A filled phonological buffer does not block conceptual preparation for verbal encoding: evidence from a reaction time paradigm

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Research on effects of the language one speaks on other, non-verbal aspects of cognition makes use of non-verbal tasks such as semantic categorization. Previous studies in this domain have faced the objection that participants may use language covertly in such tasks. To avoid this, verbal interference paradigms were introduced. The logic is that by having participants repeat nonsense syllables, their phonological buffer were occupied, and so, internal language use were blocked, while non-verbal aspects of cognition were left intact[1]. However, so far, no positive evidence is available that shows that verbal interference paradigms can indeed achieve this. The efficacy of the method is only supported by an absence of an effect between groups of speakers. Since processes involved in covert and overt language production are essentially the same - at least conceptualization and lexical selection[2] - we used an overt language production task to test whether a filled phonological buffer interfered with conceptualization/lexical selection. Based on the language production literature[3], we expected no interference effect.

In two experiments, we measured the time speakers need to verbally respond to pictures under 3 conditions. In the "interference condition" (IFC), participants were required to internally rehearse 4 syllables for later recall before a stimulus picture was shown. In go-trials, participants produced a verbal response to the picture, in no-go-trials, participants produced the syllables from memory. A cue indicated the task in each trial (go /no-go). In two further conditions, rehearsal was not required, and, thus, the phonological buffer was not filled during conceptualization. In the "no-interference condition" (NIFC), go-trials required a verbal response to the picture stimulus, and no-go trials required no response at all. The same held for the control condition "CC". In the IFC and NIFC, the cue was delayed (SOA: 300 in Exp 1 and 400 in Exp 2). In the CC, the cue coincided with stimulus onset (see Fig 1). The same experimental procedure was used in Exp 1, where stimuli showed objects (35 critical) and in Exp 2, with pictures showing event scenes (20 critical). In Exp 1, participants produced the name of the object. In Exp 2, they referred to the event using the following format: 'peels an orange', i.e., the agent was not to be mentioned. As verbs capture the core of an event, we wanted the verb to be the first word in an utterance, because being able to say the verb indicates that the event was fully conceptualized when articulation begins. 60% of all trials were fillers. These included "switch trials", where the visual stimulus alternated between the go and no-go task during the experiment (to avoid learning effects). Conditions were tested blockwise and within-subject. Trials were randomized. Block order was counter-balanced via 6 experimental lists. 30 native speakers of German participated in each experiment.

We measured reaction times (RT) between cue onset and speech onset. Our most relevant prediction was that if a filled phonological buffer does not interfere with conceptualization, RTs should be shorter in the IFC relative to the control condition. Other predictions concerned the validity of our approach, as well as switch costs.

Our analysis shows highly significant effects of condition, even after accounting for a general decrease of RTs as a function of block order. Longest reaction times were observed in the CC. Shortest reaction times occurred in the delayed cueing condition without syllable recall (NIFC) and in between are reaction times in the delayed cuing condition with syllable recall (IFC). Even though, participants had to switch between saying the syllable and referring to the stimuli in the interference condition (resulting in switch costs), naming latencies were significantly shorter than in the CC. This is only possible if they used the time between stimulus onset and cue onset for conceptualization despite their phonological buffer being occupied for syllable rehearsal. The difference between the IFC and NIFC reflects switch costs. The difference between the CC and NIFC reflects that participants start conceptualizing upon stimulus presentation and do not wait for the cue. We conclude that a filled phonological buffer does not interfere with conceptual preparation, a finding that calls the validity of "verbal interference" paradigms used in the study of language-on-cognition effects into question.

Figures

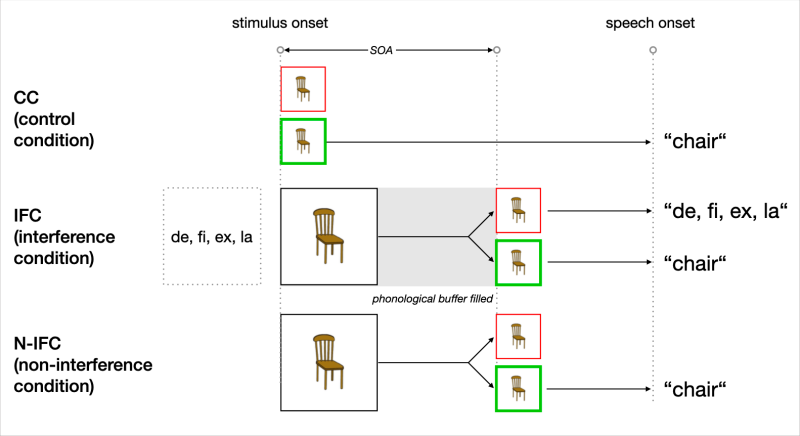


Fig 1: Experimental design in Exp 1, SOA = 300ms; green frame = go trials (speak); red frame = no-go trials ("say syllable" or "say nothing"); in Exp 2, pictures showed events scenes instead of objects

Fig. 2:
Results Exp 1

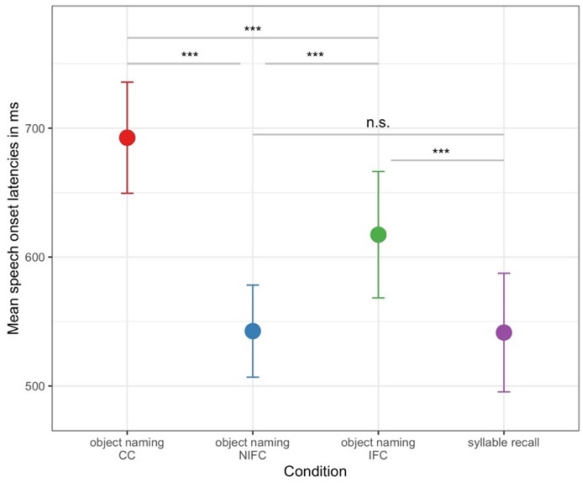
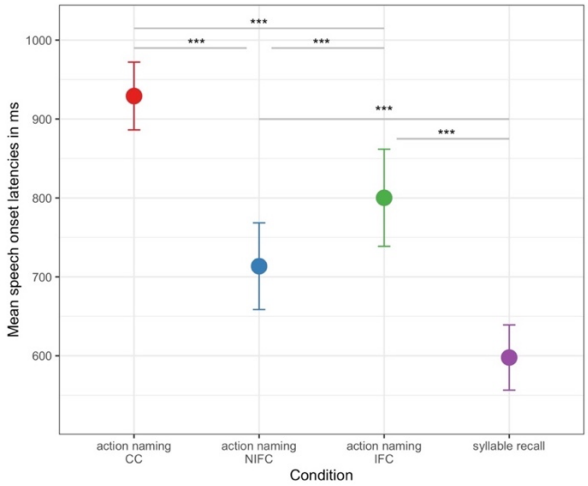


Fig. 3
Results Exp 2



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[3] Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. Behavioral and Brain Sciences (Vol. 22, Issue 1, pp. 1–75).