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## What's past is past: Neither perceptual preactivation nor prior motivational relevance decrease subsequent inattentional blindness

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### ABSTRACT

Inattentional blindness—the phenomenon that clearly visible, yet currently unexpected objects go unnoticed when our attention is focused elsewhere—is an ecologically valid failure of awareness. It is currently subject to debate whether previous events and experiences determine whether or not inattentional blindness occurs. Using a simple two-phase paradigm in the present study, we found that the likelihood of missing an unexpected object due to inattention did not change when its defining characteristic (its color) was perceptually preactivated (Experiment 1;  $N = 188$ ). Likewise, noticing rates were not significantly reduced if the object's color was previously motivationally relevant during an unrelated detection task (Experiment 2;  $N = 184$ ). These results corroborate and extend recent findings questioning the influence of previous experience on subsequent inattentional blindness. This has implications for possible countermeasures intended to thwart the potentially harmful effects of inattention.

### 1. General introduction

Human conscious perception is severely limited, which becomes evident in a variety of failures of awareness (Dehaene, Changeux, Naccache, Sackur, & Sergent, 2006). Perhaps the most striking and ecologically valid example is *inattentional blindness*, the phenomenon that even salient unexpected objects go unnoticed when attention is focused elsewhere (Mack & Rock, 1998; Simons & Chabris, 1999). The consequences of these misses in real-world settings are potentially severe, such as in road traffic (Most & Astur, 2007), aviation (Haines, 1991), or medical diagnostics (Drew, Vo, & Wolfe, 2013). Hence, it is highly expedient to understand what affects the likelihood of inattentional blindness (e.g., Downing, Bray, Rogers, & Childs, 2004; Newby & Rock, 1998). Several studies suggest that it depends on *stable features of the observer*, such as cognitive capabilities (Hannon & Richards, 2010; O'Shea & Fieo, 2015) and personality traits (Richards, Hellgren, & French, 2014). However, this view has been contested in several recent publications (e.g., Bredemeier & Simons, 2012; Kreitz, Furley, Memmert, & Simons, 2015; Kreitz, Schnuerch, Gibbons, & Memmert, 2015). The notion that *situational parameters*, such as attributes of the unexpected object, have an effect on the likelihood of inattentional blindness is much less controversial (see, e.g., Calvillo & Jackson, 2014; Mack & Rock, 1998). Perhaps most importantly,

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the detection of unexpected objects depends on a person's current attentional set: Unexpected objects are substantially more likely to be perceived when they are similar to the objects that are being attended to as part of the primary task a person is engaged in, for example, regarding perceptual features such as luminance, shape, or color (Koivisto & Revonsuo, 2008; Most, Scholl, Clifford, & Simons, 2005; Most et al., 2001).

While the role of *current* situational features of inattention blindness tasks has been thoroughly investigated, relatively little is known about the effects of *previous* events on subsequent inattention blindness. It seems reasonable to assume that one determinant of whether or not we notice something unexpected might be experience from our immediate past. After all, there is little doubt that perception is not only driven by concurrent stimulation, but also substantially shaped by previous events (see, e.g., Olivers, Meijer, & Theeuwes, 2006; Soto, Heinke, Humphreys, & Blanco, 2005; Stokes, Atherton, Patai, & Nobre, 2012). Indeed, there is some evidence that prior experience—broadly construed—does affect the likelihood of inattention blindness. *First*, indirectly alerting somebody to the possibility that additional events can occur influences whether or not they detect these events in the immediate future (Most et al., 2001): Participants who have recently been queried about a potentially overlooked unexpected object are subsequently less likely to miss another spontaneously appearing object (e.g., Kreitz, Furley, et al., 2015; Most et al., 2001). *Second*, Rattan and Eberhardt (2010) suggested that simply preactivating a certain social concept subsequently reduces the likelihood of missing an unexpected stimulus erroneously associated with that concept. *Third*, subliminally priming a detection goal decreases inattention blindness rates significantly (Légal, Chekroun, Coiffard, & Gabarrot, 2017).

