CHAPTER 9

Processing implicit and explicit causality in Spanish

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As a basic discourse relation, causality can be made explicit by means of an argumentative connective, but it can also be implicitly expressed. In the latter case, experimental evidence shows that causality is highly predictable in discourse and can be easily inferred. Therefore, the question arises as to the actual contribution of causal connectives to utterance processing. We addressed this issue in an eye tracking reading experiment, and compared how the presence or absence of the Spanish causal connective *por tanto* affects processing in its role as procedural guide. The results suggest that making the connective explicit in a consecutive relation already inferable from the meaning of the lexical expressions in the utterances slows down processing. In this sense, the nature of connectives as procedural guides (Relevance Theory, see Blakemore 1987) might be nuanced, since the extent to which a connective determines processing varies depending on the type of discourse relation at issue.

Keywords: causal relations, implicit causality, explicit causality, connectives, processing, procedural meaning

1. Introduction

Coherence is the textual property by which language users are able to derive mental representations of discourse. One of the basic discourse relations that speakers handle while they construct coherence is causality (Sanders, Spooren, and Noordman 1992: 11), which, furthermore, has been experimentally shown to be easier to process and better represented than other discourse relations (Mak and Sanders 2012: 1–2): according to the *continuity hypothesis*, causality is the most predictable discourse relation (Murray 1997; Brehm-Jurish 2005; Köhne and Demberg 2013; Zunino 2014). A further proof of the special cognitive status of causality is the fact that even in the absence of an explicit linguistic expression that signals the discourse relation – for instance, a causal connective – readers tend to infer a causal link

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between two juxtaposed segments. In fact, causal relations are implicitly conveyed with a higher frequence than other discourse relations (as shown in corpus data by Carbonell Olivares 2005 for Spanish; Asr and Demberg 2012 for English; however, see Hoek and Zufferey 2015 for partly diverging results in a cross-linguistic study of translations). When readers are confronted with an utterance like the following:

(1) *Marta and David do a lot of sport. They are in good health.*

they are able to process the second segment as a consequence of the cause stated in the first.

Both segments, however, could have been linked by means of an argumentative connective as well:[1]

(2) *Marta and David do a lot of sport. Therefore, they are in good health.*

Causal connectives introduce a discourse segment "which is anaphorically or cataphorically related to the previous segment, with which it establishes a cause-effect argumentative relation" (Domínguez García 2007: 141, our translation). Causal connectives are attributed a fundamentally procedural meaning because they act as inference-constraining guides in communication (Blakemore 1987, 2002; Martín Zorraquino and Portolés 1999). In this sense, they do not represent events or objects in the world, as opposed to conceptual-meaning expressions, and always need a mental representation upon which to display their instruction (Escandell Vidal and Leonetti 2011).

However, if causality can be inferred in the absence of an argumentative connective, the question arises as to the actual contribution of causal connectives to discourse processing. We base this paper on the tenets of the Relevance Theory and assume that argumentative connectives act as procedural guides that constrain the possible inferences in discourse. A number of experimental analyses (see e.g., Millis and Just 1994; Degand et al. 1999 for expository texts; Sanders and Noordman 2000; van Silfhout et al. 2015 for narrative texts; Nadal et al. 2016) have demonstrated that the explication of argumentative connectives can facilitate text comprehension processes. This is reflected in lower reading times, better performance in comprehension tests and a better content recall. In a similar vein to these studies, we analyze how the presence of the Spanish causal connective *por tanto* affects utterance processing versus its absence (Section 4). To that purpose, we start from the following two hypotheses, which point to opposite directions:

1. *Therefore* expresses in this case an objective, non-volitional causal relationship: the speaker is not involved in the construction of the causal relation between the events (Sanders 2005: 3). All our experimental stimuli display this type of causality.

1. If, as corpus studies and experimental evidence suggest, causality is a discourse relation inferable by default by means of the representations arising from the conceptual-meaning expressions of utterances, the processing load of implicitly linked utterances (1) should not differ from that of utterances whose segments are connected by a procedural device that makes the cause-consequence relation explicit (2), even if inserting the connective means adding information to the utterance (Loureda, Nadal, and Recio 2016).
2. However, if the explicit condition (2) compels the reader to process the causal relation by resorting to two guides, one of a lexical nature (the conceptual-meaning expressions) and one of a procedural nature (the argumentative connective *por tanto*), we expect readers to exhibit differing processing patterns for the explicit and the implicit conditions, and the effort needed to process the explicit condition to be greater.

