

## The modulation of primary task difficulty in a fast-TIPL paradigm

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Perceptual learning (PL) can occur for task-irrelevant, unattended and subthreshold stimuli presented at behaviorally relevant points in time (task-irrelevant PL) [1,2]. Recently a fast form of task-irrelevant PL (fast-TIPL) has been studied in the context of perceptual memories [3-5]. In fast-TIPL paradigms, participants perform a primary task, while they are also required to memorize task-irrelevant stimuli consistently paired with the primary task targets and distractors. Typically, participants show an improvement in memory only for task-irrelevant stimuli that are presented in temporal coincidence with the primary task targets [6]. It has been hypothesized that the successful recognition of a primary task target may induce a concomitant “attentional boost”, which in turn promote the processing and encoding of information into memory [7].

We investigated how the modulation of the primary task difficulty level can modify the succeeding recognition of task-irrelevant stimuli associated with the presentation of the primary task targets and distractors. In a 2-day experiment participants performed a letter matching (primary) task and an image recognition (secondary) task. In each trial of the primary task, a sequence of two triplets of letters (either black or white on a grey stripe) was presented. Each array of letters on grey stripe was surrounded by a different full-colour photograph of a natural scene. Six out of seven letter arrays were black (distractors), while the fourth array was white (target). Participants had to report whether the central letter of the two triplets of the target was the same or not. The primary task difficulty was manipulated by varying the distance between extreme letter of the triplets while keeping the eccentricity of central letters constant, obtaining an “easy” and a “difficult” (crowded) condition. After nine trials, participants underwent the image recognition task (old/new decision). This procedure was repeated each day for eight times, using different images of natural scene in all relevant presentations. We expected to find: (1) a difference in performance for the task-relevant feature between the two difficulty levels of the primary task, and between days; (2) a better performance in the image recognition task for images associated with the targets than with the distractors of the primary task, varying accordingly to the two task difficulty levels.

The results showed: (1) a significant crowding effect in the primary task, in both days (better performance in the “easy” than “difficult” condition); (2) a significant learning effect in the “easy” condition of the primary task (but not in the “difficult” condition); (3) a significant difference in the recognition of images displayed in the “difficult” condition, with an advantage for images paired with the (black) distractor letters of the primary task relative to images paired with (white) target letters.

We did not find the expected fast-TIPL effect (i.e., an advantage in the recognition of images paired with primary task targets). We suggest that focusing on the primary task may cause a depletion of attentional resources, which in turn prevents the “attentional boost” effect to

occur. Moreover, when the difficulty of the primary task is increased (“difficult” condition), an attentional inhibition of images paired with primary task targets occurs.

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