Argument structure: processing evidence for computation

As is known, it is possible to form many grammatical constructions from the same verb with a different argument structure e.g.: *the girl threw the ball, the ball was thrown, the throwing of the ball*, etc. For a long time, linguists have tried to figure out how these different realizations of the verbs argument structure relate to each other. The current study collected cognitive processing evidence to compare the predictions of two approaches to this issue: phrasal approaches and lexical approaches. It appeared that the predictions of the lexical approach by Müller & Wechsler (2014) are supported by the processing data.

Phrasal approaches (e.g. Goldberg & Jackendoff, 2004) explain argument structure by the lexical storage of constructions. These constructions have idiosyncratic meanings and contain slots for arguments and lexemes. Lexemes are inserted into the slots of the construction to create a linguistic expression. An example of such a construction is the ditransitive, which could be mentally represented as [NP V NP NP], with the meaning 'X caused Y to receive Z'.

In Müller & Wechsler's (2014) lexical theory, verb lexemes are stored with their *predicate argument structure*. This structure contains information about the number, type, form and semantics of the potential arguments of the verb. To form constructions, *lexical rules* are applied to the predicate argument structure. The lexical rules compute which of the potential arguments are expressed in the construction and determine their morphology. An example of a lexical rule would be the rule that forms the passive participle from the predicate argument structure. The output of a lexical rule is a construction: e.g. *the boy was kissed.* This output can however serve as the input for another lexical rule, for example the rule that forms the participle adjective: *the kissed boy.* For the lexical approach, argument structure emerges by computation, and some constructions require more computation than others because they require more lexical rules to be formed.

The two different approaches make different predictions about the processing time of constructions. The lexical approach predicts that the construction that requires the least lexical rules to be formed will be processed the fastest, following the derivational theory of complexity (Marantz 2005): constructions that need less derivations are less difficult to process. In contrast, the phrasal approach predicts that the most frequent construction will be processed the fastest, because it can be retrieved the fastest from the lexicon. To test this, the present participle (1a) and the adjective derived from the present participle (1b) in Dutch are compared. The present participle has low frequency (212 occurrences in the *Corpus Gesproken Nederlands 2016)*, but needs only one lexical rule to be formed. The adjective is highly frequent (531 occurrences in the same corpus), but needs two lexical rules to be formed. Therefore, the lexical approach predicts that the present participle will be processed the fastest, and the phrasal approach predicts that the adjective will be processed the fastest. To test these two predictions, thirty speakers of Dutch participated in a self-paced reading task. They read twenty sentence pairs with one sentence that contains a present participle and another sentence that contains an adjective that is formed from that present participle. Apart from this difference, the sentences were the same. Participants were presented with the sentences word by word, pressing the space bar to get the next word displayed. The times were measured from the appearance of the verbal lemma, either the adjective or the present participle, until the participant pressed the space bar to make the next word appear.

(1)	a.	*Het*	*snelle*	*meisje*	*gaat*	***hinkelend***	*van*	*de*	*trap.*	
		The	fast	girl	walks	hopscotching	of	the	stairs.	
		‘The fast girl goes down the stairs hopscotching.’								
	b.	*Het*	***hinkelende***	*meisje*	*gaat*	*snel*	*van*	*de*	*trap.*	
		The	hopscotching	girl	goes	fast	of	the	stairs.	
		‘The hopscotching girl goes the stairs down fast.’								

For ten pairs, the sentence with the present participle occurred first in the test, and for the other ten pairs, the sentence with the adjective occurred first. Moreover, two versions were used in which these orders where interchanged. In this way, the effect of priming by the first sentence was distributed equally over the two sentence types. Furthermore, the distance between the two sentences of one pair was always equal.

The results are analyzed with a linear mixed effects model. The model reveals that the estimated reaction time is 27.045 milliseconds (ms) lower for the present participles than for the adjectives (95% confidence interval: 10.57…43.51 ms). This difference is significant (t = 3.284, p from zero = 0.009043). This means that present participles are read faster than adjectives that are derived from present participles in Dutch. This result suggests that the number of lexical rules determines the reading time, and not the construction frequency. The data of the current study fit the prediction of the lexical approach by Müller & Wechsler (2014). However, some confounding factors cannot be completely excluded. For example, all adjectives in the design were one letter longer than the present participles. Moreover, the adjectives where always the second word of the sentence, which could have caused slower reader times than the present participles that were at the end of the sentence. Future research can try to exclude these factors. However, the current study shows how theoretical ideas can be translated in cognitive predictions and shows which predictions is in line with the data.

References

Goldberg, Adele E. and Jackendoff, Ray S. 2004. The English Resultative as a Family of Constructions. *Language* 80(3), 532–568.

Marantz, Alec. 2005. Generative linguistics within the cognitive neuroscience of language. *The Linguistic Review* 22: 429–445.

Müller, Stefan & Wechsler, Stephen. 2014. Lexical approaches to argument structure. *Theoretical Linguistics* 40(1–2), 1–76.