Research Networking Programmes

Short Visit Grant ☒ or Exchange Visit Grant ☐

Scientific Report

The scientific report (WORD or PDF file – maximum of eight A4 pages) should be submitted online within one month of the event. It will be published on the ESF website.

Proposal Title: A foreign language in the planning: How do first and second language speakers produce sentences?

Application Reference N°: 6525

1) Purpose of the visit

The aim of the proposed research project was to investigate the phonological planning scope of L2 speakers of Dutch. Picture-word interference experiments on sentence production carried out with L1 speakers of German had shown that when people are asked to produce simple subject-verb-object sentences like "*the monk read the book*," both the subject and the object of the utterance can be planned ahead prior to speech onset, as indexed by subject-related facilitation effects and object-related interference effects (Oppermann, Jescheniak, & Schriefers, 2010; Klaus, Mädebach, Oppermann, & Schriefers, in preparation). Furthermore, the object-related effect disappeared when imposing a verbal load on the speakers, suggesting a capacity-limited verbal processing storage that encompasses both speech production and verbal working memory (Klaus et al., in prep.). We reasoned that in L2 speech production it might be the case that the first and the second language compete for activation, thus imposing an artificial verbal load. To this end, we intended to investigate the scope of planning on the phonological level by having native German speakers produce simple subject-verb-object sentences in their second language Dutch, while ignoring auditorily presented distractors phonologically related to the subject or object of the sentence, or unrelated to

both. With respect to my specific contribution to this, the intention was to use the short visit to optimize the materials used for the study, complete final preparations, and begin testing participants.

2) Description of the work carried out during the visit

Some sentences could not be translated directly from German into Dutch without changing the syntactic structure, so we had to derive a number of new sentences which required new pictures (both depicted as an entire scene and an agent-only image). Thus, the majority of my first week in the workgroup was used to finish these experimental pictures as well as set up the experiment in the lab and create the experimental lists.

Furthermore, in my previous experiments on L1 speech production I had collected each participant's individual performance on a visuospatial and verbal working memory measure (backward block tapping and backward digit span, respectively), assuming at least one of these measures would predict the individual planning. However, because these measures never showed to be informative, we reasoned it might be useful to gather performance on a new measure that might be more predictive of complex cognitive processes. Despite intensive efforts to get well-suited materials for this in the existing working memory literature, we failed to find any which could be used for both Dutch and German native speakers, and thus had to create our own. To this end, we decided to use the possibility to pilot two newly constructed working memory tests, so in addition to completing the preparations for the experiment proper, I constructed a reading span task (RST) based on the English version developed by Kane et al. (2004), and an operation span task (OST) similar to that used by Piai & Roelofs (2013). Specifically the reading span task proved to be rather elaborate to prepare, because (1) the sentences provided by Kane et al. (2004) had to be translated into Dutch and German, and (2) we opted for words instead of digits or letters as memoranda, which meant that these words had to be matched for frequency and length in Dutch, German, and English, to ensure maximum comparability of the test between languages.

With all these preparations finished, the experiment was set to go. However, because the experiment so far had only been conducted in German, it was necessary to validate the experimental materials in the current language of interest (Dutch), so it was my task to implement this "pretest" experiment. More specifically, the phrasal planning scope shown in German speakers had to be replicated with the adjusted materials in Dutch native speakers to allow for any conclusions drawn from an upcoming experiment

conducted with L2 speakers. Therefore, the second week of my stay was used to initiate data collection. This included both recruiting and testing native speakers of Dutch (one session lasted approximately one and a half hours) as well as measuring the participants' speech onset latencies offline using Check Vocal (Protopapas, 2007; measuring one participant's recordings took approximately 20 minutes).

3) Description of the main results obtained

The results obtained from the first ten participants I tested in my second week in Nijmegen were far from meaningful, because (1) only after a sample of 16 participants all factors and experimental lists are entirely counterbalanced, and (2) tackling a complex human ability like phonological advance planning in sentence production usually requires a larger sample size to reduce the variance and provide a clearer image of the outcomes. Therefore, the following summary of the results will be based on a sample size of 32 participants (i.e., 22 participants were tested for this experiment after my departure).

