulate Enzyme and Alkaline Secretion. *J. Cell Biol.* 166, pp. 111–119.

[20] Sirri, V., Hernandez-Verdun, D. & Roussel, P. (2002). Cyclin-dependent Kinases Govern Formation and Maintenance of the Nucleolus. *J. Cell Biol.* 156, pp. 969–981.

This statement claims that, although the different phases that the nucleolus goes through are known, the mechanisms that govern the formation and maintenance of the nucleolus remain unclear. The only thing that is clear is that its structural organization appears to be indissociable from its function in ribosome biogenesis. In this context, the shortcomings (obstacles) of previous studies can also be identified by pointing out the unsuccessful attempt to find an answer to the problem, or by claiming that an important aspect of the field remains unsatisfactorily understood:

9) *[…]much* ***effort has been directed*** *towards defining their molecular organization.* ***Unfortunately, major uncertainties remain*** *regarding their true structure in living cells.*[21]

10) *The molecule is synthesized in the endoplasmic reticulum, transported to the cell surface, and* ***undergoes a poorly understood recycling itinerary.***[22]

At this stage, discourse is blocked at some point, as a result, the entailment that derives from the internal logic of blockage image schema is that it must stop or redirect its force by creating a new path that will lead us to a different destination from the initial one. The structure of abstracts favors this second option.

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[21] Polishchuk, R.S., Polishchuk, E.V., Marra, P., Alberti, S., Buccione, R., Luini, A. & Mironov, A. (2000). Correlative Light-electron Microscopy Reveals the Tubular-saccular Ultrastructure of Carriers Operating Between Golgi Apparatus and Plasma Membrane. *J. Cell Biol.* 148, pp. 45–58.

[22] Machleidt, T., Li, W., Liu P., Anderson, R.G.W. (2000). Multiple Domains in Caveolin-1 Control its Intracellular Traffic**.** *J. Cell Biol***.** 148, pp. 17–28.

Only one of the examples in our corpus presents a different alternative to blockage. The abstract structure presents a case of enablement and compulsion. Since there is no obstacle to block the discourse progress, it moves on by using the evidence stated in the source as force. The use of the verb *to lead* supports this idea.

11) *These reports* ***led to*** *the hypothesis that Toc159 functions as a selective import receptor for preproteins that are required for chloroplast development*.[23]

c. Stating an intended goal/outlining the means

Under the logic of the blockage image schema, colliding with a barrier causes an object (i.e., the discourse) to deviate from the initial path and directs its force toward a new destination, metaphorically conceptualized as an intended goal. The correlation is obvious: when our intention is to reach a particular destination, to satisfy this particular purpose we move from the point where we are through an intermediate sequence of spatial locations to an end point. In the abstracts, the new intended goal is announced by outlining the purpose of the study.

In some cases, the strategy implemented by the abstract merges the purpose with the method. This is a perfectly logical strategy in metaphorical

[23]Smith, M.D., Rounds, C.M., Wang, F., Chen, K., Afitlhile, M. & Schnell D.J. (2004). atToc159 is a Selective Transit Peptide Receptor for the Import of Nucleus-encoded Chloroplast Proteins. *J. Cell Biol.* 165, pp. 323–334.

terms, since the method is the path that leads to a destination. Means are the paths over which movement occurs.

12) *We **have used mutagenesis to determine** the parts of the molecule that control traffic of caveolin-1 from its site of synthesis to the cell surface.*[24]

13) ***To address this question**[defining their molecular organization of Transport intermediates], we **have developed an approach** based on the combination of the green fluorescent protein technology and correlative light-electron microscopy […]**We have applied this technique to define the structure of TIs** operating from the Golgi apparatus to the plasma membrane.*[25]

14) ***To determine** if cell cycle regulators are implicated**, we investigated the putative role of the cyclin-dependent kinases** (CDKs) on ribosome biogenesis and nucleolar organization.*[26]

The above examples show that method is very often embedded in the sentence that outlines the purpose of the study and that the intended goal tends to be expressed by means of a *to*-infinitive clause. There are cases in which neither the intended goal (purpose) nor the path (method) that leads to the goal (conclusion) are explicitly described. In such cases, findings metonymically activate an unspecified method, since results are its direct consequence. This procedure either reinforces readers' expectations about the article or creates

[24] Machleidt T, Li W, Liu P, Anderson R.G.W. (2000). Multiple Domains in Caveolin-1 Control its Intracellular Traffic. *J. Cell Biol*.148, pp. 17–28

[25] Polishchuk, R. S., Polishchuk, E. V., Marra, P., Alberti, S., Buccione, R., Luini, A. & Mironov, A. (2000). Correlative Light-electron Microscopy Reveals the Tubular-saccular Ultrastructure of Carriers Operating Between Golgi Apparatus and Plasma Membrane. *J. Cell Biol.* 148, pp. 45–58.

[26] Sirri, V., Hernandez-Verdun, D. & Roussel, P. (2002). Cyclin-dependent Kinases Govern Formation and Maintenance of the Nucleolus. *J. Cell Biol.*156, pp. 969–981.

new ones depending on whether the initial trajectory can be maintained or not after a potential obstacle is encountered.

d. Displaying results/ forces that push toward a conclusion

Results are the evidence that guides us to a conclusion; they are conceived of as forces with a vector quality (direction) that describes a single path of motion, the one which drives to a final conclusion. There is a causal relation between findings and conclusion, a fact that justifies the conception of results as forces, since they are one of the ways in which we understand causal sequences.

The abstracts discussed here tend to introduce results through verbs that act as lexical cues to identify this stage, and *to find,* or *to provide evidence* are some of the examples found here. P. Martín (2003:36) has also identified other structures commonly used to report the main results: "the *findings*, *the analyses*, or *the results* appear in subject position and they are followed by such verbs as *show, revel* or *indicate*."

15) ***We find that*** *these carriers are large (ranging from 0.3–1.7 μm in maximum diameter, nearly half the size of a Golgi cisterna), comprise almost exclusively tubular-saccular structures, and fuse directly with the plasma membrane, sometimes minutes after docking to the fusion site.*[27]

16) ***We found that*** *in intact gastric mucosa, the changes in extracellular [Ca^{2+}] secondary to carbachol-induced increases in intracellular [Ca^{2+}] were sufficient and*

[27] Polishchuk, R. S., Polishchuk, E. V., Marra, P., Alberti, S., Buccione, R., Luini, A. & Mironov, A.A. (2000). Correlative Light-electron Microscopy Reveals the Tubular-saccular Ultrastructure of Carriers Operating Between Golgi Apparatus and Plasma Membrane. *J. Cell Biol.* 148, pp. 45–58.

necessary to elicit alkaline secretion and pepsinogen secretion, independent of intracellular [Ca^{2+}] changes.[28]

Research can yield several different findings that are normally linked by the use of adverbials such as *furthermore, similarly, therefore, consistent with this, moreover.* These adverbials, as Talmy asserts (2000a), reinforce the preceding findings and thus help to support the same overall conclusion.

17) *In this report,* ***we provide evidence*** *that Toc159 is required for the import of several highly expressed photosynthetic preproteins in vivo.* ***Furthermore***, ***we demonstrate*** *that the cytoplasmic and recombinant forms of soluble Toc159 bind directly and selectively to the transit peptides.*[29]

In some cases the findings are directly reported without the use of headings, the lexical marks that identify the beginning of this stage in the path. In such cases, results are juxtaposed with the method or the purpose, as in the following examples:

18) ***We investigated*** *the putative role of the cyclin-dependent kinases (CDKs) on ribosome biogenesis and nucleolar organization.* ***Inhibition of CDK1****–cyclin B during mitosis* ***leads to resumption*** *of rDNA transcription, but is not sufficient to induce proper processing of the pre-rRNA* ***[…]***. ***Similarly***, *both translocation of the late processing machinery and pre-rRNA processing are impaired in a reversible manner by CDK inhibitors.* ***Therefore***, *CDK activity seems indispensable for the building of*

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[28] Caroppo, R., Gerbino, A., Fistetto, G., Colella, M., Debellis, L., Hofer, A. M. & Curci, S. (2004). Extracellular Calcium Acts as a 'Third Messenger' to Regulate Enzyme and Alkaline Secretion. *J. Cell Biol.* 166, pp. 111–119.

[29] Smith, M.D., Rounds, C.M., Wang, F., Chen, K., Afitlhile, M. & Schnell D.J. (2004). atToc159 is a Selective Transit Peptide Receptor for the Import of Nucleus-encoded Chloroplast Proteins. J. Cell Biol. 165, pp. 323–334.

functional nucleoli. ***Furthermore****, inhibition of CDKs* ***[…]*** *induced a dramatic disorganization of the nucleolus.*[30]

19) ***Using a visual assay*** *for export of the 60S ribosomal subunit, we isolated a ts-lethal mutation,* ***[…] The mutation results in a single amino acid substitution […] Moreover****, pre-rRNA containing ITS2 accumulates in the nucleolus of rix9-1 cells as revealed by in situ hybridization.* ***Finally****, tagged Rlp7p* ***was shown*** *to associate with a pre-60S particle, and fluorescence microscopy* ***and*** *immuno-EM* ***localized*** *Rlp7p to a subregion of the nucleolus, which could be the granular component (GC).*[31]

Evidence, therefore, is a force that makes it compulsory to move from one point to another. This way it orients the trajectory of discourse to a particular direction and discards alternative routes.

e. Reaching a goal/reaching a conclusion

After a journey along a path in which difficulties hinder the progress of the discourse, the destination, a goal, is finally reached. In the cases analyzed here, this destination coincides with the intended goal described at the beginning of the abstract.

The goal is explicitly identified by lexical expressions such as *these results suggest, all together, the data suggest, the data support, we propose*. Expressions such as these manifest a tendency to use hedging devices, and hedging can be understood as a consequence of the characteristics that define research. Mendiluce Cabrera asserts that scientific truth is subject to change, as new

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[30] Sirri, V., Hernandez-Verdun, D. & Roussel, P. (2002) Cyclin-dependent Kinases Govern Formation and Maintenance of the Nucleolus. *J. Cell Biol.*156, pp. 969–981.

[31] Gadal, O., Strauss, D., Petfalski, E., Gleizes, PE., Gas, N., Tollervey, D. & Hurt, E. (2002). Rlp7p is Associated with 60S Preribosomes, Restricted to the Granular Component of the Nucleolus, and Required for prerRNA Processing. *J Cell Biol* 157, pp. 941–951.

research findings can displace previous ones and, therefore, conclusions are not always definitive. Salager–Meyer (1990) adds that scientists tend to avoid committing themselves to absolute statements because they know that their interpretation may not be the only possible view.

20) ***The results suggest*** *that movement of caveoline-1 among various endomembrane compartments is controlled at multiple steps.*[32]

21) ***These data support*** *the function of the Toc 159 as a selective import receptor for the targeting of a set of proteins required for chloroplast biogenesis.*[33]

22) ***We propose*** *that the mechanisms governing both formation and maintenance of functional nucleoli involve CDK activities and couple the cell cycle to ribosome biogenesis.*[34]

23) ***All together, these data suggest*** *that pre-r RNA cleavage at site C_2 specifically requires Rlp7p and occurs within pre-60S particles located in the GC region of the nucleolus.*[35]

In sum, every abstract drives towards a conclusion/goal, which is constrained by (1) the particularities of the terrain, (2) the methodology used to explore it and (3) the evidence garnered from the research. When the evidence is conclusive, it leads to the endpoint, beyond which continuation is not

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[32] Machleidt T, Li W, Liu P, Anderson R.G.W. (2000). Multiple Domains in Caveolin-1 Control its Intracellular Traffic. *J Cell Biol.* 148, pp. 17–28.

[33] Smith, M.D., Rounds, C.M., Wang, F., Chen, K., Afitlhile, M. & Schnell D.J. (2004). atToc159 is a Selective Transit Peptide Receptor for the Import of Nucleus-encoded Chloroplast Proteins. *J. Cell Biol.* 165, pp. 323–334.

[34] Sirri, V., Hernandez-Verdun, D. & Roussel, P. (2002). Cyclin-dependent Kinases Govern Formation and Maintenance of the Nucleolus. *J. Cell Biol.*156, pp. 969–981.

[35] Gadal, O., Strauss, D., Petfalski, E., Gleizes, P.E., Gas, N., Tollervey, D. & Hurt, E. (2002). Rlp7p is Associated with 60S Preribosomes, Restricted to the Granular Component of the Nucleolus, and Required for prerRNA Processing. *J. Cell Biol* 157, pp. 941–951.

possible. However, when the findings are only probable at best, the conclusion will just be the source for further research.

The data we have examined here seem to suggest that the rhetorical structure of scientific abstracts in biology is shaped by the topology of source-path-goal and force-dynamics image schemas. These schemas comprise the experiences that guide our understanding of discourse via metaphor. Although we have observed some small variations in the nature of the obstacles that block discourse progress, and minor differences in the explicit description of method-means, in general terms, we can state that the abstracts follow a similar pattern.

6.2 Cognitive-science abstracts

As discussed above, the structure and internal logic of scholarly abstracts are partly determined by the characteristics of the discipline they represent. Cognitive-science is a highly interdisciplinary field involving knowledge from a number of fields, including psychology, neuroscience, computer science and engineering, philosophy of mind, anthropology, and mentalist linguistic theories.

As a science, it has unifying theoretical ideas and combines the diversity of outlooks and methods that researchers in different fields bring to the study of thought, consciousness, perception and language. As a result, much of the research in cognitive-science is both empirical and theoretical. This is why our hypothesis is that text structure in this field will largely converge with the structure of scientific discourse in biology, which we discussed in preceding

sections. In contrast with biology, however, we also hypothesize that research articles from cognitive-science will be more flexible, since they include not only the results of empirical experiments, but also the theoretical frameworks that help to interpret and lend coherence to the findings. Consequently, one would expect to find somewhat more plasticity in the structure of cognitive-science abstracts.

As in the case of biology, cognitive-science discourses are also conceptualized as a form of motion influenced by force dynamics. However, as result of the flexibility of the field, different realizations of path and force image schemas can appear, and we must account for this in our analysis. Consequently, abstracts in this section will be analyzed one by one to provide a detailed account of their structure. Counterforce and blockage schemas, along with parallel, convergent and divergent realizations of the source-path-goal schema seem to play an important role in shaping the logical and rhetorical structure of cognitive-science abstracts. The interdisciplinary and unifying character of cognitive-science can explain the convergent structure of some of the abstracts, in which the findings reported from research in different fields are used to account for certain phenomena. When those findings are coherent, conversion will shape the abstract structure; conversely, when these findings point in different directions, divergence will govern the internal logic of the abstract.

Often, cognitive-science abstracts share the same structure as abstracts in biology, in that results of previous studies are used as the starting point of the abstract. Those findings become the source from which the discourse is planned to proceed to a final goal-conclusion. However, a knowledge gap in understanding of the phenomenon acts to interrupt the course of the discourse. In terms of force dynamics, there is a blockage. This situation pushes the discourse to explore alternative paths to a conclusion.

SOURCE-PATH-GOAL AND BLOCKAGE IMAGE SHEMAS

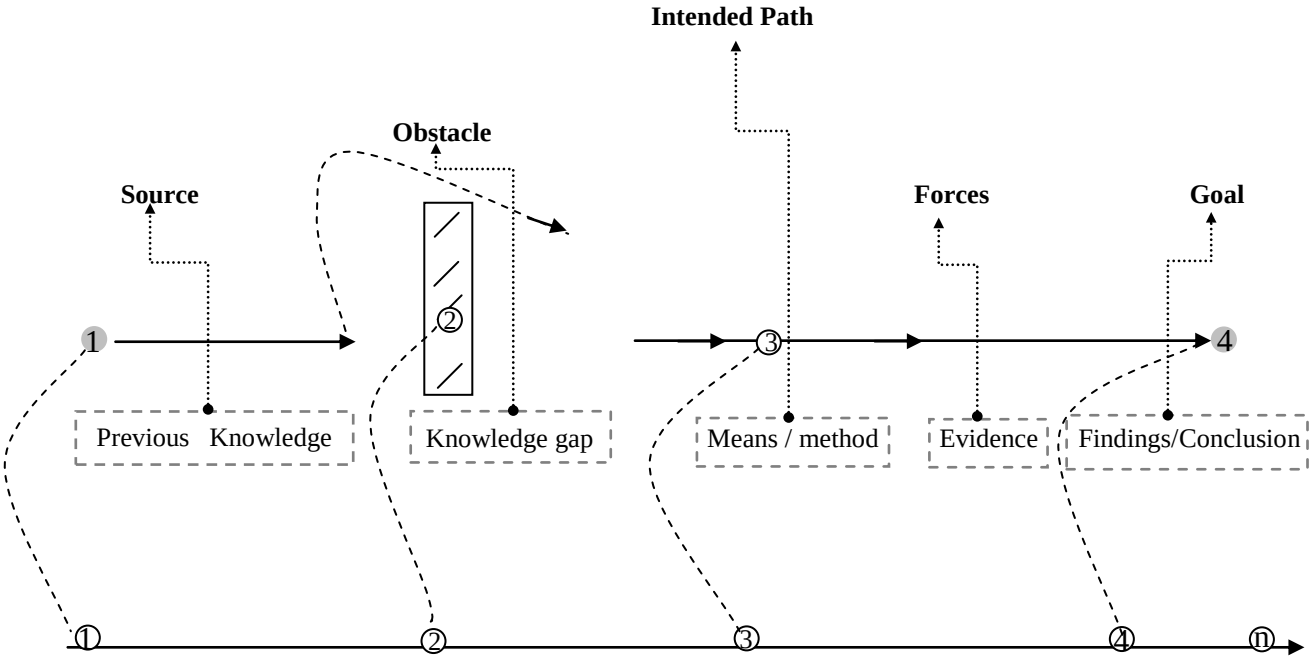

Figure 17: Source-path-goal and blockage image schemas as devices for the structural configuration of the abstract in Marsolek. (2008).

6.2.1 Source-path-goal and blockage image schemas as structural devices: What antipriming reveals about priming[36]

The abstract for the article "What antipriming reveals about priming" takes as its starting point *that information processing is more effective when it has been performed recently than when it has not*. This effect, termed repetition priming, acts as the source from which discourse is intended to progress. An obstacle, however, blocks the path because the mechanisms that account for repetition priming are not completely clear (*However, its causes are not well understood*). Such information gaps must be overcome for the discourse to move forward. In order to do so, the discourse redirects its trajectory to explore a new path, antipriming. This is made explicit when the author says: "I draw attention to the concept of antipriming." Recall that, according to Johnson (1987), paths are not inherently directional, but we can impose directionality on them. In this case, the new direction that discourse pursues is propelled by an argument-force with a high intensity, as the adjective *crucial* shows. The author has evidence that antipriming is crucial for priming, and this fact makes him redirect the discourse in that direction: *I argue that it is crucial for understanding priming*.

[36] Marsolek C.J. (2008). What antipriming reveals about priming. *Trends Cogn Sci.* 12:176–181.

The next stage is to explore the concept of antipriming and its effects. Propositions are conceptualized as locations or bounded areas; therefore, the description of concepts can be understood as a way of defining the boundaries of a location. This is relevant to the argumentative function of abstracts, since holding an argument is metaphorically understood as being located in a definite space and rejecting the ideas as being outside that bounded space:

Antipriming is a measurable impairment in processing information owing to recent processing of other information when the representations of information overlap and compete. Strengthening one representation after its usage causes priming for that item but also antipriming for some other, non-repeated items.

The findings reinforce the direction followed by the discourse by demonstrating the relevance of antipriming in priming in visual object recognition: *Recent evidence demonstrates priming and antipriming within visual object identification systems.* Findings act as new intermediate stage that describes the trajectory to a possible final goal – conclusion: *These findings might reflect a form of maintenance relearning of superimposed knowledge representations*.

The above pattern coincides with that observed in biology abstracts, and this fact shows continuity between disciplines. However, the rethorical structure of these two disciplines is not always similar. In the cognitive sciences, some texts introduce a new organization that is very different from the pattern observed in biology abstracts. For example, in some texts, such as the one below, discourse flows freely without facing any kind of obstacle. In those cases, the internal logic of the abstract emerges by means of lexical cues that

mark the different stages found along the path. This structure can be considered a realization of the enablement image schema, defined as follows: if an entity moves from a source to a destination along a path, then it will be able to pass through each intermediate point along the path, and if no obstacle blocks the further progress of the entity, it will reach the intended destination.

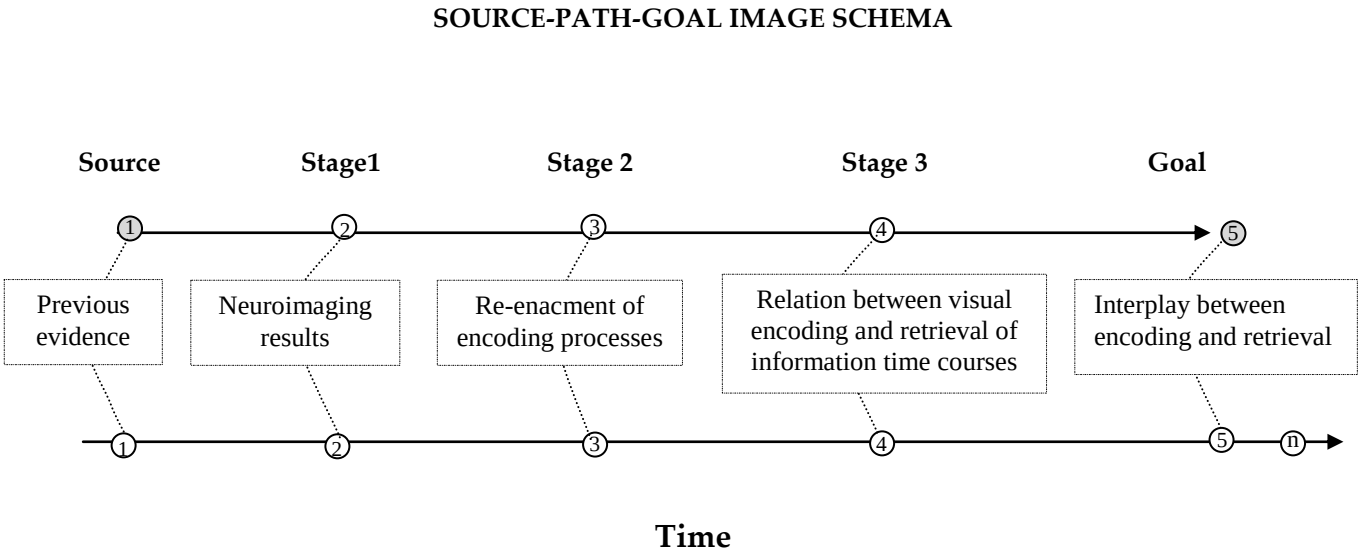

Figure 18: The source-path-goal configuration of the abstract in Marsolek (2008).

6.2.2 Source-path-goal image schema as structural device of discourse

The encoding-retrieval relationship: retrieval as mental simulation[37]

In this abstract, as in the previous ones, the results of preceding studies are taken as source: *There is increasing evidence to suggest that mental simulations underlie many cognitive processes.* These general findings are then applied to investigate more concrete cognitive process: in this case, information retrieval.

[37] Kent C., Lamberts K. *(2008).* The encoding–retrieval relationship: retrieval as mental simulation*. Trends Cogn. Sci. 12,* pp. *92–98*.

To perform this investigation, the authors describe their method in which they review results from three different fields: *We review results from three rapidly developing research areas suggesting that simulations underlie information retrieval*." The method becomes the path that links the different stages leading to the conclusion. Each point along the track is explicitly identified by linguistic expressions, in this case, adverbs that sequence the steps followed by discourse. ***First,*** *neuroimaging work indicates that cortical circuits that were activated during encoding are reactivated during retrieval.* ***Second****, retrieval is aided by behavioral re-enactment of processes involved in encoding, including re-enactment of encoding eye movements.* ***Third****, the time courses of encoding of visual features and the retrieval of information about those features are related.*

After covering each location, a final conclusion is drawn. It shows a convergence of the three areas explored by the discourse. *Overall, the evidence suggests that the often observed interactions between encoding and retrieval result from a cognitive system that, at least partially, reactivates processes that were involved in encoding to retrieve information*.

To reach a conclusion, it is not sufficient to explore only one path; discourse often needs to examine more than one route before arriving at its destination. Sometimes, these can be parallel tracks, which will never meet but can contribute separately to explain a phenomenon; these tracks can also be trajectories that end up intersecting at a certain point if there is a link that bridges the differences between them; or these can be paths that depart from

the same premise only to follow a different direction. Evidence is the trigger that forces paths to converge or diverge.

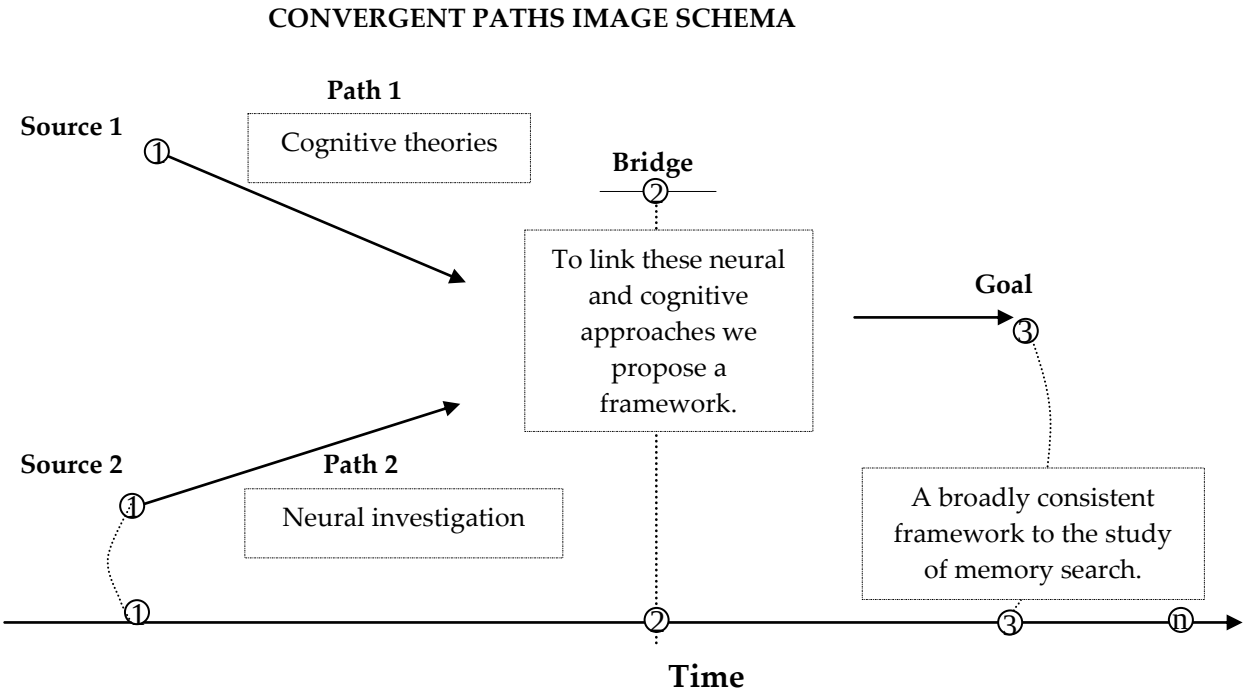

Figure 19: Convergent paths as devices for the structural configuration of the abstract in Kent and Lamberts (2008).

