

# Argument constructions and language processing: Evidence from a priming experiment and pedagogical implications<sup>1</sup>

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## **Abstract**

The notion of *argument construction* is widely accepted in Cognitive Linguistics circles as a highly explanatory theoretical construct. It has recently been incorporated into the *Lexical-Constructional Model* (LCM; Ruiz de Mendoza and Mairal 2007, 2008), a theoretical approach to meaning construction that integrates argument constructions into a broader model that incorporates meaning dimensions traditionally dealt with in the domain of pragmatics and discourse analysis. The LCM has an argument level of description, in the form of *constructional templates*, which are in general equivalent to the argument constructions postulated in Goldberg's (1995, 2006) *Construction Grammar*, although there are crucial differences in the descriptive metalanguage and the principles used to explain their linguistic behavior. Since the LCM is geared to have psychological adequacy, like all cognitive (cf. Lakoff 1990) and some functional approaches to language (e.g. Dik 1997), it is essential to find to what extent the notion of argument construction is a real processing mechanism. This paper presents a priming experiment measuring reaction times to sentences that had the same formal configurations but were based on different argument constructions, and to sentences that were formally similar and embodied the same argument construction. Subjects responded significantly faster to target sentences that shared the same construction as the previously viewed sentences. Thus, constructions appear to be psychological entities that play an important role in linguistic processing. If this is correct, then it has potentially important consequences for planning adequate L2 teaching strategies.

**Keywords:** lexical-constructional model; argument construction; constructional template; processing; priming experiment; reaction time; teaching strategies

## **1. Introduction**

The notion of *argument construction* is central to a number of construction grammar accounts, especially Goldberg's *Construction Grammar* (Goldberg 1995, 2006; Michaelis 2003), which is strongly grounded in Cognitive Linguistics (see González and Butler 2006, Dirven and Ruiz de Mendoza 2008 for a comparison among the different approaches). It is also key to the core grammar level of the *Lexical Constructional Model* (LCM), which combines insights from cognitive and functional accounts of language (Ruiz de Mendoza and Mairal 2007, 2008; Mairal and Ruiz de Mendoza, 2008; cf. Butler 2008 for a review). In all these approaches it is generally postulated that we store in our minds higher-level argument configurations that can be instantiated by lower-level configurations (e.g. verbal predicates and their associated arguments) as licensed by coercion processes. For example, compare the use of *push*, a predicate expressing caused-motion, in *Noel Gallagher of Oasis got pushed off the stage at the Virgin Festival by a rogue fan*, and *laugh*, a non-causal activity predicate, in *Ari Fleischer was laughed off the stage by reporters*. A linguistic account in which the argument structure of verbal predicates is seen as determining the overall argument structure configuration of a sentence can deal with the sentence containing *push*. However, such an account cannot adequately explain why it is possible to use the verb *laugh* with the same argument structure configuration as *push*. *Laugh* typically occurs in

the intransitive form (e.g. *He didn't say anything; he just laughed*) or in pseudo-transitive configurations with a prepositional complement (e.g. *The teacher laughed at me*). In Construction Grammar it is assumed that 'laugh' is coerced into a causal transitive format (cf. Michaelis 2003). The LCM adds a licensing factor for coercion to take place. In the example, the predicate 'laugh' can be built into the caused-motion construction because it is possible to see psychological or emotional impact in terms of physical impact, which is a form of metaphorical thought that Ruiz de Mendoza and Mairal (2007) have labeled *high-level metaphor*, since it has a more abstract nature than lexical or situational metaphors. Because of their abstract nature, high-level metaphors usually underlie grammatical phenomena.

Since postulating the existence of constructional meaning is necessary to explain the linguistic behavior of *laugh* (and many other uses of other verbal predicates, as will be seen below), we need to know if argument constructions are more than a theoretical convenience and can be regarded as cognitively adequate constructs, which means that they actually play a role in language processing. There has been some research that is suggestive of the psychological adequacy of argument constructions (cf. Goldberg 2006 for a review). The present paper aims to contribute to the still scarce literature on the psychological adequacy of postulating constructional meaning. We will do so by means of a priming experiment. The experiment shows that prior presentation of sentences with a particular construction speeds the subsequent recognition of a sentence containing the same construction. The experimental results by no means involve that constructional meaning have an overriding effect on purely syntactic processing, but they point to constructional meaning having some role. Further and more complex experimentation will be needed to find out about the balance between lexical, constructional and syntactic clues to processing. In the meantime, we believe it is enough to find that constructions are at least plausible constructs from a psychological perspective. This being so, we contend that constructions should be taken into account in second language teaching methodology.

## 2. Constructions

As noted by Schönefeld (2005), the notion of construction has a long tradition in linguistics. It may refer to either specific syntactic patterns (e.g. passives, existentials, participials) or to clause types conveying a complete idea. In Cognitive Linguistics constructions are understood differently as learned pairings of form and function, and are regarded as the basic units of language. In this view of language, the theoretical machinery used to describe lexicon and grammar is essentially the same. Many constructions are idiomatic in different degrees (cf. Fillmore, Kay, and O'Connor 1988). When a construction is fully idiomatic, i.e. when its elements resist lexical or grammatical alteration (e.g. *spill the beans*, *kick it/kick the bucket*) we have a *substantive* idiom. When a construction is a combination of fixed and variable elements, as is the case of *What's X Doing Y?*, studied by Kay and Fillmore (1999), which conveys the meaning that the situation described worries the speaker (cf. *What's that child doing in the kitchen with the carving knife?*), we have a *formal* idiom.