2. Implicit versus explicit causality

Cause-consequence discourse relations, whether implicit or explicit, can be explained by the help of the claims of *Argumentation Theory* (Anscombre and Ducrot 1994 [1980]; Iten 1999).[2]

2.1 Discourse and argumentative contents

From a semantic viewpoint, all words encode information that constrains the continuation of discourse. Utterances cannot be formulated without intending to direct the interlocutor towards a certain conclusion (while another conclusions are automatically discarded) (Anscombre and Ducrot 1994: 48). In this sense, the conceptual-meaning words contained in a discourse segment such as *Marta and David do a lot of sport* have an *argumentative orientation* (Portolés 2004) and, thus, lead to a conclusion like *they are in good health*. Moving from an argument to a conclusion is possible because mental representations formed when the linguistic expressions of an utterance are processed, they are connected with *topoi*. *Topoi* are *common* (i.e., shared by a given community whose members share that principle

2. Several authors combine these two frameworks, Relevance Theory and Argumentation Theory, to explain the role of connectives like *por tanto* for discourse comprehension. Relevance Theory defines these units in general terms as procedural guides to constrain inferential processing, whereas Argumentation Theory offers a more detailed description for the semantic instructions coded by each type of connective (see Moeschler 1989; Portolés 2001[1998]; Murillo 2010; Loureda and Acín 2010; Nadal in press).

even before discourse is instantiated, see Moeschler and Reboul 1994: 317–322); *general* (i.e., applicable to a number of situations different from the specific discourse situation) and gradable (i.e., they relate two gradable or scalar predicates, e.g., temperature and comfort) mental constructs (Anscombre and Ducrot 1994: 218). Example (1) here underlies a *topos* such as "practising sports is good for one's health", <+sports, +health>.

Taking the above into consideration, an example like (1) repeated here as (3), where both discourse segments are argumentatively co-oriented, leads to a pragmatically acceptable assumption:

(3) *Marta and David do a lot of sport. They are in good health.*

The argumentative co-orientation of the segments also allows us to explain why the discursive status of each of them (i.e., a cause and a consequence) can be processed even in the absence of a linguistic marker – a connective (experimental evidence confirms this hypothesis: Murray 1997; Zunino et al. 2011; Zunino 2014; in the same vein, continuous causal relations have been found to be more predictible and faster to process, for example, compared with counter-argumentative relations: Brehm-Jurish 2005; Drenhaus et al. 2014; Köhne and Demberg 2013; Hoek and Zufferey 2015).

Argumentative co-orientation can, however, be conventionalized by inserting an argumentative connective, in our case *por tanto* ('therefore'), which supplies procedural information to guide a hearer or reader during discourse comprehension (4):

(4) *Marta y David practican mucho deporte*. Por tanto *están sanos*.
'Marta and David do a lot of sport. *Therefore*, they are in good health.'

The instructional meaning of *por tanto* is added to the lexical guide provided by conceptual-meaning words of the premise and the conclusion (Fraser and Malamud-Makowski 1996: 864):

> Given the role of inference in establishing the contextual effects of a proposition, it should not be surprising that expressions that instruct the hearer to establish an inferential connection between two segments of discourse may be used to indicate how the proposition they introduce is to be interpreted as relevant.
>
> (Blakemore 1987: 122)

The reason why (3) and (4) above are equally plausible is that two expectations are met, a semantic-pragmatic one and a cognitive one, which merge into one. When a mental representation is derived from the first discourse segment, the

causality-by-default hypothesis (Sanders 2005)[3] applies. In the absence of further instructions, the human mind tends to process the upcoming adjacent proposition as causally related to the first:

> It seems as if the causal chain exists independently from the verbal manifestation. […] It is a form of background causality which does not have to be mentioned in any case because it will be easily inferred on the basis of the common knowledge of the world. In order to emphasize that the causal chain is the result of a mental operation I preferred the term "causal constant". It means that a causal constant may exist even if it is not explicitly expressed. (Rudolph 1996: 27)

2.2 *Por tanto* as a causal connective

Por tanto is hosted in a discourse segment that expresses the consequence or the effect of what has been stated in the previous one, which, in turn, functions as the premise of the causal relation (Martín Zorraquino and Portolés 1999: 4093–4099).

