Supplemental Data:

Task-irrelevant learning occurs only when the irrelevant feature is weak

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Supplemental Experimental Procedures

Participants

Twenty-eight participants were recruited who ranged in age from 19 to 30 years. All participants had normal or corrected-to normal vision and were naïve regarding the purpose of the experiments. All participants gave informed written consent, and the study was approved by the Boston University Institutional Review Board.

Stimuli

Motion was created by using a Movshon/Newsome type algorithm with white dots on a dark background [8]. In the motion sensitivity task and the Rapid Serial Visual Presentation (RSVP) task moving dots were presented within an annulus subtending a 1°-13° visual angle. The background was black, except for a central 1° light-grey disk. This disk remained empty during the motion sensitivity task. In the AB training task and the control task, capital letters and digits were presented in dark grey Monaco font at the center of the light grey disk. Alphanumeric stimuli subtended .2° (width) by .3° of visual angle.

Motion sensitivity task

In test sessions, participants' performance on a set of off-cardinal motion-directions (10°, 70°, 130°, 190°, 250°, and 310°) was evaluated. The method of constant stimuli was used. In each trial, a participant viewed a stimulus randomly chosen from the motion-direction set for 500 msec. A dark screen containing only the fixation bullseye was shown for 300ms followed by the presentation of a set of white arrows pointing center-out in the six possible directions. Participants were instructed to click on the arrow that represented their perceived coherent motion direction. The ratio of signal dots to the total number of dots (coherent ratio) was varied in 3 steps (3%, 5%, and 15%). Subjects had 3000 ms to make a response and a 500 ms inter-trial period separated trials. Trials of all stimulus conditions (coherence-ratio and direction) were randomly interleaved. There were 40 trials for each direction at each coherence ratio, resulting in a total number of 720 trials for the threshold measurements. No accuracy feedback was given to the participants.

Exposure sessions

During each day of the ten day exposure stage, participants performed a Rapid Serial Visual Presentation (RSVP) task. A sequence of eight items was presented in a central (1 degree) grey circle. The digit or letter was presented for 350 ms, centered in a 500 ms DRD. The participants were instructed to report 2 digits (out of "1", "2", "3", or "4") that appeared within a sequence of alphabetical letters presented at the center display, by pushing the corresponding digit keys on a computer keyboard. No accuracy feedback was given to the participants.

In the peripheral annulus a dynamic random dot display was presented which consisted of coherently moving dots (signal) and randomly moving dots (noise). For each subject, two (of six) directions were paired with the targets of RSVP task (choice of paired-direction was counterbalanced across subjects to control for preexisting biases in direction discrimination). In half of trials, one of two selected directions was temporally paired with the targets (numbers) of RSVP task in one of coherent ratios (e.g. 5%). In the other half of trials, the other selected direction was paired with the targets of RSVP task in the other coherent ratio (e.g. 50%). The motion direction paired with 1st target was identical to that paired with 2nd target in a trial. The other four directions were paired randomly with the distractors (letters) of RSVP task.

Analysis

For each test stage, the percent-correct values for each tested motion direction were averaged across subjects and for each of the three coherence levels (3%, 5% and 15%). The difference between these averaged performance score was then taken between the two tests (post-pre) and then summed across the coherence levels. For example, assume that one subject's percent-correct scores in the pre-test (in the post-test) were 15% (17%), 25% (30%), and 70% (80%) when tested with 3%, 5%, and 15% coherent motion displays, respectively. Then the Correct Improvement % was calculated as (17-15)+(30-25)+(80-70) = 17%.