Other constructions, like the caused-motion configuration (which is described by Goldberg, 1995 as X CAUSES Y TO MOVE Z), have a more abstract nature. These are called *argument constructions* since they contain argument roles related by abstract predicates. These constructions, like lexical items, have their own range of meanings (i.e. a construction can be

polysemous) and meaning relations. An example of constructional polysemy is provided by the *ditransitive construction* (Goldberg 1995: 75). Compare *Mary gave John a cake* (where X causes Y to receive Z), with *Mary baked John a cake* (where X intends to cause Y to receive Z), or *Mary denied John a cake* (where X causes Y not to receive Z). Relations between constructions, which in functional and formal models of language have been called alternations (cf. Levin, 1993), depend on other factors, some of which have been discussed by Goldberg (1995) in terms of “links” between constructions. One kind of link occurs when a construction is a more specific instance of another construction. This is the case of the ditransitive, which is a specification of the more generic subject-object construction in terms of the type of verb phrase (involving a potential or actual transfer) and semantic roles that can occur in it (agent, theme, recipient). We may also find subpart links, which relate independent constructions, such as the caused-motion and the intransitive constructions, where one profiles part of the elements of the other: *The sergeant marched the recruits* profiles the cause (the sergeant) and the theme (the recruits) elements, whereas *The recruits marched* only profiles the theme (recruits). Instance links, in turn, apply when one construction is a special case of another construction. For example, the verb *drive* may be used in a resultative sense that has an idiomatic character (*She drives me crazy/mad/\*bored/\*sad*). This kind of idiomatic construction is a special case of the resultative construction. Finally, the resultative construction in *She drank him unconscious* can be considered to be a metaphorical extension of a literal construction as in *She hammered the metal flat*, on the basis of the experiential conflation between goals and destinations (reaching a destination is a form of attaining a goal) that allow us to understand the former in terms of the latter.

The LCM bases its descriptive apparatus on *lexical* and *constructional templates*, both of which share the same descriptive metalanguage. Lexical templates consist of combinations of *lexical functions* and *semantic primes*. The former capture the semantic and pragmatic parameters that underlie predicate meaning; the latter are based on the Aktionsart (i.e. lexical aspect) characterizations proposed by Van Valin and LaPolla (1997) and Van Valin (2005) as a development of Vendler’s (1957) seminal work in this respect. Both lexical functions and semantic primes have a number of variables (or predicate arguments) within their scope. In a parallel way, constructional templates are made up of constructional functions and abstract semantic primes. Lexical variables fuse into corresponding argument structure variables (or roles) and their associated structure, thus giving rise to fully developed argument structure configurations. Interestingly, both lexical and constructional templates share the same Aktionsart characterizations, e.g. abstract predicates like CAUSE, BECOME, INGR (for ‘ingressive’), SEMEL (for ‘semelfactive’), which respectively signal cause-effect relationships, change, suddenness in a change of state, and brief duration (cf. Van Valin and LaPolla 1997, Van Valin 2005). The list of abstract predicates is only partially overlapping with those used on a rather *ad hoc* basis in Goldberg’s (1995) Construction Grammar. For example, INGR and SEMEL are not used by Goldberg, and predicates like MOVE, HAVE, DIRECT ACTION, which are used by Goldberg, are not based on Aktionsart distinctions, but have a role parallel to that of lexical functions in a lexical description. The advantage of constructional descriptions in the LCM is twofold: (i) using the same metalanguage for lexical and constructional templates endows this aspect of the model with descriptive regularity and responds to the fact that constructional descriptions are based on abstractions over a large number of verbal predicate descriptions (for example, the caused-motion construction is derived from verbal predicates such as *push* and *throw* that express caused-motion); (ii) all descriptive elements are assigned their proper role, i.e.

there is no mixing up of descriptive categories: Aktionsart elements (e.g. CAUSE, BECOME) belong to the logical structure characterization of the construction and other elements are regarded as constructional functions (e.g. LOC in the caused-motion constructional template [**do**' (x, y)] CAUSE [BECOME \*NOT **be-LOC**' (y, z)], which is read as 'an entity *x* does something to another entity *y* such that *y* is caused to become in a different location *z*'). However, despite these differences with Construction Grammar, the LCM shares with Construction Grammar the view that argument structure does not only derive from lexical items but results from the principled interaction between lexical and constructional structure.