(5) *Marta y David practican mucho deporte*. Por tanto *están sanos*.
'Marta and David do a lot of sport. *Por tanto* they are in good health.'

In addition, the consequence introduced by the connective reinforces potential inferences that may have been derived from the first segment (Domínguez García 2007: 141).

By means of its procedural meaning, *por tanto* "presents the discourse member that it introduces as a consequence *reasoned out* from the previous segment" (*DPDE* online, our translation and emphasis). Therefore, (4) could be paraphrased as follows: "Marta and David do a lot of sports. As a result, / For that reason, they are in good health."

Por tanto is a grammaticalized expression, and this has consequences for its syntactic and distributional properties (*DPDE*, s.v. *por (lo) tanto*; Domínguez García 2007: 155). *Por tanto* is syntactically isolated: it has an own melodic contour and is mostly followed by a comma. As a consequence, it is positionally versatile: it can occur in initial, medial or final position in its host segment; and does not admit modifiers (**exactamente* 'exactly', **precisamente* 'precisely' *por tanto*). Grammaticalized devices

3. According to the causality-by-default hypothesis, two causally related pieces of information are processed faster than when an additive relation holds between them: "Because readers aim at building the most informative representation, they start out assuming the relation between two consecutive sentences is a causal relation (given certain characteristics of two discourse segments). Subsequently, causally related information will be processed faster, because the reader will only arrive at an additive relation if no causal relation can be established" (Sanders 2005: 9).

have also been shown to influence processing differently from less-grammaticalized connecting devices (see Recio, Nadal, and Loureda 2018).

3. Processing study

3.1 Materials

An eye tracking reading experiment was carried out to register the processing effort of explicit versus implicit causal relations. Eye movements were tracked and registered online during reading to analyze participants' behaviour in two conditions: utterances in which the two causally related discourse segments were explicitly linked by a connective (a) and utterances where the causal relation was implicit (b).

a. Marta y David practican mucho deporte. *Por tanto*, están sanos.
b. Marta y David practican mucho deporte. Están sanos.[4]
'Marta and David do a lot of sport. *Por tanto*/Ø they are in good health.'

As stated above, if the causal relation can be inferred in the absence of a causal connective, we do not expect any differences in the processing load of utterances like (a) and (b). By contrast, since the explicit condition contains a lexical and a procedural guide, we could also expect different processing strategies to be implemented by participants and higher processing costs for utterances like (b).

The critical stimuli were divided into three areas of interest (AOIs): the first discourse segment (DS1), the second discourse segment (DS2) and the connective (CONN), where provided:

[Marta y David practican mucho deporte]$_{DS1}$. [*Por tanto*/Ø]$_{CONN}$, [están sanos]$_{DS2}$.

Average reading times per word expressed in milliseconds (ms) were computed for each AOI. Additionally, average reading times were computed for conceptual-meaning words (i.e., all utterance words except the connective) and for an average utterance word (all utterance words).

3.2 Dependent variables

Eye fixations and the processing costs they reflect are analyzed by means of three cumulative parameters, which are the dependent variables of this study: *total reading*

4. Critical items were designed in the frame of a course on General Linguistics by a group of 30 students of Translation Sciences. This way, the plausibility and objectivity of the causality presented in the utterances was checked by a larger pool of speakers.

time, first-pass reading time and *second-pass reading time*. Total reading time is a composite measure. It is computed by adding up the duration of all fixations on one AOI and is, thus, a good indicator of the global effort needed to complete information extraction in that given area. First-pass and second-pass reading time are more fine-grained measures that help provide a more accurate picture of the effort needed to recover a communicated assumption. First-pass reading time, that is, the summed fixation time spent on a region after exiting it, reflects the initial costs of extracting information from an AOI; second-pass reading time amounts to the summed duration of all fixations on an AOI during re-reading (Hyönä, Lorch, and Rinck 2003: 316). First-pass and second-pass reading times cannot be strictly equated with syntactic/semantic processing (decoding stage) and with pragmatic processes (information reconstruction stage), since information processing is not linear, but takes place in parallel stages (Escandell Vidal 2005: 88). First-pass reading is deemed to reflect the construction of a first assumption from the ostensive stimulus, while re-reading reflects the effort needed to re-interpret an utterance, that is, to confirm, enrich or correct the initial interpretation by contrasting it with the context and with other mentally stored assumptions.

