

## **Can too much information make us lose track of time?**

### The Effects of Cognitive Load on the Processing of Frequency and Duration

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Previous studies that examined judgments of frequency and duration in humans found an asymmetrical relationship: While frequency estimates were quite accurate and independent of stimulus duration, duration judgments were highly dependent upon stimulus frequency. That is, the durations of more frequent stimuli were perceived as being longer, while stimuli with longer presentation duration were not judged to be more frequent. These results do not conform with those obtained in animal research, where an interdependency of frequency and duration was found, and they are also inconsistent with findings from brain research that indicate a common mechanism for both kinds of judgments. The present data suggest that the strength of the mutual influence of frequency and duration information in humans is moderated by differences in cognitive load. In two experiments, participants processed stimuli presented with varying frequencies and durations, and cognitive load was manipulated yielding one condition with high, and one with low cognitive load.

In Experiment 1, we had  $n = 96$  participants estimate the stimulus frequencies and the presentation durations of first names presented either 2, 4, or 8 times, for either 2, 4, or 8 seconds. In doing so, participants were randomly assigned to one of two cognitive load conditions. In the condition with low cognitive load, participants were to judge stimulus frequencies and durations of 9 names, while participants in the high cognitive load condition processed frequencies and durations of 36 names. The results showed that under high cognitive load the previously found asymmetrical relationship between frequency and duration was replicated. However, when the participants had to process only 9 names, stimulus frequency and duration influenced each other mutually.

In Experiment 2, overall  $n = 66$  participants were again randomly assigned to one of two cognitive load conditions. This time, we varied cognitive load by presenting (high load) or not presenting (low load) an additional task. The participants in the low cognitive load condition had to watch advertisements of products varying in presentation frequencies and durations. In the high cognitive load condition, participants additionally were required to work on an internet task (either reading an article or watching a video) while watching pop-ups (the same advertisements as in the low load condition) appearing on the screen from time to time. The results are consistent with the findings of Experiment 1: In the low cognitive load condition, the mutual influence between frequency and duration was higher as compared to the high load condition.

In sum, the results of both studies showed that the previously found asymmetrical relationship between judgments of frequency and duration in humans occurs when the generated cognitive load of the judgment situation is high, as was the case in previous studies with human participants. However, under low cognitive load the results obtained in animal research as well as the findings from brain research – a common mechanism for the processing of frequency and duration – were supported. Results will be discussed with respect to mechanisms underlying the processing of frequency and duration.