Until fairly recently, the adequacy of postulating constructions has been mainly defended on the basis of linguistic evidence (e.g. Bybee 2003; Croft 2001; Fillmore et al. 1988; Goldberg 1995, 2006; Jackendoff 2002; Kay and Fillmore 1999; Langacker 2005; Michaelis 2003; Verhagen 2005) and some complementary evidence coming from the field of child language (e.g. Diessel and Tomasello 2001; Goldberg 2006; Tomasello 2003). The theoretical import of a constructional account of language from a linguistic perspective has been shown by Goldberg in a number of studies. To illustrate her views, we will adapt some of the observations given in Goldberg and Bencini (2005) about the power of construction-based explanations of linguistic structure. Consider, for example, the verb *sneeze* in the following sentences:

- (1)
  - a. Mary sneezed all day long.
  - b. The song is about a meatball that is sneezed off of the top of a plate of spaghetti.
  - c. She sneezed herself silly.
  - d. Did you hear the tale of a woman who took a pinch of snuff and sneezed herself to death?
  - e. The elephant sneezed a sneeze that nearly unseated his rider.
  - f. She hacked and coughed and sneezed her way to the doctor's office.
  - g. Who sneezed on my laptop?
  - h. Grandma was trying to feed the baby but got sneezed at first.
  - i. Naturopathy is nothing to be sneezed at!

In order to account for all these uses of *sneeze*, a verb-based (or projectionist) account would have to postulate multiple argument structures, each associated with a specific meaning. However, it would be rather odd to postulate senses such as 'to cause something to move by sneezing at it'—as in example (1b)— 'to cause a resultant state by sneezing' —as in examples (1c) and (1d)— 'to cause a specific type of sneeze to happen' —example (1e)— 'to remove all obstacles to reach a place by sneezing' —example (1f)— 'to make a place dirty by sneezing' —example (1g)— and 'to ignore something without giving it much thought'. In a constructionist account we only have one generic meaning for *sneeze* as the action of expelling air through the nose violently and involuntarily. This meaning is then adapted to constructional meaning requirements, thus acquiring a causal sense —examples (1b)- (1f)— and/or focusing attention on the result of sneezing —examples (1b)-(1g)— or even seeing the act of sneezing as directed to an object, whether in a literal (1h) or a non-literal way (1i). Each of these constructions may take in many other verbal predicates that share the same sensitiveness to the constructional requirements as *sneeze*. Consider now some of the many possible instantiations of the caused-motion construction:

- (2)

- a. He blew the leaf off the tree stump.
- b. She drove me into the arms of another woman.
- c. It nearly scared me out my seat.
- d. The audience laughed the actor off the stage.
- e. He stared me out of the room.
- f. They talked me into the business.
- g. She loved me back into existence.

The examples in (2) make use of a caused-motion configuration for different purposes. In (2a) the predicate ‘blow’, whose canonical use is intransitive, is transitivized thus acquiring a causal sense that licenses its use in the caused-motion construction. In this construction, the object is what Ruiz de Mendoza and Mairal (2007) have called an *effectual object*, i.e. an object that directly receives and is affected by the physical impact of the action. The adaptation of the verbal predicate and its associated argument structure that takes place in (2a) is very similar to the one in (2b), with the difference that ‘drive’ has acquired a specialized sense as a (literal) caused-motion predicate (e.g. *drive a nail into the wall*), which here, in a default interpretation, is used figuratively. Sentence (2c) has a transitive verb that would not normally signal physical causation, which points to a metaphor-based licensing of its participation in the caused-motion construction, in which there is physical causation. As a result of the metaphor, the object is treated as if it were an effectual object. Examples (2d) and (2e) take us a step further. In both we have an object-goal, grammatically marked by the preposition *at*, seen as an effectual object. In (2d), and (2e), just as in (2c), there is literal caused motion. The overall interpretive rationale behind these three examples is used in (2f), with the only difference that here motion is figurative. Finally, (2g) goes even further since ‘love’ does not designate an action but a state (cf. van Valin and LaPolla 1997) with an object within its scope. In Hallidayan grammar (cf. Halliday and Matthiessen 2004) the predicate ‘love’ has two associated roles: a sensor and a phenomenon. In (2g) the protagonist, the sensor, is seen as if she were the effector of an action and the speaker, the phenomenon, is seen as it were an effectual object.

Our discussion of the linguistic regularities in examples in (1) and (2) points to the need to take constructional meaning seriously if we want to have a better understanding of the intricacies of meaning construction. Note that Bencini and Goldberg (2000) do not deny the importance of verbal semantics in figuring out the meaning of a given construct. In fact, it is readily acknowledged that on some occasions verbal meaning is much more powerful than constructional semantics (e.g. “envy” in *The prince envied him his fortune*, where the ‘successful transfer’ core meaning of the ditransitive construction is overridden by the meaning of the verbal predicate). Rather, the fundamental point Bencini and Goldberg make is that constructions are overall better determinants of sentence meaning than verb meaning. This claim is partially compatible with our own findings (see Section 4) and also with the spirit of the LCM. In our view, the constructional account complements verb-based approaches that regard syntax either as the result of instantiating the argument structure of verbal predicates or as an autonomous system that is constrained by the syntactically-relevant thematic structure of predicates. If this is so, it is a natural question to determine the psychological adequacy of the concept of construction and its apparent role in linguistic processing at sentence level. We turn to this question in the following sections.