3.3 Participants, apparatus and procedure

The experiment was conducted with 80 participants (ongoing or completed university degree; ages 20–30). Utterances were shown on a computer screen equipped with a RED 500 eye tracker (*SMI Research*) in which three text characters amount to 1° of visual angle. Participants sat at a distance of approximately 65 cm from the screen. Reading times were registered for both eyes and an average was automatically calculated. The sampling frequency was 500 Hz. Participants read silently and at their own pace, which diminishes researcher interference, and needed about 15 minutes to complete the whole test.

3.4 Experiment design

A total of four sets with two critical utterances each were designed for the experiment: four in which the segments were linked by *por tanto* (condition (a)); four without an argumentative connective (condition (b)), and mixed with fillers and distractors in a 4:1 ratio. Critical stimuli were counterbalanced (Sandra 2009: 171) by dividing them into four lists assigned to different participant groups, so that each list only contained one utterance from each set and each participant read all conditions, but never more than one condition from the same set. For instance, condition (a) *Marta y David practican mucho deporte. Por tanto, están sanos* belonged

to a different list than the same version of condition (b), *Marta y David practican mucho deporte. Están sanos*. Items appeared in a pseudorandomized order.

Several hidden variables were controlled for in the critical items: word length (all words had between two and three syllables) and word frequency (all words are indexed within the 5,000 most frequent words in Spanish and belong to high or very high frequency ranges, Almela et al. 2005). Polysemy and homonymy were avoided, and all utterances exhibited SVO order, the most neutral in Spanish. This allows the researchers to attribute potential second-pass fixations exclusively to difficulties in the reconstruction of the communicated assumption, i.e., deriving of implicatures and contrasting the initially obtained assumption with the context and the reader's previous knowledge.

The experiment began with a trial of three practice items. Each critical stimulus was preceded by a contextualization passage and fixation crosses were placed before all items to avoid undesired corrections in first fixations.

Critical items were composed of three discourse segments. The first two segments were either linked by *por tanto*, or implicitly connected, and constituted the critical item in the strict sense. The third segment was introduced to control wrap-up effects, i.e., the effect derived by longer fixations at the end of a line or a paragraph, not considered "a stage of processing defined by its function, but rather by virtue of being executed when the reader reaches the end of a sentence" (Just and Carpenter 1980: 345).

3.5 Statistical treatment

Data were statistically analyzed using linear mixed regression models (Fahrmeir et al. 2013) with reading time as the indicator of processing effort. A model was computed for every dependent variable: *total reading time, first-pass reading time* and *second-pass reading time*.

The AOIs of each condition were included as fixed effects: first discourse segment, second discourse segment, connective (*por tanto*), conceptual-meaning words, and average utterance word. Subjects and set were included as non-nested random intercepts (individual reading paces can differ considerably, see Rayner 1998: 392). The model accounts, thus, for possible variability due to hidden factors (see Appendix 1).

Outliers or extreme values were treated before computing the mixed models. Observations were removed: (a) if the first-pass reading time was zero for any AOI formed by at least two words with the exception of the connective ("first skip"); if both the first-pass and the second-pass reading time for the AOI *average utterance word* amounted to less than 80 ms ("fast readers", Pickering et al. 2000; Reichle et al. 2003); and (c) if the total reading time for an average utterance word was higher

than 800 ms per word ("slow readers"). As a result, 28 out of 300 observations were considered extreme values and removed according to this procedure (11.6%). It is to be assumed that most of the extreme values arose from randomly occurring problems with the eye tracker. From them, 21 (7.0%) were cases of *first skip*, 13 (4.3%) were *fast readers*, and one (0.3%) was a *slow reader*.

