Verbs that are produced late are accessed early: Evidence from Dutch present perfect

Elli Tourtouri & Antje Meyer (Max Planck Institute for Psycholinguistics)
elli.tourtouri@mpi.nl

While it is widely accepted that sentence planning proceeds incrementally and speakers do not plan their entire utterance before they start speaking (Levelt, 1989), there is no consensus regarding the content of the advance planning units. For instance, is the (main) verb obligatorily part of the advance planning unit or not? Crucially, this is not merely a matter of timing, as the different approaches entail differences with regard to structure building in sentence production: An early retrieval of the verb suggests that it is necessary in syntactic structure building, because processes such as grammatical function assignment depend on the lexical properties of the verb (*lexical guidance hypothesis;* e.g., Bock & Levelt, 1994; Ferreira, 2000; Kempen & Huijbers, 1983). On the other hand, if the verb is retrieved after articulation has started, this would suggest that it is not necessary for syntactic planning. In this case, grammatical encoding would proceed based on the conceptual representation of the sentence message (*conceptual guidance hypothesis;* e.g., Fisher, Gleitman & Gleitman, 1991; Bock, Irwin & Davidson, 2004; Wagner, Jescheniak & Schriefers, 2010).

In this research, we seek to establish which of the two hypotheses (lexical guidance vs. conceptual guidance) can better account for verb retrieval, even in cases where the surface position of the verb is at the end of the sentence. To this end, we capitalise on a feature of Dutch (and other Germanic languages): verbs in present tense appear in the second sentence position, while verbs in present perfect (participles) are placed in a sentence-final position (see Table 1). In two picture-sentence interference experiments (e.g., Meyer, 1996; Momma et al., 2016), we measured participants' speech onset latencies as they produced simple sentences to describe the event or action depicted on a set of images (van de Velde et al., 2014). In both experiments, an auditory distractor verb, which was either semantically-related (synonym or antonym) or semantically-unrelated to the target verb, was presented in the infinitive form at picture onset (SOA=0 ms). Participants in Experiment 1 (N=21) produced sentences in present simple, while in Experiment 2 (N=20) they produced sentences in present perfect.[1] According to the lexical guidance hypothesis, the verb is retrieved early despite its sentence position, and a semantic interference (SI) effect is therefore predicted in both experiments. Under the conceptual guidance hypothesis, the verb is accessed on a just-on-time basis, thus a SI effect is expected only in Experiment 1.

The procedure was similar in both experiments: Participants were first familiarised with the pictures (N=57 in Exp.1; N=55 in Exp.2) and the corresponding sentence descriptions (present simple in Exp.1; present perfect in Exp.2). In a subsequent training phase, only the pictures were shown on the screen and participants had to produce the description. During this phase, the experimenter monitored participants' performance, and intervened when the verb used was neither the target nor a close synonym by repeating the sentence with the target verb. In order to create a dialogue environment, an auditory question (e.g., "What is the girl doing?"/"What did the girl do?") preceded the picture onset on each trial during the test phase. The test phase consisted of two blocks with a short break in between. Participants saw both conditions of each item, but in different blocks. The order of the blocks was randomised across participants, and the order of the trials within each block was randomised across the lists. Table 2 presents the steps followed in the data preprocessing procedure and data loss rates after each step.

Preliminary results indicate that in both experiments speech onset time was on average delayed in trials with semantically-related compared to semantically-unrelated distractors (Table 3). Linear mixed models with distractor verb as fixed effect (levels: related, unrelated) were fitted to the data (Barr et al., 2013), and confirmed the SI effect in both experiments (Table 4). These results offer two important insights regarding the scope of advance planning in sentence production: (a) they suggest that the verb lemma is retrieved at the outset of sentence planning, even in case the surface position of the verb is obligatorily at the end of the sentence, in line with the lexical guidance hypothesis, and (b) they indicate that at the lemma level interference can arise from verbs in different forms (cf. that uninflected verbs interfere with both inflected forms in Exp.1, and participles in Exp.2).