### 3. Syntax-based or construction-based processing?

The idea that syntactic structure is of primary importance in sentence comprehension is hardly questionable. Powerful evidence in favor of this claim can be found in pause tests and eye movement analysis while processing structurally ambiguous sentences (e.g. Frazier and Rayner 1982). A good example is provided by work on so-called “garden-path sentences”, i.e. sentences whose structural ambiguity mislead readers into selecting the wrong interpretation, such as *The old man the boats* (Rumelhart 1977) or *The prime number few* (Milne 1982). For example, in a reading-aloud protocol, Rumelhart (1977) reports that experimental subjects would make a pause between *man* and *the boats* while reading aloud the sentence *The old man the boats*. The pause was interpreted as an indication of structural reanalysis and subsequent reinterpretation where *man* is a verb and the adjective *old* is the head of a noun phrase. However, there is also evidence not only that syntactic parsing is not always the primary factor in sentence comprehension, but also that syntactic structure may be completely overridden by, for example, lexical and world knowledge (e.g. MacDonald 1993; MacDonald et al. 1994, St. John and McClelland 1990) or factors related to exemplar-based frequency, i.e. the piecemeal learning of thousands of constructions and the frequency-biased abstraction of regularities within them (Ellis 2002).

The observation that world knowledge may override syntax-based processing is not new at all. For example, as far back as 1966, Slobin found that non-reversible passives like *The flowers are being watered by the girl* are understood and remembered more easily than reversible passives like *The boy was hit by the girl*. The lexical sequence *flowers-water-girl* allows us to come up with an interpretation without making use of syntax (we do not expect flowers to water girls), which is not the case with the sequence *boy-hit-girl* (boys may hit girls or girls may hit boys). Evidently, lexically-cued common world knowledge plays a role in interpretation to such an extent that it may override syntax (cf. Slobin 1966).

But the question of sentence comprehension goes beyond merely attesting to the importance of lexical knowledge and frequency factors. Since there is linguistic support in favor of the existence of argument-based constructions, it is legitimate to inquire into their psychological status and their role, if any, in sentence comprehension. The psychological nature of idiomatic constructions, whether substantive or formal, has been investigated in much detail by Gibbs (1994), who argues that they are often partially non-compositional and grounded in metaphor. Whether we accept Gibb’s thesis or not, the psychological reality of idioms (i.e. their status as accessible and interpretable linguistic units) is as self-evident as the psychological reality of simple and compound content-carrying lexical items and should pose no problem in terms of what cognitive linguists often refer to as the *cognitive commitment* (cf. Lakoff 1990). This commitment aims to make linguistic generalizations either compatible with or subservient to empirical evidence coming from research in any branch of the cognitive sciences (including experimental psychology, neurology, and artificial intelligence). However, the psychological reality of non-idiomatic (or argument) constructions, like those discussed in the previous section, is a matter of controversy.

In recent years the validity of argument constructions has been explored from the point of view of psycholinguistic research (cf. Hare and Goldberg 1999; Bencini and Goldberg 2000; Goldberg and Bencini 2005). Let us take an example. Bencini and Goldberg (2000) report experimental evidence of two sorting experiments designed to find out whether argument constructions play a role in determining sentence meaning. Participants were required to sort four sets of sentences in terms of their overall meaning. Each set presented one of the verbs in four

different constructions: transitive (e.g. *Pat threw the hammer*), ditransitive (e.g. *Chris threw Linda the pencil*), caused-motion (e.g. *Pat threw the key onto the roof*), and resultative (e.g. *Lyn threw the box apart*). The stimuli used were designed so as to minimize content overlap that could distort the results of the experiment. Thus, the experiment avoided the use of identical lexical items or near synonyms in the stimuli other than the verbal predicate tested. For example, sentences like *Pat shot the duck* and *Pat shot the duck dead* were discarded since they would likely be grouped together on the basis of shared content, despite the fact that they make use of different constructions (transitive versus resultative). Sentences like *Pat shot the elephant* and *Patricia stabbed a pachyderm*, which make use of the same construction, were also excluded since they would probably be grouped together not on constructional grounds but simply because of the use of close synonyms. In the experiment, 7 out of 17 participants sorted entirely by construction, no participant sorted entirely by verb, and the other 10 produced mixed sorts. Further testing, which consisted of computing a deviation score from entirely verb-based and construction-based scores, showed that the mixed-performance participants did not sort by relying exclusively either on the verb or on the construction. The results suggest that verb-centered (i.e. projectionist) views of meaning interpretation may not be sustained since constructions play a significant role whatever the processing style of the individual.

