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Scene incongruity and attention



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ABSTRACT

Does scene incongruity, (a mismatch between scene gist and a semantically incongruent object), capture attention and lead to conscious perception? We explored this question using 4 different procedures: Inattention (Experiment 1), Scene description (Experiment 2), Change detection (Experiment 3), and Iconic Memory (Experiment 4). We found no differences between scene incongruity and scene congruity in Experiments 1, 2, and 4, although in Experiment 3 change detection was faster for scenes containing an incongruent object. We offer an explanation for why the change detection results differ from the results of the other three experiments. In all four experiments, participants invariably failed to report the incongruity and routinely mis-described it by normalizing the incongruent object. None of the results supports the claim that semantic incongruity within a scene invariably captures attention and provide strong evidence of the dominant role of scene gist in determining what is perceived.

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1. Introduction

It has long been recognized that incongruity within a scene has a unique role in perception (Bruner & Postman, 1949). In this early and classic paper, the authors examine how the violation of perceptual expectancies affects perception. “The principal concern of this paper”, they write, “is with the perceptual events which occur when perceptual expectancies fail of confirmation – the problem of incongruity. Incongruity represents a crucial problem for a theory of perception because, by its very nature, its perception represents a violation of expectation. An unexpected concatenation of events, a conspicuous mismatching, an unlikely pairing of cause and effect – all of these have in common a violation of normal expectancy.” (p. 208).

Since then congruity and incongruity effects on perception have been studied by a host of other researchers (e.g. Biederman, 1972; Biederman, Mezzanotte, & Rabinowitz, 1982; Davenport & Potter, 2004; Greene, Botros, Beck, & Fei-Fei, 2015; Henderson & Hollingworth, 1998; Hollingworth & Henderson, 2000; LaPointe, Lupianez, & Milliken, 2013; Palmer, 1975). Some general findings of this research are that objects consistent with their contexts (i.e. with scene gist) are identified more correctly and faster than objects that are inconsistent (Biederman et al., 1982; Davenport & Potter, 2004; Palmer, 1975; Rémy, Vayssière, Pins, Boucart, & Fabre-Thorpe, 2014). In contrast, changes to inconsistent objects are detected faster in change detection tasks (Hollingworth & Henderson, 2000), although LaPointe et al. (2013) found this latter to be true only when change detection requires localization of the change. When change detection requires identification of the change, the outcome reverses and identification of consistent objects occurs faster (LaPointe et al., 2013).

Interest in the question of incongruity has re-emerged more recently in the service of trying to understand the degree to which information integration occurs outside of consciousness. On one view, information integration requires conscious

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processing, (e.g. Baars, 2002; Treisman, 2003), so that if incongruity were picked up outside of consciousness it would argue against this view and would be strong evidence of some kind of unconscious input integration.

But whether or not incongruity is picked up without awareness and defies unconscious integration because it is inconsistent with expectancies, (and, therefore, leads to the capture of attention and conscious processing), there is now considerable evidence that some information integration does occur outside of awareness (see for example Dehaene on ensemble processing outside of awareness (2014).

The bulk of the recent research on the question of whether a semantically incongruent scene (e.g. a snowman on a beach in contrast to a sand castle) is picked up outside of awareness and captures attention has been done by Mudrik and colleagues who have given the question a positive answer (Mudrik, Deouell, & Lamy, 2011; Mudrik, Faivre, & Koch, 2014; Mudrik & Koch, 2013), while a paper by Moors, Boelens, van Overwalle, and Wagemans (2016) suggests a negative one.

Mudrik and colleagues have looked at incongruity and perceptual processing in several ways. In one set of experiments (Mudrik & Koch, 2013), they explored subliminal priming by incongruent scenes and showed that when a scene depicting an incongruent action, e.g. a woman baking a chessboard rather than a pan of cookies, is presented subliminally, it slows subsequent responses to a liminal scene depicting either an incongruent or congruent action. This is taken by the authors as evidence that incongruity is picked up outside of awareness, and, because it is a violation of prior associations or expectations, requires additional processing, which is why it slows subsequent responding. “Arguably, when integration involves previously learned associations, acquired during past conscious experiences, it can be unconsciously performed... Yet when the scene involves objects that were not previously integrated during conscious perception, (i.e. incongruent scenes), integration fails. This failure may lead to the allocation of additional attentional resources and may thereby hinder subsequent performance.” (Mudrik & Koch, 2013, p. 9). On this view incongruity mandates attentional engagement and conscious processing.