6.2.3 Convergent paths as structural devices of discourse

Memory search and the neural representation of context[38]

This abstract is an example of a convergent structure in which two parallel lines of research merge by means of a framework designed to reach a conclusion.

The abstract starts with a type of rhetorical question, which in turn implicitly points to an intended goal, which is to provide an answer to that question. *A challenge for theories of episodic memory is to determine how we focus*

[38] Polyn S. M. & Kahana M. J. (2008). Memory search and the neural representation of context. *Trends Cogn Sci*. 12(1), pp. 24–30.

memory search on a set of recently learned items. The discourse assesses the approaches that have previously dealt with episodic memory and examines their results. *Cognitive theories suggest that the recall of an item representation is driven by an internally maintained context representation that integrates incoming information with a long time-scale. Neural investigations have shown that recalling an item revives the pattern of brain activity present during its study.* Proceeding in this way, the discourse shows that both perspectives are not incompatible and that a connection between them can be forged. The discourse builds a bridge, lexically indicated by the verb *to link*, between both theories by using a model that combine cognitive and neural investigations. *To link these neural and cognitive approaches, we propose a framework in which context is maintained and updated in prefrontal cortex, and is associated with item information through hippocampal projections.* The last paragraph of the abstract can be interpreted as a pier that strengthens the bond between both lines of research, since it confirms the coherence of the framework with several areas relevant to the survey. *The proposed framework is broadly consistent with neurobiological studies of temporal integration and with studies of memory deficits in individuals with prefrontal damage.*

The abstract definitely shows how two parallel paths can come together to lead the discourse to a coherent conclusion. Each line of thought adds its own contribution to create a single track with a single directionality.

Paths sometimes converge only to later diverge. In experimental research, evidence is time bound and each new survey can provide findings

that oppose previous ones; as a consequence, results that at one time pointed to the convergence of two tracks can be displaced by new ones showing radical differences between the same tracks.

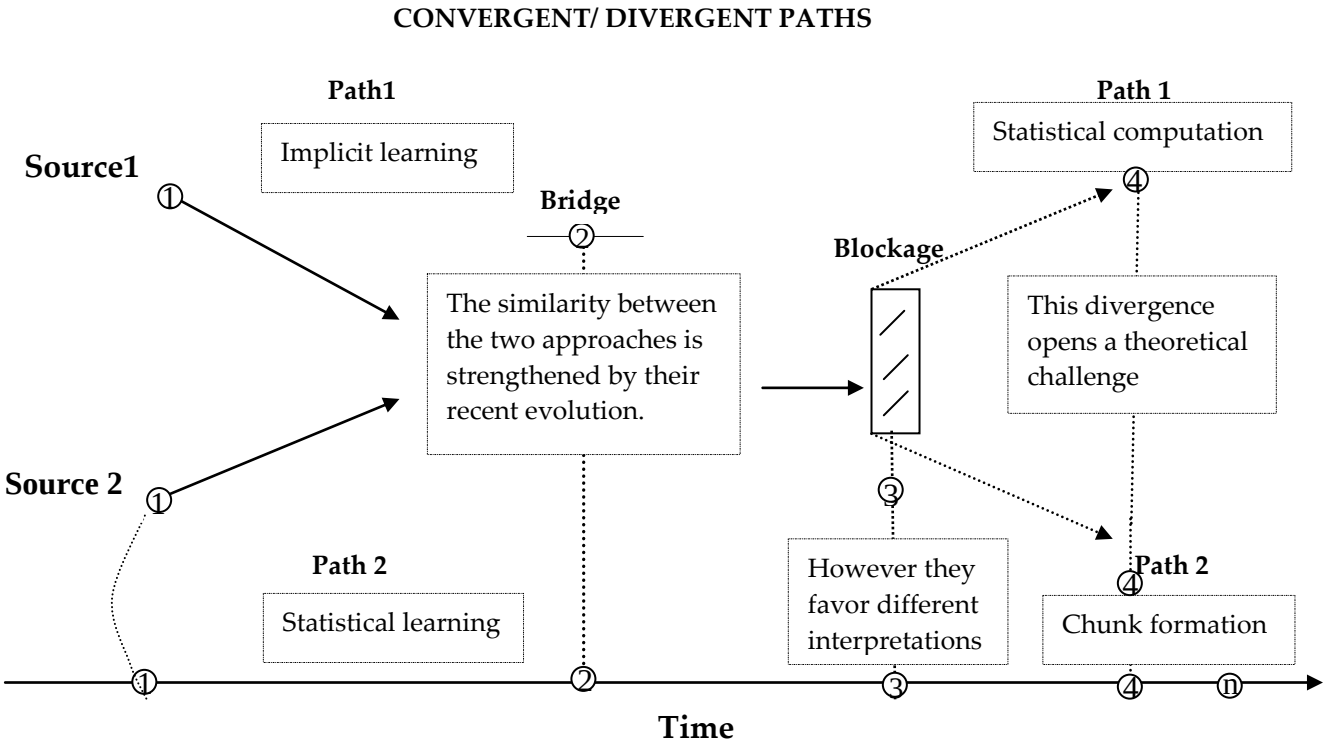

Figure 20: Convergent and divergent paths as structural devices for the abstract in Polyn and Kahana (2008).

6.2.4 Convergent and divergent paths as structural devices

Implicit learning and statistical learning: one phenomenon two approaches[39]

This text is an example of the situation described above, as the abstract shows how two different approaches to language acquisition and object knowledge formation (implicit learning and statistical learning) can merge as research findings identify similarities between the two.

[39] Perruchet, P., & Pacton, S. (2006). Implicit learning and statistical learning: One phenomenon, two approaches. *Trends Cogn Sci*. 10(5), pp. 233–238.

The domain-general learning mechanisms elicited in incidental learning situations are of potential interest in many research fields, including language acquisition, object knowledge formation and motor learning. ***They have been the focus of studies on implicit learning*** *for nearly 40 years.* ***Stemming from a different research tradition, studies on statistical learning*** *carried out in the past 10 years after the seminal studies by Saffran and collaborators,* ***appear to be closely related, and the similarity between the two approaches is strengthened further by their recent evolution****.*

The new track resulting from the intersection of implicit learning and statistical learning finds an obstacle, which is introduced by an adversative clause. This obstacle obstructs the progress of the discourse and forces it to break the bond between the two paths.

Once the link has been dissolved, the path forks and the differences between the two lines of research are revealed.

However*, implicit learning and statistical learning research favor different interpretations, focusing on the formation of chunks and statistical computations, respectively.*

We examine these differing approaches and suggest that ***this divergence*** *opens up a major theoretical challenge for future studies.*

The last sentence provides evidence that this divergence hinders the discourse movement because it faces a crossroads that demands a major choice. This situation will also affect future studies, since researchers will also need to decide which of the two paths is more appropriate to carry out their survey.

In sum, the analysis of our corpus of cognitive-science abstracts shows that these also present a rhetorical structure determined by path, force and link image schemas. Moreover, it confirms that image schemas are not rigid or fixed, but rather malleable structures that "can take on any number of specific instantiations in varying contexts" (Johnson, 1987: 30). This property of image schemas can account for the various realizations of the conceptual metaphor that guides us in reasoning about discourses. The basic structural components and logic of image schemas adapt to specific situations and this helps to organize discourse in terms of convergent or divergent paths, as well as to develop argumentative strategies in response to blockage or counterforce dynamics.

6.3 Literary abstracts

The previous sections gave us an insight into the internal logic and rhetorical structure of two scientific areas that base their research on experimental work. Biology and cognitive-science abstracts show that the reporting of empirical work is highly standardized. Even though texts in certain fields, such as cognitive-science, can present a more flexible structure, abstracts in both fields are based on the source- path- goal and force image schemas.

The present section explores abstracts from the field of literature, a discipline that differs greatly from the two other fields examined here. The study of literary texts is constrained by the academic tradition followed by the

researcher. Some theorists base their interpretation of texts on the author's intentions, biography, or influences; or they base their analysis on the historical and cultural context surrounding the author's work. Other critics claim that the text stands apart from the author, and that texts have meaning only in relation to other texts, not to the lives of their authors. Once the text is detached from the author, the reader (in this case, the researcher) is free to interpret the text in very different ways. Consequently, meaning does not only reside in a text or in the author's intention, but it is also constructed in the reader's mind.

Literary studies rarely deal with a type of data that can be subjected to empirical tests. Hence, literary papers tend to be much more qualitative and flexible than scientific research. This characteristic of literary studies is coherent with the hypothesis that literary abstracts are likely to have a much less standardised format than we see in empirical work.

Helen Tibbo (1992) discussed the universal applicability of abstracting standards—I-M-R-C—and concluded that such standards are well conceived for abstracting scientific writing, but they do not match the reality of nonscientific writing. Matín (2003) also observed that abstracts written for disciplines in which experimental research is the current mode of investigation were convergent to the I-M-R-C structure, while theoretical abstracts usually showed a different rhetorical structure and style.

We argue here that path and force image schemas will mainly shape the structure of literary abstracts, although their realizations will adopt more

complex patterns. The absence of empirical data and the possibility of open interpretation can give rise to an internal logic that is less lineal and more intricate. Consequently, abstracts in this section will also be analyzed individually (as we did with cognitive-science abstracts) to gain a better insight into their rhetorical structure and organizational patterns.

The first example of this corpus illustrates an obvious reality that confirms the previous argument: paths do not always reduce to straight lines. We tend to conceive of paths simply as rectilinear vectors, but in reality they can take on other shapes, such as that of a cycle. When the internal logic of an abstract reproduces a circular path, it depicts a track that starts at a particular place and moves through a series of successive stages until the discourse ultimately returns to the initial state.

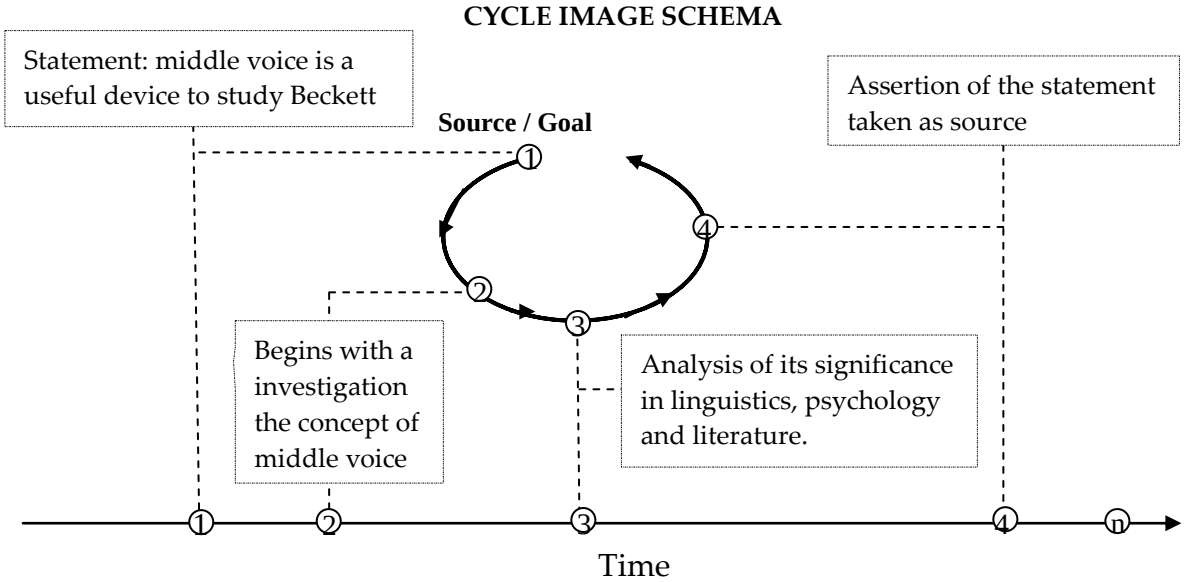

Figure 20: Cycle image schema as structural device for the abstract in Barry (2008).

6.3.1. Cycle image schema as structural device

One's Own Company: Agency, Identity and the Middle Voice in the Work of Beckett[40]

"One's Own Company: Agency, Identity and the Middle Voice in the Work of Beckett" is an example of abstract governed by a circular structure. The abstract begins by asserting that the concept of middle voice is a useful device to reflect on Beckett's work. *The concept of the middle voice, a voice denoting experience that falls between the designations of active and passive, subjective and objective, is a particularly useful one in thinking about Beckett's work.*

This claim becomes the source from which discourse flows to reach a destination, which in this case coincides with the point of departure. This might seem somewhat paradoxical, to be sure. However, on its way toward a conclusion, the discourse passes through several stages. The first of these stages is marked by the verb *begin*, and it is subdivided into different substages: investigation of the middle voice concept from the point of view of linguistics, and evaluation of its semantic and metaphorical significance for different disciplines: linguistics, psychology and literature. These intermediate locations are necessary to proceed; they link the source and the goal. In order to take a step forward, discourse must pass through each intermediate location, in this case the evaluation of the middle voice device.

[40] Barry, E. (2008). One's Own Company: Agency, Identity and the Middle Voice in the Workof Samuel Beckett. *Journal of Modern Literature.* 31(2), pp.115-132.

This article begins with an investigation of the linguistic concept of the middle voice and the semantic and metaphorical significance given to it in modern linguistic, psychological, and literary thought.

The next step, the beginning of which is signalled by the adverb *then*, shapes the path with a circular trace. The discourse returns to the initial state by arguing that middle voice is an adequate concept to approach Beckett's production. *It will then argue for its usefulness for thinking about two related aspects of Beckett's work.*

The abstract completes its route by redefining the boundaries of the proposition used as source and goal. As we previously said, this technique helps to establish which arguments belong to the line of thought defended by the article and which ones are excluded. This way, dissenting arguments can be identified, since they will be outside its limits. In this process, the discourse can also proceed in different steps, as the following example shows.

***First**, the questions of agency and the will that recur throughout Beckett's* oeuvre, *and **second**, how Beckett's early preoccupation with witness—the idea of having to be seen in order to be—transforms itself in the solitary worlds of Beckett's later works.*

This abstract shows that a successful process of reasoning requires a "right route", it does not matter whether it follows a straight or a circular path as long as it leads to a coherent conclusion.

Sometimes, the path that we take to approach a certain topic is only one of the possible routes that can be used. To examine other possibilities may entail

covering parallel tracks or even opposing paths. Choosing one route normally implies rejecting the others, but sometimes there are alternative options. The following abstract exemplifies how two opposing theories, which are prone to diverge, merge into a new one against all expectation.

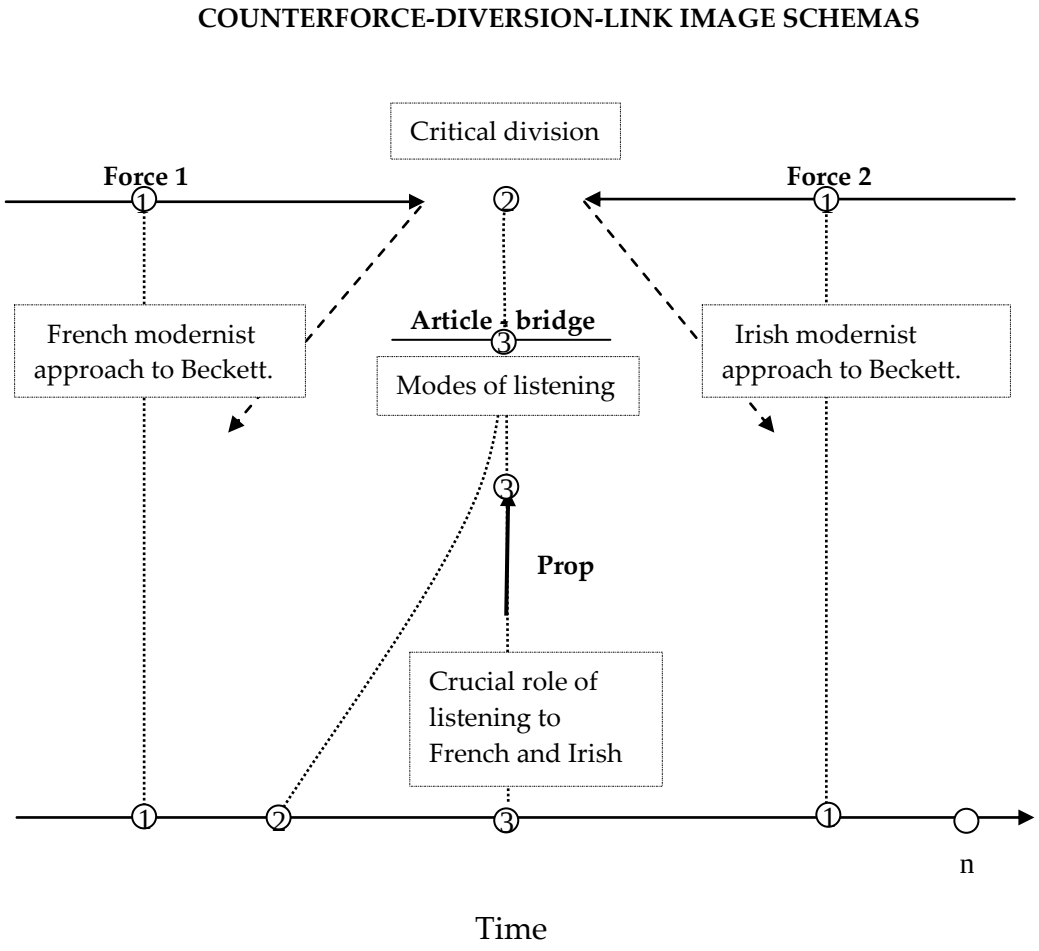

Figure 21: Counterforce, diversion and link image schemas as structural devices for the abstract in Janus, (2007).

6.3.2 Counterforce, diversion and link image schemas as structural devices

In one ear and out the others: Beckett .... Mahon. Muldoon[41]

French and Irish approaches to Beckett's work are conceptualized as forces that move along a path in different directions until they crash into each other, as a result both lines of thought see their trajectories blocked and are forced to stop or redirect their path. In any case, neither of them can prevail over the other.

This situation involves implicit counterforce and diversion image schemas defined by Johnson (1987: 46) as "two equally strong and determined force centers that collide face to face, with the result that neither can go anywhere or there is a change of force vectors." In this abstract, French and Irish modernist approaches to Beckettian poetics of silence and babble are the forces that collide face to face in *In One Ear and Out the Others: Beckett . . . . Mahon. Muldoon*. They read Beckett from two opposing perspectives: *Critical attention to the Beckettian poetics of silence and babble is divided between French modernists, who hear Beckettian silence and babble as a function of the metaphysics of absence (Bataille), and Irish modernists, who hear Beckettian silence and babble as a function of the politics of presence (W.J. McCormack).* The internal logic of the gestalt entails that a force moving in opposite direction to another force will be able to block its progress. As a result, they will not be able to reach their

[41] Janus, A. (2007). In One Ear and Out the Others: Beckett... Mahon. Muldoon. *Journal of Modern Literature* 30 (2), pp. 180-196.

intended destination and both forces will be compelled to take separate ways. The article, however, emerges as a bridge that links French and Irish interpretations of Beckett's production. As the next extract shows, it bridges the gap that separates both readings of Becket's poems by proposing a new concept of Beckettian modes of listening, one that pays attention to voices between absence (French reading) and presence (Irish reading). The method, which proposes a typology of modes of listening, acts as a bridge that runs between French and Irish extremes, thus filling the space between them.

This article bridges such critical divisions by proposing a typology of Beckettian modes of listening: listening as a mode of poetic attention to the murmurs of voices which can no longer, or not yet, be fully apprehended (voices caught between the extremes of silence and noise, between absolute absence and full presence).

The final paragraph claims the centrality of listening to both Irish and French poetics; that way, the discourse justifies the link between both theories, which, in metaphorical terms, can be interpreted as a counterforce, a prop, which holds up the bridge. *Listening would not only be fundamental to the genealogy of Irish poetics that runs from the bilingual Beckett to his not entirely monolingual successors, Derek Mahon and Paul Muldoon, but fundamental to the critical genealogy that runs from the modernism of Bataille to the post-modern poetics of Jean-Luc Nancy.*

The internal logic that shapes the abstract results in a structure that diverges from common expectations. Two unrelated image schemas, diversion

and link, merge into the same text to create a discourse that does not conform to a rigid structural pattern, such as that of experimental studies.

Francis and Liddy (1991), in their study of nonscientific abstracts, suggest that theoretical (i.e., nonempirical) research is mediated through argumentation and they conclude that, in fact, the rhetorical structure of argument seems to be a useful framework to describe how theoretical abstracts are structured. Since critics must convince the reader to accept their interpretation of a text rather than one of many other opposing readings, argumentative strategies are absolutely necessary. This characteristic of literary studies can account for the frequency with which abstracts are governed by the blockage image schema.

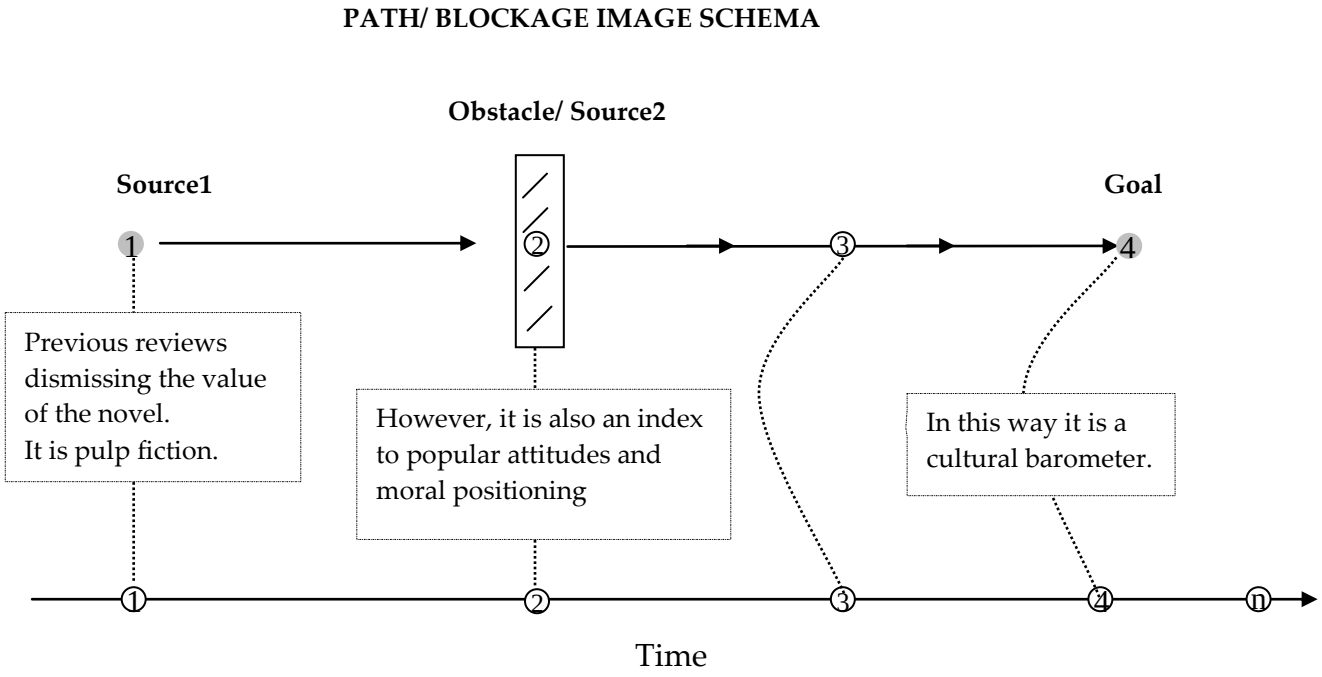

Figure 22: Path and blockage image schemas as structural devices for the abstract in Janus, (2007).

6.3.3 Path and blockage image schemas as structural devices

Tough Guys Don't Dance and Popular Criminality[42]

This abstract is an example of how the interaction of the source-path-goal and force-dynamics image schemas play a part in the way we conceptualize argumentation in the domain of discourse. The abstract takes as a starting point previous reviews of the novel *Tough Guys Don't Dance,* all of which agree in arguing that the novel is an example of pulp fiction that does not deserve serious attention. *Norman Mailer's Tough Guys Don't Dance (1984) has often been dismissed as an example of formulaic pulp fiction that is unworthy of serious critical attention*. This first argument is immediately blocked by a new one, introduced by the logic gater *however*: *However, it is also a novel that provides a useful index to popular attitudes and moral positioning with regard to obscenity, violence, and other forms of criminal behavior.* This statement partially acknowledges the truth of the first statement but then blocks it with a set of reasons that are presented as more important. The novel can be seen as an example of pulp fiction, but there is a more important issue leading to the opposite conclusion: it is a valuable work because it provides an insight into American culture. As a result, the new argument blocks the previous one and displaces it.

Once the discourse has moved toward a new location, the next step is to provide the reader with a detailed description of the area that specifies its limits

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[42] Ryan, J.E. (2006*). "*Tough Guys Don't Dance and Popular Criminality**.*** *Journal of Modern Literature* Vol. 30(1), pp. 17-22

and determines its directionality. *In Mailer's hands, the new reality of the late twentieth century is shown to include a "criminal" turn in American popular culture; this criminal turn has had the effect of "decriminalizing" a substantial portion of activities that for previous generations had been considered as vices*.

Having accepted that this new location is suitable, the end of the path (that is, the conclusion) is introduced as a consequence of the previously presented facts. It asserts that Norman Mailer's novel is a cultural barometer of the American society, and this conclusion overcomes the dismissal of previous reviews. *In this way, Tough Guys Don't Dance serves as an extremely revealing cultural barometer, one that has the capacity for providing a narrative index to a significant transformation of popular taste and morality.*

The abstract exemplifies once more how force dynamics function extensively in the domain of discourse, preeminently in the process of argumentation, as Talmy (2000) argues.

The main function of an abstract is to help readers to decide whether they want to read the rest of the paper or not, and this may explain why the abstract begins, in most cases, with an outline of the route that the discourse will follow. In this outline, the abstract usually details, one by one, the different locations that will be covered on the way to a conclusion. If readers know the path that the discourse is going to explore they can decide whether they want to join the trip or not. As Lakoff (1993: 244) asserts, communication--in this case the publication of an abstract "is giving someone a guided tour of some rational

argument or of some intellectual terrain." An abstract is an example of such a guided tour, where the author acts as a guide and provides readers with a detailed map of the area that they are going to visit.