Interpretation of model estimates was performed focusing on the strength of the observed reading time differences. Since our analyses comprise several models with a big amount of potential pairwise comparisons and our interest lies equally in a great number of such comparisons and not exclusively on specific ones, hypothesis tests were not performed and p-values for the differences found are not reported. Instead, as previously mentioned, the focus is set on the interpretation of the effect magnitudes present in the data.

To that purpose, average procesing times (ms) per word were computed and considered for each AOI. Differences between conditions under 5% were considered marginal; a difference of 5 to 9.99% was considered small; from 10 to 19.99% it was taken as a medium effect, and, finally, large effects were interpreted when the difference amounted to over 19.99%.

4. Results

4.1 Total reading time

Table 1 shows the total reading time per word needed to process the different AOIs marked for utterance in condition (a) (explicit condition with *por tanto*) versus condition (b) (implicit condition).

Table 1. Total reading time in milliseconds (ms). Explicit condition (*por tanto*) vs implicit condition

	Explicit condition *(por tanto)*	**Implicit condition (Ø)**	**Difference**
DS1	236.10	233.79	0.99%
DS2	**223.87**	170.87	**31.02%**
conceptual meaning word	226.29	215.88	4.82%
average utterance word	**254.73**	215.88	**18%**
connective *por tanto*	325.82	–	–

Taking into consideration an average utterance word, the explicit condition is processed more slowly than the implicit condition (254.73 versus 215.88 ms, equal to 18%); such increase in reading time seems to originate at the DS2, which is read over 31% more slowly when preceded by a connective (in contrast, the two DS1

exhibit very similar reading times, < 1% difference). The presence of *por tanto* in a cause-consequence discourse relation, thus, seems to increase processing effort. Using a procedural guide (Blakemore 1987, 2002; Martín Zorraquino and Portolés 1999 for Spanish) to make explicit an argumentative relation already inferable from the content of the discourse segments themselves not only does not facilitate processing, but even slows it down. The instruction of the connective can be considered cognitively circumstantial to some extent, as it does not lead to higher contextual effects. This would support our second hypothesis, since the effort invested to read the connective, more than for the remaining AOIs, increases the global processing load of its utterance. At the same time, however, the instruction coded by *por tanto* evens out the time invested by participants to read each of the two causally related segments, which, compared to the implicit condition, now show more homogeneous processing times. The presence of *por tanto*, thus, seems to foster a more balanced distribution of the processing load across the cause and consequence segment (see also Nadal et al. 2016).

4.2 First-pass reading time

For first-pass reading times registered for the condition with *por tanto* and for the implicit condition (Table 2) three results are worth highlighting. Firstly, like total reading time, the presence of *por tanto* slows down processing at the DS2, 40.08% more costly than in the implicit condition (188.37 vs 134.47 ms). Secondly, in global terms, that is, considering an average utterance word, the condition with *por tanto* requires 210.02 ms per word during first-pass reading (i.e., during the construction of an initial assumption), 27.08% more than the average utterance word in the implicit condition (165.27 ms). Finally, if only conceptual-meaning words are considered (i.e., excluding the reading time of *por tanto*), the differences mentioned are reversed, and the implicit condition exhibits now 23.29% longer reading times.

Table 2. First-pass reading times in milliseconds (ms). Explicit condition (*por tanto*) vs implicit condition

	Explicit condition (*por tanto*)	**Implicit condition (Ø)**	**Difference**
DS1	191.23	185.91	2.86%
DS2	**188.37**	134.47	**40.08%**
conceptual-meaning word	134.05	**165.27**	**23.29%**
average utterance word	**210.02**	165.27	**27.08%**
connective *por tanto*	269.50	–	–

In light of these data, and in line with the results found for the total reading time, we can conclude that, during the construction of an initial assumption, *por tanto* constitutes the attention focus during processing within its utterance. As a result, an increase is registered for an average utterance word, while processing costs are more homogeneously distributed between the DS1 and the DS2 than in the implicit condition. *Por tanto* assumes a leading role in the construction of causality and re-distributes the times needed to process other AOIs, thus imposing a different pattern than that obtained for the implicit condition. Again, this would support our second hypothesis. Furthermore, *por tanto* leads to a slowdown when processing its DS2 (40%), compared with the implicit condition, where the DS1 requires a higher processing time than the DS2 both during first-pass and total reading time.

