EXAMINING THE PERCEPTION OF TEMPORAL INTERVALS SEQUENCES USING DIFFERENT STIMULUS AND RESPONSE MODALITIES

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Interacting with a dynamic world requires the capacity to perceive and represent temporal intervals and patterns. Often, as in speech or music perception, patterns composed of multiple temporal intervals are of importance. Using the auditory input modality, and following Penel, Hollweg and Brody [1], we have presented sequences of three brief tone pips (i.e., sequences of two temporal intervals) to human subjects. Participants had to reproduce the presented sequences via either tapping, or vocal responses, or placing two vertical lines on a screen at a position that represented the timing of the second and third pips. In contrast to Penel et al's previous study, here the total time between the first and last pip was not fixed, but varied from trial to trial within the range 700 to 1300ms. The timing of the middle pip was drawn, for each trial, from a uniform distribution between the first and the last pip.

Successfully carrying out the tasks requires the subjects on each trial to sense the stimuli, store a mental representation of them in short-term memory, and then report the sequence via motor activity. In order to separate effects due to the reporting method from effects of other processing stages, we examined three different output modalities (spatial, vocal and tapping). Similarly, to distinguish effects pertinent to sensation, we had two different input modalities (auditory and visual) in our experiment.

The main effect that we observed was that the accuracy of reproduction depends on the ratio of two intervals of a stimulus, with greatest accuracy when the ratio is 1:1, and high accuracy for one or two pairs of ratios, each pair of the form (m:n and n:m). The effect was the same for different input and output modalities.

We used the distribution of reported reproductions as surrogates for the distribution of mental representations that the subjects formed of the temporal sequences. Using these distributions, we could predict performance in a classical two interval, two-alternative forced-choice (2AFC) experiment. Here subjects hear a first three-pip sequence, then a second three-pip sequence, and must compare the two sequences, producing a binary response as a result of the comparison. Predicted performance matched the experimentally-obtained performance with the same dependence of the ratio of two intervals as in the reproduction task. This result further indicates that the observed ratio effect is not due to the motor component of the reproduction task.

References