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Pause length variations within and between speakers over time

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Abstract

In the current study, intra-turn pause variation has been investigated within and between speakers in dialogues. Results show that there is a tendency for different speakers to prefer different pause locations within turns. There was further a significant correlation in the majority of the dialogues between how the median lengths of pauses varied for the speakers over the course of the dialogues. The conclusion that can be drawn from this study is that speakers seem to show individual patterns as to where they prefer to pause within turns, but pause length variations tend to be correlated between speakers in the same dialogue.

1 Background

When two persons are engaged in conversation with each other, they tend to mirror each other in several ways, for example in which words they choose to use (Brennan, 1996). The terminology used to describe this is not uniform; a number different terms have been used to describe this process. In this study we will use the term *entrainment*. Edlund et al. argue that to capture the dynamics and temporal aspects of entrainment, it is necessary to use a method that does not rely on single measures but compares the speakers' behaviour over time (Edlund et al., 2009). In this study, we will use the method presented in Edlund et al. (2009) and develop it further to capture the pause variations in dialogues. We will also investigate the pause patterns each speaker presents, to analyze whether all pause features are equally affected by entrainment, or if some features tend to be more affected than others. There is evidence that different persons employ different pause patterns which seems to be consistent regardless of the conversation partner (Van Donzel and Koopmans-van Beinum, 1996). We have two hypotheses:

- hypothesis 1: the speakers will adjust their pause lengths to become more similar to the speaker they are talking to
- hypothesis 2: each speaker has a particular pause pattern that does not change much despite interacting with different people

1.1 Pause categories

Silent intervals can occur within a speaker's turn, and between two speakers' turns. The majority of silences in conversation are shorter than 1000ms (Heldner and Edlund, 2010), but there is of course a lot of intra- and interspeaker variability. Silent intervals between speaker's turns are often referred to as *gaps*, while *pauses* then refer to the silent intervals within a speaker's turn (Sacks et al., 1974). In this paper the focus is on pauses (silent intervals within turns), which can be further subdivided into different categories. A pause that occurs within a turn can have at least two functions. Firstly, it provides time for the speaker to plan what he/she is going to say. Secondly, it may also allow the speakers to negotiate who is going to take the turn. Below, three different types of pauses within turns are described:

- pauses that occur within a speaker's turn but not at a possible TRP (Transition Relevance Point).

- pauses that occur within a speaker's turn, at a possible TRP, where speaker change does not take place.
- pauses that occur at the beginning of a speaker's turn, when the speaker has been nominated by the previous speaker.

2 Method and material

Five persons, all female speakers of Swedish, were recorded while speaking in pairs. Altogether, 6 dialogues were recorded, each lasting approximately 10 minutes. The subjects received a question to discuss but were informed that they were allowed to stray from the subject.

The dialogues were transcribed in Praat. As in Edlund et al (2009), a moving average window was used to smooth the pause length variations, and pause lengths were interpolated for each speaker to provide continuous pause lengths measurements throughout the dialogues.

3 Results and discussion

Our first hypothesis was that we would find evidence of entrainment in pause length variation. What we found was that in the majority of the dialogues, there was a significant positive correlation between pause length variations in the speakers. However, in one dialogue there was a significant negative correlation, and one dialogue showed no significant correlation at all. It would therefore be interesting to apply the method to a larger amount of data to see if there is still a positive correlation in the majority of the cases. It would also be interesting to investigate how the dialogue that showed a negative correlation differs from the other dialogues; if it is possible to find any explanation for the negative correlation within the conversation structure.

One problem when moving on to larger amounts of data is the time needed to transcribe the data and to identify pauses. It is common to detect pauses automatically, with some type of silence detector, and this is a very cost-efficient method of identifying pauses and makes it possible to handle larger amounts of data. However, it is likely that an automated method gives a somewhat different result than manual identification of pauses. For example, in automatic pause identification a minimum pause length is often set to exclude occlusion intervals in stop consonants, but when identifying pauses manually there is no need to set such a minimum length, since it is possible to exclude occlusion intervals anyway. To see if, and then how, pause identification methods influence the results, a comparison between results derived with the different methods should be carried out.

Our second hypothesis was that we would find pause patterns that do not change much in spite of the different conversation partners. When we examined the percentages of different pause types for each speaker and dialogue, there did seem to be at least two different patterns. Some of the speakers tended to prefer to pause at possible TRPs, whereas others preferred to pause at a places which would not be perceived as possible TRPs. This is also something that should be investigated more extensively.

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The impact of gender and bilingualism on cognition: the case of spatial perspective-taking

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Introduction

Bilingual children demonstrate cognitive advantages (Bialystok, 1999) including theory of mind (Kovacs, 2009). One theory suggests that bilingualism improves inhibitory control (Bialystok, Craik, & Luk, 2008). Others suggest elements of executive function beyond inhibition are implicated. However, little is known about the impact of bilingualism on cognition in adulthood.