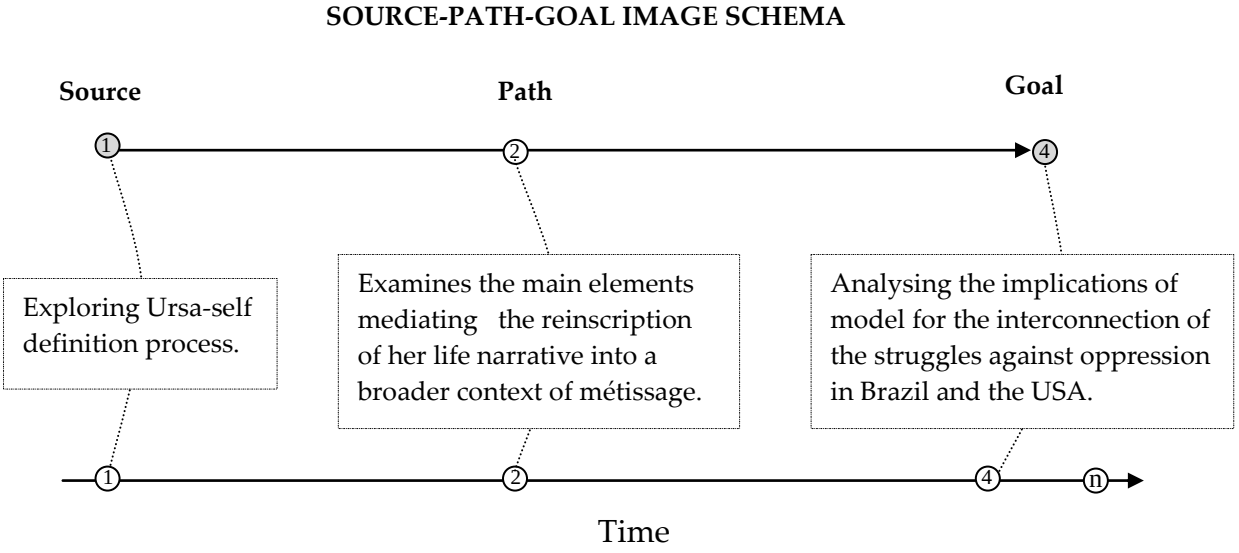


Figure 23: Source-path-goal image schema as structural device in the abstract *Tough Guys Don't Dance and Popular Criminality* by Ryan (2006).

6.3.4 Source-path-goal image schema as structural device of discourse

Wallace Stevens Parts of an Autobiography, by Anonymous[43]

This text represents the pattern describe above faithfully. It starts by showing a general view of the route described by the abstract:

This article explores how Gayl Jones's Corregidora constructs, through the journey of its main protagonist Ursa Corregidora, a viable model for dealing with the painful legacy of slavery, oppression and haunting by the past.

[43] Renza, L.A. (2008). Wallace Stevens: Parts of an Autobiography, by Anonymous. *Journal of Modern Literature*, 31(3), pp. 1–21.

At this point, the reader is a bit more familiar with the terrain surveyed and is thus prepared for the description of the different intermediate stages on the path. The sequence of motion is marked by the adverbs *after* and *finally*, which show how the discourse progresses from one bounded area to another.

The process of self-redefinition in which Ursa engages is based on the reconfiguration of family and sexuality and the hybridization of her relationship to individual as well as collective narratives. ***After*** *probing Ursa's complex psychological journey, the article examines the main elements mediating the reinscription of her life narrative into a broader context of métissage involving sexual and historical resistance, anchored in the story of Palmares as a Brazilian maroon community (quilombo).* ***Finally,*** *the article analyzes the implications and resonances of this model of revision/reclamation for Gayl Jones and her theorization of the interconnectedness of struggles against oppression in Brazil and the United States.*

Once the route has been described, and the reader is ready to make a decision: to continue reading or to look for a new approach to the topic.

The analysis of the previous abstracts seems to confirm the assertions of Tibbo, Francis and Liddy, (1991) who stated that the structure of theoretical research articles is less foreseeable and more flexible than the one found in natural sciences. Moreover, it corroborates the thesis that the internal logic in these types of texts is very often mediated by an argumentative purpose. The malleability of the conceptual metaphor DISCOURSE IS A FORM OF MOTION INFLUENCED BY FORCE DYNAMICS and of the image schemas that shape its structure makes this conceptual metaphor suitable for structuring any type of text.

6.4. Results and discussion

The Cognitive Theory of Metaphor has decisively influenced the way we understand abstract reasoning and conceptualization. Metaphor is no longer considered just a matter of language, a device used for aesthetic purposes, but fundamentally a matter of thought that plays a crucial role in conceptualization inside and outside language, as revealed by the conventional orientation of objects such as charts of the stock market. These objects have been created by humans to accord with the conceptual metaphor MORE IS UP and they are an example of how metaphor imposes structure on real life. Metaphor is therefore a cognitive mechanism that facilitates reasoning and permits us to understand and express abstract or complex concepts in terms of more concrete, basic, and familiar ones. This conception of metaphor grants it a key role in our conceptual system. As Lakoff and Johnson state "Our ordinary conceptual system, in terms of which we think and act, is fundamentally metaphorical in nature." (Lakoff & Johnson, 1980: 3)

In applying the Cognitive Theory of Metaphor to discourse analysis we have explored how the way we conceptualize discourse, via metaphor, contributes to shaping its structure and internal logic. Since, as we have seen above, many metaphors are made real in actual social practice, it is logical to believe that the structure of discourse could be determined by the conceptual metaphor that allows us to understand and experience discourse in the way we

do, and so it seems to be in the case of the abstracts that we analyzed. Scientific abstracts on biology and cognitive-science, on the one hand, and literary abstracts, on the other, show that their internal logic and rhetorical structure are governed by the conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS, which acts as a baseline that is sufficiently flexible to adapt to specific textual circumstances. So, in general terms, discourse should have a beginning, then proceed in a linear fashion and make progress in stages toward a final goal as possible obstacles are overcome. However, although this is true, evidence shows that this structure is only one of many possible configurations of a text as the particularities that define each discipline demand different realizations of the same metaphor.

6.4.1 Abstracts on biology

Biology abstracts confirm that reporting empirical work is highly standardized, partly because the conventions about style and structure established by the scientific community are widely accepted and clearly defined; the abstract structure is expected to follow the linear sequence: introduction, method, results, and conclusion (I-M-R-C). In addition, because researchers work with data that can be empirically tested, this structure is well-suited to prove hypotheses. When a hypothesis has been confirmed, the researcher can rule out other possibilities that would lead him to explore erroneous paths. This gives stability to the sequence of logical connections established between ideas and, at the same time, impedes the use of more convoluted routes. As a well-marked path avoids

detours or secondary roads and leads us straight to our destination, empirical data help to prevent unnecessary diversions in the reasoning process.

After examining the dominant structure of scientific abstracts, we argue that the I-M-R-C structure is selected because it perfectly fits our conceptualization of discourse as a form of motion along a path influenced by force dynamics. Although there are slight variations, the rhetorical organization of abstracts in biology tends to match the following description: the abstract begins by presenting evidence that includes previous knowledge about the field which acts as the source from which the discourse should proceed to a final location-goal. However, its progress is blocked by a gap, a poorly understood aspect that prevents the total comprehension of the source and operates as an obstacle. In terms of force dynamics, there is blockage that pushes discourse to redirect its orientation toward a new intended goal. This new destination is announced in the article through the purpose of the study. In order to reach the new goal, means-method are crucial, since they are the paths over which motion occurs. The next stage is to report the main results obtained; these findings operate as a sum of forces with a directionality that drive to a conclusion-goal, which normally coincides with the intended goal given in the abstract.

6.4.2 Abstracts on cognitive-science

In the case of cognitive-science, the interdisciplinary character of the field partly determines the structure and internal logic of abstracts. This discipline combines a wide range of views and methods that researchers in different fields apply to the study of thought, consciousness, perception and language. The more empirical cognitive-science disciplines (e.g., cognitive psychology and neurosciences) follow as closely as possible the scientific method based on empirical tests; however, other disciplines (e.g., cognitive linguistics) tend to base their research on introspective, intuitive and theoretical methods.

This distinction between empirical and theoretical methods is relevant to discourse structure, since the discourse describes not only the results of scientific experiments, but also more theoretical aspects, thus making its structure more flexible. The reasoning process that underlies discourse is free to explore a myriad of paths: as long as there is no evidence against these paths, then they cannot automatically be discarded. As a consequence, the structure of discourse is also open to different realizations of the conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS.

The analysis of cognitive-science abstracts shows that, although they are largely convergent to the structure of biology abstracts, at least two other alternative realizations of the conceptual metaphor discussed above are used in cognitive science abstracts, convergent and divergent text structures. Discourse can examine two parallel paths that converge if the evidence provides us with a

link that eliminates the differences between them. The interdisciplinary and unifying character of cognitive-science can explain the convergent structure of some abstracts that synthesize findings from research in different areas to account for certain facts. However, when findings point in different directions, the paths split and divergence governs the internal logic of the abstract. In the processes of convergence and divergence, counterforce and blockage dynamics play a prominent role, since they determine the organization of the text.

6.4.3 Literary abstracts

Literary studies deal with data that are not normally analyzed empirically; as a result, experimental work is replaced by theoretical research, which is inherently much more qualitative and introspective. The absence of empirical data and the possibility of open interpretation—resulting from the fact that meaning resides not only in the text *qua* stimulus or the author's intentions, but also in the reader's mind—give rise to less linear and more intricate structures.

The circular structure is one example of an intricate, nonlinear organization, and it illustrates how our reasoning does not always describe straight paths; discourses can depict a circular track that starts in a particular place, passes through a series of successive stages, and finally progresses (returns) toward the initial state.

The argumentative function of literary texts also marks the internal logic of abstracts. The discourse must provide the reader with convincing arguments

in favor of the author's interpretation; at the same time, these arguments should rule out (or downplay) other possible readings. As a result, the logic of blockage image schema governs the structure of the discourse and determines the function of the arguments that perform a double role, as persuasive devices, and as obstacles to opposing readings. This analysis, therefore, strongly suggests that the data and the purpose of the discourse mark its structure

The present study shows that the metaphorical expressions that define discourse as a path are more than stylistic devices. Discourse is conceived of as the physical activity of moving in space toward a goal-conclusion and this is manifested in the actual arrangement of ideas in a text. In this respect, discourse markers act as lexical cues that inform us about the path the discourse is following, the possible obstacles that it will find, the bridges that will emerge between the trajectories being explored, and the arrival at the destination.

This metaphorical conceptualization of a text is not motivated by an objective similarity between entities in the world, but rather by certain schematic resemblance at the structural level between the source and the target domain. Path and force image schemas are the gestalts that underlie the source domain, and their internal logic and structural components are projected onto the target domain through mappings that shape our conception of the discourse and permit us to make inferences about discourses using our experience with paths and forces.

Depending on the discipline and its degree of empiricism, the analysis presented here shows that discourse can adopt different realizations of the same conceptual metaphor. Those fields in which research is based on empirical tests disseminate their findings using a highly standardized type of discourse; in contrast, disciplines that combine experimental and theoretical research, or which are exclusively based on qualitative and introspective analysis, can utilize a wider variety of structures. In any case, the source-path-goal and force-dynamics image schemas are basic structural devices that can be used to account for the informative and/or persuasive purpose of abstracts.

In establishing textual coherence, previous results are obviously relevant, since "the way a text is structured can ensure coherence" Richardson and Morgan, 2003:175). If the organizational structure of texts is a direct consequence of our metaphorical conceptualization of discourse (as our qualitative analysis suggests), then global coherence--which is crucial to create a meaningful and organized overall representation of the text (Graesser et al., 2003)--must rely on conceptual metaphor. Clearly, both writers and readers look for both local and global coherence in a text. Readers, in their attempt to understand the text and make it meaningful, assume that unfolding events are governed by a structure. Based on our analysis, we contend that this search for meaning is guided by metaphorical mappings, particularly those having to do with the source-path-goal and force dynamics image schema. Hence, we believe that the underlying structure of a text, and in turn its global coherence, is

metaphorical in nature. The conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS, and its underlying image schemas, given their gestalt characteristics, help writers and readers to impose structure for comprehension. This human predisposition, as we showed in section 2.1, is found not only at the linguistic level but also at the perceptual level. Moreover, we argue that just as the grammatical form of a sentence has its own schematic meaning (which is invariable regardless of the actual words), discourse macrostructure is inherently meaningful too, regardless of the actual content of the text. This is possible because this conceptual metaphor encodes schematic aspects of bodily experience related to paths and forces that provide information (i.e., inferences) that is not always specified in the text itself but which is dependent on its overall organization.

In sum, text organization appears to confirm our conceptualization of discourse as a journey. This journey is guided by the author and may lead straight to the intended destination or it may contain obstacles, crossroads, and secondary routes that hamper progress. In any case, just as travelers rely on traffic signs, so readers rely on the lexical cues that indicate the logical sequencing of the text. These cues (mainly connectives) act as prompts that trigger expectations about the possible local connections existing between ideas. In this way, readers are able to organize the text content.

Given the relevance of these types of discourse markers, the next section of this thesis evaluates three types of connectives (causal, consecutive and concessive) to explore their embodied basis.

7. EMBODIMENT, CONNECTIVES, AND LOCAL COHERENCE

At the microstructural level of discourse analysis, this thesis represents an attempt to provide empirical evidence in support of the premise that both the general structure of a text as well as the local coherence relations on which it relies have corporeal bases. In this view, image-schemas and conceptual metaphor represent one of the ways in which bodily experience creates the foundation that gives meaning to connectives, as it has been shown to do for other abstract concepts (see section 3.1.2). This understanding of connectives negates the notion that the meaning of connectives is purely a matter of logic and truth values, as Inhelder and Piaget (1958) argue. Rather, we assert that the meaning of connectives, at least in part, is derived from embodied experience.

To test this hypothesis, we developed four experiments to evaluate causality as well as consecutive and adversative relations, which can be considered the other side of the "causal coin." The starting point for these experiments was the assumption that the domain of causation is metaphorically structured by force-related image schemas, as Talmy (2000a) and Lakoff and Johnson (1978) argue.

The purpose of these experiments, therefore, is to assess the extent to which the dominant metaphorical conceptualization of causation and its underlying image schemas—the source-path-goal and force-dynamics image schemas—can predict when language users describe the interaction of two

entities in a scene as causal or non-causal (non-causal used here to mean consecutive or concessive) and, in turn, its linguistic encoding.

7.1 How do we conceptualize causation?

According to Lakoff, (1998) our most fundamental understanding of causation is purely metaphorical: "No literal and non-prototype-based definition of causation exists that covers all the causation concepts and their inferences" (1998:77). Causation, like other abstract concepts, needs more concrete notions to be conceptualized. In this particular case, our experience with motion in space and forces serve as the source domain for this abstract concept.

The conceptualization of causation depends on a general level metaphor: the event structure metaphor—a system of metaphorical mappings that work together to characterize events and their constituents parts. Hence, "notions like states, changes, processes, actions, causes, purposes, and means, are characterized metaphorically in terms of space, motion, and force" (Lakoff 1993: 220). As a result, in the event structure metaphor, space (the source domain) is mapped onto overall event structure (the target domain), thus "giving way to a series of correspondences by which we understand events, causes and purposive actions" (Lakoff & Johnson, 1999: 192). Two of these

mappings, which we describe below, extend the logic of force and forced movement to the conceptualization of causes and causation.

THE LOCATION EVENT –STRUCTURE METAPHOR

STATES ARE LOCATIONS (BOUNDED REGIONS IN SPACE).
CHANGES ARE MOVEMENTS (INTO OR OUT OF BOUNDED REGIONS).
CAUSES ARE FORCES.
CAUSATION IS FORCED MOVEMENT
ACTIONS ARE SELF-PROPELLED MOVEMENTS.
PURPOSES ARE DESTINATIONS.
MEANS ARE PATHS TO DESTINATIONS.
DIFFICULTIES ARE IMPEDIMENTS TO MOTION.
EXPECTED PROGRESS IS A TRAVEL SCHEDULE
EXTERNAL EVENTS ARE LARGE, MOVING OBJECTS.
LONG TERM, PURPOSEFUL ACTIVITIES ARE JOURNEYS.

Table 5: THE LOCATION EVENT-STRUCTURE METAPHOR (Lakoff & Johnson1999:179)

This conceptualization of causation is considered to be the most prototypical of the approximately 20 different ways of conceiving of causality, which are organized as a radial category. In this context, CAUSES ARE FORCES acts as the prototype to father a set of conventional extensions where causation is conceptualized as emergence, links, sources, paths, essences, and so on (Lakoff 1998; Lakoff, 1987 ; Lakoff & Johnson,1980, 1999). Even though each of these metaphors is different, they share some characteristics with the prototype, a fact

that makes them members of the category but not the best examples of causation, in Rosch's terms (1978).

From this view, the central member of the category would have the following properties:

PROTOTYPICAL CAUSATION
There is a patient that undergoes some change and an agent that brings it about.
The change of state is physical.
The agent has the change of state as a goal.
Carrying out that goal requires motor activity.
The agent is primarily responsible for the change in the patient.
The agent is energy source and the patient is energy goal.
The agent touches the patient with his body or an instrument.
The agent monitors the change in the patient via sensory perception

Table 6: Properties that define prototypical causation (Lakoff & Johnson, 1980)

As with any other prototype, this one is a central example of the concept that represents the primary features of how we have categorized the many single examples of causation that we have experienced (Rosch, 1977, 1978). Our direct causal experience, therefore, becomes critical to the concept formation, a fact that has been supported by studies on cognitive development and perception, as we will see in the next section.

7.2 Causation from perception and action

Developmental psychology has found evidence that supports the role of embodied experience as a determining factor in various aspects of children's cognitive development, among them conceptualization. These data reopen the debate between those who argue that the cognitive growth of infants depends on innate properties and those who state that the sensorimotor interaction with the environment is a crucial aspect in this process.

Recent cognitive-development studies on causal perception and understanding support the latter view, since they have shown that action crucially affects the perception of causality (Rakison, 2009, Rakison & Krogh, 2011). Previous studies (Leslie, 1982, 1984, 1988, 1995; Leslie & Keeble, 1987) have suggested that children—even 6 month-old infants—are receptive to causation and distinguish between causal and noncausal events because all humans are equipped with an innate concept of causal power from infancy that undergoes little or no variation over time. According to Leslie and Keeble (1987), this innate concept explains why—even if spatiotemporal contiguity and succession in time are insufficient to explain how we think about causation—babies (and adults) perceive causation in film clips that have been designed in accordance with the launching effect but not in clips that show a delayed launching. In other words, when movement of a second object does not immediately occur upon impact but is delayed. Delayed launching is thought to be perceived as non-causal because causation is understood as forced

movement, which implies not only contiguity and succession but also force. It is this property of force (i.e., causal power) that Leslie and Keeble assume to be innate and activated in concurrence with contiguity and succession.

Recent studies, however, have shown that infants' action experience is what facilitates their ability to perceive causality (Cicchino & Rakison, 2008; Rakison, 2009; Rakinson & Krohg, 2011), and this fact supports Piaget's hypothesis that actions performed by infants (such as the manipulation of objects) affect their perceptual and cognitive development (Piaget, 1953).

In a recent study, Rakison (2009) found that 4½-month-old children are able to perceive causality in simple events after they are given real-world experience of causal action; that is, once they have had the chance to engage in causal actions, such as interacting with balls by using mittens with Velcro to catch them. Rakison developed a 3-stage experiment involving two experimental groups. In the first stage, one group of children interacted with a green ball while wearing red Velcro sticky mittens and a second group of infants did the same, except that the red mittens had no Velcro and so they could not grasp the balls.

In the second phase of the experiment, both groups of children were habituated to the interaction between two balls of different colors in the launching condition (an object (A) moves toward another stationary object (B) until they are adjacent, then A stops moving and B moves in the same direction and similar speed as A). In other words, a red ball moved across the screen

from left to right until it hit a green ball, thereby causing it to move. After habituation, in the third and final stage, children were presented with three different film clips based on the colored balls shown in phase 2 of the experiment. In one clip, the balls moved in the opposite direction as that shown in the habituation exercise; that is, balls moved from right to left rather than left to right. In the second stimulus, the agent and recipient roles, as well as the direction of movement direction were reversed so that the green ball (rather than the red one) moved from right to left until it hit the red ball. Finally, the third clip showed a noncontact event in which the green ball stopped before colliding with the red one. Experimenters registered and compared the babies' visual fixation (percentage of viewing time spent on the different events) and found that both groups spent more time looking at the noncausal event than the familiar event, which indicated that they could detect differences in the continuity of the events. Importantly, however, it was only those infants who had worn Velcro mittens who spent more time looking at the causal switch display than the familiar one, indicating that they perceived the causality of the events (Rakison, 2009).

A replication study developed by Krogh (2009) tried to determine whether the results that Rakison obtained were motivated by a resemblance between the physically-manipulated objects (balls) and those shown on the display, or whether children are able to abstract causal relations and generalize them to other contexts. Krogh's design was identical to that of Rakison except

for the fact that during the interaction phase children wore blue Velcro mittens and manipulated yellow toy cubes, which were perceptually very different from the red and green balls used in the habituation and test displays. Results confirmed that "infants looked longer to an event in which the agent-recipient relation changed relative to a familiar causal event. This provides further evidence that 4 ½ -month-old infants abstract information about causality from their self-produced actions, and that the particular objects infants interact with do not constrain their perception of causality in the test events." (Krogh, 2009:16)

In sum, studies of babies' understanding of causality highlight that our interaction with the environment plays a crucial role, but it remains unclear why. An image-schematic approach to this phenomenon might be a suitable explanation because it emphasizes the role of experience in human conceptualization and understanding. This would explain why only those children that have real-world causal experiences can go beyond a pure kinetic interpretation of what they perceive (i.e., two independent objects that move at certain times and in a certain direction) to assign agent and recipient roles to the objects involved in such events and to understand that agents cause recipients to change physical state. As Gibbs argues, developmental psychology may reveal how embodied experience shapes our understanding of causality (Gibbs, 2005).

In adults, the question of how subjects perceive and understand causality also has a long history (e.g., see Scholl & Tremoulet, 2000; Sperber & Premack, 1995). However, one of the most influential approaches to this topic was Michotte's research on the perception of causality, which continues to inspire and influence current studies on this issue, such as the ones described above. Michotte believed that it was possible to establish systematic relations between stimuli and reactions in the study of perception, and on the basis of this assumption, he designed a series of 100 experiments to investigate how we perceive causality (Michotte, 1946). Using the launching effect described above, Michotte proved that subjects saw a causal relation in this type of interactions. Subjects' description of the stimulus went beyond a pure kinetic description of what they perceived (i.e., motion patterns), since subjects interpreted it as a collision wherein A caused B's motion rather than as two independent objects moving at certain times in a certain direction. Michotte then developed a theory of causation "rooted in automatic visual processing that provided a stark contrast to previous philosophical theories such as that of Hume," which argued that "no mark of causation could be directly perceived from any possible sensory evidence" (Wagemans , van Lier & Scholl, 2006:12). That is, only the spatial and temporal arrangement of events, and not their causal connections, could be sensed. According to this view, our sense of causation is evoked by events that are constantly conjoined in our experience and that

follow a certain pattern: one is prior to the other and they are contiguous in space and time (Wagemans, van Lier & Scholl, 2006).

Michotte, however, showed that by manipulating the time that went by between the collision and the moment in which the second object started to move he could elicit or fail to elicit a judgment of causation in his subjects. This finding was inconsistent with Hume's analysis of causation, since it proved that temporal and spatial contiguity were not enough to conclude that an event was causative. Moreover, he showed that habituation did not suffice to make events look like causation, since some events, even if repeated several times, were never described as causative whereas others were judged to be causal on the first try (Twardy & Bingham, 2002). These facts led Michotte to disregard the role of experience in the process and to argue that the visual system was the only source of these perceptual judgments, possibly triggered by an innate perceptual mechanism.

Practically all studies of the perception of causality assume that vision is the only sensory input involved in its perception. According to this assumption, even though causality seems to imply kinetic and dynamic properties, and only the former can be visually perceived, the information about the movements of an object that the visual system gathers is sufficient for us to be able to extract its dynamic properties. In other words, the kinetic characteristics of an event, such as the form of the trajectories after the interaction of two objects or changes in their velocity and direction, can be recruited by the visual system and be

used to detect its dynamic properties (i.e. the presence of a force and the extent of its influence). In short, people's perceptual systems allow them to *see* the dynamics of an event via its kinematics (Runeson & Frykholm, 1983). This is what is known as inverse dynamics (Wolff, 2008).

The question that arises is how the dynamics of events are perceived from kinetic information. Based on the evidence provided by the studies on visual perception, this process can only be explained if the particular characteristics of our perceptual and cognitive systems are taken into consideration. As we explained in chapter 3, the perception of a scene is not just the sum of its geometry, spatial relations, light, shadow, and color; rather perception also implies the integration of cross-modal sensory interactions, attention, expectations and previous knowledge. In the case of causality, we argue that its perception involves the integration of information not only from the visual system, but also from the haptic, auditory and vestibular systems, as well as the knowledge and expectations triggered by our embodied experience with forces. Thus, based on this hypothesis, all this information is activated by visual input during the process of perception in order to extract the dynamics of the event.

In this respect, White (2006) emphasizes the role of the haptic system as an important source of sensory input in making causal inferences. The haptic system includes kinetic and skin pressure sensors that recruit information about our location in space and our movements, as well as the effects of our actions on

the objects that we act upon. According to White (2006), "causal understanding originates with the direct experience of our own actions on objects, and extends out from this point of origin to other domains by a form of schema matching" (p.166). That is, the perceived stimulus is compared to abstracted stored representations of causal experiences which can result in a good fit: "such a match imbues the stimulus with richer interpretations involving causality, which are not explicit in the simpler stimulus itself" (White, 2006:166).

In contrast, as Verfaillie and d'Ydewalle discuss (1991), there is evidence that our cognitive system uses past experience to simulate a perceived entity's future behavior (i.e., future trajectory). For example, if an object traveling along a trajectory disappears, perceivers anticipate where it would be if it were still on the trajectory, recognizing it faster if it is shown at this point than at the point it disappeared or at any other point. Hubbard, Blessum, and Ruppel (2001), likewise, found similar results in displays designed according to the launching effect. In this case, perceivers' memories for the final location of the launched target were usually displaced forward in the same direction as the launcher motion.

This phenomenon has been attributed to spatiotemporal coherence or low level processes such as pursuit eye movements and visual persistence (Hubbard, 2004). However, recent findings support the idea that knowledge, specifically knowledge of the target identity, affects the simulation of its trajectory, so that when subjects believe that an ambiguous object is a rocket,

they simulate a different trajectory compared to when they believe it is a steeple (Reed & Vinson, 1996).

Therefore, we can conclude that we do not limit ourselves to what we perceive; rather we use what we perceive as cues to activate overall conceptualizations across modalities. This can explain how the brain bridges the gap between what is given to the sensory systems (motion patterns) and what is actually experienced by the perceiver (force dynamics).

7.2.1 What do we activate when we perceive causality?

From the point of view of embodied cognition, the perception of causality is specifically mediated by the activation of force-dynamic image schemas. This means that, we "perceive causality by applying our own embodied experience of how we act upon objects or they act upon us" (Gibbs, 2006:55). Our ability to make inferences about the interaction of people and objects, therefore, does not depend on our understanding of an abstract rule or concept for dynamics or causality; instead, it is grounded in our recurrent bodily encounter with physical forces that push and pull us.

Image schemas, as experiential gestalts, are recruited and mapped onto the visual stimuli by filling in gaps in the stimuli information. In this way, the visual display is interpreted as depicting a causal interaction. In other words, the stimulus gives us kinetic information and our embodied experience provides the other necessary data to interpret a situation as causal. Priority in

time (precedence), contiguity, and constant conjunction between two objects is the type of information that we can extract from a visual stimulus, but it is not enough to understand a situation as causal; rather, it is the idea that there is a force interrelationship which makes it causal. We cannot visually perceive the force administered to an object or its resistance, but our experience, compressed into force dynamics image schemas, overcomes these shortcomings.