Finally, from the fact that conceptual meaning words are processed more slowly in the absence of the connective (165.27 ms, over 23%) we can conclude that the procedural meaning of *por tanto* plays down the contribution of the lexical expressions of the utterance to recovering the initial assumption, compared to utterances in which no connective is provided.

4.3 Second-pass reading time

During re-reading, where mainly the ostensively communicated assumption is reconstructed, in the comparison of both conditions (Table 3) two results stand out. On the one hand, in the explicit condition more time is needed to read an average conceptual-meaning word than the connective. This suggests that *por tanto* is not very costly during the re-processing stage, which constrasts with the results obtained for first-pass reading, where the connective was the attentional focus.

Table 3. Second-pass reading times in milliseconds (ms). Explicit condition (*por tanto*) vs implicit condition

	Explicit condition (*por tanto*)	**Implicit condition (Ø)**	**Difference**
DS1	44.78	**47.69**	**6.5%**
DS2	35.40	37.02	4.37%
conceptual-meaning word	**92.14**	50.41	**82.78%**
average utterance word	44.62	**50.41**	**12.98%**
connective *por tanto*	56.32	–	–

On the other hand, processing a conceptual meaning word in the explicit condition is 82.78% more costly than processing it in the implicit condition. As a result, we can argue that the leading role of the connective has faded away and recovering

the communicated assumption is done by resorting to the lexical guides of the utterance.

In a nutshell, the data suggest that using *por tanto* to signal a continuous cause-consequence discourse relation already expected from the inferred content of the lexical expressions of the utterance slows down processing. Despite exhibiting lower processing costs during second pass reading, in total reading time, that is to say, when both the initial construction and the reconstruction of the communicated assumption are considered, making the connection explicit by means of *por tanto* involves additional processing load.

5. Conclusions

Experimental approaches like the one adopted in this eye tracking study can help gain insight into the cognitive activity generated by procedural-meaning items, and provide further evidence on the distinctive semantic, syntactic and pragmatic features of connectives. In this work we have supplied experimental data from an eye tracking reading task to show how implicit or explicit (marked by *por tanto*) causal discourse relations are processed in Spanish. Results from the comparisons drawn between the two experimental conditions seem to support our second hypothesis: processing a cause-consequence relation signaled by *por tanto* is more effort-demanding than processing two causally-related adjacent segments. This finding allows us to make several claims.

Firstly, as a procedural-meaning linguistic device, the argumentative causal connective *por tanto* requires longer reading times than the conceptual-meaning words of its utterance in total and first pass reading time. Its role as an inferential guide (Blakemore 1987) and the asymmetrical relation that holds between it and linguistic items with a conceptual meaning – procedural devices always require the presence of some conceptual representation upon which to display their instructional meaning, but not the other way around, see Leonetti and Escandell Vidal (2004: 4) – confer it special relevance during the construction of an initial assumption, which is reflected in longer reading times. But it is precisely at the stages where the connective attracts the higher processing load, when its procedural instruction also balances the processing load of the cause and the consequence. By contrast, in the implicit relation, results show an imbalance in the processing load of the two segments in early and global measures.

Secondly, as has been shown in a number of works, for cognitive reasons, causality can be processed by default (Rudolph 1996; Murray 1997; Sanders 2005, among others). The high cognitive predictability of causal relations (Brehm-Jurish 2005; Asr and Demberg 2012; Köhne and Demberg 2013, among others) explains

the longer reading times of the utterances in the explicit conditions in the first-pass and in the total reading time. Again, the second hypothesis is confirmed, whereas the first one can be refuted: causality expressed by means of lexical devices seems to be sufficient for the reader to construct a communicated assumption and to derive implicatures from it. Thus, the procedural guide might be perceived as non-essential to deriving additional contextual effects. In this sense, the nature of connectives as interpretive guides (Blakemore 1987) might be nuanced: experimental evidence shows that the extent to which a connective determines processing varies depending on the type of discourse relation at issue.