---

[1] Data collection is ongoing. We plan on collecting data from 42 participants for both experiments

Table 1. Example material

	Target sentence	Target verb	Related distractor	Unrelated distractor
Exp. 1	Het meisje **kietelt** de jongen *The girl tickles the boy*	kietelen *tickle*	strelen *caress*	vastleggen *capture*
Exp. 2	Het meisje heeft de jongen **gekietelt** *The girl has the boy tickled*	kietelen *tickle*	strelen *caress*	vastleggen *capture*

Table 2. Data loss rates after each step of preprocessing

	Exp.1 (present simple)	Exp. 2 (present perfect)
Corrupted sound files	4.43%	0.14%
Used verb not target/synonym	17.7%	16.38%
Disfluent utterance (pauses > 500ms, filled pauses, revisions)	10.56%	12.79%
Speech onset time > 3000 ms/2.5 SD	3.56%	2.43%

Table 3. Mean speech onset times and SDs per experiment

	Exp. 1 (present simple)		Exp. 2 (present perfect)	
Distractor verb	Mean	SD	Mean	SD
Semantically related	1276.4 ms	495.73 ms	1330.89 ms	525.39 ms
Semantically unrelated	1213.57 ms	445.27 ms	1240.07 ms	482.25 ms

Table 4. Results

		β	*SE*	*t*	*p*
Exp. 1 (present simple)	Intercept	1262.59	80.34	15.71	< .001***
	Distractor verb	60.22	15.58	3.86	< .001***
Exp.2 (present perfect)	Intercept	1293.1	87.19	14.83	< .001***
	Distractor verb	87.57	31.68	2.76	.009**

References

Barr, D., Levy, R., Scheepers, C., & Tily, H. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language, 68*, 255–278.

Bock, J. K., Irwin, D. E., & Davidson, D. J. (2004). Putting first things first. In J. M. Henderson & F. Ferreira (Eds.), *The integration of language, vision, and action: Eye movements and the visual world* (pp. 249–278). New York, NY: Psychology Press.

Bock, K., & Levelt, W. J. M. (1994). Language production: Grammatical encoding. In M. A. Gernsbacher (Ed.), *Handbook of Psycholinguistics* (pp. 945–984). London, UK: Academic Press.

Ferreira, F. (2000). Syntax in language production: An approach using tree-adjoining grammar. In L. Wheeldon (Ed.), *Aspects of language production* (pp. 291–330). Cambridge, MA: MIT Press.

Fisher, C., Gleitman, H., & Gleitman, L. R. (1991). On the semantic content of subcategorization frames. *Cognitive Psychology*, 23, 331–392.

Kempen, G., & Huijbers, P. (1983). The lexicalization process in sentence production and naming: Indirect election of words. *Cognition*, 14, 185–209.

Levelt, W. J. M. (1989). *Speaking: From intention to articulation*. Cambridge, MA: MIT Press.

Meyer, A. S. (1996). Lexical access in phrase and sentence production: Results from picture–word interference experiments. *Journal of Memory and Language*, 35, 477–496.

Momma, S., Robert Slevc, L., & Phillips, C. (2016). The timing of verb selection in Japanese sentence production. *Journal of Experimental Psychology: Learning Memory and Cognition*, 42(5), 813–824.

van de Velde, M., Meyer, A. S., & Konopka, A. E. (2014). Message formulation and structural assembly: Describing "easy" and "hard" events with preferred and dispreferred syntactic structures. *Journal of Memory and Language*, 71(1), 124–144.

Wagner, V., Jescheniak, J. D., & Schriefers, H. (2010). On the flexibility of grammatical advance planning during sentence production: Effects of cognitive load on multiple lexical access. *Journal of Experiment Psychology: Learning, Memory, and Cognition*, 36, 423–440.