



ELSEVIER

Contents lists available at ScienceDirect

## Acta Psychologica

journal homepage: [www.elsevier.com/locate/actpsy](http://www.elsevier.com/locate/actpsy)

## Dual-tasking with simple linguistic tasks: Evidence for serial processing

Amie Fairs<sup>a,b,\*</sup>, Sara Bögels<sup>a,c</sup>, Antje S. Meyer<sup>a,c</sup><sup>a</sup> Max Planck Institute for Psycholinguistics, P.O. Box 310, 6500AH Nijmegen, the Netherlands<sup>b</sup> International Max Planck Research School for Language Sciences, P.O. Box 310, 6500AH Nijmegen, the Netherlands<sup>c</sup> Donders Institute for Brain, Cognition and Behaviour, P.O. Box 9010, 6500GL Nijmegen, the Netherlands

## ARTICLE INFO

## Keywords:

Dual-task interference

Semantic interference

Picture naming

Psychological refractory period

Task choice

## ABSTRACT

In contrast to the large amount of dual-task research investigating the coordination of a linguistic and a non-linguistic task, little research has investigated how two linguistic tasks are coordinated. However, such research would greatly contribute to our understanding of how interlocutors combine speech planning and listening in conversation. In three dual-task experiments we studied how participants coordinated the processing of an auditory stimulus (S1), which was either a syllable or a tone, with selecting a name for a picture (S2). Two SOAs, of 0 ms and 1000 ms, were used. To vary the time required for lexical selection and to determine when lexical selection took place, the pictures were presented with categorically related or unrelated distractor words. In Experiment 1 participants responded overtly to both stimuli. In Experiments 2 and 3, S1 was not responded to overtly, but determined how to respond to S2, by naming the picture or reading the distractor aloud. Experiment 1 yielded additive effects of SOA and distractor type on the picture naming latencies. The presence of semantic interference at both SOAs indicated that lexical selection occurred after response selection for S1. With respect to the coordination of S1 and S2 processing, Experiments 2 and 3 yielded inconclusive results. In all experiments, syllables interfered more with picture naming than tones. This is likely because the syllables activated phonological representations also implicated in picture naming. The theoretical and methodological implications of the findings are discussed.

## 1. Introduction

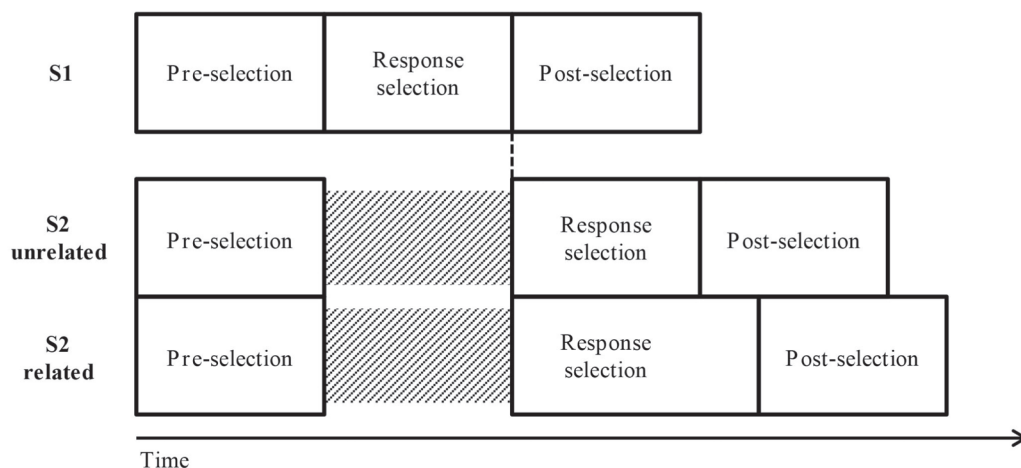
A key issue in cognitive psychology is how different cognitive processes are coordinated with one another. This issue has often been investigated in dual-task paradigms, where on each trial participants are asked to respond to two stimuli presented in quick succession. Many dual-task studies have investigated combinations of a linguistic and a non-linguistic task (e.g., Ayora et al., 2011; Cleland, Tamminen, Quinlan, & Gaskell, 2012; Cook & Meyer, 2008; Ferreira & Pashler, 2002). There is much less research concerning combinations of two linguistic tasks. Such research is, however, of great importance for psycholinguistics. This is because language is most often used in conversation, where upcoming speakers can begin to plan their utterances while they are still listening to their interlocutor (Barthel, Sauppe, Levinson, & Meyer, 2016; Bögels, Magyari, & Levinson, 2015; Levinson & Torreira, 2015; Sjerps & Meyer, 2015). While such linguistic dual-tasking is often seen as essential for holding a conversation, the underlying skills are still poorly understood. For instance, it is currently unknown how utterance comprehension is affected by concurrent speech planning, or how speech planning is affected by concurrent