In the experiment described in this paper, we examine the impact of bilingualism on spatial perspective-taking because it is a challenging domain for adults (Schober, 1993) and bilingual children show perspective-taking advantages. Because adult perspective-taking is modulated by memory and inhibition (Brown-Schmidt, 2009; Lin, et al., 2010), we also used individual differences measures (inhibition, memory, etc.) to specify the cognitive mechanisms underlying the bilingual advantage in adulthood, if one exists.

Finally, gender and verbal ability are likely to influence performance. Superior spatial skills are often attributed to males (Voyer, Nolan & Voyer, 2000), while females may possess superior theory of mind (Baron-Cohen, 2003). Further, bilingual adults may be at a disadvantage when it comes to verbal tasks (Sandoval, et al. 2010).

Participants engaged in a dialogue during which they were given instructions to trace a course through a map of objects. Crucially, the experimenter holds a different spatial perspective on the map. In the easy condition, the experimenter gives directions from the perspective of the participant; in the hard condition, the experimenter gives directions according to her own (opposite) perspective of the map. While the bilingual verbal disadvantage predicts poorer performance in the easy condition, if the bilingual perspective-taking advantage extends to adulthood, bilinguals should have equivalent or better performance in the hard condition. If so, this would suggest that bilinguals more easily adjust to an opposing perspective.

2 Methods

2.1 Participants

Participants were 32 monolingual English speakers (16 female) and 33 bilinguals (21 female) who spoke English and ≥1 other language fluently.

2.2 Materials and Procedure

Participants filled out a language background questionnaire. They then performed a series of tasks to measure perceptual speed, working memory, and inhibition. Then they completed the dialog task in either the hard or easy condition.

The experimenter sat across the table from the participant. A barrier prevented non-verbal communication. In the easy condition, the experimenter's maps were oriented like the participant's, and the experimenter gave directions from the perspective of the subject while the participant drew a path (Figure 1a). In the hard condition, the experimenter's maps showed the opposite visual perspective from the participant (Figure 1b) and the experimenter gave directions from her own perspective. A practice trial was followed by 10 critical trials. An error was considered any deviation from the given directions.

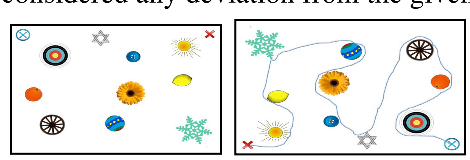

Figure 1. left: example of map seen by participant (1a), right: example experimenter map- hard condition (1b).

3. Results

There were 174 data points (opportunities for error) for each participant (Table 1).

	Monolingual		Bilingual	
	Easy	Hard	Easy	Hard
Female	8.5	26.3	19.1	25.3
Male	1.8	29.3	6.5	35

Table 1. Average errors per condition

Performance was better in the easy condition. While language experience and gender both modulated performance, perceptual speed, working memory, and inhibition scores revealed no significant differences between bilinguals and monolinguals, or males and females.

The data were analyzed in a mixed model. A significant effect of condition ($p<.0001$) was due to more errors in the hard condition. A significant effect of language ($p<.05$) was due to more errors by bilinguals compared to monolinguals. These main effects were qualified by a significant condition by gender interaction ($p< 0.01$). In the easy condition, monolinguals outperformed bilinguals, ($p<.01$) and males outperformed females ($p<.001$). These deficits were eliminated in the hard condition, where there were no significant effects of language or gender.

4. Discussion

The error data coincided with our hypothesized pattern for the language effects. In the easy condition, when subjects were not required to take an opposite spatial perspective, monolingual subjects performed significantly better than bilinguals. This is consistent with research on a bilingual disadvantage in linguistic tasks (Sandoval et al., 2010). In the hard condition, where there was the added difficulty of taking the perspective of the experimenter, monolingual and bilingual subjects did equally well. The disappearance of a bilingual disadvantage in the hard condition suggests that the perspective-taking aspect of the task proves to be a greater challenge for the monolingual participants, indicating a possible bilingual advantage in the domain of perspective-taking. Regarding gender, the female disadvantage in the easy condition may be related to previous reports of a male advantage in spatial abilities (Voyer et al., 2000). The fact that females performed as well as males in the hard condition suggests that females have less difficulty dealing with a challenging spatial perspective, consistent with research demonstrating a female advantage in theory of mind (Baron-Cohen, 2003).

These results suggest the cognitive exercise involved in learning and speaking a second language affects brain mechanisms that are also involved in other domains, such as perspective-taking. However, the source of the bilingual advantage may be due to more general cognitive differences between monolinguals and bilinguals (e.g., Bialystok et al., 2008). Thus, perhaps bilingual participant's facility at adapting to the speaker's egocentric perspective was due to their better executive function.

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