Further evidence in favor of the psychological reality of argument constructions comes from priming experiments. Priming has been argued to be a promising way of tapping into linguistic processes (Braningan et al. 2005). Interestingly enough, as reported by Hare and Goldberg (1999) and Goldberg and Bencini (2005), there are priming experiments that tend to support syntactic processing as the overriding factor in sentence comprehension. These experiments, in principle, would undermine the theoretical status of constructions as relevant factors in guiding interpretation. For example, when shown a picture that could be described either with a ditransitive (e.g. *John gave the dog a biscuit*) or a prepositional dative sentence (e.g. *John gave a biscuit to the dog*), subjects were more likely to describe it with a ditransitive if they had been primed with a preceding unrelated ditransitive (Bock and Loebell 1990; see also Bock, Loebell, and Morey 1992). However, as Hare and Goldberg (1999) note, the syntactic primes used in the experiments sometimes shared significant semantic structure with the target sentences. For example, the prepositional locative *The widow drove an old Mercedes to the church* was found to prime the prepositional dative *The widow gave an old Mercedes to the church*. At first sight, priming may be attributed to syntactic similarity despite the different thematic structure. But the two sentences share enough lexical content to interfere in the results and, as observed by Goldberg and Bencini (2005), the dative and locative expressions are instances of the caused-motion construction. These two facts are enough to provide a reliable alternative interpretation of Bock and Loebell's (1990) results. However, in order to test whether semantic factors play a role in cases of priming like this, Hare and Goldberg (1999) replicated Bock and Loebell's (1990) experiment, but introducing a third prime, a 'provide with' structure (e.g. *The officers provided the soldiers with guns*), which is syntactically similar to the prepositional dative (NP V NP PP) and parallels the ditransitive in terms of the order of semantic roles (<agent, recipient, theme>). Results showed that 'provide with' expressions prime ditransitives as much as ditransitives themselves, which again argues in favor of the important weight of constructional meaning in sentence comprehension.

#### **4. A grammaticality judgment priming experiment**

In the research context that we have described, priming effects were obtained for ditransitive constructions. Other experiments, such as the one based on sorting tasks, considered transitive, ditransitive, caused-motion, and resultative configurations. We wonder whether priming effects would reinforce the findings obtained on the basis of sorting tasks. We further wonder whether other constructions, such as the *benefactive*, the *instrument subject*, the *X one's way*, and the *reciprocal* constructions would also respond positively to priming tests. Note that the constructions explored in the sorting task were very closely related from a formal and even semantic perspective. This observation is fairly evident in the case of the transitive-ditransitive connection, but it also holds for the resultative and caused-motion constructions, which can be considered extensions of the basic transitive pattern; cf. *The blacksmith hammered the metal* (transitive) > *The blacksmith hammered the metal flat* (resultative)/*into the shape of a bird* (figurative use of caused-motion to express result). The resultative and caused-motion constructions require an effectual object of the action, which explains the need for them to be constructed on the basis of a prototypical transitive pattern. In contrast, our own choice of additional constructions enhances formal and semantic diversity rather than relatedness: the benefactive focuses on the argument that receives the benefit of the action; the instrument subject construction gives prominence to the instrument of the action by promoting it to the subject position; the way-construction (e.g. *Ellen pushed her way through obstacles* ‘created a way through obstacles by pushing’) conflates action and manner of action into the verbal predicate which has a fixed object (*one's way*) that is treated (through metaphor-based licensing) as if it were an effectual object rather than the result of the action; and the reciprocal construction is semantically transitive but grammatically intransitive (e.g. in *Raymond and Carla met*, Raymond meets Carla and Carla meets Raymond). We also decided to explore a different priming task based on grammaticality judgments. The reason for this is that grammaticality judgments would allow us to design a more complex experiment in terms of the broader range of constructions for which pictorial representation would hardly be feasible.

We achieved our experimental design goal by comparing sentences that contain particular constructional templates, such as *Henry and Myra agreed* (which contains a reciprocal construction) with sentences such as *Kristie and Dan studied* which have the same syntactic structure, but no reciprocal construction. This was inspired by a study by Costa and Sebastián-Gallés (1998), in which the syllabic structure of primes had an effect on the reaction times of targets with the same syllabic structure. In the grammaticality judgment task we employed, subjects saw strings of words on the computer screen and had to decide whether the string made a good English sentence or a bad one. Reaction times served as the dependent variable. The following subsections give the details of the experiment and discuss the results.

#### 4.1. Subjects

Test subjects consisted of 36 linguistically naïve native English-speaking college students enrolled in undergraduate foreign language classes: 12 females and 23 males, with an average age of 22.8 (range: 18-26).

#### 4.2. Stimulus items

A total of 12 test sentences were used: two sentences for each of six different constructional

templates (see Appendix). In the grammaticality judgment task, these 12 sentences were targets that were immediately preceded by three priming sentences. The primes either had the same constructional template as the target or only shared syntactic similarity. The former were our research objective and the latter acted as a control condition on the former. For example, the reciprocal test sentence *Henry and Myra agreed* was preceded by one of the two following sets of sentences:

(3)

**Same Constructional Template**

Raymond and Karla met.  
Jon and Barney visited.  
Klein and Garcia collaborated.

**Only Syntactically Similar**

Beth and Wally sneezed.  
Kristie and Dan studied.  
Lee and Holly graduated.

