

How are words stored in the mental lexicon? A pupillometry study

The structure of the mental lexicon is at the heart of psycholinguistic research. Do we store fully-fledged representations that incorporate all features associated with a concept, or do we have minimal representations that are only enriched when used in a specific context? To answer this, researchers have studied whether polysemous words such as 'school' and 'paper', or metonymies such as 'Vietnam' can be processed at a similar cost regardless of the intended meaning used (e.g., 'Vietnam' for the country, or 'Vietnam' for the war, Frisson & Pickering, 1999, 2001; Klein & Murphy, 2001). In this regard, one popular account argues that all lexical entries are structured in an underspecified manner (Frisson, 2009). According to this view, polysemous words such as 'school' have a minimally informative representation in the mental lexicon that is enriched in context, leading to a fully specified representation.

This *underspecification account* has so far been tested in the domain of nouns. If we assume (as Frisson, 2009, does) that a large part (perhaps all) of the entries in the mental lexicon are underspecified, then we should seek out evidence for underspecification in other types of polysemous lexical representations.

This makes the case of maximum standard absolute adjectives (MSAA) interesting. MSAs such as 'straight' have been claimed to be precise in their semantics (e.g., to mean 'perfectly straight', Kennedy, 2007). They are, however, often used imprecisely when precision is not relevant for the interpretation (e.g., to mean 'straight enough'). Imprecise interpretations have been described as a type of lexical pragmatic adjustment (e.g., Lasersohn, 1999, Leffel et al., 2016; Sperber & Wilson, 1986): The precise representation is retrieved and pragmatically adjusted when a specific context calls for it.

An alternative explanation of this phenomenon could be derived from the *underspecification account*. It could be that imprecision is not a pragmatic adjustment, but instead that MSAs are underspecified for precision in the mental lexicon. Whether they are to be interpreted precisely or imprecisely depends on the supporting context.

One way of testing this hypothesis is to examine the processing effort of contextualized MSAs. Do imprecise interpretations always result in added processing cost regardless of context? Or can precise and imprecise interpretations be derived with similar effort when embedded in a facilitating context? The former result would support the pragmatic adjustment account, whereas the latter would be in line with an underspecification view of the lexicon.

To test this, we conducted two pupillometry experiments in Norwegian. In each experiment, 42 participants saw 12 critical items made up of facilitating contexts together with a target spoken utterance which contained an absolute adjective such as straight. In Experiment 1 the context was both visual and discursive: Participants saw a picture illustrating the intended referent (e.g., a perfectly straight line or a somewhat squiggly line) together with a matching one-sentence written context presenting the situation (see Figure 1). The contexts elicited either a precise or an imprecise interpretation of the adjective (CONDITION: 'loose' vs. 'strict' contextual expectations) and had been previously normed. Experiment 2 was identical but included the discourse context only. After seeing the context, participants heard a critical utterance unfold while looking at cross in the middle of the screen. We measured pupil dilation time-locked to the onset of the MSAA until the end of the trial. We then fitted a linear 'maximal' mixed-effects regression model of pupil dilation, with CONDITION as a predictor. In Experiment 1, imprecise interpretations resulted in significantly more pronounced pupil dilation relative to precise interpretations ($p < 0.05$). In Experiment 2, we failed to find a difference between conditions ($p = 0.18$). However, a between-experiment comparison revealed no significant difference between experiments ($p = 0.369$), and no interaction between EXPERIMENT and CONDITION ($p = 0.14$). The difference between 'loose' and 'strict' conditions was significant when pooling together data from both experiments ($p < 0.05$).

Our results are more in line with the view that the lexical meaning of MSAs is precise, with imprecise interpretations requiring additional processing effort as a result of the derivation of a pragmatic inference. The results do not support a view in which MSAs would be underspecified for precision.

Loose

Jasmin hadde veldig dårlig tid på matteprøven, og tegnet raskt en strek under delsvaret med blyanten sin.

Jasmine was running out of time on her maths test, and rashly drew a line under the partial answer with her pencil.



Strict

Jasmin hadde veldig god tid på matteprøven, så hun tegnet nøye en strek under delsvaret med linjalen sin.

Jasmine had plenty of time on her maths test, so she carefully drew a line under the partial answer with her ruler.



Target Sentence

Streken til Jasmin er rett

*Jasmin's line is **straight***

Figure 1: Example of critical item in both 'loose' and 'strict' conditions. Experiment 1 showed discourse and visual context, while Experiment 2 showed only the written discourse context. The target sentence was heard via speakers after participants read the context and pressed the SPACEBAR to continue.

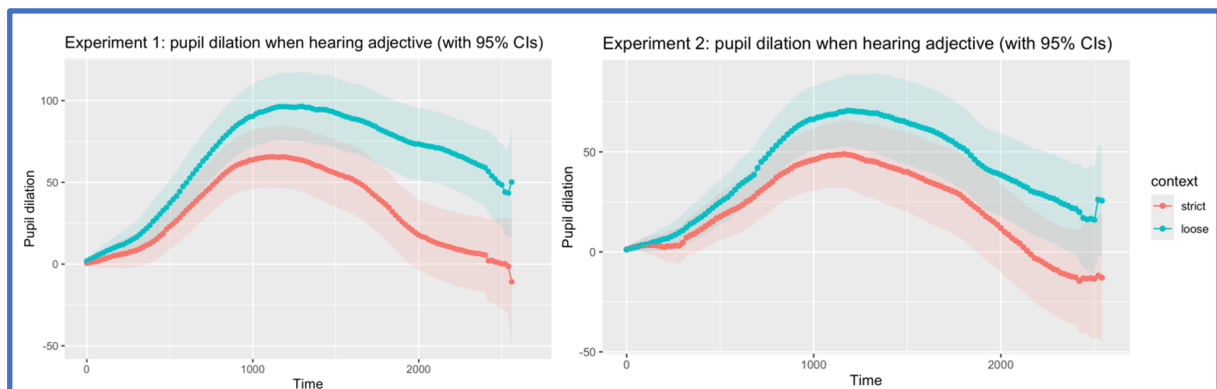


Figure 2: Results of Experiments 1 and 2. Pupil dilation was baseline corrected using a subtractive baseline and is time-locked to the onset of the MSAA

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