Table 1. Mean naming latencies (M) and error rates (E%) broken down by SOA, primed element, and relatedness.

	SOA			
	150		300	
	M	E%	M	E%
Subject-related	870 (34)	8.3 (1.3)	850 (35)	10.3 (1.6)
Subject-unrelated	915 (34)	8.6 (1.1)	868 (32)	8.3 (1.2)
Difference	**-45**$^{***/**}$	**0.3**	**-18**	**2.0**
Object-related	905 (32)	11.1 (1.6)	874 (34)	9.4 (1.2)
Object-unrelated	919 (35)	8.0 (1.3)	871 (34)	8.1 (1.3)
Difference	**-14**	**3.1**	**3**	**1.3**

Note. SOA = stimulus-onset asynchrony. ** p < .01, *** p < .001. Negative difference scores reflect facilitation, positive difference scores reflect interference.

Table 1 displays the results broken down by primed element (subject vs. object), SOA (150 ms vs. 300 ms), and relatedness (phonologically related vs. unrelated) for the offline measured naming latencies and error rates. As can be seen, the subject-related facilitation effect observed in a number of previous studies proved to be reliable, albeit decreasing in size at the later SOA (the main effect of relatedness was highly significant and the interaction of SOA and relatedness was significant at a trend level). However, averaged across all 32 participants, an object-related interference effect was only obtained descriptively in the error rates at SOA 150 ms (which, however, was not confirmed in an analysis of variance), but not in the naming latencies. This constituted a failure to replicate the activation pattern found in previous studies with the current materials. Naturally, we examined the current data set for possible hints as with regard to this replication failure, including separate block analyses, utterance duration analyses and separate analyses for different subgroups of the participant sample.

Only the latter proved to be helpful. We correlated the participant's individual RST and OST scores with the respective phonological effects they provided, and the only significant correlation was that of RST score and the size of the object-related effect at SOA 150 ms (r = -.35, p = .05). This means that at least some of the variance in the object-related effects could be explained by the individual differences in the RST scores, with high spanners trending towards object-related facilitation and low spanners towards object-related interference. This differential pattern of non-initial activation in sentence planning has a number of important implications. First, it shows that the material we adapted from German into Dutch is indeed suited for examining phonological activation beyond the first element of simple sentences. Second, to the best of my knowledge, this is the first time a direct relationship between an established measure of verbal working memory and phonological planning processes has been shown, which might also account for contrasting object-related effects (i.e., interference vs. facilitation) obtained in the literature. Third, and most importantly for the current project, this relationship should also be helpful in dissociating possible variable results in the study of phonological advance planning in L2 speakers. That is, the size of the planning scope in L2 speakers might vary as a function of the inter-subject variability of the RST performance—an important step towards understanding individual differences in speech production.

4) Future collaboration with host institution (if applicable)

The present results obtained from the work I carried out during my visit as well as the data collected after that provide new insight to the question of how individuals plan their speech. Given the time constraints we were only able to conduct an experiment

with native speakers which was meant to serve as a validation of the materials used for the L2 experiment. However, the L2 experiment is definitely still on the agenda and planned to be carried out as soon as possible, especially with regard to the new insights obtained. I therefore intend to continue working with my supervisors in Nijmegen on this project, thus extending the focus of my PhD project (phonological advance planning in native speakers) to the field of bilingualism. Furthermore, the relationship between phonological advance planning and verbal working memory capacity as measured by the newly constructed reading span task requires and deserves further experimental validation. The analyses we carried out here were of an entirely post hoc nature, so decent empirical science naturally requires a carefully planned out confirmation of these hypotheses.

5) **Projected publications / articles resulting or to result from the grant *(ESF must be acknowledged in publications resulting from the grantee's work in relation with the grant)***

not yet planned

6) **Other comments (if any)**

References

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