All the sentences in (3) share a ‘NP objectless VP’ formal configuration, but the set on the left fulfills the requirements for ascription to the reciprocal construction (cf. *Raymond and Karla met each other*; *Jon and Barney visited each other*; *Klein and Garcia collaborated with each other*) while the set on the right does not (*\*Beth and Wally sneezed (at) each other*; *\*Kristie and Dan studied each other*; *\*Lee and Holly graduated each other*). We used this arrangement for all our test-stimuli sentences, which resulted in 12 blocks of four items: three primes followed by a test target. All of the sentences in these blocks were licit English sentences. An additional 40 licit sentences (e.g. *They competed for her attention*) and 68 illicit sentences (e.g. *Josey knelt the ocean awake*) that were syntactically similar to the other primes were also included as distractors so that subjects were not aware of our real test targets. The constructional heterogeneity of the control primes and the inclusion of distractors were intended to reduce the possibility of the control primes creating misleading expectations that would slow down the interpretation of the control targets. This design resulted in a total of 156 sentences.

Two different test sets were designed. In the first set, one of each of the 12 target sentences with one of the six constructional templates was preceded by three priming sentences with the same constructional template, and the other six target sentences by three priming sentences that were only syntactically similar (see (3)). The second test set differed only in that the type of primes that preceded each target was reversed. This design allowed us to compare reaction times to the same sentence that had been preceded by different kinds of primes.

#### 4.3. Procedure

Before starting the experiment the subjects were randomly assigned to view one of the two test sets. They were then seated at a computer and given these instructions:

In this study you will see sentences on the screen. Your job is to determine if the sentence is correct or not. If it is correct press the key marked GOOD. If it is not correct press the key marked BAD. Now, put your left index finger on the BAD key and your right index finger on the GOOD key. The screen also has notes marked GOOD and BAD to help you. Let's do some practice sentences so you know what to expect. Please try to answer as quickly as possible.

At this point the subjects responded to four practice items and were then given a chance to ask

questions. If they understood the task they went on to the experiment that lasted about 10 minutes. If not, they were given more instructions and repeated the practice items before continuing on to the test items.

The order in which the sentences were presented was quasi-randomized so that the 108 distractor sentences (68 incorrect and 40 correct) were randomly dispersed among the test blocks, and the test blocks were randomized in regards to each other. In this way, each subject received a different order of the 156 items. Of course, within the test blocks the three primes all appeared before the target sentences and their order was fixed. The sentences were presented in large black font on a white background in the center of the screen in standard American English orthography. The sentences appeared on the screen for 2200ms with a lag of 1933ms of blank screen between each one. Pilot studies showed this pace was slow enough that people felt they had enough time to read and respond, to the sentences, but quick enough that they had to remain focused on the task. The DMDX<sup>2</sup> presentation software was used to carry out the experiment.

#### 4.4. Results and discussion

Technical difficulties resulted in the loss of data from one subject. Of the 420 responses to the targets (35 subjects times 12 test items) three responses were not registered because they were made while the next item was being presented. In addition, 41 responses were errors in which subjects mistakenly pressed the BAD key for a test item. Errors were marked in the output file generated by the presentation software. Together errors comprise ten percent of responses to test items. Mean reaction times for the remaining items were used as the dependent variable in a paired t-test. The independent variable was whether the test sentence was preceded by priming sentences with the same constructional template or sentences that were only syntactically similar.

No significant difference was found between the two groups ( $t(11) = 1.9, p = 0.084$ ). However, inspection of the mean reaction time for each of the 12 test sentences revealed that in all cases but two, priming the target sentences with sentences with the same constructional template yielded quicker response times. What is more, the two exceptions were the two resultative test sentences (*Garrett cut their hair short*; *Protesters burned the office black*). The goal of the experiment was to test whether constructional templates in general play a part in linguistic processing. The fact that the resultative sentences do not yield the same priming effect needs to be pointed out, and merits further attention. At this stage we can only speculate. We suspect that the problem is that test-stimuli sentences like *Brittany saw the statute broken*, *Sarah perceived the relationship unhealthy*, and *Josh thought the treatment fair* are more than syntactically similar to resultatives; they are non-central cases of resultative, that is, they have some resultative ingredient at some stage in processing. For example, *Brittany saw the statute broken* metonymically suggests that someone did something to the statute and as a result it was broken. The same reasoning schema may be applied to the rest of the examples. If this speculation is true, resultatives will most likely resist an experimental design that attempts to discriminate between constructional and syntactic priming. At the same time, this problem should not distract us from the broader goal of examining constructional templates experimentally. For this reason, we felt justified in removing the resultative sentences and performing another t-test on the remaining ten items. This analysis demonstrates a clear tendency toward facilitative priming ( $t(9) = 2.92, p = 0.017$ ). On average, target sentences that were primed by sentences with the same constructional template were responded to 180.44ms faster than in the syntactically similar condition (1536.21ms versus 1716.65 ms respectively).

The results of the experiment are heartening because the paradigm appears to provide a way of testing that to some extent disentangles syntax from constructional templates. On the one hand, subjects carried out a straightforward task of reading sentences and making a binary choice as to whether the sentences were correct or not. The test sentences were short, syntactically simple, and relatively simple semantically as well. On the other hand, reaction times are known to be influenced by a myriad of factors such as word frequency, collocation frequency, spelling regularity, etc. There is no guarantee that the priming effect measured in the present study was not affected by confounding syntactic, grammatical, or pragmatic factors that were not controlled for. We trust that future studies will give more insight into such possible confounds in a priming study of this nature.

