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Cognition 98 (2005) 177–197
www.elsevier.com/locate/COGNIT

Capacity limits for face processing

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Received 28 January 2004; revised 12 October 2004; accepted 22 November 2004

Abstract

We present three experiments in which subjects were asked to make speeded sex judgements (Experiment 1) or semantic judgements (Experiments 2 and 3) to face targets and nonface items, while ignoring a solitary flanking distractor face or a nonface stimulus. Distractors could be either congruent (same response category) or incongruent (different response category) with the target. Distractor congruency effects were consistently observed in all combinations of target–distractor stimulus pairs, except when a distractor face flanked a target face. The failure to find congruency effects in this condition was explored further in a fourth experiment, in which four task-irrelevant flankers were simultaneously presented. Once again, no face–face congruency effects were found, even though comparison distractors interfered with face and nonface targets alike. However, four simultaneously presented distractor faces did not interfere with nonface targets either. We suggest that these experiments demonstrate a capacity limit for visual processing in these conditions, such that no more than one face is processed at a time.

Keywords: Face; Capacity limit; Distractor

1. Introduction

A central issue in the study of selective visual attention concerns the extent to which task-irrelevant stimuli are processed. One established technique of measuring such processing is target–distractor interference, in which responses to a task-relevant target stimulus can be affected by a simultaneously presented task-irrelevant distractor. To the extent that distractors are processed, target RTs are slowed by incongruent relative to

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doi:10.1016/j.cognition.2004.11.004

congruent distractors. This *distractor interference* effect is highly robust, at least in situations of low perceptual load (e.g. when only one relevant stimulus is presented; see Lavie, 1995, 2000), and generalizes across various classes of target–distractor stimulus pairs (e.g. letter–letter, Eriksen & Eriksen, 1974; picture–word, Smith & Magee, 1980).

Although a great deal is known about selective attention, rather little is understood about how visual attention and face processing interact. This is remarkable as there is probably no other class of visual stimuli that can match the social and biological importance, and that has been studied as extensively as the human face (e.g. Bruce & Young, 1998; Young, 1998). This is also unfortunate as the role of selective attention may be imperative in understanding how the human brain processes faces. The experiments reported here sought to explore the relation between selective attention and face processing in target–distractor interference paradigms. Specifically, we examined whether responses to a target *face* can be affected by distractor *faces*.

A number of studies indicate that people may be unable to ignore irrelevant distractor faces (Jenkins, Burton, & Ellis, 2002; Lavie, Ro, & Russell, 2003; Young, Ellis, Flude, McWeeney, & Hay, 1986). Consequently, in a face–face interference task, one might expect the normal pattern of interference to occur, with target RTs varying as a function of distractor congruency. However, a few recent studies hint against this reasoning and suggest that face processing may be subject to capacity limits, such that only a single face can be processed at a time (Boutet & Chaudhuri, 2001; Jenkins, Lavie, & Driver, 2003; Palermo & Rhodes, 2002). If that is true, processing a target face may prevent the intrusion of a distractor face, thereby eliminating any congruency effects from that distractor.

To date, several studies have shown that irrelevant face distractors are processed reliably with a concurrently presented nonface target. Young et al. (1986) examined interference effects between simultaneously presented photographs and printed names of famous people. Using a semantic classification task (pop-star/politician), participants were required to classify either the face or the name whilst ignoring the distractor, which could be either congruent (e.g. same occupation) or incongruent (different occupation) with the target. Names reliably interfered with the classification of faces. More importantly, faces also interfered with the classification of name targets. Indeed, faces interfered more with names than names interfered with faces. Recently, Lavie et al. (2003) extended this paradigm to investigate the effect of task-relevant load on irrelevant distractor processing. According to Lavie's perceptual load theory of selective attention (Lavie, 1995, 2000), the processing of visual information proceeds automatically until available capacity is exhausted. Therefore, irrelevant information is excluded from processing when task-relevant, attended-to stimuli demand all available capacity. To provide a test for this theory with meaningful stimuli, Lavie et al. (2003) measured interference from a flanking distractor upon the classification of a central word or a famous name embedded among several letter strings. Perceptual load of the relevant task was manipulated by varying the number of strings in the interference displays. In accord with the load theory, congruency effects from meaningful nonface distractors, such as photographs of fruits and musical instruments, were eliminated by increasing relevant load. Intriguingly though, interference from famous face distractors was entirely unaffected by these load manipulations, leading Lavie et al. (2003) to suggest that face processing may proceed automatically, independent of target processing.