In sum, what matters in perceiving causality is not accuracy in assessing the properties of the objects, their speed, resistance, or mass, but rather the fact that we use this information as a cue to activate contextually relevant prior knowledge and experience.

The theory of force dynamics, as developed by Talmy (1988) within the framework of cognitive semantics, provides an excellent way to analyze the link between our conceptualization of causality and its linguistic expression. This theory argues that our understanding of causality relies on our ability to detect the force patterns that underlie causal events, that is, to perceive the interrelationships among two forces of unequal strength: the Agonist and its opposing element, the Antagonist. Both the Agonist and the Antagonist have an intrinsic tendency towards either action or rest that can either persist or be overcome during their interaction depending on their relative strengths. These force oppositions are thought to be captured by language in causative and concessive construction by combining specific patterns of focal attention with causative verbs and connectives (Talmy, 1988). The following chapter is

dedicated to analyse the force dynamics theory and its implications for the conceptualization of the notion of causation.

8. AN INSIGHT INTO THE FORCE DYNAMICS THEORY

Talmy (2000) asserts that the force dynamics theory reflects our experience of force in terms of how physical entities interact, that is, our intuitive understanding of forceful interactions, which includes the exertion and resistance of force, the blockage of force and the removal of such blockage. He also argues that the logic of force is not only present in physical interactions, but can be metaphorically extended to more abstract domains such as psychological states and social interactions, as well as to the domain of discourse where its influence is found "preeminently in directing patterns of argumentation, but also in guiding discourse expectations and their reversal" (Talmy, 2000a: 409). Talmy also states that force "has a direct grammatical representation" (Talmy, 2000a: 409) in a set of closed-class words, which includes causal and adversatives conjunctions along with modal verbs. In this view, causal and concessive connectives are grammatical markers of force dynamic relations, which act as lexical cues for the reader to infer patterns of force between adjacent sentences. Specifically, in causal and concessive sentences, the main clause expresses the outcome of the agonist-antagonist interaction, with the agonist as its grammatical subject and the subordinate

clause (introduced by a causal or concessive connector) functioning to describe the antagonist's behavior and relative strength. Causal sentences present the antagonist as the dominant force while concessive sentences, in contrast, emphasize the antagonist's weakness (Talmy, 1988).

As a consequence, the sentence in (1) illustrates a pattern of force in which the first entity, the plane, tends toward motion but cannot impose its tendency because the second entity, fog, is stronger and blocks its motion. In (2), the plane still tends toward motion, but now is stronger than the force opposing it (fog), so it is able to continue its tendency.

1. The plane could not take off because of fog.

2. The plane took off despite fog.

The advantage of this analysis is that, as Talmy points out, "it provides a framework in which a set of basic notions not usually considered related are brought together in a natural way that reveals their underlying character and actual affinity" (1988:416). That is the case of the relation between causative and concessive relations which can be understood as two poles of the same concept.

What, then, is the difference between cause and concession? In causative situations, the tendency of the agonist is not for the final result but, since it is opposed by a stronger antagonist, the result occurs. In Talmy's words: "the patterns that constitute the general causative category have in common one property, absent from all other force dynamic patterns [...] this property is that

the agonist's resultant state of activity is the opposite of its intrinsic actional tendency" (1988:418).

The causative category, therefore, possesses the configuration shown in Table 7:

	Patient tendency for the resultant state	Antagonist-Agonist opposition	Occurrence of Result
Cause	N	Y	Y

Table 7: causal pattern

In concessive situations, however, the tendency of the agonist is for the final result and, even though it encounters opposition from the antagonist, the agonist manages to impose its initial tendency because it is stronger.

According to the previous description, the general concessive category possesses the configuration displayed in Table 8:

	Patient tendency for the resultant state	Antagonist-Agonist opposition	Occurrence of Result
Concession	Y	Y	Y

Table. 8 Concessive pattern

Therefore, the main difference between concessive and causal relations is that, in the case of concession, the agonist's resultant state of activity is congruent with its intrinsic tendency because the exertion of force by the antagonist does not ultimately affect the final outcome, even though it provides

resistance. In the case of causatives, however, the antagonist manages to impose its force on the agonist, which is not able to enforce its intrinsic tendency.

Having described the main differences between causal and concessive relations, we now provide a more detailed account of some of their subtypes and lay the theoretical foundations for our empirical work, with the caveat this is not intended to be a complete inventory of all these relations. Rather I shall only describe those patterns that are the object of our research.

As we stated before, the general category of causation includes several different kinds of causal relations, including compulsion, blockage, and attraction. In Talmy's work, these relations are represented through diagrams that contain a variety of elements. For example, the agonist and antagonist are represented, respectively, by a circle and a concave shape. The intrinsic tendency of the agonist and the result of its interaction with the antagonist are represented by two symbols: the black dot (•) indicates tendency towards rest, and the arrow (>) tendency towards action. Finally, the relative strength of the entities is indicated by the + symbol, which represents the strongest of the two forces.

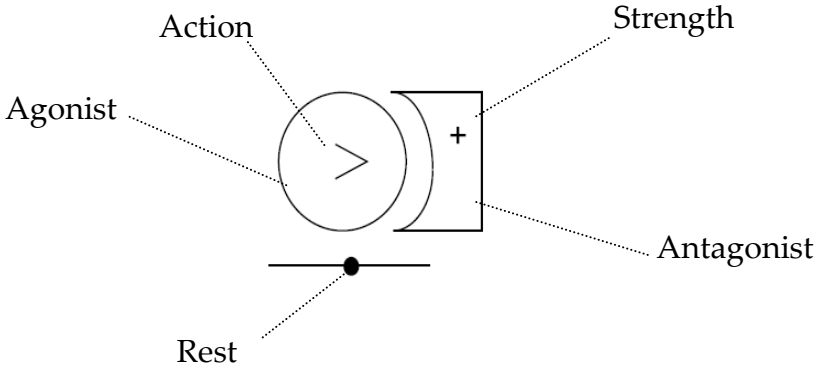


Figure 24. Components of force dynamics diagrams

Compulsion: In compulsion situations, the agonist has a tendency towards rest that is opposed by the antagonist, which exerts its force on the agonist to overcome its resistance, thus causing it to move.

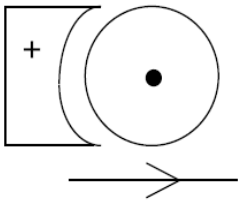


Figure 25. Compulsion (Talmy, 1988:415)

Blockage: The agonist has a tendency towards motion which is blocked by the antagonist; the agonist, then, is forced to remain in place.

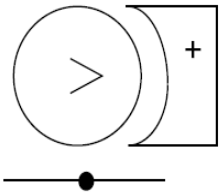


Figure 26. Blockage (Talmy, 1988:415)

By extending the framework proposed by Talmy, we can also explore a third pattern of force dynamics: attraction. As in the other causal patterns, the antagonist is more powerful than the agonist and impinges steadily on it until the agonist is forced to move.

Attraction specifically describes a situation in which the agonist has an initial tendency toward rest that is overcome by the influence of a more forceful antagonist which sets the agonist in motion by pulling on it.

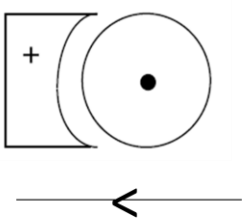


Figure 27. Attraction

In short, it can be stated that the force-dynamic interpretation of causative patterns is that "an object has a natural force tendency and will manifest it unless overcome by either steady or onset impingement with a more forceful object from outside" (Talmy, 1988: 419). The details of the agonist-antagonist interactions and their result are summarized in table 9.

	Agonist tendency for the resultant state	Antagonist-Agonist opposition	Occurrence of Result
Cause	N	Y	Y
Compulsion	N (Tendency: rest)	Y	Y (Motion)
Blockage	N (Tendency: motion)	Y	Y (Rest)
Attraction	N (Tendency: rest)	Y	Y (Motion)

Table 9. Agonist-antagonist interaction in detail

As in the case of causation, concessive relations can be classified into various subtypes that meet the basic requirement of continuity between the natural tendency of the agonist and the resultant state after the antagonist's intervention. The following are some examples.

Compulsion without result: In this type of interaction, the agonist has a tendency towards rest that is opposed by a weaker antagonist, which exerts its force on the agonist but does not succeed in making it move.

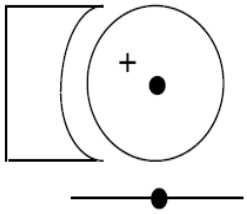


Figure 28. Compulsion without result (Talmy, 1988:415)

Blockage without result: In this case, the agonist's tendency towards motion is hindered by an external force, the antagonist, which tries, unsuccessfully, to block its progress, since the agonist manages to continue its intended path by either redirecting its trajectory or overcoming the obstacle/antagonist.

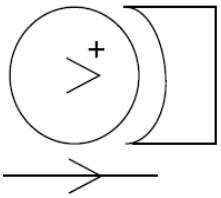


Figure 29. Compulsion without result (Talmy, 1988:415)

As in the case of causatives, we can extend Talmy's force dynamics theory to explore a third type of concessive pattern: attraction without result. As in the other concessive patterns described above, in this type of interaction, the agonist manifests its intrinsic tendency despite encountering steady opposition from the antagonist.

Attraction without result: The agonist has an intrinsic tendency towards rest that it is able to maintain despite being pulled by the antagonist. As a result, the agonist remains in place.

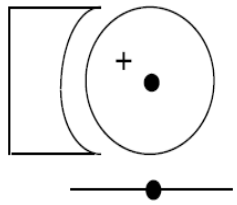


Figure 30. Attraction without result

Now that we have examined the main characteristics of the concessive interactions, we can state that the force-dynamic interpretation of concession is that an object will manifest its intrinsic tendency towards rest or motion despite encountering opposition from another entity, provided that the opposing object is weaker. A detailed summary of the possible forceful interactions grouped under the conceptual aegis concession is provided in Table 10.

	Patient tendency for the resultant state	Antagonist-Agonist opposition	Occurrence of Result
Concession	Y	Y	Y
Compulsion without result	Y (Tendency: rest)	Y	Y (Rest)
Blockage without result	Y (Tendency: motion)	Y	Y (Motion)
Attraction without result	Y (Tendency: rest)	Y	Y (Rest)

Table 10. Concessive forceful interactions

All in all, force dynamic interactions appear to successfully capture the essence of causal and concessive relations, at least from a theoretical perspective. However, available evidence is insufficient to determine whether the force dynamics theory is really representative of how people conceptualize causation and concession. However, the empirical work of Wolff (1996, 2002a, 2002b, 2007) and, Morera and de Vega (2010) supports this insight, as will see in the next section.

8.1 Force dynamics in language: empirical evidence

Several studies have found empirical evidence that force dynamics premises are more than just theoretical devices to describe causal relations. In fact, the force dynamics theory successfully accounts for our conceptualization of causation and its various manifestations as well as its linguistic coding.

Wolff (1996, 2003, 2007), for example, has analyzed in depth how the force dynamics theory captures the underlying meanings of our linguistic expressions of causation. His research has mainly focused on empirically testing how the interaction of two forces affects people's judgments about causation. In addition, Wolff lays the foundations around which causal verbs are clustered. Of the various mechanisms that languages use to encode causation, Wolff's research focuses on two types of English causal verbs: lexical causatives (i.e., verbs that encode the notion of cause and result simultaneously, as in *Rose destroyed the letter*) and periphrastic causative constructions (i.e., structures that

encode the notions of cause and effect in various verbs, as in *The rain forced us to stop the game*). Wolff examined the semantic properties of these causal verbs by applying the force dynamics model.

Wolff's model is based on an adaptation of Talmy's theory of force dynamics (1988), as well as incorporating Jackendoff's elaboration of certain aspects of the original proposal (1991). Wolff , like Talmy, argues that causation and its particular subcategories—enabling and preventing—are "specified according to whether one entity (the patient) changes or remains the same with respect to a particular location or state as a consequence of the forces associated with it and another entity (the affector) that impinges on it" (Wolff & Song, 2003:283). Consequently, force dynamic patterns underlie our general conceptualization of causation but each subtype has its own particularities and is distinguished from the others by the following three factors that specify how two forces may interact: a) the tendency of the patient (i.e., agonist) for the result, b) the presence of opposition between the affector (i.e., antagonist) and patient; and c) the occurrence of a result.

Wolff's account also incorporates an important insight from Jackendoff; some forceful interactions may involve concordance (i.e., the presence of the same intrinsic tendency towards rest or motion in both entities) rather than opposition between the affector and the patient. For this reason, Wolff also incorporates the presence of concordance between the patient and the affector as a determining factor for causation.

Based on these theoretical assumptions, Wolff designed an experiment to examine whether the above mentioned parameters could account for the semantic organization of English periphrastic causative verbs. A group of 26 subjects were asked to sort 48 sentences (containing 23 periphrastic causative verbs) from the British National Corpus into as many groups as they felt necessary. The sorting results underwent a multidimensional scaling analysis that showed "a pattern of clustering as predicted by the force dynamic model" (Wolff & Song, 2003:290). Participants sorted the verbs into three main groups: cause-type verbs, prevent-type verbs and enable-type verbs. With a 95% confidence level, these differences are statistically significant. The result of Wolff and Song's experiment support Talmy's assertion that causal, enabling and preventing types of causation match people's understanding of causal relations as expressed in ordinary language (Wolff, 2003)

In a second set of experiments, Wolff (2002) provided evidence that the force dynamics model is able to predict the type of vector configurations that underlie the concepts of cause, enable and prevent. Therefore, the model can anticipate which events people will judge to be causal, enabling or preventing. According to this model, the concept of cause implies a situation in which the tendency of the patient is not for the result but rather is opposed by the affector, which then leads to the occurrence of the result. In enabling situations, however, the tendency of the patient is for the result and the affector does not oppose the result, but instead assists in the realization of this tendency.

Preventing occurs when the tendency of the patient is towards the occurrence of the result but is opposed by the affector; as a consequence, the result does not take place.

These predictions were tested in a series of experiments in which participants viewed a set of realistic 3D animations designed to illustrate the three patterns of force described above (causal, enabling and preventing configurations). These visual displays had two parts. The first one showed a boat (the patient) moving across a pool towards a cone (the target). This animation showed the boat's tendency. In the second part, a bank of fans (i.e., the affector) started blowing air. The force exerted by the bank of fans could either assist the boat in its movement or oppose it to determine its final direction. After watching the animations, participants had to select one of four linguistic descriptions that best described the occurrence. All four sentences were the same ("The fans ____ the boat to [from] hit[ting] the cone"), with one important difference: the verb, which was either *caused*, *helped* or *prevented*. There was a fourth option: *none of the above*, which the researchers expected participants would choose when the animation did not match any of the force patterns previously described. Results confirmed that "the vector model is capable of not only specifying distinct types of causal concepts, but also distinguishing between causation and non-causation" (Wolff, 2002:5).

Finally, Wolff (2007) empirically tested whether, as Talmy asserts, "force dynamics has a more general role in language and its concepts and distinctions

are extended by languages to their semantic treatment of psychological and social elements and interactions" (Talmy, 1988:430). In this case, participants were presented with animations in which the forces were nonphysical. The affector was a police officer and the patient a woman who intended to cross the street. In some animations, the intentions of the police officer and the woman were in conflict, whereas in others, they were in concordance. As in the previous case, after each animation participants chose the sentence (from 5 options) that best described what they had seen. Three of the sentences were similar, except for the verb, which was either *caused*, *enabled*, or *prevented*: (*The officer [verb] the woman [to or from] walk[ing] up to the man*). Another option included a sentence with the adversative marker *despite*. The last option was *none of the above*. The results confirmed that the dynamics model can be extended to explain people's judgments about social causation and provided further evidence that it is able to distinguish cause from other causal and noncausal concepts (Wolff, 2007).

A recent study (Morera & de Vega, 2010) has made even more progress in this area. These researchers examined the role of force dynamic patterns as structural devices in causal and concessive sentences in Spanish. They also evaluated the fine-grained semantic differences between connectors of the same category. That study combined the force-dynamics theory with two other parameters: emotional valence and subjectivity. Emotional valence refers to the emotional inferences that readers automatically make when comprehending a

text (Graesser et al, 1994) while subjectivity indicates whether the information contained in the sentence is objective, factual, or epistemic. Morera and de Vega included these two factors in their analysis because they may explain subtle semantic differences among connectors of the same type (Degand & Pander Maat, 2003).

In the experiment, participants were asked to complete a list of 40 unfinished sentences, each one ending with either a causal marker (*porque* 'because' or *puesto que* 'given that') or a concessive marker (*aunque* 'although' or *a pesar de que* 'in spite of'). Then, subjects' answers were examined and classified according to three variables: type of force dynamics (physical, intra-psychic, or interpersonal), emotional valence (negative, positive, or neutral) and continuity of the valence between the stimuli and the participants' responses. The resulting data was submitted to a discriminant analysis that showed "a powerful statistical function that clearly discriminated between sentences with causal and adversative connectives" (Morera & de Vega, 2010:522). "Results also confirmed that sentences with causal and adversative connectives mainly differ in their polarity or continuity" (Morera & de Vega, 2010:522), where continuity implied causing or enabling forces and discontinuity describes preventing forces. In this respect, sentences with the causal connectives *porque* and *puesto que* showed continuity in force dynamics, whereas sentences with the adversative markers *aunque* and *a pesar de que* involved a shift in force dynamics. With regards to subjectivity, this study also revealed that sentences

with *porque* and *aunque* usually expressed internal or volitional events, and sentences with *puesto que* and *a pesar de que* were associated with external or factual social events.

In sum, empirical research supports the notion that force dynamic interactions modulate our conceptualization of causation. However, some questions are still unanswered. For example, it is not clear whether the findings reported above can be extended to other languages. As Morera and de Vega point out, their studies are based on a single language and cannot be generalized to other languages where similar patterns could be predicted. Therefore, cross-linguistic analyses are necessary to consolidate their results and interpretations. This limitation, along with the fact that "research on expressions of causality rarely moves beyond the examination of lexical and periphrastic causatives" (Song & Wolff, 2003:2) has shown the need to further develop this field of research. Specifically, what is needed is a series of cross-linguistic experiments that examine in greater detail the characterization of causality by analyzing how people extract causality from dynamic visual information and how this is linguistically encoded in other languages. To answer these questions, I carried out a series of experiments. The results of these experiments are described in the following chapter, along with a discussion of the conceptualization of causality and two of its natural counterparts— concessive and consecutive relations— in English and Spanish.

9. AN EMBODIED APPROACH TO COHERENCE: EXPERIMENTALWORK

In this thesis an embodied approach to the study of causal connectives is used. The aim is to map out the cognitive mechanisms and principles that might account for the conceptualization of these connectives. We argue that connectors, traditionally considered procedural devices, also refer to our embodied experience via conceptual metaphor. To verify this claim, four experiments were designed. The starting point for these experiments is that of prototypical conceptualization of causation as forced motion where CAUSATION IS FORCED MOVEMENT and CAUSES ARE FORCES. The first experiment analyzed the causal location metonymy (CAUSES ARE SOURCES), in which an initial location stands for a force and hence for a cause. The other three experiments focus on the CAUSES ARE FORCES metaphor.

9.1 CAUSES ARE SOURCES: Experiment 1

Based on the assumption that conceptualization is embodied and therefore inextricably linked to perception and experience, this first experiment attempts to provide further evidence for the interplay between spatial and perceptual processes, and the conceptualization of the notions of cause and consequence. As stated before, causality may be conceptualized from many points of view, one of which is the causal source metaphor. This metaphor implies "a causal path from an initial location to a resulting location" (Lakoff, 2003: 87), where the source is a determining factor for the final location/result.

Causal source metaphor

Source	>	the situation that provokes a certain effect / a force
Path	>	the particular course of action triggered by the source
Final location	>	resulting effect

Table 11. CAUSES ARE SOURCES METAPHOR

The causal source metaphor profiles the source and goal of an event, in the sense that there is an initial situation or event [source] that propels motion towards a specific final location [effect or consequence]. As a result, the notions of cause and consequence rely on force, motion and space to be understood. This is why we argue that activation of these two concepts might be favoured by using a spatially congruent prime in reading comprehension tasks, which would result in shorter reaction times in judging whether a pair of clauses linked by either a causal or consecutive connective were sensible or not.

9.1.1 Method

Participants:

A total of six native English speakers (4 of whom were right-handed) took part in a pilot experiment. All participants had normal or corrected to normal vision and none were dyslexic. Participants were asked to evaluate 100 sentences, half of which were intended to be sensible and half intended to be nonsensical. The subjects were told to judge whether these sentences made sense or not.

Materials: Linguistic stimuli

Sentences were randomly selected form the British National Corpus and manipulated so that the number of words per clause would not exceed 16 tokens. Sentences described cause-effect events that could be linked by either causal or consecutive relations, signaled linguistically by two discourse markers: *because* and *so* respectively. Half of the sentences were intended to make sense with the other half manipulated to describe nonsensical causal or consecutive relations. The following is an example:

Sensible sentences:

a. I paid for the taxi last night because Luc had forgotten his wallet at home.

b. I broke both my arms last week so I wasn't able to write anything.

Nonsensical sentences:

a. Eddie had broken his right arm because I played the match instead.

b. Amy was an extremely honest person so she always cheated a lot

Visual stimuli

Participants were presented with a dynamic spatial prime: a short schematic video showing a circle moving from the left of the screen to the right and either the source of trajectory traced by the circle or its final location were profiled by means of a flickering arrow. These two primes were intended to be congruent with our metaphorical conceptualization of cause and consequence respectively (see figures 31 and 32).

Sentences were presented in one block which contained equal number of logical and nonsensical sentences (25 sensible causal sentences, 25 sensible consecutive sentences and 50 nonsense sentences, half of which contained a causative marker (*because*) and the other half a consecutive marker (*so*). An equal number of prime-connector congruent and noncongruent combinations were used (50 combinations in which the sentence connector and the schematic video matched (because-source/so–goal) and 50 cases in which the sentence connector and the video mismatched (because-goal/so-source)). The design of the experiment was counterbalanced between subjects.

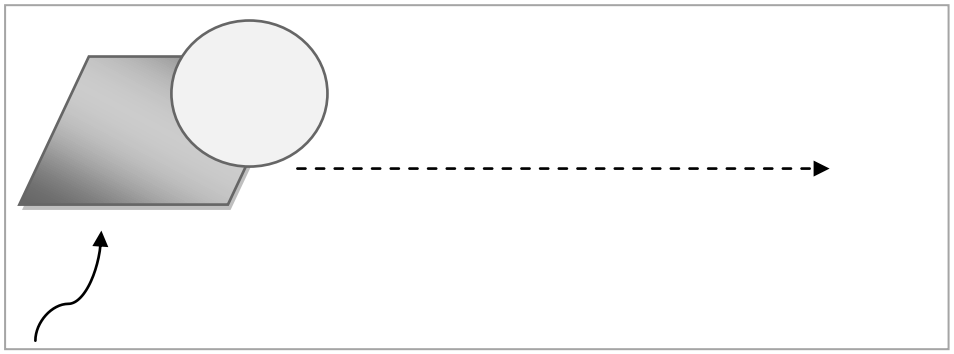


Figure 31. Source-cause prime

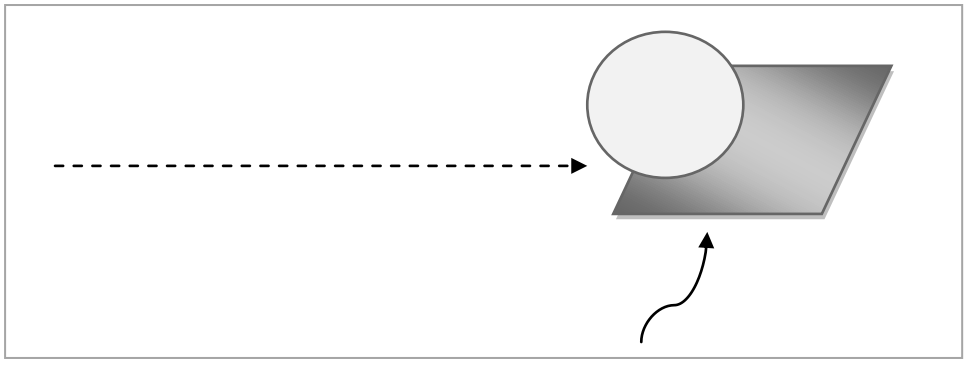


Figure 32. Goal-consequence prime

9.1.2 Procedure

The experiment used E-prime 2.0 software on a PC running Windows XP. The keyboard was used as the input device. Two keys, *k* and *d*, were chosen and covered with blue and yellow stickers, respectively, to avoid response interferences The neutral colors blue and yellow were chosen in an attempt to avoid positive or negative connotations that could lead to errors during the experiment.

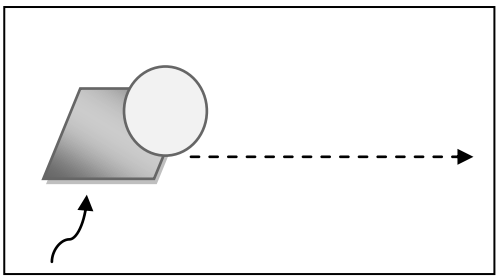
After being given on-screen instructions, participants were presented with a series of logical and nonsensical sentences and asked to decide as quickly and accurately as possible whether each sentence made sense or not. If the sentence made sense, subjects were told to press the blue button, and if not, the yellow button. The sentences were split into two parts separated by the prime. Subjects read the first part of the sentence. Immediately thereafter, they watched a dynamic visual stimulus and then read the second part of the sentence, which was headed by either a causal or consecutive connector shown in the middle of the screen. Participants first performed two sets of practice exercises to familiarize themselves with the procedure. Each block consisted of 20 trials run with filler stimuli. The practice trials followed the same format as the experimental trials except that errors and correct answers were displayed in the practice trials but not in the real trials.

Sensible sentences

Because

Congruent condition

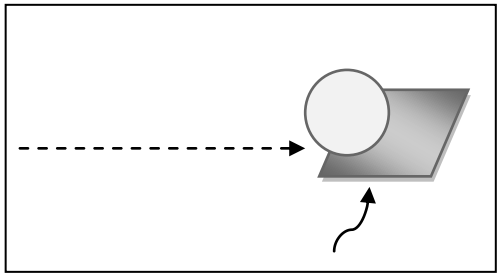
a) I paid for the taxi last night



because Luc had forgotten his wallet .

Incongruent condition

b) The phone was dead

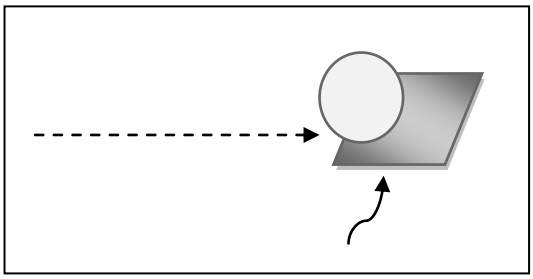


because the storm had affected the line.

