

The influence of perceptual characteristics on auditory redundancy gains

Hannes Schröter¹, Luisa S. Frei², Rolf Ulrich¹, and Jeff Miller³

¹University of Tübingen, Germany

²University of Glasgow, Scotland, UK

³University of Otago, New Zealand



Introduction. The Redundant Signals Effect (RSE) refers to the phenomenon that responses to two redundant signals are usually faster than to single signals. There are two kinds of models to explain the RSE: race models and coactivation models. Evidence for coactivation is provided whenever the probability that RT is less than or equal to a given time t is higher for the redundant signals condition than for the sum of the single signal conditions.

Schröter, Ulrich, & Miller (2007) discovered that in the auditory modality, both an RSE and coactivation only occur when the redundant auditory stimuli differ substantially from each other. If the stimuli are too similar, however, they are fused into a single percept preventing an RSE.

A recent study (Fischer & Miller, in press) provided evidence of a larger RSE for responses to onsets than to offsets of visual stimuli. This result suggests that perceptual characteristics can influence the RSE in the visual modality.

Aims. The present study assessed redundancy gains for responses to onsets and offsets of auditory stimuli to investigate whether or not perceptual characteristics also influence the RSE in the auditory modality.

Methods. Two experiments were conducted. The design and procedure were the same for both experiments – only the stimuli were different: Experiment 1 used identical sinusoidal tones, Experiment 2 used a sinusoidal tone and white noise.

Within each experiment there were two tasks: In the onset task, participants had to respond as soon as they detected the onset of any tone. In the offset task, participants were asked to respond as soon as one or two tones terminated.

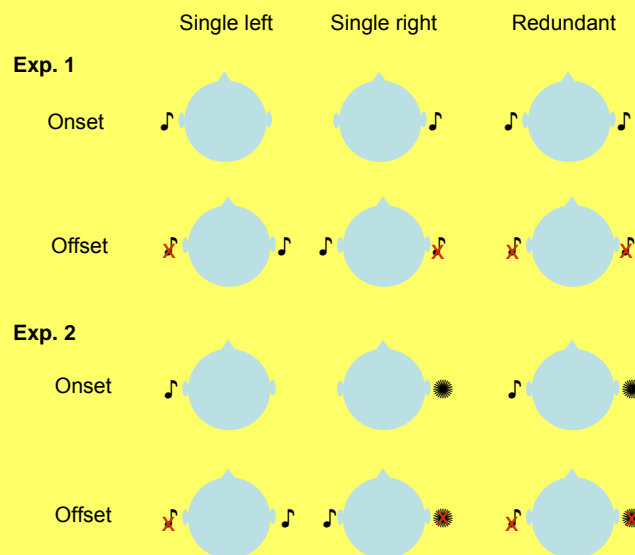
Each experiment examined 40 participants. Each participant was tested in both the onset and the offset task. The order of tasks, the response hand and (in Experiment 2) the stimulus-to-ear-mapping were counterbalanced across participants.

Results.

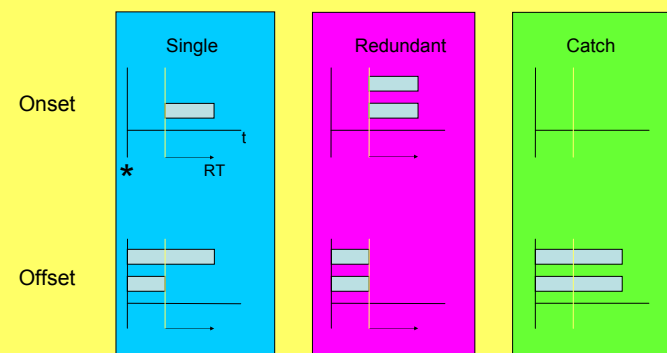
Experiment 1: No RSE in the onset task, but a significant RSE and evidence for coactivation in the offset task.

Experiment 2: RSE and coactivation for both onset and offset tasks, with larger redundancy gains in the offset task.

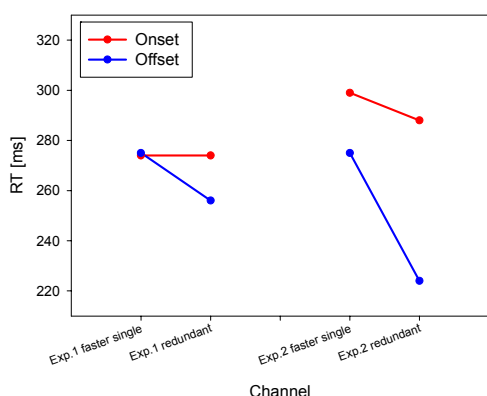
Stimuli.



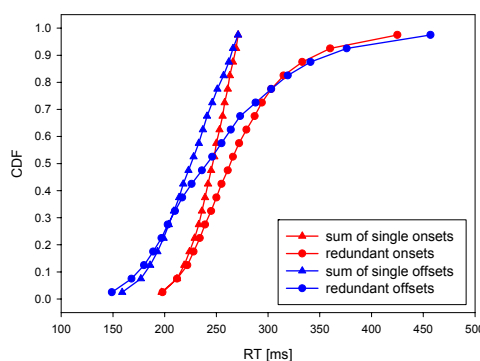
Trial procedure.



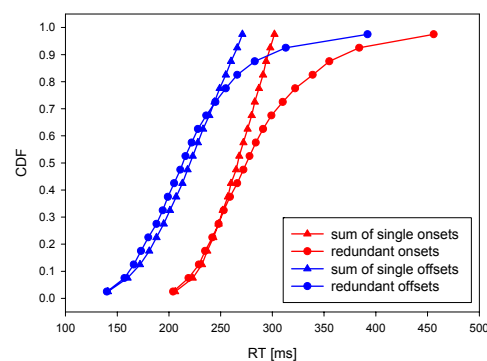
Mean RT for Experiments 1 and 2



CDFs for Onsets and Offsets in Exp. 1



CDFs for Onsets and Offsets in Exp. 2



Discussion. The results in the onset conditions of Experiments 1 and 2 replicated the findings of Schröter et al. (2007), suggesting that the occurrence of an RSE depends on whether or not redundant stimuli are fused into a single percept. The results in the offset condition contrasted with those obtained previously with visual stimuli: a larger redundancy gain was observed with auditory offsets than with auditory onsets, providing further evidence of an influence of perceptual characteristics on the RSE. Therefore, this finding supports the idea that perceptual mechanisms are at least partial contributors to the RSE. Furthermore, the results suggest that visual and auditory redundancy gains are differentially affected by stimulus on- and offsets.

References.

Fischer, R., & Miller, J. (in press). Differential redundancy gain in onset detection versus offset detection. *Perception & Psychophysics*.
Schröter, H., Ulrich, R., and Miller, J. (2007). Effects of redundant auditory stimuli on reaction time. *Psychonomic Bulletin and Review*, 14, 39-44.

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