Gorilla watching: Effects of exposure and expectations on inattentional blindness

Vanessa Beanland (vanessa.beanland@anu.edu.au)  
Department of Psychology, The Australian National University  
Canberra, ACT 0200 Australia

Kristen Pammer (kristen.pammer@anu.edu.au)  
Department of Psychology, The Australian National University  
Canberra, ACT 0200 Australia

Abstract
Inattentional blindness (IB) occurs when an individual fails to notice an unexpected object because their attention is engaged by another task. Most research has excluded participants with IB knowledge on the belief that any knowledge of IB would invalidate experiments by causing participants to “expect the unexpected”. Previous research has shown that expectations can significantly influence IB rates, specifically through determining attentional set. We conducted a series of experiments to determine whether knowledge of and exposure to IB research had any effect on expectations and rates of IB. Experiment 1 compared participants with either little or no preexisting knowledge of IB and found that IB knowledge did not predict experimental rates of IB. Experiment 2 compared first year psychology students with moderate IB knowledge to later-year students with high IB knowledge. Again, knowledge was not a significant predictor of IB rates. Experiment 3 manipulated IB knowledge, with half the participants given detailed information on IB. High knowledge participants were significantly more likely to notice the unexpected stimulus, but primary task accuracy was significantly lower for noticers compared to nonnoticers, suggesting that noticers may have adopted a dual task strategy. Overall, these results suggest that preexisting IB knowledge only affects rates of IB if it allows participants to form specific and accurate expectations about the experiment.

Keywords: attention; awareness; expectations; inattentional blindness.

Introduction
If you were monitoring a monochromatic scene, would you notice the sudden appearance of a red object? Most people confidently predict they would and are surprised by research demonstrating that many observers fail to notice such obvious events (Most et al., 2001). For this reason inattentional blindness (IB), the failure to notice unexpected stimuli when attention is engaged by another task (Mack & Rock, 1998), has captured the interest of both researchers and lay people. IB research can be traced back to the 1970s, when Neisser and colleagues (Neisser, 1979; Neisser & Becklen, 1975) devised a superimposed video paradigm for investigating selective visual attention. When participants selectively attended to one of two overlapping videos, they did not consciously perceive odd unexpected events in the unattended video (Neisser & Becklen, 1975). Decades later, Mack and Rock (1998) found a similar effect in a series of experiments using simple, static computerised stimuli. Their original prediction was that people would be unable to fully process an object’s features under conditions of inattention, but to their surprise many participants reported not having noticed the object at all (Mack & Rock, 1998; Mack, Tang, Tuma, Kahn, & Rock, 1992; Rock, Linnett, Grant, & Mack, 1992). They coined the term “inattentional blindness” (Rock et al., 1992, p. 502) to describe this phenomenon and their experiments provided a framework that has been used for investigating IB since that time. Interest in IB surged after Simons and Chabris (1999) published their “gorilla” experiment, based on Neisser’s (1979) earlier work, in which participants who counted ball passes during a videotaped basketball game failed to notice either a woman carrying an umbrella or a person in a gorilla suit crossing the screen (Simons & Chabris, 1999). Since then IB has permeated popular culture, ranging from Internet videos to television advertisements and even driver education courses.

This popularity poses a paradox for IB researchers: as more people learn about the research, fewer are eligible to become research participants. This is because, according to the criteria initially outlined by Mack and Rock (1998), all participants should be completely naïve to the experimental aims and paradigm:

An important feature of the inattention method is that it permits only one critical trial per subject … because once subjects have been asked about something on the screen other than the cross (and possibly seen it as well), it is likely that they now will be actively looking for something else and thus no longer view the critical stimulus under conditions of inattention. Two consequences of this limit of one inattention trial per subject are that each experiment requires a large number of subjects, and each new experiment demands a new, naïve group of subjects. (p. 8)

Based on this, several subsequent studies deliberately excluded those who reported prior familiarity with any IB paradigm (Apfelbaum, Apfelbaum, Woods, & Peli, 2008; Cartwright-Finch & Lavie, 2007; Clifasefi, Takarangi, & Bergman, 2006; Memmert, 2006; Memmert, Simons, & Grimme, 2009; Most, Scholl, Clifford, & Simons, 2005; Most, Simons, Scholl, & Chabris, 2000; Most et al., 2001; Simons & Chabris, 1999; Simons & Jensen, 2009; Wayand,
Levin, & Varakin, 2005; White & Aimola Davies, 2008). Other studies have not excluded participants but noted that their observers were naïve (Ariga, Yokosawa, & Ogawa, 2007; Beck & Lavie, 2005; Downing, Bray, Rogers, & Childs, 2004; Jingling & Yeh, 2007; Mack et al. 1992; Moore & Egeth, 1997; Moore, Grosjean, & Lleras, 2003). The question is what constitutes “familiarity”; does knowledge of one IB paradigm generalise to all other IB paradigms, or is this assumption overly cautious? Further, what effect does familiarity with or knowledge of IB actually have on the occurrence of IB?