In another set of papers Mudrik and colleagues (Mudrik, Deouell et al., 2011) looked at the influence of scenes depicting an incongruent action on binocular rivalry using Continuous Flash Suppression (CFS). They report that incongruent scenes escaped perceptual suppression faster than comparable congruent scenes, which they think may be because the incongruity, unlike congruity, cannot be resolved without consciousness. In still another paper also entailing binocular rivalry, Mudrik and colleagues report that when one eye views a congruent image and the other an incongruent version of the same image, e.g., a man drinking from a glass versus a man ‘drinking’ from a hairbrush, the incongruent image persists in consciousness longer, that is, it dominates the congruent one. This is again taken as evidence that the incongruity requires more attention and thus takes longer to be resolved (Mudrik, Deouell et al., 2011). In another experiment Mudrik and colleagues (Mudrik, Lamy, & Deouell, 2010) found event related potential (ERP) differences in the processing of similar scenes depicting either a congruent or incongruent action such that contextual congruity affects scene processing earlier.

The findings that scenes with an incongruity break though suppression associated with binocular rivalry and dominate for longer than comparable congruent scenes is not, however, uncontested. In fact, the exact opposite has been reported. Like Mudrik and colleagues, Pinto, van Gaal, de Lange, Lamme, and Seth (2015) used CFS but found in contrast, that images consistent with expectation (the expectations were created at the outset of the experiment by the experimenters) entered consciousness faster than neutral or unexpected images.

An even more recently reported set of experiments also provided results (Moors et al., 2016) that are at odds with those reported by Mudrik and colleagues. Their studies, which were designed as an attempt to replicate the Mudrik et al. findings, were closely modeled on the Mudrik experiments, and in fact used scenes from the Mudrik archive and the same CFS procedure. These researchers failed to find any evidence of a congruity effect. They found no evidence that scenes containing objects that were incongruent with scene gist broke through suppression any faster than the comparable congruent scenes. The first of their 3 experiments quite faithfully repeated Mudrik, Deouell et al.’s (2011) procedures but included an additional condition in which the scenes were inverted. They reasoned that if there is a congruity effect, it should not be apparent in the scene inversion condition. Unlike Mudrik et al., they found that congruent scenes actually broke suppression faster than incongruent ones, although this difference did not reach significance. Also, and not unexpectedly, they found a scene inversion effect, such that upside-down scenes took longer to break through suppression than right side up ones. The remaining 2 experiments confirmed their main finding of no congruity effect.

These two sets of experiments by two different groups of researchers raise serious questions about whether incongruity between an object and the gist of a scene or minimally between two objects in a scene is extracted outside of awareness and leads to the capture of attention and consequent conscious processing.

This is the question addressed by the 4 experiments reported in this paper. Our interest in the question stems from our long term interest in the role of attention and inattention in perception (Mack & Rock, 1998) and so is not primarily concerned with the question of whether semantic information integration occurs outside awareness. Rather the question at issue is whether semantic incongruity within a scene is likely to capture attention and consequently be consciously perceived. This is explicitly argued by Mudrik and colleagues (Mudrik et al., 2014) where they write that, “The difficulty of identifying the object or integrating it with the scene then affects participants’ performance: it raises the attentional saliency of the scene causing it to emerge into awareness sooner. . . .” (p. 7).

The experiments described in this paper used different phenomena to address the question of whether scene incongruity captures attention. In one set of experiments using an inattentional blindness (IB) procedure, we looked at whether scene incongruity, that is a scene containing an object that is inconsistent with the gist of the scene (e.g., a woman putting a chessboard in an oven), is more likely to be perceived under conditions of inattention, (and therefore reduce or defeat inatten-

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