

Does loudness contribute to the memory benefit for accented words?
Effects of stimulus loudness and proportion of occurrence on recognition memory

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Pitch accents highlight particularly informative parts of utterances [1, 2]. Their presence orients listeners' attention to accented words [3, 4], leading to more elaborative semantic processing [5, 6] and better recognition memory for those words [7-9]. Pitch accents convey linguistic meaning (signaling importance) but are also acoustically salient (accented words stand out perceptually from unaccented words). Therefore, it remains unclear how these top-down and stimulus-driven processes interact in determining memory for spoken information. In this study, we focused on loudness as one of the acoustic dimensions conveying pitch accents, and asked: Does the relative loudness of accented vs. unaccented words contribute to the finding that they are remembered better? Previous work has provided no clear answer.

The current study examined how loudness and the proportion of louder to quieter words affect recognition memory for words presented in lists (chosen to minimize context-based elaboration). In the exposure phase of each experiment, participants (adult native speakers of Dutch) heard 64 Dutch words, presented more quietly or loudly (10 dB difference). To minimize variations of attention, they were asked to categorize each word as quiet or loud. After a non-verbal filler task, they performed an old/new recognition task for these words and an equal number of new ones. In the exposure phase of Experiment 1, both loudness types appeared equally often. There was no loudness effect on hit rates. In Experiment 2, we varied the proportion of louder words (25% or 75%, tested between participants), reasoning that participants might prioritize the salient, less frequent stimulus type. This expectation was confirmed: There was a memory benefit for the infrequent stimulus type. In both experiments, participants categorized words as louder or quieter during exposure, so the infrequent stimulus type condition in Experiment 2 coincided with the infrequent response condition. Experiment 3 thus replaced this task with a word-end detection task. The memory benefit for the less frequent, louder stimuli persisted. In sum, there was no memory benefit for louder words, but only for the less frequent stimulus type. We conclude that in lists, words that perceptually stand out by a difference in loudness and by being the less frequent stimulus type are better remembered. This implies that any stimulus-driven memory benefit for pitch accented words may arise from their perceptual salience: Accented words stand out from surrounding words in an utterance because they occur less frequently and differ in loudness, in addition to other phonetic features, and this may contribute to their better memorization.

References

- [1] Cole, J. Prosody in context: a review. *Language, Cognition and Neuroscience*, 2015.
- [2] Ladd, D. R., & Arvaniti, A. Prosodic Prominence Across Languages. *Annual Review of Linguistics*, 2023.
- [3] Káldi, T., & Babarczy, A. Linguistic focus guides attention during the encoding and refreshing of working memory content. *Journal of Memory and Language*, 2021.
- [4] Kristensen, L. B., Wang, L., Petersson, K. M., & Hagoort, P. The interface between language and attention: prosodic focus marking recruits a general attention network in spoken language comprehension. *Cerebral Cortex*, 2013.
- [5] Brunellière, A., Auran, C., & Delrue, L. Does the prosodic emphasis of sentential context cause deeper lexical-semantic processing? *Language, Cognition and Neuroscience*, 2019.
- [6] Wang, L., Bastiaansen, M., Yang, Y., & Hagoort, P. The influence of information structure on the depth of semantic processing: How focus and pitch accent determine the size of the N400 effect. *Neuropsychologia*, 2011.
- [7] Fraundorf, S. H., Watson, D. G., & Benjamin, A. S. Recognition memory reveals just how CONTRASTIVE accenting really is. *Journal of Memory and Language*, 2010.
- [8] Fraundorf, S. H., Watson, D. G., & Benjamin, A. S. The effects of age on the strategic use of pitch accents in memory for discourse: A processing-resource account. *Psychology and Aging*, 2012.
- [9] Zhou, Y., van der Burght, C. L., & Meyer, A. S. Investigating the role of semantics and perceptual salience in the memory benefit of prosodic prominence. *Proceedings of Speech Prosody 2024*, 2024.

Figures and Tables

Figure 1: Hit rates across exposure conditions. Dots represent means per participant. Lines connect data points from the same participant. Error bars represent standard errors.