## 5. Constructions and second language learning

Very recently, Valenzuela and Rojo (2008) have replicated the sorting study by Bencini and Goldberg (2000) described in Section 3 above. Following the trend initiated by Liang (2002) and pursued by Gries and Wulff (2005), who analyze the behavior of non-native speakers of English, their study uses Spanish learners of English as subjects. The sorting task in Valenzuela and Rojo's study has yielded results that are consistent with the ones in Bencini and Goldberg (2000) for native speakers: the Spanish learners of English in their experiment tended to rely on constructional over verbal meaning. But Valenzuela and Rojo have additionally chosen to complement these results in two ways. First, they provide us with an analysis of the use of the ditransitive construction in the *International Corpus of Learner English* (ICLE), which they compare with Gries and Stefanowitsch's (2004) analysis of related data for native speakers of English in the *International Corpus of English* and with data from German and Polish L2 speakers in other studies. The comparison reveals that some of the central uses of the ditransitive construction are shared by L1 and L2 speakers. The study also shows that both native speakers and Spanish learners of English use verbs like *teach* and *offer* in the same proportion in the ditransitive and prepositional variants. Second, Valenzuela and Rojo offer further evidence on the use of the ditransitive construction through an acceptability rating task, which reveals that Spanish learners of English perceive ditransitives containing a personal pronoun as more acceptable than their prepositional counterparts. These findings are also in harmony with the study carried out by Martínez-Vázquez (2008), which examines the extent to which learners' L1 typology affects comprehension and production of L2 constructions. The study focuses on the caused-motion construction and shows that learners of English with a source language that has a similar construction (German, Dutch, Swedish) make a better use of the construction in L2 than those whose mother tongue makes limited or no use of the construction (Spanish, French, Italian).

Considered together, the L2 experiments and corpus analysis strongly suggest that constructional configurations play a relevant role in second language learning and use. If further considered in the light of the L1 experiments and the linguistic evidence, the L2 results have necessary implications for language pedagogy, especially when an L2 construction has no straightforward counterpart in L1. Think of the productivity of the caused-motion pattern in English, which is not shared by Spanish, where a word-to-word rendering of sentences like *Phil was cheated out of his job* (one of our constructional primes) is impossible (cf. *\*Phil fue engañado hacia fuera de su trabajo*). Spanish requires a generic causative predicate like *hacer* ('make', 'cause to') plus an object-infinitival construction and a separate manner adjunct:

(4)

A	Phil	le	hic-ieron	sal-ir	de	su
DAT	Phil[NAME]	DAT.SG	make-INDEFPRET.3PL	go.OUT-INF	of	POSS.3SG
trabajo	con	engaño-s				
job	with	trick-PL				

‘Phil was cheated out of his job’

However, in the secondary predication syntactic environment Spanish uses a “manipulative” construction similar to the English one though this possibility is mostly restricted to directive uses of the verb *querer* (‘want’) (cf. González 2008a,b):

(5)

Te	quier-o	en	mi	despacho	ya
ACC.SG	want-PRS.1SG	in	POSS.1SG	office	now

‘I want you in my office now!’

This manipulative construction has an English counterpart, as in *I want/expect you in my office now!* Awareness of this similarity may help Spanish learners of English understand the essentials of both literal and figurative uses of the caused-motion construction. This is possible because the manipulative construction is midway between cases of actual physical caused-motion (*He pushed me into his office*) and others where motion is caused to happen through psychological or emotional mechanisms (*He laughed me out of his office*), some of which are implicitly manipulative (cf. *He stared me out of the room*, where “stare” stands for ‘signaled by staring’).

Our discussion inevitably leads us to contrastive linguistics (cf. Weilbacher and Boas 2006) as a necessary ingredient for explicit language teaching which is ideally based on what has been dubbed a “pedagogical grammar”, that is, a principled inventory of all the form-meaning units of a language and their relations, whatever their nature, combined with a didactic approach as to how to best learn them (Dirven 2001; De Knop and De Rycker 2008). Furthermore, a pedagogical grammar should have not only descriptive but also explanatory adequacy (Ruiz de Mendoza 2008), which means that all relevant generalizations have to be taught in a way that is intuitively accessible to students. An example like *He laughed me out of his office*, which involves high-level metaphor, can be taught by first relating it to other cases of caused-motion, which can be graded from more literal to less literal uses, and then revealing the underlying rule that licenses the use in this construction of verbal predicates that do not express caused motion. The rule in fact is very simple: if the verb can be interpreted as having an effect that may cause a reaction to its object, then the verb may occur in the construction (e.g. stare can make people think that the person staring at them wants them to do something; being laughed at can make people feel bad and act accordingly; etc.).

In any event, the adequacy of a pedagogical grammar needs to be grounded in empirical research into the psychological validity of the categories it uses and into the way people make use of these categories in both L1 and L2. To put it rather crudely, if constructions were not a psychologically real category, learners would profit very little from their inclusion in any learning materials. The present paper has added to the state of the art in the effort to provide

empirical validation of the notion of construction. Of course, our experimental data do not falsify the syntax-based-processing thesis; but if taken in combination with the rest of the (still fragmentary) empirical research into constructional meaning, they suggest that constructional meaning is useful to understand some aspects of language production and comprehension.

