

Crossmodal to unimodal transfer of temporal perceptual learning

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Crossmodal to unimodal transfer of temporal perceptual learning

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Abstract

Subsecond temporal processing is crucial for activities requiring precise timing. Here, we investigated perceptual learning of crossmodal (auditory–visual or visual–auditory) temporal interval discrimination (TID) and its impacts on unimodal (visual or auditory) TID performance. The research purpose was to test whether learning is based on a more abstract and conceptual representation of subsecond time, which would predict crossmodal to unimodal learning transfer. The experiments revealed that learning to discriminate a 200-ms crossmodal temporal interval, defined by a pair of visual and auditory stimuli, significantly reduced crossmodal TID thresholds. Moreover, the crossmodal TID training also minimized unimodal TID thresholds with a pair of visual or auditory stimuli at the same interval, even if crossmodal TID thresholds are multiple times higher than unimodal TID thresholds. Subsequent training on unimodal TID failed to reduce unimodal TID thresholds further. These results indicate that learning of high-threshold crossmodal TID tasks can benefit low-threshold unimodal temporal processing, which may be achieved through training-induced improvement of a conceptual representation of subsecond time in the brain.

Keywords

multisensory/crossmodal processing, perceptual learning, specificity/transfer, time perception

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Methods

Participants and Apparatus

Twenty-four participants, 9 males and 15 females, aged 18–22 years, with a mean age of 21.9 years, took part in the experiment. All participants were students at the University of York and had no prior experience with the experiment. The experiment was conducted in a sound-attenuated room. Participants were seated in front of a computer monitor and a response box. The computer monitor was positioned at a distance of 20 cm from the participants. The response box was positioned at a distance of 20 cm from the participants. The computer monitor displayed the stimuli and the response box was used to record the participants' responses. The stimuli were presented on a computer screen with a resolution of 1,920 × 1,080 pixels. The response box was a custom-built device that allowed participants to respond to the stimuli by pressing one of two buttons. The response box was connected to the computer via a USB cable. The computer was a Dell Optiplex 7020 with a 4th generation Intel Core i7 processor and 16 GB of RAM. The operating system was Windows 10. The experiment was controlled using the software package Psychtoolbox (Brainard & Pong, 1998) running on a Mac OS X computer. The stimuli were presented on a computer screen with a resolution of 1,920 × 1,080 pixels. The response box was a custom-built device that allowed participants to respond to the stimuli by pressing one of two buttons. The response box was connected to the computer via a USB cable. The computer was a Dell Optiplex 7020 with a 4th generation Intel Core i7 processor and 16 GB of RAM. The operating system was Windows 10. The experiment was controlled using the software package Psychtoolbox (Brainard & Pong, 1998) running on a Mac OS X computer.

Stimuli and Procedures

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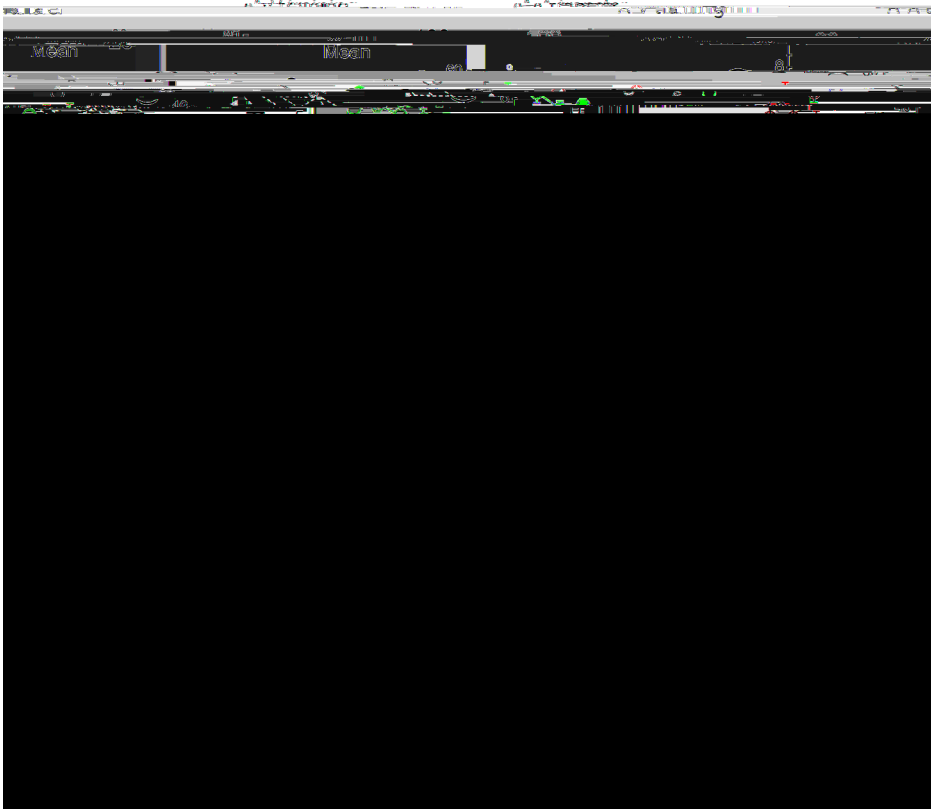
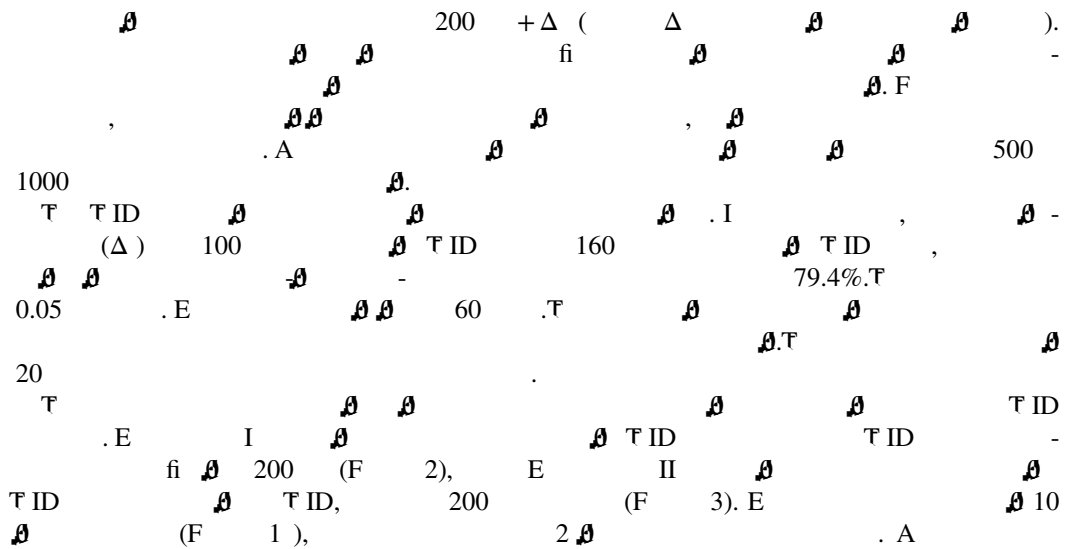


Figure 3. Transfer of crossmodal auditory–visual TID learning to unimodal auditory TID. Upper panels: The average A–V TID learning curve (left), the average A–A TID thresholds before and after A–V TID learning and with extra direct A–A TID training (middle), and a summary of individual and average percentage improvements (right). Lower panels: Individual data.





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