So

Congruent condition

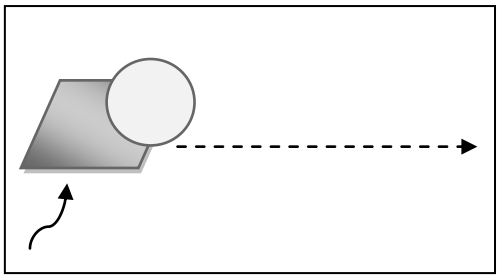
a) I broke both my arms last week



so I wasn't able to write anything

Incongruent condition

b) His Spanish was bad



so I gave him some lessons

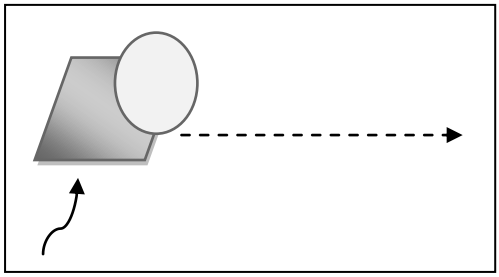
Figure 33: Source/goal experimental paradigm in discourse structure

Nonsense sentences

Because

Congruent condition

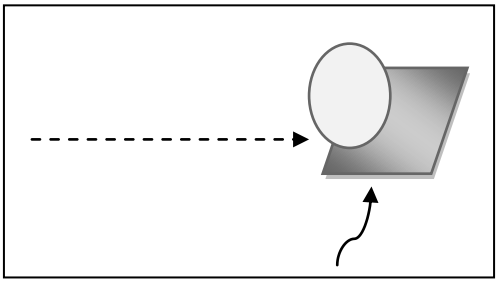
a) Eddie had broken his right arm



because I played the match instead

Incongruent condition

b) I trust you blindly

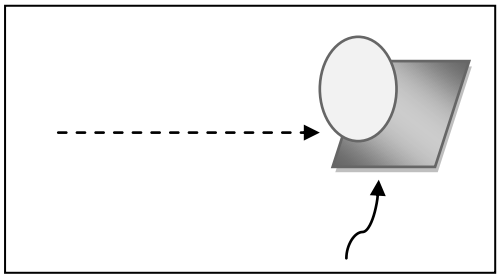


because you cheated on me

So

Congruent condition

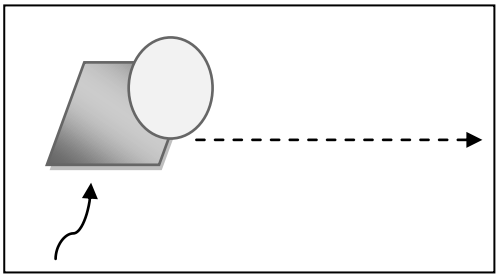
a)Amy was extremely honest



so she always cheated a lot

Incongruent condition

b) It was one of my favorites churches



so the interior was very ugly

Figure 34: Source/goal experimental paradigm in discourse structure.

Once the practice trials were completed, the participant began the real trial. While the subjects performed their evaluation of the sentences, they also watched a visual display as described above (i.e., with motion from left to right, with the source of motion highlighted in some instances and the goal in others). These images could be congruent or incongruent with the sentence connector (see figures 33 and 34).

The computer registered reaction times, that is, the time needed to read the first part of the sentence, watch the visual priming, read the second part of the sentence, comprehend and press the blue (yes) or yellow (no) keys The computer also recorded with key was pressed (either blue-yes or yellow-no).

9.1.3 Results

Analysis of reaction times showed that the interaction between animations and sentence type (causal or consecutive) was not significant. Consequently, we cannot draw any conclusions from this aspect of the experiment and, therefore, the result can be considered null. Among the many reasons that could explain this result, the most likely is related to the experimental design: in particular to the fact that subjects could judge whether the sentences made sense or not by ignoring the video (prime). In other words, although the prime was designed to influence task performance, it may not have achieved its aim. Another factor that might have influenced the result is that the vocabulary included in the sentences, which was taken from a corpus of fiction texts, might not have been sufficiently representative of the most

common words used in everyday English and, as a consequence, this could have affected latencies

	Response time	
	Match	Mismatch
Cause	1615.20 ms	1358.36 ms
Consequence	1591.54 ms	1700.71ms

Table 12. Mean response times (in ms) and proportion of correct responses for experiment 1

Temporal overlap and integrability between the prime and the sentence might also be determining factors in explaining the result of this experiment. According to Kaschak et al. (2005), when the perceptual stimulus and the sentence are processed sequentially (i.e., when there is no temporal overlap) and the visual stimulus and the content of the sentence are integratable (i.e., the prime is specific enough to be easily integrated in the simulation of a sentence) there should be a matching advantage. However, when there is no temporal overlap and the prime and content of the sentence cannot be integrated, a null effect may be observed. "The stimulus should have little or no effect on the processing of the sentence. Because the perceptual mechanisms can process the percept (i.e., the prime) and the simulation of the sentence independently due to the lack of temporal overlap and shared content between them" (Kaschak et al., 2005).

Given the null result of the first experiment, we designed a new set of experiments. This time, we concentrated on central member of the category of

causation CAUSES ARE FORCES, where the logic of force dynamics appears to map onto the logic of causation via conceptual metaphor. The purpose of this new set of experiments was to evaluate the capacity of this metaphor and its underlying images schemas to predict which of the stimuli observed by experimental subjects would be judged to depict causal or adversative relations.

9.2 CAUSES ARE FORCES: Experiments 2 and 3

According to Lakoff and Johnson (1999:177), the category of causation is radial and "the most fundamental case is the manipulation of objects by the direct application of force which results in motion or other physical change." If this is true, then the activation of the prototype by visual displays should guarantee a high degree of agreement between subjects in judging a situation to be causal or non-causal, as well as when selecting the most suitable linguistic encoding for that situation. Based on such assumptions, experiments 2 and 3 were developed.

9.2.1 Method

Participants:

Twenty five English speakers and thirty Spanish speakers took part in these two experiments. All participants had normal or corrected to normal vision and none reported being dyslexic. Participants were asked to view a series of dynamic displays and then rate the effectiveness of a set of sentences to

describe those displays. A detailed explanation of the experiment is given below.

Visual stimuli

Participants were presented with a total of 34 short videos made from an animation package (Adobe Flash CS5). Of these videos, 22 were designed to depict causative and concessive force-dynamic patterns by showing the forceful interaction between two entities (vehicles, boats or footballs). The remaining 12 videos were fillers. Frames illustrating the beginning, middle, and end of some of the animations used in the experiment are provided below, along with a brief explanation of the force-dynamic pattern underlying their design.

Six of the animations depicted **causal compulsion**. In each display, one of the objects (the agonist), appeared in a resting state in the middle of the screen while a second object (the antagonist) entered the scene to collide with the first object, thus causing the agonist's to move.

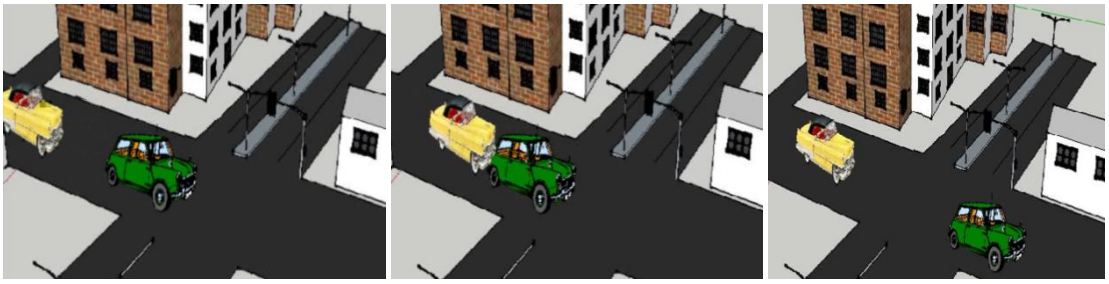


Figure 35. Compulsion pattern. The yellow car acts as the antagonist, which is more powerful than the agonist, the green car, and therefore it causes it to move upon impact.

Another set of six videos was designed to represent **concessive compulsion**. As in the previous case, the first stationary object was shown (for 2

seconds, on average) in the center of the screen at which time another entity appeared on the screen and crashed into the first object. However, unlike the previous experiment, the first object remained unmoved despite the impact.

Figure 36. Compulsion without result pattern. The red boat acts as the antagonist, which is less powerful than the agonist, the grey boat, and therefore it is not able to impose its force on it.

As described in the previous section, as a result of the interaction of two forces of unequal strength, one can either block or merely hinder the path of the other. This is what is known, respectively, as causative and concessive blockage.

In our experiment, the first situation was depicted through three videos that showed how an object (a car, boat or ball) obstructed the trajectory of another, whose progress was halted by the first object (Figure 37).

Figure 37. Causative blockage. The red boat acts as the antagonist, which is stronger than the agonist, the grey boat, and effectively blocks its path.

However, another group of animations showed an entity that was able to manifest its tendency towards motion by overcoming the blockage of an

opposing object. These displays illustrated cases of blockage without result or concessive blockage.

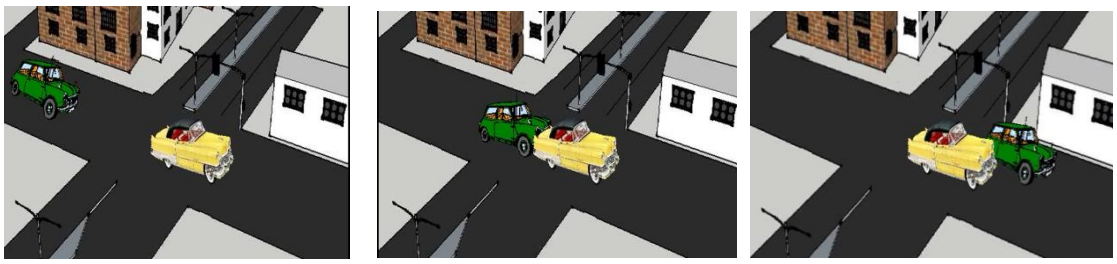


Figure 38. Blockage without result pattern. The yellow car acts as the antagonist that hinders the advance of the green car, which plays the role of the agonist.

Four more displays were designed to depict the force dynamic patterns of attraction and attraction without result. In the first case, a car (or boat) pulled on a rope attached to another car (or boat) until the former was able to set the latter in motion and move it towards itself.

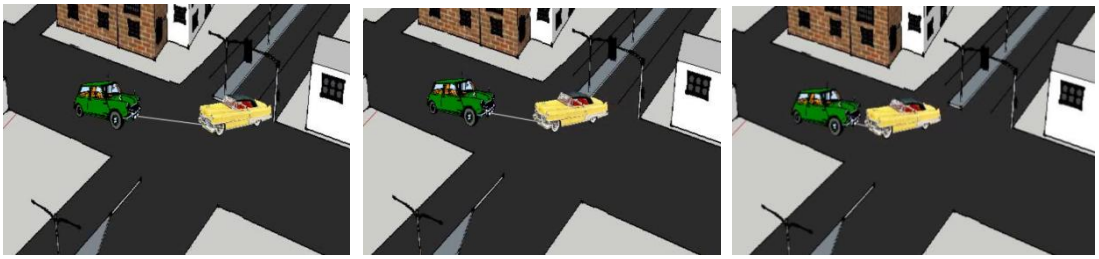


Figure 39. Attraction pattern. The green car acts as the antagonist, which is stronger than the agonist, the yellow car, and is able to pull on it.

In other videos (Figure 40), one object (the agonist) attempts to exert its force on the other, but without success, as the antagonist manifests its tendency towards rest and so remains in place despite being tugged vigorously.

Figure 40. Attraction without result pattern. The red boat acts as the antagonist, which being weaker than the agonist, the grey boat, is not able to tug it.

Finally, twelve more videos were used as fillers. In these cases, the visual stimuli did not depict any type of forceful interaction between entities. The objects appear simultaneously on the screen and act independently from each another. We predicted that subjects would not identify any agonist or antagonist and, therefore, the events represented in these videos would not be judged as either causative or concessive.

Figure 41. Null pattern. The yellow car moves forward on the right-hand side of the road while the green car moves backwards on the left.

Once the visual stimuli had been created, we proceeded to elaborate several possible linguistic descriptions for each of the stimuli. We hypothesized that subjects would choose descriptions containing the connector *because* when the displays showed compulsion, blockage, or attraction and descriptions containing the connector *although* when ineffective compulsion, blockage, or

attraction was depicted. In the remaining cases, we expected that participants would choose the option, *none of the above*.

Linguistic stimuli

English and Spanish, like other languages, provide several ways of expressing causal and concessive relations including conjunctions (e.g., because, although) and prepositions (because of, thanks to, despite, in spite of). While all these structures can be used to encode the notions of CAUSE and CONCESSION, in this study only conjunctions are examined. We created two linguistic descriptions that included causal and concessive conjunctions for each of the visual stimuli shown to participants. The only difference between the two sentences was the connector (either *because/porque* or *although/aunque)* linking the main and subordinate clauses. One of the sentences was always congruent with the event depicted in the video whereas the other one was not. Moreover, subjects were also provided with a third option labeled "none of the above" which we expected participants to choose when confronted with fillers. The following is an example:

After watching a video depicting one car crashing into another to cause the second car to move upon impact (compulsion pattern), participants were presented with the sentences below (the first is the best description of the event).

1. The green car crossed the intersection **because** the yellow car hit it from behind.

2. The green car crossed the intersection **although** the yellow car hit it from behind.

3. None of the above.

9.2.2 Procedure

The experiment was run using E-prime 2.0 software on a PC running Windows XP and the keyboard was used as the input device.

After being given on-screen instructions, subjects were presented with the 34 different animations which were shown in random order. Then subjects were asked to choose the sentence that best described what they have watch by pressing 1, if the first sentence was the best description; 2, if the best description was the second sentence or 3, when neither the first nor the second clauses could describe the event depicted in the video.

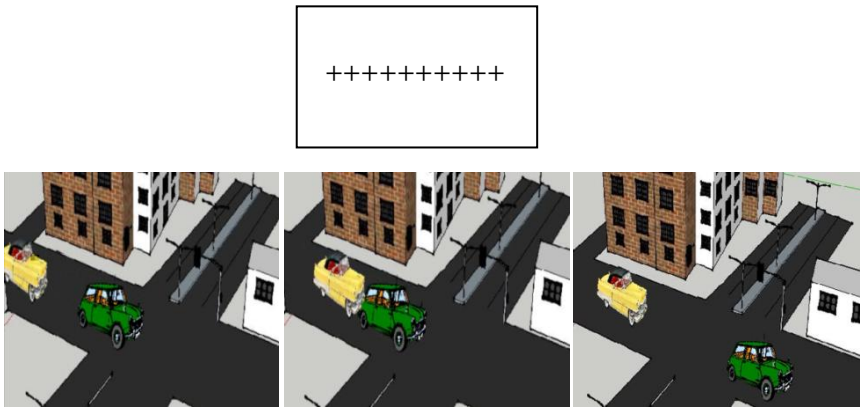


Figure 42. Example of a trial. The first phase is that of fixation; the second, the visual stimulus; and third the possible descriptions the participants could use to describe the visual stimulus.

As in the first experiment, all participants partook in a set of practice exercises to familiarize themselves with the procedure. In this experiment, subjects completed four trial runs with filler stimuli. The practice trials followed the same format as the trials in the rest of the experiment, except that animations were not randomized.

Once the participants had been familiarized with the task, they then proceeded to choose the best sentence to describe the visual stimuli. A total of 81 sentences (including the option "none of the above") were shown. The computer registered which key was pressed for each trial and judgment time.

9.2.3 Results and Discussion

These experiments investigated whether the force dynamic model could predict which situations would be judged to be causal, concessive or unclassifiable and whether the language (i.e., English or Spanish) affected the predictions. Our results confirmed the predictions of the model. Tables 13 and 14 show the proportion of times people chose each of the 3 options for each configuration of forces.

	CAUSE			CONCESSION			
Configuration of forces	Compulsion	Attraction	Blockage	Compulsion Without result	Attraction Without result	Blockage without result	Unclassifiable
Porque	92.5%	95%	94.4%	-	-	-	-
Aunque	-	-	-	82.5%	78.3%	73.3%	-
Ninguna	-	-	-	-	-	-	80%

Table 13. Percentage of times Spanish speakers chose each of the three possible options for each of the force patterns.

	CAUSE			CONCESSION			
Configuration of forces	Compulsion	Attraction	Blockage	Compulsion Without result	Attraction Without result	Blockage without result	Unclassifiable
Because	96.25%	97.5%	96.67%	-	-	-	-
Although	-	-	-	85%	92.5%	92%	-
Neither	-	-	-	-	-	-	68%

Table 14. Percentage of times English speakers chose each of the three possible options for each of the force patterns.

Spanish speakers correctly categorized as causal or concessive 83.5% of the events. Only 16.5% of events were erroneously classified. These results support the accuracy of the model in distinguishing between causal and concessiverelations.

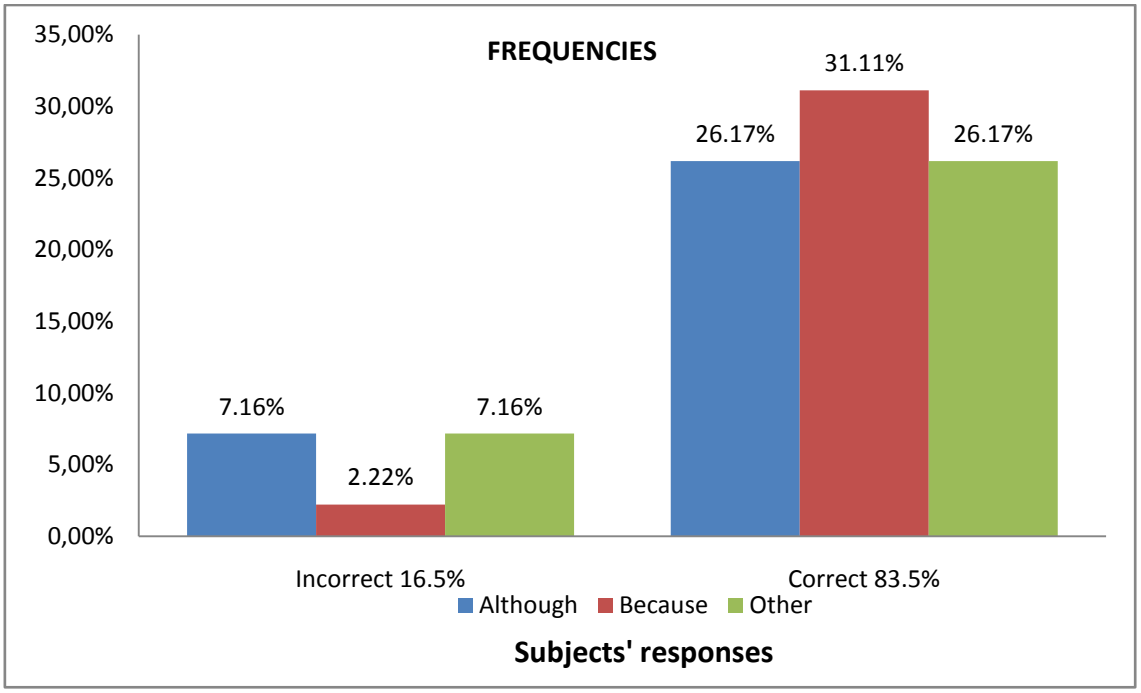


Figure 43. Frequencies

Results for English speaking participants were similar and consistent with the predictions of the force dynamics theory: 81.6% of events were identified correctly vs. only 18.4% incorrectly.

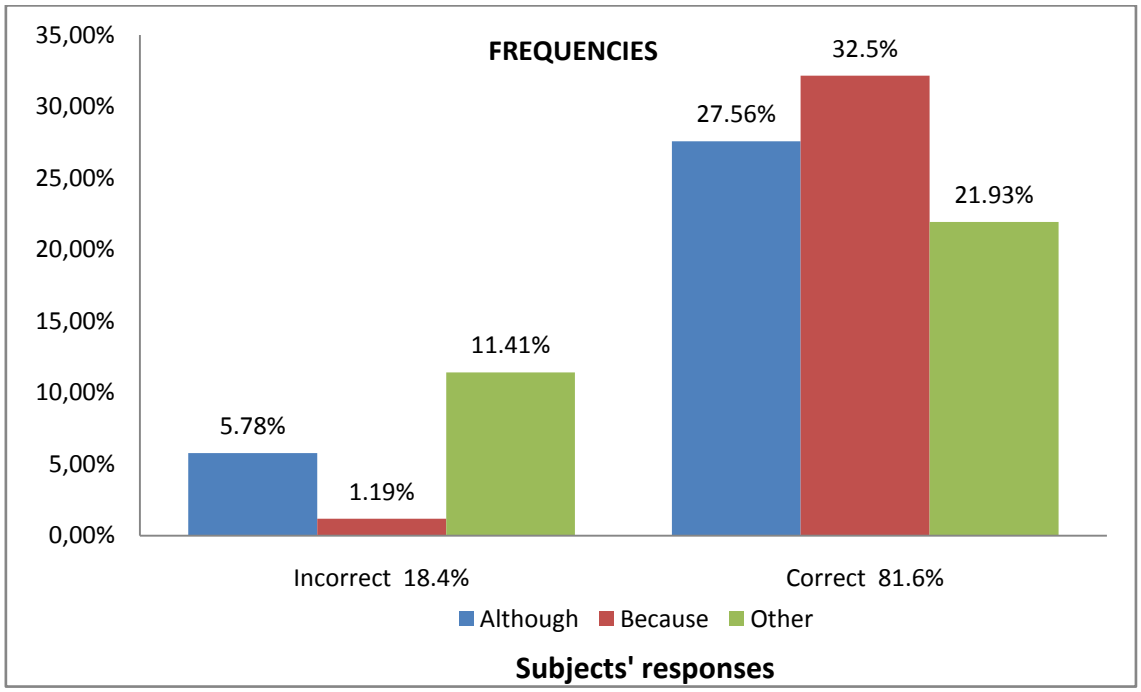


Figure 44. Frequencies

A chi-square test of independence, performed to examine the relation between the factors Configuration Type (i.e., configuration of forces) and Response Type (i.e., *because*, *although* or *none of the above*), revealed that the relation between these variables was significant in both experiments, [χ^2 (2, N = 30) = 28.614 p <.00] and [χ^2 (2, N = 25) = 70.79, p<.00], respectively.

Chi-Square Tests/ Spanish participants

	Value	Df	Asymp. Sig. (2 sided)
Pearson Chi-Square	28.614[a]	2	.000
Likelihood Ratio	32.531	2	.000
Linear-by-Linear Association	.000	1	1.000
N of Valid Cases	810		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 44.67.

Chi-Square Tests/ English participants

	Value	Df	Asymp. Sig. (2 sided)
Pearson Chi-Square	70.796[a]	2	.000
Likelihood Ratio	78.168	2	.000
Linear-by-Linear Association	21.367	1	.000
N of Valid Cases	675		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 41.33.

Table 15. Chi Square tests for Spanish and English participants

Results from Pearson's chi-square test confirm that the force-dynamic model agrees with the observed frequencies, as we observed no significant differences between the predictions of the model and the observed frequencies.

As expected, results showed that Spanish participants chose *porque* 'because'—as opposed to *aunque* 'although'—for the animations in which vehicles, boats or balls conformed to the patterns of compulsion, attraction or blockage and the antagonist was able to impose is force on the agonist. Therefore, subjects judged as causal those animations that followed the N-Y-Y structure which describes the intrinsic tendency of the agonist, the agonist/antagonist opposition and the occurrence of result. (See Table 16)

	Patient tendency for the resultant state	Antagonist-Agonist opposition	Occurrence of Result
Cause	N	Y	Y

Table 16. Causal pattern

Similarly, participants chose *aunque* when the entities conformed to the patterns of compulsion, attraction or blockage, and the agonist was stronger than the antagonist. As a result, even though the agonist encountered opposition from the antagonist, it managed to impose its tendency. Therefore subjects judged as concessive the Y-Y-Y type of occurrences (see table 17).

	Patient tendency for the resultant state	Antagonist-Agonist opposition	Occurrence of Result
Concession	Y	Y	Y

Table 17. Concessive pattern

The Pearson chi-square test performed for each of the force dynamic configurations also supported the initial predictions: force dynamics theory is able to predict fine-grained distinctions within the general category of causation. So, for causative vs. concessive compulsion occurrences, statistical analysis showed that there was a significant relationship between the agonist tendency, agonist/antagonist opposition, and result and the connector chosen by participants: *porque* for effective compulsion and *aunque* for compulsion without result, [$\chi^2(1, N=30) = 5.48, p = 0.0019$]. In the case of causative and concessive attraction, subjects were more likely to select *porque* when the antagonist was able to force the agonist to move towards itself and *aunque* when the agonist remained in place despite the force exerted by antagonist against it [$\chi^2(1, N=30) = 7.21, p = 0.015$]. Finally, for causative and concessive blockage [$\chi^2(1, N=30) = 14.84, p = 0.001$], participants chose *porque* when the antagonist provided effective blockage of the agonist's intrinsic tendency, and they selected *aunque* when the antagonist only hindered the agonist's tendency.

Results from the English-language experiments strongly agreed with the model and with Wolff's findings on causative verbs and the different configurations of forces underlying verbs such as *cause* and *prevent*. Data analysis revealed that most subjects categorized configurations that conformed to the structure N-Y-Y as causative, and Y-Y-Y patterns as concessive. Participants chose *because* when the tendency of the agonist was towards rest, which was opposed and overcome by the antagonist, causing the agonist to

move; similarly, participants chose *although* when the antagonist was not strong enough to make the agonist move, [$\chi^2(1, N=25) = 12.12, p = 0.005$]. In attraction patterns, the outcome of the interaction between the agonist and the antagonist was the determining factor in participants' choice. When the agonist was set in motion by the pulling force of the antagonist, subjects chose sentences with the connector *because* as the best description, as opposed to *although*, which was chosen when the antagonist was weaker than the agonist and was not able to move it towards itself, [$\chi^2(1, N=25) = 4, p = 0.045$]. Finally, results indicated a significant preference for the marker *because* in situations of blockage if the tendency of the agonist towards motion was blocked by the antagonist, and *although* was preferred if the agonist managed to continue its path [$\chi^2(1, N=25) = 6.82, p = 0.009$].

These experiments provide empirical support for the involvement of force dynamics in our conceptualization of causation and concession. The results of the experiments show that people's linguistic descriptions of a set of realistic animations fit with the expectations triggered by the configuration of forces that underlie their design. Moreover, these findings confirm that the agonist tendency, the relative strength of the agonist and the antagonist and the outcome of their interaction (i.e., motion or rest), are crucial for their categorization in both English and Spanish, since those three factors act as the scaffolding for our conceptualization of causative and concessive events and determine its linguistic expression.

Our findings also appear to support the idea, as Lakoff and Johnson argue in *Philosophy in the Flesh* (1999), that causation is a radial category. The most central or prototypical instance of a radial category is "the direct application of force resulting in motion or other physical change" (Lakoff &Johson, 1999: 253). Variations of this fundamental case of causation result in less prototypical or peripheral forms that differ in their "degree of directness or in whether the effect is positive or negative"[44] (Lakoff & Johson, 1999: 77). (See Figure 45.)

To explore the radial nature of causation we analyzed subjects' responses and reaction times, since accuracy and speed of reaction are considered effective indicators of prototypicality.