comprehension. Evidence concerning these important issues can come from dual-task studies with two linguistic tasks. In the present study, we used dual-task paradigms to examine how the processing of a syllable or a tone was combined with picture naming. This research had two goals: (1) to explore the usefulness of dual-task paradigms for research on the coordination of speaking and listening; specifically to determine whether previous key findings of studies using non-linguistic stimuli could be replicated with linguistic stimuli, and (2) to contribute to psycholinguistic theories of conversation; specifically to examine how a key component of speech planning, lexical selection, could be combined with the processing of a spoken syllable.

We used two paradigms, the psychological refractory period (PRP) paradigm (Pashler, 1994), and the task choice (TC) paradigm (Besner & Care, 2003). Both paradigms used the same stimuli, namely one of two tones or syllables (stimulus 1, S1) and a picture with a written distractor word (stimulus 2, S2), but they differed in the tasks. In the PRP experiment (Experiment 1) two overt responses were required: identification of the tone or syllable and naming of the picture. In the TC experiments (Experiments 2 and 3) no overt response was required for S1. Instead, S1 instructed the participant in how to respond to S2, by

\* Corresponding author at: Max Planck Institute for Psycholinguistics, P.O. Box 310, 6500AH Nijmegen, the Netherlands.

E-mail address: [amie.fairs@mpi.nl](mailto:amie.fairs@mpi.nl) (A. Fairs).



**Fig. 1.** Diagram of tone/syllable identification (S1; task 1 - top bar) and picture naming with distractors (S2; task 2 - bottom two bars) at SOA 0 ms. The pre-selection stages of the two tasks are carried out simultaneously. The response selection stage of S1 is carried out before the response selection stage of S2. Semantic interference occurs in the response selection stage, with a longer stage for related compared to unrelated stimuli. The greyed area shows the cognitive slack.

naming the picture or by reading aloud the distractor. Earlier PRP experiments (Piai, Roelofs, & Schriefers, 2014; Schnur & Martin, 2012) using non-linguistic S1 found that participants strongly preferred to postpone lexical selection until after response selection of S1. In contrast, earlier TC experiments have shown that the initial processing of non-linguistic S1 can occur in parallel with lexical selection. Our aim was to determine whether we would replicate these patterns with both non-linguistic and linguistic S1. One hypothesis is that syllables and tones should be processed in the same way. An alternative is that syllables, being linguistic stimuli, may automatically activate associated linguistic representations and consequently interfere more with lexical selection than tones, and/or that the processing of a linguistic S1 may be hampered more by concurrent picture naming than processing of a non-linguistic S1. Because of such cross-talk participants may adopt more sequential processing strategies when syllables rather than tones are used as S1. In the remainder of this Introduction we focus on the predictions for the PRP experiment (Experiment 1). The predictions for the TC paradigm are laid out later (Experiments 2 and 3).