However, the notion that prior experience affects inattention blindness is not undisputed. *First*, the abovementioned effect of previous knowledge is relatively limited. An abstract, generalized knowledge of the phenomenon or of the possibility that additional events can occur does not suffice to reduce the likelihood of missing spontaneously appearing stimuli. Rather, a relatively specific expectation about potential additional objects in the given context must be formed to diminish inattention blindness (Beanland & Pammer, 2010; Kreitz, Furley, et al., 2015; Ward & Scholl, 2015). *Second*, we recently failed to observe clear-cut effects of preactivation. In two experiments (with a total of 221 participants), we demonstrated that participants did not detect an unexpected colored shape more frequently after previous engagement with the concept of this very color (Kreitz, Schnuerch, Furley, Gibbons, & Memmert, 2015): Neither mentioning the color several times before the appearance of the unexpected stimulus nor priming the color implicitly via related concepts significantly reduced the susceptibility to inattention blindness. Fittingly, detection rates of an unexpectedly appearing gorilla were not affected by subliminally priming the semantic concept of a gorilla (Légal et al., 2017).

As the evidence regarding the potential influence of prior experience on the likelihood of inattention blindness is somewhat mixed, we further investigated this issue in the present study. We revisited the idea that preexposure to certain stimulations in one context might determine whether or not we subsequently notice related stimuli in another context, even if they are unexpected (Kreitz, Schnuerch, Furley, et al., 2015; Rattan & Eberhardt, 2010). Specifically, we tested whether perceptual preactivation of a color reduces the likelihood of missing an object of this color (Experiment 1) and whether a color that is motivationally relevant for a while is later noticed more frequently (Experiment 2).

## 2. Experiment 1

As mentioned above, previous work suggests that *semantic* preactivation of a certain color does not affect whether an unexpected object crosses the threshold of awareness in an inattention blindness scenario (Kreitz, Schnuerch, Furley, et al., 2015; Légal et al., 2017; but see Rattan & Eberhardt, 2010). In the first experiment, we addressed an even more basic issue and investigated whether *perceptual* preactivation influences inattention blindness. Prior studies in various fields have shown that perceiving a stimulus earlier in time influences how this stimulus is perceived (and attended to) at a later stage. Priming studies indicate that objects are identified more accurately and more quickly if the object was presented before (Tulving & Schacter, 1990; Wiggs & Martin, 1998). This facilitatory effect of perceptual repetition not only applies to entire objects, but also to individual features, such as colors (e.g., Goolsby & Suzuki, 2001). Based on these findings, it seems feasible that even the threshold of declarative awareness of an unexpected object might be crossed due to prior activation of the object's central features. It is widely assumed that sensory input needs to pass a certain threshold to reach awareness, which is often achieved by additional amplification (Dehaene et al., 2006). Perceptual preactivation might be an important means for such amplification, allowing otherwise unnoticed stimuli to be consciously detected (Kreitz, Schnuerch, Furley, et al., 2015).

To test this idea, we conducted a straightforward experiment: Participants first performed a simple task in which they were (or were not) repeatedly and incidentally exposed to a certain color (priming phase). In a second task, an object of the same or a different color appeared unexpectedly (inattention blindness phase). We assessed whether the unexpected object was detected more frequently if its color had previously been presented for several minutes (i.e., perceptually preactivated) than if it had not been presented.

### 2.1. Method

#### 2.1.1. Participants

A total of 200 participants took part in Experiment 1. All participants gave written informed consent and received candy as compensation. We excluded participants from analysis if they (a) indicated in the follow-up questionnaire that they had anticipated the unexpected object or knew that inattention blindness was the subject of the study (7 participants) or (b) did not notice the unexpected object in the control condition in which they did not have to perform the primary task (full-attention trial; 4 participants). All participants reported normal or corrected-to-normal vision and performed adequately during the priming phase (no outliers

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