Variation in prosodic planning among individuals and across languages

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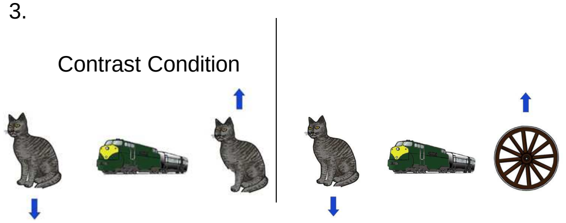
BACKGROUND

- Previous research (Swets et al., 2007; Petrone et al., 2011) found associations between working memory (WM) and the amount of prosodic material readers and speakers package together for comprehension and production.
  - Larger WM capacity seems to lead to larger prosodic packages during speech planning: Petrone et al. (2011) showed that the scope of incremental prosodic planning increased along with WM.
  - However, Petrone et al. did not distinguish WM effects from processing speed, and had participants read prepared utterances rather than plan their own speech.
  - Although previous studies have found associations between WM and planning scope in language production (Swets et al., 2014, Petrone et al., 2011) in different languages, no studies have assessed such effects cross-linguistically in the same study.
- *RESEARCH QUESTIONS:* Is the size of prosodic increments during language production, as measured by the occurrence of pauses, associated with individual differences in WM and speed of processing?

METHOD

French (n = 32), German (n = 31) and English (n = 30) speakers described 3-object arrays with similar-looking (contrast) or different (control) objects in Positions 1 and 3.

Contrast Condition



Target utterances

CONTRAST: "The **four-legged cat** moves below the train and the **three-legged cat** moves above the train."

CONTROL: "The cat moves below the train and the wheel moves above the train."

PROCEDURE

- Experimenter served as addressee: Moved objects around in Powerpoint to match descriptions.

DESIGN AND PREDICTIONS

VARIABLES

- Sentence type (contrast vs. control)
- Language spoken: German, English, French
- Individual differences measures (left as continuous in analyses using linear mixed effects models):

WM assessed by reading span variant (e.g., Swets et al., 2007).

Processing speed assessed by letter comparison task (Salthouse, 1996). Task: To accurately complete as many "same" or "different" judgments as possible in 30 s. Task executed twic[...]e used.

YCX ____ YMX

HTRBDP ____ HTRBDP

LNDPRSKQB ____ LNDPRSJQB

MEASURES: Speech initiation time and number of pauses per utterance (defined as 70 ms or more between vocalizations).

- HYPOTHESES AND PREDICTIONS
  – If WM and processing speed underlie prosodic planning chunks both variables should predict unique variance in the number of pauses speakers make during articulation. In

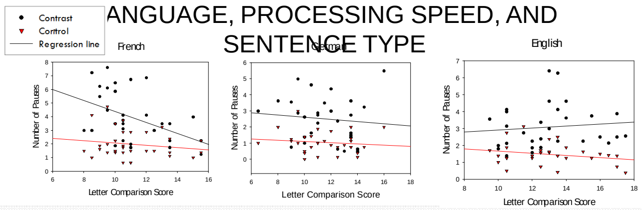
RESULTS

Mean speech onset time varied across languages, but did not vary as a function of WM or processing speed (SE in parentheses):

		French	German	English
Speech onset time in seconds	Contrast	2.15 (.26)	3.36 (.27)	2.97 (.27)
	Control	1.45 (.08)	1.82 (.09)	1.60 (.09)

Although speed of processing was associated with contrast sentence pauses in French, this pattern did not hold in German or English:

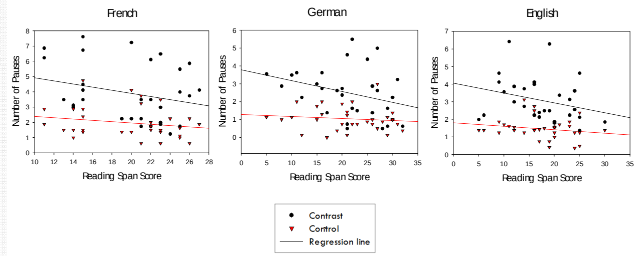
NUMBER OF PAUSES AS A FUNCTION OF LANGUAGE, PROCESSING SPEED, AND SENTENCE TYPE



RESULTS CONTINUED

- Pause occurrences varied across languages, and this mea was associated with WM span in all of them:

MEAN NUMBER OF PAUSES AS A FUNCTION OF LANGUAGE, WM SPAN, AND SENTENCE TYPE



SUMMARY OF RESULTS

- Neither WM nor processing speed predicted variability in speech onset time in any languages tested.
- French speakers began their speech more quickly, but paused more often than German and English speakers, suggesting a greater degree of "incremental" planning for French speakers, and a longer scope of planning for English and German speakers.
- WM explains unique variance in pause frequency above and beyond variance due to processing speed: As WM increases, the number of pauses speakers produce per utterance decreases. This effect was stronger in the higher-load contrast sentences.
- Processing speed was only associated with pause frequency in French.

CONCLUSIONS

- Individual differences in WM lead to differences in planning processes, such that higher WM supports the planning of larger prosodic "chunks".
- Processing speed may be more useful in more "incremental" languages in which speakers begin speech more quickly and create smaller prosodic chunks, e.g. French.

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