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Appendix 1. Example of the first experimental list

Token set 1. Variable a

Context	*Marta y David son un joven matrimonio que disfruta mucho de su tiempo libre. Se conocieron en un grupo de senderismo.* 'Marta and David are a young couple who really enjoy their free time. They met in a hiking group.'
Critical stimulus	**Marta y David practican mucho deporte. Por tanto, están sanos.** (Salen a correr por el parque todas las tardes.) '**Marta and David do a lot of sport. Therefore, they are in good health.** (They go running in the park every afternoon)'
Filler	Los fines de semana hacen excursiones en bicicleta por la montaña. 'On the weekends they make mountain bike trips.'

Token set 2. Variable b

Context	*María y Carlos son dos niños de cinco años que se pasan el día comiendo.* 'María and Carlos are two children, they are five years old and spend all the day eating.'
Critical stimulus	**María y Carlos comen mucho dulce. Están gordos.** (El médico quiere ayudarles a cambiar su alimentación.) '**María and Carlos eat a lot of candy. They are fat.** (The doctor wants to help them change their diet.)'
Filler	Sus padres les regañan constantemente por comer tantas golosinas. 'Their parents constantly scold them for eating so many goodies.'

Token set 3. Distractor

Context	*Luis y Pablo son hermanos y vienen de una familia rica. El año pasado heredaron mucho dinero y algunas propiedades.* 'Luis and Pablo are siblings and come from a rich family. Last year they inherited a lot of money and some properties.'
Distractor	**Luis y Pablo tienen pocos problemas. Los dos viven felices.** (Han tenido mucha suerte en la vida.) '**Luis and Pablo have few problems. Both live happily**. (They have have been very lucky in life.)'
Filler	Solo trabajan por hobby en la bodega familiar, así que tienen mucho tiempo para viajar. 'Their hobby is to work at the family winery, so they have a lot of time to travel.'

Token set 4. Distractor

Context	*Juan y Ana son un matrimonio que vive en un pueblo y tiene varios huertos.* 'Juan and Ana are a couple that lives in a village and has several orchards.'
Distractor	**Ana y Juan toman mucha fruta. Por eso están sanos.** (Hace mucho tiempo que no van al médico.) '**Ana and Juan eat a lot of fruit. That's why they are healthy.** (They have not been to the doctor for a long time.)'
Filler	Llevan una vida tranquila y sin sobresaltos. 'They lead a quiet life without frights.'

Appendix 2. Mixed models

Table 4. Total reading times

Area of interest	Estimate	Std. error	Pr(>|t|)
Intercept	228.77	13.68	
Conceptual meaning word *por tanto*	−2.48	16.43	0.0879
Average utterance word *por tanto*	25.96	16.43	0.0115
Average utterance word Ø	−12.89	17.63	0.0465
DM1 *por tanto*	7.33	16.43	0.0655
DM1 Ø	5.02	17.63	0.0761
DM2 *por tanto*	−4.90	16.43	0.0657
DM2 Ø	−57.09	17.63	0.0001
Connective *por tanto*	97.55	16.43	<0.0001

Table 5. First-pass reading times

Area of interest	Estimate	Std. error	Pr(>|t|)
Intercept	179.56	11.15	
Conceptual meaning word *por tanto*	−45.51	13.55	<0.0001
Average utterance word *por tanto*	30.46	13.56	0.0027
Average utterance word Ø	−14.29	14.59	0.0305
DM1 *por tanto*	11.67	13.56	0.0392
DM1 Ø	6.35	14.59	0.0664
DM2 *por tanto*	8.81	13.56	0.0517
DM2 Ø	−45.09	14.59	0.0002
Connective *por tanto*	89.94	13.56	4.2877

Table 6. Second-pass reading times

Area of interest	Estimate	Std. error	Pr(>|t|)
Intercept	49.31	12.28	
Conceptual meaning word *por tanto*	42.83	15.83	0.0008
Average utterance word *por tanto*	−4.69	15.83	0.0001
Average utterance word Ø	1.10	17.03	0.0948
DM1 *por tanto*	−4.53	15.83	0.0775
DM1 Ø	−1.62	17.03	0.0924
DM2 *por tanto*	−13.91	15.83	0.0382
DM2 Ø	−12.29	17.03	0.0473
Connective *por tanto*	7.01	15.83	0.0659