Experiment 1 was a near-replication and extension of Experiment 4 conducted by Piai et al. (2014), which we describe in some detail. On each trial of Piai et al.'s study, participants carried out a response to a tone (S1) and named a picture (S2). The stimulus onset asynchrony (SOA) between tone and picture onset was 0 ms or 1000 ms. Piai et al. (2014) manipulated the difficulty of lexical selection by combining the pictures with written distractor words that were categorically related to the picture names (as in “deer-rabbit”) or unrelated. Numerous studies have demonstrated that categorically related distractors slow down picture naming compared to unrelated ones (e.g., Damian & Martin, 1999; Roelofs, 2003; Schriefers, Meyer, & Levelt, 1990). The difference in naming latencies between the related and unrelated distractor conditions is termed the semantic interference effect (Glaser & Dünghoff, 1984; Schriefers et al., 1990) and is attributed to competition between distractor and picture names arising during lexical selection (Roelofs, 1992, 2003). Briefly, when a picture-word compound is seen, the written distractor and picture activate their associated lexical representations in parallel. Due to mutual activation between categorically related lexical representations, lexical selection for the target name is hampered more by a related compared to an unrelated distractor, as it takes longer to resolve competition.

The main question addressed by Piai et al. (2014) was when lexical selection occurred relative to the selection of the response to the tone. Relevant evidence came from comparing the interference effects at the two SOAs. At the 1000 ms SOA, response selection for the tone and lexical selection were most likely carried out in sequence. Consequently, the usual semantic interference effect should be observed. In contrast, when the tone and picture were presented simultaneously, response selection for the tone and lexical selection could be

coordinated in different ways. Dual-task theories often distinguish three task stages: pre-selection, response selection, and post-selection (Meyer & Kieras, 1997; Pashler, 1994; Pashler & Sutherland, 1998; Tombu & Jolicœur, 2003). Response selection constitutes a processing bottleneck; that is, only one response can be selected at a time (Pashler, 1984, 1994). This bottleneck has been assumed to be structural (Pashler, 1994) or strategic (Meyer & Kieras, 1997).<sup>1</sup> In contrast to response selection, the pre-selection and post-selection processes for two tasks can run in parallel with any other stage.

To return to Piai et al.'s study, if lexical selection is part of pre-selection processes, it should occur in parallel with pre-selection and response selection processes for the tone. Any competition between target and distractor should be resolved during the “cognitive slack” (Pashler, 1994), i.e. the time that lexical selection waits until the response to the tone has been selected. Therefore at the 0 ms SOA, the semantic interference effect should be absent or much reduced compared to the effect seen at the 1000 ms SOA. In contrast, if lexical selection is part of response selection or post-selection processes (see Fig. 1), there is no cognitive slack to absorb the semantic interference effect. Consequently, the effect should be as strong at the 0 ms as at the 1000 ms SOA. This is because in both cases, lexical selection occurs after response selection for the tone.

Piai et al. (2014)'s results supported the latter hypothesis. Participants were overall slower to name the pictures at the 0 ms than at the 1000 ms SOA, and slower in the related than in the unrelated distractor condition, and these effects were additive. In other words, the interference effect was not absorbed into cognitive slack at the 0 ms SOA. This pattern of results is consistent with the pattern seen in a number of other studies using the same paradigm (Ayora et al., 2011; Ferreira & Pashler, 2002; Piai, Roelofs, & Schriefers, 2011; Piai et al., 2014; Schnur & Martin, 2012; but see Dell'Acqua, Job, Peressotti, & Pascali, 2007). It supports the view that the semantic interference effect does not arise prior to, but during or after response selection. It also implies that participants strongly preferred to select the responses to the tone and the picture in sequence.

The main question for Experiment 1 of the present study was whether we would observe the same pattern of results as Piai et al. (2014) when we combined picture naming with tone identification, as they had done, and with syllable identification. Thus, in addition to SOA (0 ms and 1000 ms) and relatedness between target and distractor, we varied whether S1 was one of two syllables or one of two tones (S1 type). An obvious hypothesis is that the nature of S1 should not affect

<sup>1</sup> Other theories assume no such bottleneck. Response selection of two tasks can be carried out in parallel, but posit a finite amount of capacity which is shared between tasks (Tombu & Jolicœur, 2003).

Download English Version:

<https://daneshyari.com/en/article/11029812>

Download Persian Version:

<https://daneshyari.com/article/11029812>

[Daneshyari.com](https://daneshyari.com)