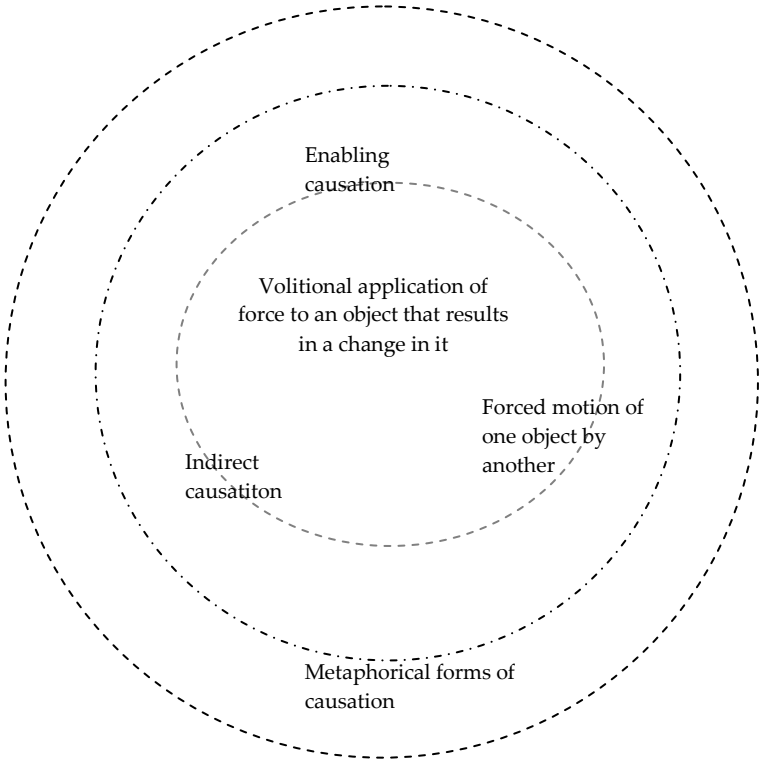


Figure 45.The radial category of causation

[44] Herein the effect is considered positive here if it implies motion and negative if the application of force does not result in motion.

Some studies on prototypes suggest that people tend to prefer highly prototypical stimuli over more unusual exemplars. Posner and Keele, for example, found that subjects classify prototypical random dot patterns with greater speed and efficiency than distorted patterns (Posner & Keele, 1968). Similarly, Reber and colleagues provided evidence that fewer neural resources are recruited on perceiving prototypical patterns (Reber et al., 1998a, 1998b).

If there is a positive correlation between prototypicality and accuracy, as the above-mentioned studies suggest, then the results of our study indicate that causal events are more prototypical, central to the category, than concessive events, since they reveal lower error rates in their classification. In experiments 1 and 2, participants responded accurately in 93.3% (experiment 1) and 96.4% (experiment 2) of cases in which the animations represented causal events (effective compulsion, blockage or attraction). In contrast, the match rate was only 78.5% and 85%, respectively, when concessive events (ineffective forceful interactions) were depicted

Given the findings described above (i.e., that causal events were more accurately matched with their linguistic description than concessive ones), we proceeded to analyze the response latencies to determine whether reaction times in causal events are shorter. According to the literature, prototypicality should result in faster reaction times. Dambacher et al. (2009), for example, found that predictable stimuli elicited faster reaction times than less predictable stimuli, probably because the brain builds predictions of forthcoming events to

decrease the processing load. Another explanation might be that subjects can apply different level of analysis to a sequence, that is, they "are capable of segmenting the same behavior into small components of actions or into larger, grosser components" (Harvey, 1976: 223). For example, we might see a person get up from his chair, walk to a door and close it, or we might see the same sequence as a single action (closing the door). According to Harvey "one factor which affects unit size [i.e. segmentation] is that of predictability" (p. 231). In general, unit analysis for unexpected actions tends to be closer to fine-unit analysis, whereas for highly organized sequences it is closer to gross-units. This suggests that matching events that contain unexpected or less prototypical actions with their linguistic description requires a more complex analysis and, consequently, more time.

Research in the field of textual coherence has found that causal relations are processed faster than temporal and additive relations (Louwerse, 2001; Caron et al., 1988; Sanders & Noordman, 2000), likely due to the existence of a cognitive representation of causal relations (Sanders & Noodman, 2000). Polarity has also been shown to influence processing. Wason and Johnson-Laird, among others, have found that utterances with negative polarity are processed more slowly than positive utterances s (Wason & Johnson-Laird, 1972; Clark, 1974). Connectives are considered to have a positive polarity when the conjoined clause depicts events that are continuous with the main clause; otherwise, the polarity is negative. Thus, according to Sanders, *although* is

prototypical in negative polarity causal relations, which typically involve a violation of expectation; *because*, in contrast, is prototypical for positive polarity causal relations (Knott & Sanders, 1998).

In the context of the studies discussed above, we analyzed the mean reaction times of participants in experiments 2 and 3 to assess whether the perception and processing of causative and concessive events resulted in different reaction rates. We theorized that differences in reaction times might be indicative of the degree of prototypicality. A significant difference in reaction times would confirm that clause type and polarity make a difference in processing. Therefore, even though the study was not specifically designed to test reaction times, the software made it possible to collect the necessary data, mean reaction times (RT) were calculated for each subject for each condition (i.e., causal or concessive) and for accurate and inaccurate responses. In experiment 1, testing revealed that data in the causal condition were processed slightly faster than data in the concessive condition. Mean reaction times for Spanish speakers were 7791.7955ms (SD± 2366.04028) and 7893.1090ms (SD± 2443.49399) for the causative and the concessive conditions, respectively.

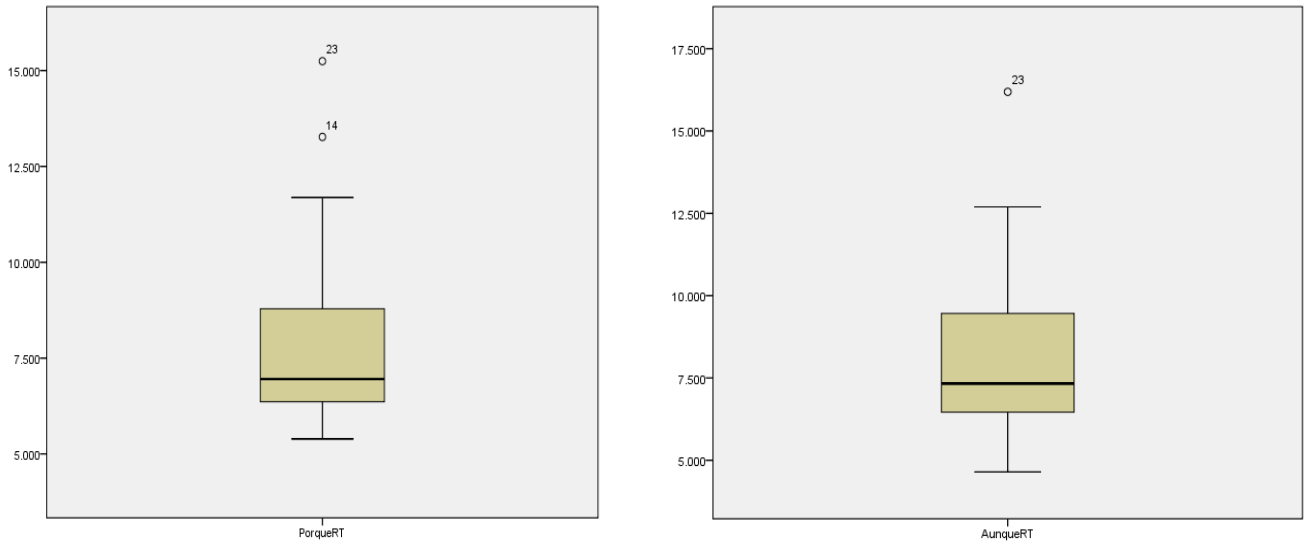


Figure. 46 Reaction times for causal and concessive events.

In contrast, results in English speakers showed a different tendency. Mean reaction times for causative events was slightly higher, [6930.2578 (SD± 2191.22688)] than for concessive events [6667.6267 (SD± 1728.35914)].

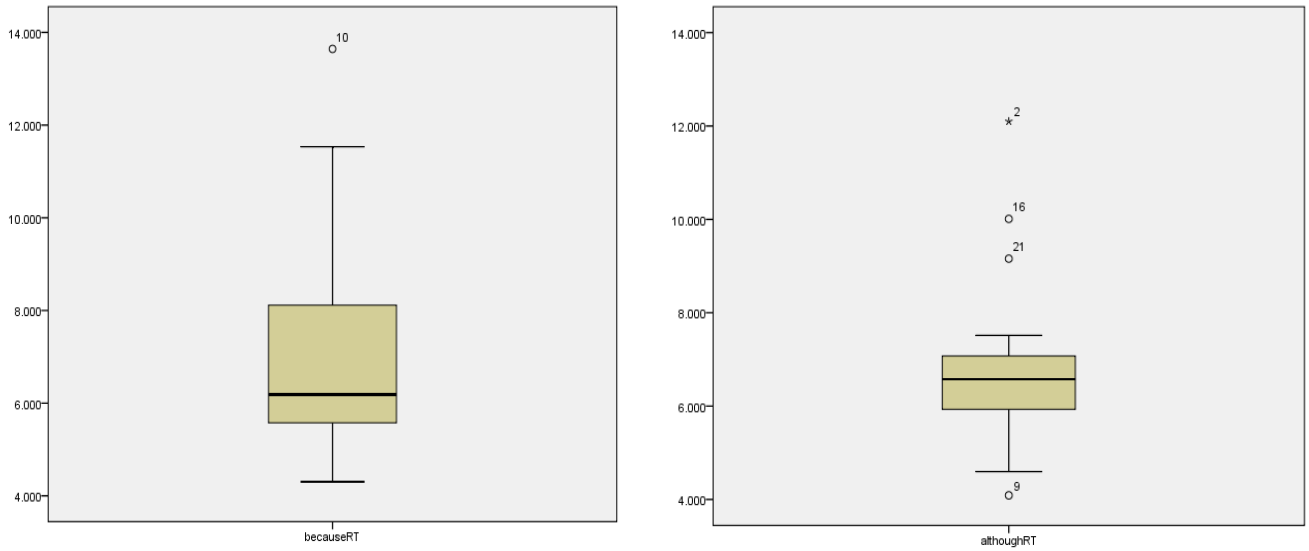


Figure. 47 Reaction times for causal and concessive events.

The Kolmogorov-Smirnov Test for normality showed that the mean reaction times had a normal distribution around the mean in both experiments. (See tables 18 and 19). Next, I used a T-test for two dependent

samples to determine if differences in RT were statistically significant. I found no significant differences in mean reaction times between causative and concessive conditions in experiment 1 (t = -429, p = 0.671), nor in experiment 2 (t = 807, p = 0.427). These results are consistent with the findings reported by de Vega (2005), who evaluated in an on-line study whether subjects processed sentences (in Spanish) with causal markers faster than clauses with adversative ones. Like our study, de Vega found no significant difference in processing speeds, nor did he find a facilitative effect. The only significant difference in that study was that, for both types of clause, participants read the second clause much slower when the connective was inappropriate.

One-Sample Kolmogorov-Smirnov Test for Spanish speakers RT

		PorqueRT	AunqueRT
N		30	30
Normal Parameters[a]	Mean	7791.7955	7893.1090
	Std. Deviation	2366.04028	2443.49399
Most Extreme Differences	Absolute	.205	.168
	Positive	.205	.168
	Negative	-.155	-.092
Kolmogorov-Smirnov Z		1.124	.092
Asymp. Sig. (2-tailed)		.160	.363

a.Test distribution is Normal.

Table 18 Kolmogorov –Smirnov Test for Spanish participants

One-Sample Kolmogorov-Smirnov Test for English speakers RT

		BecauseRT	AlthoughRT
N		25	25
Normal Parameters[a]	Mean	6930.2578	6667.6267
	Std. Deviation	2191.22688	1728.35914
Most Extreme Differences	Absolute	.193	.194
	Positive	.193	.194
	Negative	-.120	-.095
Kolmogorov-Smirnov Z		.963	.971
Asymp. Sig. (2-tailed)		.312	.302

a.Test distribution is Normal.

Table 19 Kolmogorov –Smirnov Test for English participants

The neutralization of the processing advantage of causal relations and positive polarity, supported by other studies, can be motivated by another parameter: *direction*. Direction is the order in which events appear in the sentences. Connectors can be classified either as forward or backward markers. Forward connectives maintain the iconic sequence of events in the world (e.g., The street was blocked, *so* the car had to stop); whereas backward connectives change the sequential order of events (e.g., The car had to stop, *because* the street was blocked). This factor has also been proven to have a significant effect on processing time. Noordman (2001), for example, found that people are faster at processing causally related sentences that follow the basic order (cause-consequence) vs. sentences that follow the nonbasic order (consequence-cause).

This could explain the results of our analysis, since *because* and *although* are backward connectives that follow the consequence-cause pattern.

In sum, the findings of experiments 2 and 3 provide more data in the study of causal and concessive relations and in the conceptualization of these relations. We have empirically confirmed that force-dynamics theory accurately describes causal and concessive relations and can predict the types of events that subjects will judge to be causal or concessive on the basis of three parameters: the agonist intrinsic tendency toward motion or rest, the agonist-antagonist opposition, and the outcome of their interaction. The lower error rates observed in subjects' categorization of causal relations suggest that such relations are more central than concessive relations. The fact that we found no significant differences in processing time between causal and concessive relations, despite the well-known processing advantage of causal clauses, is probably due to the fact that because-clauses, like although-clauses, do not keep the iconic sequence of events in the world, thus slowing down processing times.

9.3 Do connectives encode force themselves? Experiment 4

The fourth experiment, conducted in Spanish, attempted to promote the use of subjects' general knowledge about causation and concession and avoid the use of verbs that specified forced movement. The objective was to test whether subjects' choices were conditioned by the presence of force dynamic

verbs in the sentence of or by the interplay between the animation and the sentence connective (i.e., porque 'because' and *aunque* 'although').

9.3.1 Method

Participants:

Thirty Spanish speakers with normal or corrected-to-normal visual acuity participated in the experiment. All subjects were naive as to the specific experimental question. Each participant judged the effectiveness of a total of 27 sentences to describe the content of an equal number of dynamic displays that they have previously viewed.

Materials

The animations used here were the same as in Experiments 2 and 3. Likewise, the sentences used in experiments 2 and 3 were adapted to include a nonce verb in their coda, which replaced the force dynamic verbs used in the previous experiments: e.g "El coche verde cruzó la intersección porque el coche amarillo lo planqueó por detrás" ('The green car crossed the intersection because the yellow car [nonce verb] it from behind) vs. "El coche verde cruzó la intersección aunque el coche amarillo lo planqueó por detrás" ('The green car crossed the intersection although the yellow car [nonce verb] it from behind).

A total of nine nonce verbs were created by using the guidelines of the program "Cognitiva.Lectoescritura", which has been designed to assess processes of attention, visual discrimination, decodification and assimilation of

the Spanish language syllabic structure in children. The resultant words consisted of a minimum of 2 syllables that followed orthographical rules, using the most common syllabic structures in Spanish, cv, cvc, ccv, and its phonotactic constraints (Alarcos Llorach, 1950). This can be seen in Table 20.

	Compulsion	Blockage	Attraction	Unspecified
Nonce verbs	Plucar	Trafegar	Vimar	Llumir
	Trondear	Dispearse		Trondar
	Planquear			Bandar

Table 20. The syllabic structure of the pseudoverbs complied with the Spanish classification of syllables as directas (cv) mixtas (cvc) and sinfones (ccv).

The linguistic stimuli intended to describe four types of situations: causative events that implied compulsion attraction or blockage (nine sentences); concessive events in which no effect was obtained despite the forceful interaction of the entities (nine sentences). The third and final set of nine sentences served as catch trials (participants were expected to choose: *ninguna de las anteriores* 'none of the above').

9.3.2 Procedure

The general trial structure was identical in all three experiments. As in the case of the experiments described above, experiment 3 was run using E-prime 2.0 software on a PC running Windows XP and the keyboard was used as

the input device. Each trial started with the presentation of a black cross in the middle of the screen. Participants were instructed to maintain focus on the cross. After 500 ms, a video was shown for approximately 500 ms and immediately replaced by three sentences. Participants were asked to read the sentences and choose the one that best described what they had seen.

The order of the animations was randomized except for those included in the practice block and the choices always included a sentence with the causal connective, *porque* 'because'; another sentence with the concessive connector, *aunque* 'although', and *ninguna de las anteriores* 'none of the above.' Participants were required to respond by pressing one of three response keys (1, 2, 3) with whichever hand they preferred to use. The computer then registered the key pressed and the response time.

9.3.3 Results and discussion

Once again, the predictions of the model were confirmed by our results. Table 21 shows the proportion of times participants chose each of the three options for each configuration of forces (compulsion, attraction and blockage with or without result) and for unspecified events.

The results revealed that subjects can infer patterns of force between consecutive sentences guided only by a causal or concessive marker. This reinforced our hypothesis that causal and concessive connectives independently encode force dynamic relations. The fact that subjects were able to make a

correct choice even when the subordinate clause contained a nonsense verb—which provided no information about the type of forceful interaction between the agonist and the antagonist (i.e. compulsion, attraction or blockage)—confirms that it is the causal or concessive marker that triggers readers' expectations and inferences. Moreover, the marker restricts the possible range of connections that can be established. As Talmy (1983) asserted, markers anticipate the relative strength of the antagonist and the intrinsic tendency of the agonist. Causal connectives introduce a stronger antagonist, while concessive connectives announce a weaker antagonist.

As shown in table 21, when the agonist showed resistance to move but ultimately did so due to pressure from the antagonist, participants mainly chose sentences whose subordinate clause was headed by a causal marker. However, for events that depicted ineffective compulsion, attraction or blockage, participants generally chose sentences containing the concessive connector *aunque* as the best description of the event.

	CAUSE			CONCESSION			
Configuration of forces	Compulsion	Attraction	Blockage	Compulsion Without result	Attraction Without result	Blockage without result	Unclassifiable
Porque	93.33%	98.33%	92.22%	-	-	-	-
Aunque	-	-	-	85%	83.3%	65.3%	-
Ninguna	-	-	-	-	-	-	69%

Table 21. Percentage of times Spanish speakers correctly chose each of the three possible options for each of the configurations of force.

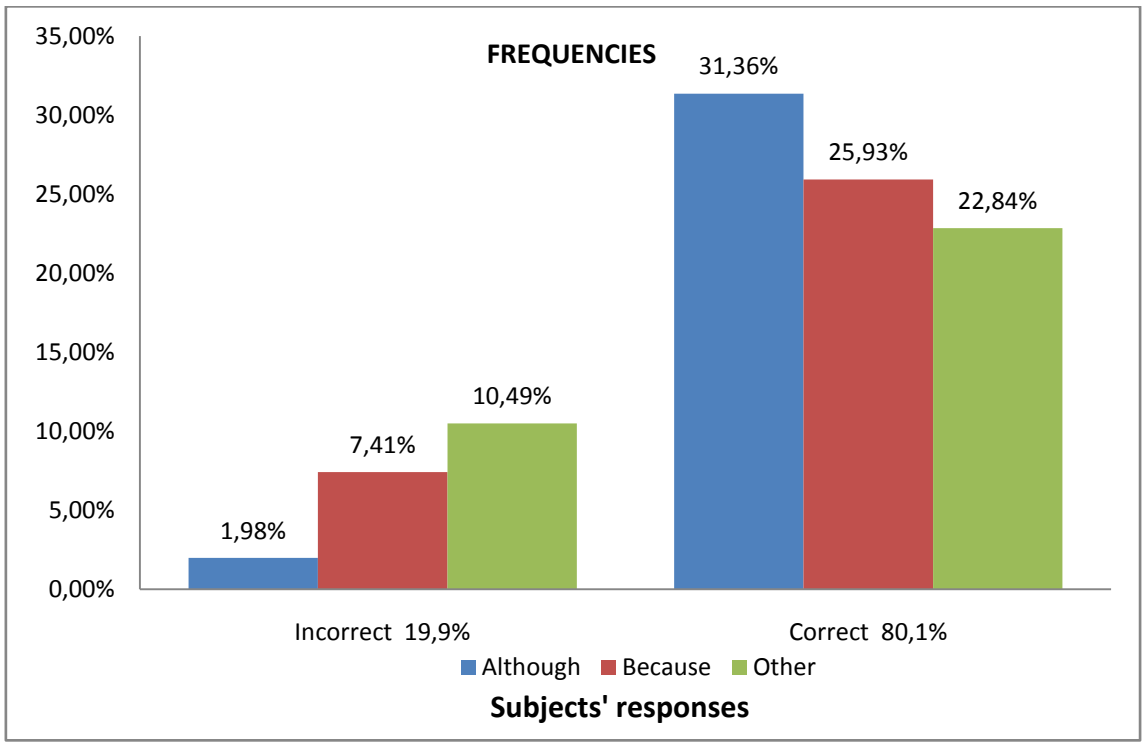


Figure 48. Frequencies

The likelihood that participants made the correct choice by chance alone was less than 0.0% according to results of the chi-square test of independence. The association between the configuration of forces shown by the videos and subjects' responses was significant [χ^2 (2, N = 30) = 56.760 p <0.00]

Chi-Square Tests for Spanish participants

	Value	Df	Asymp. Sig. (2 sided)
Pearson Chi-Square	56.760[a]	2	.000
Likelihood Ratio	64.006	2	.000
Linear-by-Linear Association	7.259	1	.007
N of Valid Cases	810		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 53.67

Table 22 Chi-Square test for Spanish participants

As in experiments 1 and 2, findings from the Pearson chi-square test showed that the force dynamics configurations were significantly related to the subjects' responses. This supports the validity of the force dynamic model to predict the range of situations that people are likely to judge as causal or concessive. For causative vs. concessive compulsion, there was a significant relationship between the configuration type and response type dimensions [$\chi^2(1, N=30) = 54.31, p = 0.037$]. For causative and concessive attraction, the result was similar [$\chi^2(1, N=30) = 8.11, p = 0.004$], with participants selecting *porque (because)* when the antagonist overcame the agonist's resistance to movement by pulling on it and *aunque* 'although' when the agonist resisted the tugs of the antagonist. Finally, for causative and concessive blockage, findings were also significant [$\chi^2(1, N=30) = 20.46, p = 0.001$], with participants choosing *porque* when the antagonist completely blocked the agonist, and selecting *aunque* when the antagonist only hindered the agonist's way.

These findings are consistent with the idea that discourse markers are not lexically empty function words but are actually semantically rich concepts that trigger certain expectations and inferences and that contain not only information from previous sentences but also general knowledge. In causal and concessive relations, this information also includes our knowledge of force dynamics.

Finally, as in experiments 1 and 2, we also analyzed subjects' responses and reaction times to assess the existence of prototypicality and the processing

advantage of causal coherence relations. Once again, we found that participants were able to correctly match the animation to the linguistic description with a high degree of accuracy (94.07%) when the animations represented effective compulsion, attraction or blockage (i.e. causal events). This result confirms the prediction of force dynamics theory. The match rate was lower (77.7 %) when the animations depicted forceful interactions that did not yield any result (i.e. concessive events). As in experiments 1 and 2, the higher accuracy rate obtained in causal events strongly suggests that causal events are more prototypical than concessive ones.

Statistical analysis of response latencies found no significant differences in the perception and processing of causative and concessive events. Mean reaction times were 9132.0257ms (SD± 3003.98522) and 9168.7777ms (SD±3215.6222) for the causative and the concessive conditions, respectively. The T-test confirmed that there were no significant differences in mean choice reaction times between causative and concessive conditions ($t = -083$, $p = 0.93$). Thus, neither manifested a processing advantage.

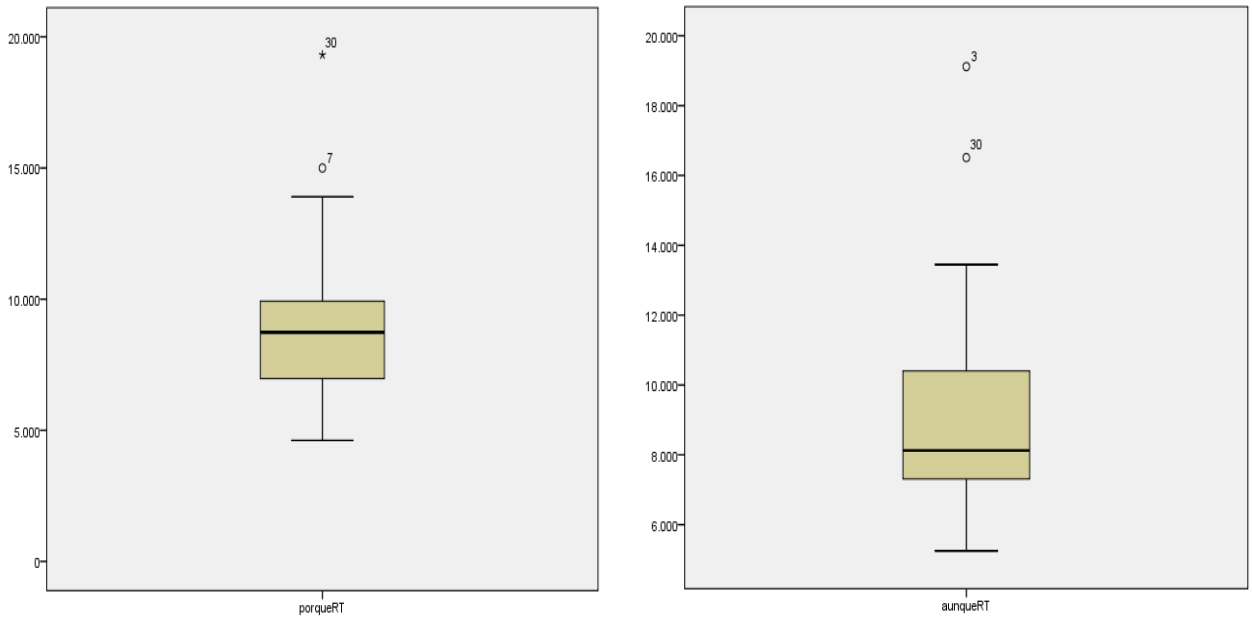


Figure 49. Reaction times for causal and concessive events.

Overall, experiment 4 empirically supports the notion that the force dynamics image schemas underlying the structure of causal and concessive events determine their conceptualization and linguistic coding. Moreover, this experiment also provided evidence to suggest that causal and concessive relations are not only encoded in verbs, as shown by Wolff, but also in the connectives themselves, which limit and identify relevant assumptions and expectations, thus leading to an appropriate interpretation of the communication.

In short, the present study emphasizes the embodied representational basis of causation and concession, given the fact that they appear to be grounded in more concrete concepts such as compulsion, attraction or blockage. Image schemas, therefore, are fundamental to interpreting their meaning because they capture our embodied experience with forces, which we then rely

on to draw inferences and generate expectations. Consequently, understanding the role of these image schemas may be useful to predict discourse behavior and thus improve textual processing.