## 6. Conclusions

The idea that constructional templates play a part in linguistic processing is a central tenet of cognitive linguistic models such as the Goldbergian strand of *Construction Grammar* (Goldberg 1995, 2006) and the *Lexical Constructional Model* (Ruiz de Mendoza and Mairal 2007, 2008). There is linguistic evidence that constructions play a role in meaning construction. A number of recent investigations have focused on providing psycholinguistic evidence for the psychological status of constructions in processing (e.g. Bock and Loebell 1990; Hare and Goldberg 1999). However, the experiments, one of which was based on visual primes and the other on a sentence-sorting task, have only dealt with a restricted set of closely related constructions. We decided to design a complementary experiment based on linguistic primes that investigated a broader range of constructions, some of which were not related to the ones explored in the previous experiments. In our experiment, subjects were primed with syntactically similar sentences, and sentences that were both syntactically similar and that embody the same argument construction. The latter type yielded a facilitatory priming effect. That is, subjects responded 180.44ms faster to target sentences that shared the same construction as the previously viewed sentences. Thus, constructions appear to be psychological entities that play a role in linguistic processing. It remains to be seen how constructional meaning interacts with other factors (e.g. overall or specific syntactic configuration, lexical content, frequency) to give rise to different processing strategies and styles. What we know about constructional meaning as having a role in language use, however, may be profitably used in enhancing second language teaching strategies.

## Notes

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2. [www.u.arizona.edu/~kforster/dmdx/dmdx.htm](http://www.u.arizona.edu/~kforster/dmdx/dmdx.htm)

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## Appendix-Test Stimuli

### Caused Motion

#### Primes: Same Constructional Template

Phil was cheated out of his job.  
Courtney was laughed out of the office.  
Julio was tossed out of the bar.

#### Primes: Only Syntactically Similar

Joan was arrested out of the country.  
Tom was playing out of his league.  
Gold was found out of the area.

**Target:** Jason was pushed out of the way.

Ushers forced people from the building.  
The government erased them from existence.  
Marie coaxed him from depression.

The sergeants pushed them from the start.  
Kevin admired her from a distance.  
She learned it from an e-mail.

**Target:** The explosion threw them from the car.

### Benefactive

#### Primes: Same Constructional Template

Jay carved toys for the orphans.  
Jimmy picked flowers for his sister.  
Mom fixed waffles for us.

#### Primes: Only Syntactically Similar

Terry designed models for a hobby.  
Bart told jokes for his amusement.  
Kent was imprisoned for his actions.

**Target:** Jared played songs for his friends.

Paul wrote a book for his kids.  
She sacrificed her time for her family.  
He wrote a check for the charity.

He swallowed it for ten dollars.  
They raced cars for the excitement.  
We visited monuments for a holiday.

**Target:** They did things for others.

### Resultative

#### Primes: Same Constructional Template

Ron kicked the door open.  
Spence smashed the box flat.  
Tom ate himself sick.

#### Primes: Only Syntactically Similar

Brittany saw the statute broken.  
Sarah perceived the relationship unhealthy.  
Josh thought the treatment fair.

**Target:** Garrett cut their hair short.

I wore those tires bald.  
They stuffed their faces full.  
Dave ran us ragged.

They believed the situation impossible.  
Biologists judged the land infertile.  
Ira felt the oven hot.

**Target:** Protesters burned the office black.

### Instrument Subject

**Primes: Same Constructional Template**

The ball broke the window.  
 The crane lifted the beam.  
 The antibiotic killed the bacteria

**Primes: Only Syntactically Similar**

The doctor cured the disease.  
 The workers loaded the truck.  
 The lawyer established his innocence.

**Target:** Heat melted the ice.

The explosion hurled rocks.  
 The paint ruined the carpet.  
 The electron split the atom.

The farmer fertilized the fields.  
 The hunters shot the ducks.  
 The survivors opened the coconuts.

**Target:** The lightning started the fire.**To X one's way****Primes: Same Constructional Template**

Carlos worked his way through college.  
 Ellen pushed her way through obstacles.  
 Keaton cut his way through the jungle.

**Primes: Only Syntactically Similar**

Jesus described his way through parables.  
 Shannon got her way through manipulation.  
 Jolene proved her way through experimentation.

**Target:** Casey worked his way through the book.

They munched their way through the supplies.  
 He talked his way through problems.  
 She picked her way through Moscow.

He forced his way through intimidation.  
 They got their way through trickery.  
 She described her way through gestures.

**Target:** Rain filtered its way through cracks.**Reciprocal****Primes: Same Constructional Template**

Raymond and Karla met.  
 Jon and Barney visited.  
 Klein and Garcia collaborated.

**Primes: Only Syntactically Similar**

Beth and Wally sneezed.  
 Kristie and Dan studied.  
 Lee and Holly graduated.

**Target:** Henry and Myra agreed.

The opponents concur.  
 The lovers kiss.  
 The brothers share.

The prisoners escape.  
 The workers strike.  
 The students study.

**Target:** The judges cooperate.