10. GENERAL CONCLUSIONS

This thesis consists of in-depth research into the contribution of embodied experience to the integration of meaning (i.e., global and local coherence) as well as into the corporeal basis of abstract non-spatial language, particularly causal and concessive markers. In this final section, I summarize the main contributions of this research. I also discuss how this thesis contributes to validating previous findings on this topic and to providing evidence that the embodied substratum of human conceptualization and abstract notions can be traced across languages, specifically English and Spanish. Suggestions for future research based on the present study will be given. Finally, the implications of this thesis will be discussed.

10.1 Main contributions

This thesis started from the premise that human cognition is embodied and meaning can be equated to conceptualization, a process whereby words serve as prompts for an array of conceptual operations and the recruitment of background knowledge (Evans & Green, 2006). In this context, the main source of meaning is human bodily and social experience, which is transformed into skeletal mental representations known as image schemas and extended to abstract notions by means of a basic cognitive operation such as conceptual metaphor Langacker (1987, 1991), Lakoff (1987), Johnson (1987) Talmy (2002a, 2002b).

The evidence presented here and by other authors contributes to puts an end to the classical symbol grounding problem (i.e., the conception of language as a series of auditory and visual symbols that are randomly linked to their referents and meaning). Language is not just a mirror to the external world, but instead it is constrained by the nature of our bodies and unavoidably incorporates our embodied experience: perception, motion, exertion of force, etc. Image schemas and conceptual metaphor are basic carriers of meaning that account for the sense of concrete and abstract concepts; language is the instrument used to encode conceptual structure and externalize our vision of the world.

Since we do not usually communicate with isolated words but rather in strings of clauses that must be connected to one another to be meaningful and since we cannot say or attend to everything at once (cf. Winter, 1986:88), it stands to reason that structure is necessary to communicate meaning. Thus, in any analysis of what makes a text meaningful, coherence must be considered a fundamental semantic notion whose study requires the same methods and descriptive constructs as independent words (Langacker, 2008).

Discourse studies distinguish between two types of coherence relations: global and local coherence. The first has to do with the organization of the text macrostructure and the second refers to the mechanisms that promote interclausal integration. Our initial hypothesis was that this division is unnatural since both types of coherence are metaphorical in nature and

therefore have embodied foundations. As a result, we argued that text macrostructure is shaped and constrained by the way we conceptualize the abstract notion of discourse as motion is space, and text microstructure (i.e., local coherence), when based on causative patterns, is shaped and constrained by our metaphorical conceptualization of causes as forces.

In sum, it seems fair to assume that our metaphorical conceptualization of discourse is among the basic organizational mechanisms that shape the macrostructure of a text and thus plays a decisive role in the sequencing of information. In other words, the claim proposed in this thesis is that the metaphorical conceptualization of discourse as a form of motion along a path is a structural factor so powerful that is able to shape text organization and unify discourse patterns across disciplines beyond the conventions of genre and personal rhetoric style.

The qualitative analysis of a corpus of abstracts belonging to disciplines that range from science to liberal arts confirms that the overall organization of all the abstracts rely on a common pattern: a sort of journey which departs from an initial argument or premise and proceeds, through a series of intermediate steps, to a conclusion. This pattern acts as a structural baseline from which other elaborations are potentially possible. However, these variations depend on the discipline, its degree of empiricism, and the function of the text (i.e., informative or argumentative). Thus, the rhetorical structure of scientific abstracts in the area of biology was very stable with little or no variation among

authors; by contrast, sequencing in cognitive science and literature tends to be more flexible but is, nevertheless, also shaped by the metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS and the topology of its underlying image schemas (i.e., source-path-goal and force-dynamics).

These results may be explained partly by the conventions established by the scientific community, and partly by the type of data being presented. In the natural sciences, such as biology, data is experimental and empirical, and this fact gives stability to the sequence of logical connections established between ideas. In contrast, in other fields of research data is sometimes less quantifiable, more subjective and, consequently, discourse (in the form of the abstract) has a more malleable structure.

The systematization of this pattern of discourse across disciplines is considered evidence that supports the assumption that conceptual metaphor imposes structure on reality, thereby making it comprehensible. In discourse, conceptual metaphor enhances coherence because both writers and readers rely on a kind of skeletal template, one which is intrinsically meaningful, in order to integrate and comprehend the content of a text. As a result, just as a clause has an inherent meaning that remains stable regardless of the actual linguistic expression used, so too do the introduction, body and conclusion of a text. They encode the source, path and goal of a reasoning process. Indeed, this macrostructure imposes a certain construal on the events described in the text, a

construal that is common to any purposeful activity. Insofar as texts, and abstracts in particular, are created and read, respectively, to disseminate findings and gather information, these texts become purposeful activities and hence a kind of journey.

Discourse, like any other purposeful action, inherits the main characteristics of the Event Structure metaphor in which purposes are destinations and purposeful actions are self-propelled motion toward a destination. This concept is useful if we are to understand how authors structure what they are saying in a discourse and it also sheds light on the meaning of certain sequential discursive markers such as *then*, *next*, and *finally*, among others. Every idea or argument that appears in the text acts a figure against the remainder of the background knowledge and has its own function: premises set the point of departure; arguments, findings and evidence outline the route to follow; and conclusions indicate the arrival at a final destination. In Langacker's words, abstracts (like paragraphs or chapters) "can even be considered symbolic [i.e., form-meaning pairings], since their characterization involves both formal and semantic properties" (2008:481). In terms of form, abstracts have a prototypical length and organization and semantically they are expected to introduce and develop a topic and finish with a conclusion. "This description is "both vague and tenuous. It is not entirely vacuous, however, and conscientious writers invoke it as a guide" (Langacker, 2008: 481).

Discourse macrostructure has its foundation in a web of local coherence relations that account for intersentence integration. Among the different types of local coherence relations identified in the realm of discourse analysis and text linguistics, the present thesis concentrates on the study of causal relations and its natural counterparts, concessive and consecutive links, all of which are specifically signaled by connectives. The general purpose here was to determine whether connectives have any specific content beyond their traditional truth-functional interpretation. Theoretical proposals from cognitive linguistics, conceptual metaphor and image schemas, were analyzed, and empirically investigated to explore the conceptual content and embodied basis of discourse markers.

Our experiments examined how visuospatial information could have an effect on the cognitive representation and linguistic coding of forceful interactions, which are reflected in the use of specific connectives depending on whether the interaction was perceived as causal, concessive or consecutive. Consistent results obtained across the experimental subjects showed that causal and concessive connectives (*because*, *although*, *porque* and *aunque*) are metaphorically conceptualized and that their semantic content relies on our embodied experience with forces.

Our first experiment investigated causal and consecutive relations, with the metaphor CAUSES ARE SOURCES taken as the starting point. Our aim was to determine whether the use of a prime—in this case, congruent visual displays,

in which either the source or the goal of a trajectory were profiled—would result in shorter reaction times in deciding whether a pair of clauses linked by either a causal or consecutive connective made sense or not. A positive effect of the prime would constitute persuasive evidence that the source-path-goal image schema was automatically activated as core components of the meaning of causal and consecutive connectives. However, no significant results were found. These null results may have arisen from methodological issues in the experiment, such as difficulty ensuring subjects' attention to the visual stimuli, limitations in the number of items and their literary characteristics and the lack of temporal overlap between the prime and the sentences. As Kaschak (2005) suggests, the null results may have been due to the schematic nature of the prime, which may not have been integrated with the content of the sentence. In any case, this failure to find a result cannot be viewed as evidence against conceptual-metaphor theory.

Experiments 2 and 3 explored the metaphorical basis of causal and concessive markers, this time using the metaphor CAUSES ARE FORCES. Results showed that, in both English and Spanish, force dynamics is able to predict which situations will be judged as causal or concessive. Subjects' consistent agreement is evidence in favor of the idea that image schemas affect linguistic judgments and it also reveals the experiential content that is recruited by English and Spanish speakers when they use or face the connectives *because/porque* and *although/aunque.*

a. **Causal connectives:** ***because / porque***

Interactions where an entity (the agonist) cannot manifest its natural tendency towards motion or rest because it is overcome by either stable or onset impingement with a more forceful entity (the antagonist) are judged to be causal and linked to the connective *because/porque* across forced-choice response tasks.

b. **Concessive connectives:** ***although/ aunque***

Concessive interactions encoded by the markers *although/aunque*, however, were associated with patterns of force in which an entity (the agonist) is able to manifest its intrinsic tendency in spite of the opposition from another weaker entity (the antagonist).

Taken together, these experiments showed that three parameters underlie the core meaning of causative and concessive connectives: the agonist with an intrinsic tendency toward motion or rest, the agonist-antagonist opposition, and the outcome of their interaction, which manifest in forceful interaction such as compulsion, attraction and blockage with or without result.

Our findings also suggest that causal relations are more central to the category than concessive ones (as the causality by default theory suggests) since their categorization had systematically lower error rates than concessive relations. This implies that concessive patterns require more cognitive effort because subjects expect a causal arrangement by default and only contemplate other alternatives when they fail to identify a causal arrangement. However,

this theoretical extra cognitive processing requirement for identifying concessive relations was not confirmed by differences in response latencies, which were not significant. Two factors may explain this null effect: first, subjects were given unlimited time to answer; second, the processing advantage that causal clauses tend to manifest could be neutralized by the fact that sentences with *because* do not retain the iconic sequence of events in the world (the effect precedes the cause).

Experiment 4 tested whether subjects' choices were conditioned by the presence of verbs that encode forceful interactions between two w entities or by text markers (i.e *porque* 'because' and *aunque* 'although'), which would prove our initial hypothesis. Thus, in this experiment, forcedynamics verb were replaced with nonsensical verbs that did not activate any type of force pattern per se.

Despite this fact, results showed that subjects were fully consistent in their responses, despite the fact that the subordinate clause contained a nonsense verb. This means that they were able to infer patterns of force between consecutive sentences only guided by a causal or concessive marker. These results reinforced our hypothesis that causal and concessive connectives encode force dynamic relations on their own, in other words, that they are essentially meaningful. Certainly their semantic content is more vague and abstract than that of open-class words, but even though connectives are quite schematic at the semantic pole, the crucial point is that our results support the

claim that even the most grammatical forms are meaningful. Our findings are in line with the lexico-grammar continuum hypothesis supported by Cognitive Grammar and Cognitive semantics (Langacker, 2008, Talmy, 2008) and suggest that the classical notion that connective are semantically empty expressions whose purpose is to serve as syntactic connector between clauses should be rejected. Connectives are meaningful and motivated expressions rather than vacuous and arbitrary words.

Our experiments confirm Talmy's claim that markers anticipate the relative strength of the antagonist and the intrinsic tendency of the agonist. Consequently, whereas causal connectives introduce a stronger antagonist, concessive connectives announce a weaker antagonist (Talmy, 1983). This thesis also replicates the studies conducted by Wolff and associates (Wolff, 2007, 2008; Wolff & Zettergren, 2002a; Wolffet al., 2002b), and Morera and de Vega (2010), who also found that force dynamics underlies the conceptualization of causation and concession. The contribution of the present thesis is that we provide additional empirical evidence—through a comparative study of English and Spanish—that supports the embodied nature of causal and concessive relations across languages. Moreover, we have obtained evidence to support the idea that pattern of compulsion, attraction or blockage may be encoded not only by verbs, but also by causal and concessive connectives.

In conclusion, the present study emphasizes the embodied representational basis of causation and concession, since these coherence

relations appear to be grounded in more concrete concepts: force interactions. Image schemas and conceptual metaphor are crucial because they compress our embodied experience with forces and extend it to notions as abstract as causation and concession in order to make these notions comprehensible. As with any other conceptual metaphor, the embodied experience that is recruited allows us to draw inferences and generate expectations that may be useful to predict discourse behavior and to improve textual processing. This is in line with Brown and Yule's (1983) model, which treats discourse as a process. In this view, readers do not wait until they have read the whole text in order to try to make sense of it. Instead, readers use information in the text and their world knowledge to try to make sense of the discourse from the very beginning. Moreover, the discourse-as-a-process model is interested in determining how data are processed, both by the author and his/her audience; consequently, this model takes into account not only the reader's conceptualization of discourse but also the writer's, These two conceptualizations might coincide if both rely on the conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS as a guide.

10.2 Further research

As stated previously, the present research should only be interpreted as an exploratory attempt at applying the findings of cognitive linguistics to discourse analysis. The aim was to trace the links between the structure of the

text, its cognitive representation, and the processes of text production and understanding. Further research in this field could help to explain the impact of text structure on reading comprehension and to determine the extent to which comprehension could be facilitated if texts were organized according to patterns that follow the guidelines of the conceptual metaphor DISCOURSE IS A FORM OF MOTION ALONG A PATH INFLUENCED BY FORCE DYNAMICS. In other words, further research could explore how conceptual metaphor can help writers and readers to better organize and understand a text by using their own embodied experience to enhance coherence among the different parts of a text, both in their first and second languages.

The relationship between causation/concession and force dynamics merits further investigation, which we detail here:

a. It would be very fruitful to explore whether other types of forceful interactions (enablement, removal of restraint, or diversion) could also predict subjects' responses when categorizing a scene as causal or concessive.

b. The nature of the prime also requires further attention. Visuospatial displays have been proven to be effective prompts for activating forceful interaction, but if sensory perception and motor actions support human understanding of words and concepts (i.e, if the sensorimotor system is activated when comprehending or encoding causal and concessive relations), then the actual physical exertion of force in the form of compulsion, blockage or attraction by experimental subjects during a task should also serve as a successful prime. A

match advantage effect would support those studies that argue for overlapping systems for perception and action, and comprehension.

c. It would also be relevant to use empirical tests to examine the role of embodied experience (i.e., force image schemas) in the representation of psychological and social causal relations. Such experiments could use as a starting point Talmy's claim that physical force patterns extend to intra- and inter-psychological force interactions by metaphorical analogy (PSYCHOLOGICAL FORCES ARE PHYSICAL FORCES and SOCIAL POWER IS FORCE).

d. Finally, another interesting area of research would apply a similar methodology to the study of causation and concession in sign languages. In this case, the aim would be to examine whether the results obtained in oral languages could be replicated. This would offer new evidence in favor of the idea that image schemas, as cognitive entities, hold for any language including sign languages.

Finally, considering the fact that causation is a radial category with the volitional application of physical force to an object as its the central prototype (Lakoff & Johnson, 1999), then it seems essential that more peripheral metaphorical extensions also be analyzed—as we did in the first experiment of this thesis with the metaphor CAUSES ARE SOURCES.

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APPENDIXES

APPENDIX A

SWALE'S MODEL FOR INTRODUCTIONS

(Swales, 2004: 230 - 232)

Move 1: Establishing a territory (citations required)

Step 1 Claiming centrality and/ or

Step 2 Making topic generalizations of increasing specificity and/or

Step 3 Reviewing items of previous research.

Move 2: Establishing a niche (citations possible)

Step 1A: Indicating a gap **or**

Step 1B: Counter-claiming

Step 1C: Question raising

Step 1D: Questioning a tradition

Move 3: Occupying the niche

Step1: Announcing present research descriptively and/or purposively

Step 2: Presenting research questions or hypotheses

Step 3: Definitional clarifications (optional)

Step 4: Summarizing methods (optional)

Step 5: Announcing principal outcomes

Step 6: Stating the value of the present research

Step 7: Outlining the structure of the paper

APPENDIX B

ABSTRACTS ON BIOLOGY

ABSTRACT 1

Correlative Light-Electron Microscopy Reveals the Tubular-Saccular Ultrastructure of Carriers Operating between Golgi Apparatus and Plasma Membrane

Roman S. Polishchuk[a], Elena V. Polishchuk[a], Pierfrancesco Marra[a], Saverio Alberti[a], Roberto Buccione[a], Alberto Luini[a], and Alexander A. Mironov[a]

Transport intermediates (TIs) have a central role in intracellular traffic, and much effort has been directed towards defining their molecular organization. Unfortunately, major uncertainties remain regarding their true structure in living cells. To address this question, we have developed an approach based on the combination of the green fluorescent protein technology and correlative light-electron microscopy, by which it is possible to monitor an individual carrier in vivo and then take a picture of its ultrastructure at any moment of its lifecycle. We have applied this technique to define the structure of TIs operating from the Golgi apparatus to the plasma membrane, whose in vivo dynamics have been characterized recently by light microscopy. We find that these carriers are large (ranging from 0.3–1.7 μm in maximum diameter, nearly half the size of a Golgi cisterna), comprise almost exclusively tubular-saccular structures, and fuse directly with the plasma membrane, sometimes minutes after docking to the fusion site.

Source

Obstacle

Intended Goal

Means / Path

Conclusion / Goal

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ABSTRACT 2

Extracellular Calcium Acts as a "Third Messenger" to Regulate Enzyme and Alkaline Secretion

Rosa Caroppo[1], Andrea Gerbino[1], Gregorio Fistetto[1], Matilde Colella[1,2], Lucantonio Debellis[1], Aldebaran M. Hofer[2], and Silvana Curci[1,2]

Source

It is generally assumed that the functional consequences of stimulation with Ca^{2+}-mobilizing agonists are derived exclusively from the second messenger action of intracellular Ca^{2+}, acting on targets inside the cells. However, during Ca^{2+} signaling events, Ca^{2+} moves in and out of the cell, causing changes not only in intracellular Ca^{2+}, but also in local extracellular Ca^{2+}. The fact that numerous cell types possess an extracellular Ca^{2+} "sensor" raises the question of whether these dynamic changes in external $[Ca^{2+}]$ may serve some sort of messenger function. We found that in intact gastric mucosa, the changes in extracellular $[Ca^{2+}]$ secondary to carbachol-induced increases in intracellular $[Ca^{2+}]$ were sufficient and necessary to elicit alkaline secretion and pepsinogen secretion, independent of intracellular $[Ca^{2+}]$ changes. These findings suggest that extracellular Ca^{2+} can act as a "third messenger" via Ca^{2+} sensor(s) to regulate specific subsets of tissue function previously assumed to be under the direct control of intracellular Ca^{2+}

Obstacle

Findings / Force

Conclusion / Goal

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ABSTRACT 3

AtToc159 Is a Selective Transit Peptide Receptor for the Import of Nucleus-encoded Chloroplast Proteins

Matthew D. Smith[1], Caleb M. Rounds[1], Fei Wang[1], Kunhua Chen[2], Meshack Afitlhile[1], and Danny J. Schnell[1]

Source

The members of the Toc159 family of GTPases act as the primary receptors for the import of nucleus-encoded preproteins into plastids. Toc159, the most abundant member of this family in chloroplasts, is required for chloroplast biogenesis (Bauer, J., K. Chen, A. Hiltbunner, E. Wehrli, M. Eugster, D. Schnell, and F. Kessler. 2000. *Nature*. 403:203–207) and has been shown to covalently cross-link to bound preproteins at the chloroplast surface (Ma, Y., A. Kouranov, S. LaSala, and D.J. Schnell. 1996. *J. Cell Biol.* 134:1–13; Perry, S.E., and K. Keegstra. 1994. *Plant Cell.* 6:93–105). These reports led to the hypothesis that Toc159 functions as a selective import receptor for preproteins that are required for chloroplast development. In this report, we provide evidence that Toc159 is required for the import of several highly expressed photosynthetic preproteins in vivo. Furthermore, we demonstrate that the cytoplasmic and recombinant forms of soluble Toc159 bind directly and selectively to the transit peptides of these representative photosynthetic preproteins, but not representative constitutively expressed plastid preproteins. These data support the function of Toc159 as a selective import receptor for the targeting of a set of preproteins required for chloroplast biogenesis.

Unsolved Question

Findings / Force

Conclusion / goal

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ABSTRACT 4

Cyclin-dependent Kinases Govern Formation and Maintenance of the Nucleolus

Valentina Sirri, Danièle Hernandez-Verdun and Pascal Roussel

In higher eukaryotic cells, the nucleolus is a nuclear compartment assembled at the beginning of interphase, maintained during interphase, and disorganized during mitosis. Even if its structural organization appears to be undissociable from its function in ribosome biogenesis, the mechanisms that govern the formation and maintenance of the nucleolus are not elucidated. To determine if cell cycle regulators are implicated, we investigated the putative role of the cyclin-dependent kinases (CDKs) on ribosome biogenesis and nucleolar organization. Inhibition of CDK1–cyclin B during mitosis leads to resumption of rDNA transcription, but is not sufficient to induce proper processing of the pre-rRNA and total relocalization of the processing machinery into rDNA transcription sites. Similarly, at the exit from mitosis, both translocation of the late processing machinery and pre-rRNA processing are impaired in a reversible manner by CDK inhibitors. Therefore, CDK activity seems indispensable for the building of functional nucleoli. Furthermore, inhibition of CDKs in interphasic cells also hampered proper pre-rRNA processing and induced a dramatic disorganization of the nucleolus. Thus, we propose that the mechanisms governing both formation and maintenance of functional nucleoli involve CDK activities and couple the cell cycle to ribosome biogenesis.

Source

Obstacle

Intended goal

Means / Path

Findings / Force

Conclusion / Goal

Key Words: rDNA transcription; cyclin-dependent kinase; pre-rRNA processing; inhibitor; nucleolus

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ABSTRACT 5

Rlp7p Is Associated with 60S Preribosomes, Restricted to the Granular Component of the Nucleolus, and Required for pre-rRNA Processing

Olivier Gadal[1], Daniela Strauss[1], Elisabeth Petfalski[2], Pierre-Emmanuel Gleizes[3], Nicole Gas[3], David Tollervey[2] and Ed Hurt[1]

Many analyses have examined subnucleolar structures in eukaryotic cells, but the relationship between morphological structures, pre-rRNA processing, and ribosomal particle assembly has remained unclear. Using a visual assay for export of the 60S ribosomal subunit, we isolated a ts-lethal mutation, *rix9-1*, which causes nucleolar accumulation of an Rpl25p-eGFP reporter construct. The mutation results in a single amino acid substitution ($F_{176}S$) in Rlp7p, an essential nucleolar protein related to ribosomal protein Rpl7p. The *rix9-1* (*rlp7-1)* mutation blocks the late pre-RNA cleavage at site C_2 in ITS2, which separates the precursors to the 5.8S and 25S rRNAs. Consistent with this, synthesis of the mature 5.8S and 25S rRNAs was blocked in the *rlp7-1* strain at nonpermissive temperature, whereas 18S rRNA synthesis continued. Moreover, pre-rRNA containing ITS2 accumulates in the nucleolus of *rix9-1* cells as revealed by in situ hybridization. Finally, tagged Rlp7p was shown to associate with a pre-60S particle, and fluorescence microscopy and immuno-EM localized Rlp7p to a subregion of the nucleolus, which could be the granular component (GC). All together, these data suggest that pre-rRNA cleavage at site C_2 specifically requires Rlp7p and occurs within pre-60S particles located in the GC region of the nucleolus.

Source

Obstacle

Means / Path Findings / Force

Conclusion / Goal

Key Words: rRNA processing; ribosome biogenesis; ribosome export; nucleolus

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ABSTRACT 6

Multiple Domains in Caveolin-1 Control its Intracellular Traffic

Thomas Machleidt[a], Wei-Ping Li[a], Pingsheng Liu[a], and Richard G.W. Anderson[a]

Caveolin-1 is an integral membrane protein of caveolae that is thought to play an important role in both the traffic of cholesterol to caveolae and modulating the activity of multiple signaling molecules at this site. The molecule is synthesized in the endoplasmic reticulum, transported to the cell surface, and undergoes a poorly understood recycling itinerary. We have used mutagenesis to determine the parts of the molecule that control traffic of caveolin-1 from its site of synthesis to the cell surface. We identified four regions of the molecule that appear to influence caveolin-1 traffic. A region between amino acids 66 and 70, which is in the most conserved region of the molecule, is necessary for exit from the endoplasmic reticulum. The region between amino acids 71 and 80 controls incorporation of caveolin-1 oligomers into detergent-resistant regions of the Golgi apparatus. Amino acids 91–100 and 134–154 both control oligomerization and exit from the Golgi apparatus. Removal of other portions of the molecule has no effect on targeting of newly synthesized caveolin-1 to caveolae. The results suggest that movement of caveolin-1 among various endomembrane compartments is controlled at multiple steps.

Source

Obstacle

Means / Path

Findings / Force

Conclusion / Goal

Key Words: caveolae, membrane traffic, protein sorting, Golgi apparatus, endoplasmic reticulum.

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APPENDIX C

ABSTRACTS ON COGNITIVE SCIENCE

ABSTRACT 1

What Antipriming Reveals about Priming

Chad J. Marsolek

Across many domains of cognition, information processing is more effective when it has been performed recently than when it has not. This effect – termed repetition priming – is ubiquitous; *however, its causes are not well understood*. Here, I draw attention to the concept of antipriming and argue that it is crucial for understanding priming. Antipriming is a measurable impairment in processing information owing to recent processing of other information when the representations of information overlap and compete. Strengthening one representation after its usage causes priming for that item but also antipriming for some other, non-repeated items. Recent evidence demonstrates priming and antipriming within visual object identification systems. These findings might reflect a form of maintenance relearning of superimposed knowledge representations.

Source

Obstacle

New path

Force

Defining boundaries

Findings/ Force

Possible Conclusion/ Goal

ABSTRACT 2

The encoding – Retrieval Relationship: Retrieval as Mental Simulation

Christopher Kent, Koen Lamberts

There is increasing evidence to suggest that mental simulations underlie many cognitive processes. We review results from three rapidly developing research areas suggesting that simulations underlie information retrieval. First, neuroimaging work indicates that cortical circuits that were activated during encoding are reactivated during retrieval. Second, retrieval is aided by behavioural re-enactment of processes involved in encoding, including re-enactment of encoding eye movements. Third, the time courses of encoding of visual features and the retrieval of information about them are related. Overall, the evidence suggests that the often observed interactions between encoding and retrieval result from a cognitive system that, at least partially, reactivates processes that were involved in encoding to retrieve information.

Method / path

First stage

Second stage

Third stage

Conclusion

ABSTRACT 3

Memory Search and the Neural Representation of Context

Sean M. Polyn, Michael J. Kahana

A challenge for theories of episodic memory is to determine how we focus memory search on a set of recently learned items. Cognitive theories suggest that the recall of an item representation is driven by an internally maintained context representation that integrates incoming information with a long time-scale. Neural investigations have shown that recalling an item revives the pattern of brain activity present during its study. To link these neural and cognitive approaches, we propose a framework in which context is maintained and updated in prefrontal cortex, and is associated with item information through hippocampal projections. The proposed framework is broadly consistent with neurobiological studies of temporal integration and with studies of memory deficits in individuals with prefrontal damage.

Gap / Intended goal

Path 1

Path 2

Bridge /Link

Pier / Force

ABSTRACT4

Implicit Learning and Statistical Learning: One Phenomenon, Two Approaches

Pierre Perruchet, Sebastien Pacton

The domain-general learning mechanisms elicited in incidental learning situations are of potential interest in many research fields, including language acquisition, object knowledge formation and motor learning. They have been the focus of studies on implicit learning for nearly 40 years. Stemming from a different research tradition, studies on statistical learning carried out in the past 10 years after the seminal studies by Saffran and collaborators, appear to be closely related, and the similarity between the two approaches is strengthened further by their recent evolution. However, implicit learning and statistical learning research favor different interpretations, focusing on the formation of chunks and statistical computations, respectively. We examine these differing approaches and suggest that this divergence opens up a major theoretical challenge for future studies.

Path 1

Path 2

Bridge/ Link

Obstacle

Divergence

APPENDIX D

ABSTRACTS ON LITERATURE

ABSTRACT 1

One's Own Company: Agency, Identity and the Middle Voice in the Work of Samuel Beckett

Elizabeth Barry
University of Warwick

The concept of the middle voice, a voice denoting experience that falls between the designations of active and passive, subjective and objective, is a particularly useful one in thinking about Beckett's work. This article begins with an investigation of the linguistic concept of the middle voice and the semantic and metaphorical significance given to it in modern linguistic, psychological, and literary thought. It will then argue for its usefulness for thinking about two related aspects of Beckett's work: first, the questions of agency and the will that recur throughout Beckett's oeuvre, and second, how Beckett's early preoccupation with witness — the idea of having to be seen in order to be — transforms itself in the solitary worlds of Beckett's later works.

Source

Stage 1

Stage 2

Goal/Return to the source

Keywords: Beckett / middle voice / stylistics / agency / identity

ABSTRACT 2

In One Ear and Out the Others:Beckett . . . . Mahon . Muldoon

Adrienne Janus
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Critical attention to the Beckettian poetics of silence and babble is divided between French modernists, who hear Beckettian silence and babble as a function of the metaphysics of absence (Bataille), and Irish modernists, who hear Beckettian silence and babble as a function of the politics of presence (W.J. McCormack). This article bridges such critical divisions by proposing a typology of Beckettian modes of listening: listening as a mode of poetic attention to the murmurs of voices which can no longer, or not yet, be fully apprehended (voices caught between the extremes of silence and noise, between absolute absence and full presence). Listening would not only be fundamental to the genealogy of Irish poetics that runs from the bilingual Beckett to his not entirely monolingual successors, Derek Mahon and Paul Muldoon, but fundamental to the critical genealogy that runs from the modernism of Bataille to the post-modern poetics of Jean-Luc Nancy.

Force 1
Force 2
Bridge/ Link
Pier / Force

Keywords: Samuel Beckett / Paul Muldoon / Derek Mahon / murmurs /

ABSTRACT 3

Tough Guys Don't Dance and Popular Criminality

James Emmett Ryan
Auburn University

Norman Mailer's *Tough Guys Don't Dance* (1984) has often been dismissed as an example of formulaic pulp fiction that is unworthy of serious critical attention. However, it is also a novel that provides a useful index to popular attitudes and moral positioning with regard to obscenity, violence, and other forms of criminal behavior. In Mailer's hands, the new reality of the late twentieth century is shown to include a "criminal" turn in American popular culture; this criminal turn has had the effect of "decriminalizing" a substantial portion of activities that for previous generations had been considered as vices. In this way, *Tough Guys Don't Dance* serves as an extremely revealing cultural barometer, one that has the capacity for providing a narrative index to a significant transformation of popular taste and morality.

Source / Force

Obstacle

New location

Conclusion / Goal

Keywords

Norman Mailer / obscenity / New Journalism / fiction / *Tough Guys Don't Dance*

ABSTRACT 4

Wallace Stevens: Parts of an Autobiography, by Anonymous

Louis A. Renza

This article explores how Gayl Jones's *Corregidora* constructs, through the journey of its main protagonist Ursa Corregidora, a viable model for dealing with the painful legacy of slavery, oppression and haunting by the past. The process of self-redefinition in which Ursa engages is based on the reconfiguration of family and sexuality and the hybridization of her relationship to individual as well as collective narratives. After probing Ursa's complex psychological journey, the article examines the main elements mediating the reinscription of her life narrative into a broader context of *métissage* involving sexual and historical resistance, anchored in the story of Palmares as a Brazilian maroon community *(quilombo).* Finally, the article analyzes the implications and resonances of this model of revision/reclamation for Gayl Jones and her theorization of the interconnectedness of struggles against oppression in Brazil and the United States.

General shot of the route

First stage

Second stage

Final stage

APPENDIX E

a. Sensible causal sentences

1. She did not speak the French of France **because** she was from Martinique.
2. I'll be very brief **because** time is short and I am in a hurry.
3. Sarah was very worried **because** the train she was waiting for was late.
4. My neighbour, Mrs Patty, couldn't buy anything **because** she didn't have any money.
5. Patients often died of simple infections or viruses **because** penicillin had not been discovered.
6. Lucille liked spending her holidays in France **because** she loved the European lifestyle.
7. Mary didn't say anything **because** she did not know what to say.
8. We chose that day to go on an excursion **because** it didn't rain.
9. The ponies were hungry and very tired **because** they hadn't eaten in days.
10. They felt ill **because** their clothes were wet and they didn't have much food.
11. I paid for the taxi **because** Luc had forgotten his wallet at home.
12. The phone was dead **because** the storm had affected the telephone line.
13. I felt very tired and miserable **because** I had had a bad day.
14. The microphone wasn't working **because** someone had cut the amplifier cable.
15. The place was looking a complete mess **because** I had given a party.
16. She was the new leader **because** she had been elected by absolute majority.
17. Harry changed his last name **because** he didn't want to be recognised.
18. They called him Rubberneck **because** a good third of his height was neck.
19. This morning I couldn't make some red tea **because** we had run out.
20. Someone had lit a fire in the kitchen **because** the room was warm.
21. That tree was different from the others **because** it had big branches.

22. Alice decided to phone the police **because** so many strange things were happening.

23. She had always tried to avoid him **because** he was very boring.

24. I felt completely miserable **because** everything was going wrong with our relationship.

25. British airline cancelled its flights **because** it was snowing and planes couldn't take off.

26. The train was very late **because** the snow had blocked the track

b. Nonsense causal sentences

1. The child was frightened **because** I stayed with him until the storm was over.
2. He could not speak Masai **because** he always was accompanied by an interpreter.
3. The room was very hot, **because** she began to fan herself while she talked.
4. I'm still officially on holiday **because** I won't answer all these e-mails.
5. She had no experience as a shop assistant, **because** the boss rejected her application.
6. He was feeling a bit low, **because** I did my best to cheer him up.
7. He knew he wouldn't be welcome at the wedding **because** he sent some flowers.
8. They could not open the door, **because** they got in through the window.
9. It was raining heavily and the wind was blowing **because** we could not ride our horses.
10. You work and lived with him, **because** you must know him better than most.
11. We'd known each other from childhood **because** we had a lot in common.
12. Peter's family also liked Mary very much, **because** she was a welcome visitor.
13. Michael was making slow progress with his research **because** his boss gave him an ultimatum.
14. Everybody in this town tells the same tale about him, **because** I believe it.
15. Eddie could not come because he had broken his arm, **because** I came instead.

16. The crossing takes two and a half hours, **because** we'll dock at three to be on time.

17. The family was going to a concert, **because** they couldn't find anyone at home.

18. I trust both of you, **because** I'll tell you the truth about the robbery.

19. Some of the things he said made no sense **because** the committee rejected his proposal.

20. In the evening it rained heavily, **because** I stayed in and watched television.

21. Mr. McDougal was an impressionist painter like her **because** they had plenty in common.

22. They didn't find any fingerprints, **because** I doubt if they'll come up with anything.

23. The new patient didn't need anything, **because** she returned to the treatment room.

24. When we arrived the film had finished, **because** we decided to return home.

25. Jobs are scarce at the moment, **because** you should take advantage of this opportunity.

a. Sensible consecutive sentences

1. Marcus removed his dark glasses **so** I could look at his face.

2. The new flat was smaller **so** I sold some of my furniture.

3. The car was too large for the lane **so** they walked in.

4. Sarah wasn't at his desk **so** no awkward questions were asked.

5. She doesn't have a job **so** she is looking for a vacancy.

6. John wanted to explore the area **so** Nick drove him into the town.

7. She looked a bit cold **so** I wrapped my blanket round her shoulders.

8. She likes the flowers and plants in her room, **so** I left them there.

9. I could think of nothing to say **so** I gave a nod of agreement.

10. I didn't really know what to say, **so** I just looked at Marie.

11. Winters in Scotland are very cold **so** I'm glad I got an electric fire.

12. I loved that picture **so** Mary let me stick it on the wall.

13. It's too cold to sit around for long, **so** I walked onto the bridge.

14. The appointment with my client got cancelled, **so** I just stayed at home.

15. There was nothing worth watching on television, **so** he went back into the kitchen.

16. Joe's mother had sent him some After Eights **so** he offered Sarah one.

17. There were no other chairs in the office **so** he couldn't sit down.

18. His Spanish was almost non-existent, he couldn't communicate, s**o** I gave him lessons.

19. There was no answer to his knock, **so** he knocked again and waited patiently.

20. Heavy coughing always means pneumonia, **so** I gave her an injection of vitamin K.

21. Cathy was suffering terrible toothache, **so** he phoned the dentist to make an appointment.

22. It was getting dark **so** he pulled the curtains and put on the light.

23. She was drunk, **so** she did not care about the consequences of her behaviour.

24. The Government sent the children out of the cities **so** they shouldn't be bombed.

25. The sun clouded over, **so** they picked up their things and returned home.

b. Nonsense consecutive sentences

1. I have always wanted his approval **so** he is my father.

2. Tina never wants to play with Jo **so** she is a real cheat.

3. She is always angry with me **so** I never do anything useful.

4. She suspected that something had happened **so** the door had been left open.

5. I cannot send the letter to Mary **so** I cannot remember her address.

6. I didn't buy the house I liked **so** I didn't have enough money.

7. Mr. Brown hired Dorothy **so** he thought that she was the best candidate.

8. My aunt told me about the job vacancy **so** I needed work.
9. Yesterday morning Mrs. Fisher washed and polished the car **so** it was dirty.
10. Peter chose a dry martini **so** it was his favourite.
11. He wears a hat **so** he wants to disguise that he is bald.
12. They chose the London Hospital **so** they knew a doctor who worked there.
13. He wanted my mother to stay **so** she knows how to cook his favourite dish
14. She called the taxi around five o'clock, **so** she was meeting Giles.
15. He valued her advice **so** he found it almost impossible to make decisions.
16. He said that he would be quick **so** his editor was waiting for him.
17. He disliked her **so** her had no sense of humour.
18. It was one of my favourite churches, **so** the interior was really beautiful.
19. I thought that she was older **so** her hair was pure white.
20. They talked to her slowly **so** she was from France.
21. I cried like a schoolgirl **so** I was scared and I felt lonely.
22. I couldn't see his face **so** a huge tree was in my way.
23. They drank sherry rather than Tio Pepe so they preferred its sweet taste.
24. I spent the weekend in Holland **so** Karen was giving a talk there.
25. She must have been crying **so** she looked so happy

APPENDIX F

SENTENCES EXPERIMENT 2

PRACTICE BLOCK

1. Blockage

1. a. The green frog couldn't cross to the other side because the net blocked the way.

1. b The green frog couldn't cross to the other side although the net blocked the way.

2. Blockage with movement

2. a. The green frog was able to cross to the other side because the net blocked the way.

2. b. The green frog was able to cross to the other side although the net blocked the way.

3. Compulsion

3. a. The pin fell because the bowling ball hit it.

3. b. The pin fell although the bowling ball hit it.

4. Compulsion without movement

4. a. The pin didn't fall because the bowling ball hit it.

4. b. The pin didn't fall although the bowling ball hit it.

5. Fillers

5. a. The green frog was able to cross to the other side because the path was blocked

5. b. The green frog was able to cross to the other side although the path was blocked.

6. Fillers

6. a. The bowling ball rolled down the left gutter because the pin was in the middle of the alley

6. b. The bowling ball rolled down the left gutter although the pin was in the middle of the alley.

REAL EXPERIEMENTAL BLOCK

7. Compulsion without movement

7.1. a. The green car crossed the intersection because the yellow car hit it from behind.

7.1. b. The green car crossed the intersection although the yellow car hit it from behind.

7.2. a. The red boat began to move through the water although the grey boat hit it from behind.

7.2. b. The red boat began to move through the water because the grey boat hit it from behind.

7.3. a. The black ball rolled across the field because the red ball hit it.

7.3. b. The black ball rolled across the field although the red ball hit it.

7.4. a. The red ball rolled to the right of the goal although the black ball hit it.

7.4. b. The red ball rolled to the right of the goal because the black ball hit it.

8. Attraction with movement

8.1. a. The yellow car moved because the green car pulled on the rope.

8.1. b. The yellow car moved although the green car pulled on the rope.

8.2. a. The grey boat moved towards the shore although the red boat tugged it.

8.2. b. The grey boat moved towards the shore because the red boat tugged it.

9 Blockage

9.1. a. The yellow car blocked the green car because it stopped in the middle of the intersection.

9.1.b. The yellow car blocked the green car although it stopped in the middle of the intersection.

9.2. a. The red boat blocked the grey boat although it stopped in the middle of the sea.

9.2. b. The red boat blocked the grey boat because it stopped in the middle of the sea.

9.3. a. The black ball couldn’t enter the goal because the red ball blocked it.

9.3. b. The black ball couldn’t enter the goal although the red ball blocked it.

10. Compulsion without movement

10.1. a. The green car couldn’t move forward because the yellow car pushed it.

10.1. b. The green car couldn’t move forward although the yellow car pushed it.

10.2. a. The grey boat didn’t move forward although the red boat pushed it.

10.2. b. The grey boat didn't move forward because the red boat pushed it.

10.3. a. The black ball didn't roll down the field because the red ball hit it.

10.3. b. The black ball didn't roll down the field although the red ball hit it.

10.4. a. The black ball didn't move down the field although the red ball hit it.

10.4. b. The black ball didn't move down the field because the red ball hit it.

11. Attraction without movement

11.1. a. The yellow car didn't move because the green car pulled it.

11.1. b. The yellow car didn't move although the green car pulled it.

11.2. a. The grey boat didn't move although the red boat tugged it.

11.2. b. The grey boat didn't move because the red boat tugged it.

12. Blockage and redirection

12.1. a. The green car could cross the intersection because the yellow car blocked the street.

12.1. b. The green car could cross the intersection although the yellow car blocked the street.

12.2. a. The grey boat made its way to the coast although the red boat blocked it.

12.2. b. The grey boat made its way to the coast because the red boat blocked it.

12.3. a. The black ball entered the goal because it bumped into the red ball.

12.3. b. The black ball entered the goal although it bumped into the red ball.

13. Fillers

13.1. a. The yellow car crossed the intersection because the green car followed it.

13.1. b. The yellow car crossed the intersection although the green car followed it.

13.2. a. The grey boat crossed the ocean toward the coast because the red boat followed it.

13.2. b. The grey boat crossed the ocean toward the coast although the red boat followed it.

13.3. a. The black ball entered the goal although the red ball rolled downhill.

13.3. b. The black ball entered the goal because the red ball rolled downhill.

13.4 a. The yellow car moved forward because the green car stopped on the right side of the road.

13.4 b. The yellow car moved forward although the green car stopped on the right side of the road.

13.5. a. The red boat reached the shore although the grey boat blocked the passage.

13.5. b. The red boat reached the shore because the grey boat blocked the passage.

13.6. a. The black ball entered the goal because the red ball blocked it.

13.6. b. The black ball entered the goal although the red ball blocked it.

13.7. a. The yellow car moved forward because the green car was going in reverse.

13.7. b. The yellow car moved forward although the green car was going in reverse.

13.8. a. The grey boat reached the shore although the red boat blocked the passage.

13.8. b. The grey boat reached the shore because the red boat blocked the passage.

13.9. a. The black ball entered the goal because the red ball blocked it.

13.9. b. The black ball entered the goal although the red ball blocked it.

APPENDIX G

SENTENCES EXPERIMENT 3

PRACTICE BLOCK

1. Blockage

1 .a. La rana no pudo cruzar al otro lado porque la red bloqueaba el camino.

1. b. La rana no pudo cruzar al otro lado aunque la red bloqueaba el camino.

2. Blockage with movement

2. a. La rana pudo cruzar al otro lado porque la red bloqueaba el camino.

2. b. La rana pudo cruzar al otro lado aunque la red bloqueaba el camino.

3. Compulsion

3. a. El bolo cayó porque la bola lo golpeó

3. b. El bolo cayó aunque la bola lo golpeó

4. Compulsion without movement

4. a. El bolo no cayó porque la bola lo golpeó.

4. b. El bolo no cayó aunque la bola lo golpeó

5. Fillers

5. a. La rana pudo cruzar al otro lado porque el camino estaba bloqueado.

5. b. La rana pudo cruzar al otro lado aunque el camino estaba bloqueado.

6. Fillers

6. a. La bola se desvió hacia la izquierda porque el bolo estaba en medio del pasillo.

6. b. La bola se desvió hacia la izquierda aunque el bolo estaba en medio del pasillo.

REAL EXPERIEMENTAL BLOCK

7. Compulsion without movement

7.1. a. El coche verde cruzó la intersección porque el coche amarillo lo golpeó por detrás

7.1. b. El coche verde cruzó la intersección aunque el coche amarillo lo golpeó por detrás.

7.2. a. El barco rojo empezó a moverse aunque el barco gris lo golpeó por detrás.

7.2. b. El barco rojo empezó a moverse porque el barco gris lo golpeó por detrás.

7.3. a. La pelota negra rodó a través del campo porque la pelota roja la golpeó.

7.3. b. La pelota negra rodó a través del campo aunque la pelota roja la golpeó.

7.4. a. La pelota roja rodó hacia la derecha de la portería aunque la pelota negra la golpeó.

7.4. b. La pelota roja rodó hacia la derecha de la portería porque la pelota negra la golpeó.

8. Attraction with movement

8.1. a. El coche amarillo se movió porque el coche verde tiró de la cuerda.

8.1. b. El coche amarillo se movió aunque el coche verde tiró de la cuerda.

8.2.a. El barco gris avanzó hacia la costa aunque el barco rojo tiraba de él

8.2.b. El barco gris avanzó hacia la costa porque el barco rojo tiraba de él

9 Blockage

9.1. a. El coche amarillo bloqueó al coche verde porque se detuvo en medio del cruce.

9.1. b. El coche amarillo bloqueó al coche verde aunque se detuvo en medio del cruce.

9.2.a. El barco rojo bloqueó al barco gris aunque se detuvo en medio del mar.

9.2.b. El barco rojo bloqueó al barco gris porque se detuvo en medio del mar.

9.3.a. La pelota negra no pudo entrar en la portería porque la pelota roja la bloqueó.

9.3.b. La pelota negra no pudo entrar en la portería aunque la pelota roja la bloqueó.

10. Compulsion without movement

10.1. a. El coche verde no pudo avanzar porque el coche amarillo lo empujó.

10.1 .b. El coche verde no pudo avanzar aunque el coche amarillo lo empujó.

10.2. a .El barco gris no se movió aunque el barco rojo lo empujó.

10.2. b. El barco gris no se movió porque el barco rojo lo empujó.

10.3. a. La pelota negra no rodó hacia abajo del campo porque la pelota roja la golpeó.

10.3. b. La pelota negra no rodó hacia abajo del campo aunque la pelota roja la golpeó.

10.4. a. La pelota negra no rodó hacia abajo del campo aunque la pelota roja la golpeó.

10.4. b. La pelota negra no rodó hacia abajo del campo porque la pelota roja la golpeó.

11. Attraction without movement

11.1. a. El coche amarillo no se movió porque el coche verde tiró de él.

11.1. b. El coche amarillo no se movió aunque el coche verde tiró de él

11.2. a. El barco gris no se movió aunque el barco rojo tiró de él.

11.2. b. El barco gris no se movió porque el barco rojo tiró de él.

12. Blockage and redirection

12.1. a. El coche verde pudo cruzar la intersección porque el coche amarillo bloqueó la calle.

12.1. b. El coche verde pudo cruzar la intersección aunque el coche amarillo bloqueó la calle.

12.2.a. El barco gris se abrió camino hacia la costa aunque el barco rojo lo bloqueó.

12.2. b. El barco gris se abrió camino hacia la costa porque el barco rojo lo bloqueó.

12.3. a. La pelota negra entró en la portería porque chocó contra la pelota roja.

12.3. b. La pelota negra entró en la portería aunque chocó contra la pelota roja.

13. Fillers

13.1. a. El coche amarillo cruzó la intersección porque el coche verde lo seguía.

13.1. b. El coche amarillo cruzó la intersección porque el coche verde lo seguía.

13.2. a. El barco gris se dirigió hacia la costa porque el barco rojo lo seguía.

13.2. b. El barco gris se dirigió hacia la costa porque el barco rojo lo seguía.

13.3. a. La pelota negra entró en la portería aunque la pelota roja rodó cuesta abajo.

13.3. b. La pelota negra entró en la portería porque la pelota roja rodó cuesta abajo.

13.4. a. El coche amarillo avanzó porque el coche verde se detuvo en el lado derecho de la calle.

13.4. b. Coche amarillo avanzó porque el coche verde se detuvo en el lado derecho de la calle.

13.5. a. El barco rojo alcanzó la costa aunque el barco gris bloqueó el paso.

13.5. b. El barco rojo alcanzó la costa porque el barco gris bloqueó el paso.

13.6. a. La pelota negra entró en la portería porque la pelota roja la boqueó.

13.6. b. La pelota negra entró en la portería aunque la pelota roja la boqueó.

13.7. a. El coche amarillo avanzó porque el coche verde iba marcha atrás.

13.7. b. El coche amarillo avanzó aunque el coche verde iba marcha atrás

13.8. a .El barco gris alcanzó la costa aunque el barco rojo bloqueó el paso.

13.8. b. El barco gris alcanzó la costa porque el barco rojo bloqueó el paso.

13.9. a. La pelota negra entró en la portería porque la pelota roja la bloqueó.

13.9. b. La pelota negra entró en la portería aunque la pelota roja la bloqueó.

APPENDIX H

SENTENCES EXPERIMENT 4

PRACTICE BLOCK

1. Blockage

1. a. La rana no pudo cruzar al otro lado porque la red trafegaba el camino.

1. b. La rana no pudo cruzar al otro lado aunque la red trafegaba el camino.

2. Blockage with movement

2. a. La rana pudo cruzar al otro lado porque la red trafegaba el camino.

2. b. La rana pudo cruzar al otro lado aunque la red trafegaba el camino.

3. Compulsion

3. a. El bolo cayó porque la bola lo planqueó

3.b. El bolo cayó aunque la bola lo planqueó

4. Compulsion without movement

4. a. El bolo no cayó porque la bola lo planqueó.

4. b. El bolo no cayó aunque la bola lo planqueó

5. Fillers

5. a. La rana pudo cruzar al otro lado aunque la red trafegaba el camino.

5. b. La rana pudo cruzar al otro lado aunque el camino estaba trafegado.

6. Fillers

6. a. La bola se desvió hacia la izquierda porque el bolo trafegaba pasillo

6. b. La bola se desvió hacia la izquierda aunque el bolo trafegaba el pasillo.

REAL EXPERIEMENTAL BLOCK

7. Compulsion without movement

7.1. a. El coche verde cruzó la intersección porque el coche amarillo lo planqueó por detrás

7.1. b. El coche verde cruzó la intersección aunque el coche amarillo lo planqueó por detrás.

7.2. a. El barco rojo empezó a moverse aunque el barco gris lo plaqueó por detrás.

7.2. b. El barco rojo empezó a moverse porque el barco gris lo planqueó por detrás.

7.3. a. La pelota negra rodó a través del campo porque la pelota roja la planqueó.

7.3. b. La pelota negra rodó a través del campo aunque la pelota roja la planqueó.

7.4. a. La pelota roja rodó hacia la derecha de la portería aunque la pelota negra la planqueó.

7.4. b. La pelota roja rodó hacia la derecha de la portería porque la pelota negra la planqueó.

8. Attraction with movement

8.1. a. El coche amarillo se movió porque el coche verde vimó de la cuerda.

8.1. b. El coche amarillo se movió aunque el coche verde vimó de la cuerda

8.2. a. El barco gris avanzó aunque el barco rojo dilaba de él

8.2. b. El barco gris avanzó hacia la costa porque el barco rojo dilaba de él

9 Blockage

9.1. a. El coche amarillo trafegó al coche verde porque se detuvo en medio del cruce.

9.1. b. El coche amarillo trafegó al coche verde aunque se detuvo en medio del cruce.

9.2. a. El barco rojo trafegó al barco gris aunque se detuvo en medio del mar.

9.2. b. El barco rojo trafegó al barco gris porque se detuvo en medio del mar.

9.3. a. La pelota negra no pudo entrar en la portería porque la pelota roja la trafegaba

9.3 .b. La pelota negra no pudo entrar en la portería aunque la pelota roja la trafegaba.

10. Compulsion without movement

10.1. a. El coche verde no pudo avanzar porque el coche amarillo lo trondeó

10.1. b. El coche verde no pudo avanzar aunque el coche amarillo lo trondeó

10.2. a. El barco gris no se movió aunque el barco rojo lo trondeó.

10.2. b. El barco gris no se movió porque el barco rojo lo trondeó.

10.3. a. La pelota negra no rodó porque la pelota roja la planqueó.

10.3. b. La pelota negra no rodó hacia abajo del campo aunque la pelota roja la planqueó.

10.4. a. La pelota negra no rodó hacia abajo del campo aunque la pelota roja la planqueó.

10.4. b. La pelota negra no rodó hacia abajo del campo porque la pelota roja la planqueó.

11. Attraction without movement

11.1. a. El coche amarillo no se movió porque el coche verde vimó de él

11.1. b. El coche amarillo no se movió aunque el coche verde vimó de él

11.2. a. El barco gris no se movió aunque el barco rojo vimó de él.

11.2. b. El barco gris no se movió porque el barco rojo vimó de él.

12. Blockage and redirection

12.1. a. El coche verde pudo cruzar la intersección porque el coche amarillo trafegó la calle.

12.1. b. El coche verde pudo cruzar la intersección aunque el coche amarillo trafegó la calle.

12.2. a. La pelota negra entró en la portería porque plucó contra la pelota roja.

12.2. b. La pelota negra entró en la portería aunque plucó contra la pelota roja.

13. Fillers

13.1. a. El coche amarillo cruzó la intersección porque el coche verde lo llumía.

13.1. b. El coche amarillo cruzó la intersección porque el coche verde lo llumía.

13.2. a. El barco gris se dirigió hacia la costa porque el barco rojo lo llumía.

13.2. b. El barco gris se dirigió hacia la costa porque el barco rojo lo llumía.

13.3. a. La pelota negra entró en la portería aunque la pelota roja trondó cuesta abajo.

13.4. a. El coche amarillo avanzó porque el coche verde se dispeó en el lado derecho de la calle.

13.4. b. El coche amarillo avanzó porque el coche verde se dispeó a la derecha.

13.5. a. El barco rojo alcanzó la costa aunque el barco gris trafegó el paso.

13.5. b. El barco rojo alcanzó la costa porque el barco gris trafegó el paso.

13.6. a. La pelota negra entró en la portería porque la pelota roja la trafegó.

13.6. b. La pelota negra entró en la portería porque la pelota roja la trafegó.

13.7. a. El coche amarillo avanzó porque el coche verde bandaba marcha atrás.

13.7. b. El coche amarillo avanzó aunque el coche verde bandaba marcha atrás.

13.8. a. El barco gris alcanzó la costa aunque el barco rojo trafegó el paso.

13.8. b. El barco gris alcanzó la costa porque el barco rojo trafegó el paso.

13.9. a. La pelota negra entró en la portería porque la pelota roja la trafegó.

13.9. b. La pelota negra entró en la portería aunque la pelota roja la trafegó.