The argument in Mack and Rock’s (1998) quote above is that knowledge of IB prevents an observer from subsequently experiencing the phenomenon by altering their expectations. The reasoning stems from the context in which their research originated; their IB paradigm was originally developed as a means of investigating preattentive processing. Mack and Rock (Mack & Rock, 1998; Mack et al., 1992; Rock et al., 1992) claimed that in order for processing to be truly preattentive, the stimulus of interest must be subject to complete inattention. Accordingly they had the critical stimulus of interest appear unexpectedly while the observer was performing a primary attention-consuming task. As noted by Braun (2001), Mack and Rock’s (1998) attempt to manipulate attention simultaneously manipulated expectation and since that time it has been assumed that lack of expectation is a requirement for inducing IB. Braun (2001) argues that perception without attention is possible (Lee, Itti, Koch, & Braun, 1999), suggesting that IB results not from inattention but rather from manipulating attention through task expectations.

Expectations have been demonstrated to significantly affect rates of IB. Using a cueing paradigm, White and Aimola Davies (2008) demonstrated that expectations about the number of items to be viewed predicted whether observers exhibited IB. Observers with valid expectations about the number of task-relevant stimuli were significantly more likely to demonstrate IB, compared to those with numerical expectations that either overstated or understated the number of stimuli subsequently presented (White & Aimola Davies, 2008). The role of expectation in IB has also been addressed indirectly, such as by systematically manipulating the similarity of unexpected stimuli to other items in the display. Most et al. (2001, 2005) demonstrated that unexpected objects are significantly less likely to be noticed when they are featurally distinct from the attended objects in a display. Rates of noticing drop even further (i.e., rates of IB increase) when the unexpected object is similar to unattended items within the display, even reaching zero (100% IB) if the unexpected and unattended objects are identical (Most et al., 2001). Collectively these findings suggest that expectations are influential because observers form an attentional set based on the stimulus items that they expect to be present in the display. Therefore expectation does not necessarily increase the likelihood of detecting a critical stimulus; some expectations make detection less likely. This is consistent with literature on attentional capture, which indicates that expected distractors may be less likely to capture attention in an additional singleton paradigm (e.g., Bacon & Egget, 1994).

Based on current evidence, it is not clear how knowledge-altered expectations will actually influence IB: they may decrease IB because the critical stimulus is no longer completely unexpected, but conversely may increase IB because participants can classify the stimulus as an irrelevant distractor. More importantly, no past research has directly investigated whether IB knowledge does in fact alter expectations in subsequent IB experiments. Given the important practical and methodological implications, we conducted a series of experiments to investigate whether knowledge affects rates of IB and what level of knowledge is required to produce a significant effect.

**Experiment 1**

Experiment 1 investigated the effect of preexisting IB knowledge in a sample of psychology undergraduates. Most participants had been exposed to IB research previously but their knowledge was limited and none were familiar with the exact paradigm used in the current series of experiments. However, applying the strict exclusion criteria used in some previous studies these participants would have been excluded. The experimental aim was to determine whether such strict criteria are necessary by comparing naïve and nonnaïve observers to assess whether a low level of IB knowledge alters rates of IB in experimental settings.

**Method**

**Participants** Seventy-two undergraduates (71% female; M_{age} = 21.4 years) participated voluntarily for a class activity or course credit. All participants provided informed consent and had normal or corrected-to-normal vision as measured by accuracy on a Snellen chart. Eight additional participants were excluded due to: poor vision (1); failure to follow instructions (1); failure to detect the unexpected stimulus under full attention (1); experimenter error (1); and realising the experiment topic (4).

**Apparatus and Stimuli** Stimuli were presented on a desktop computer using a 21” CRT presentation monitor with a refresh rate of 85 Hz, 32-bit colour and display resolution of 1024 × 768 pixels. Eye movements were monitored using a Cambridge Research Systems Video Eyetracker Toolbox system incorporating a fixed 50 Hz camera and a headrest. A custom program was written using Presentation (Neurobehavioral Systems, Inc.) The display area subtended 28.8° × 21.6° visual angle, with a light grey background (luminance 57 cd/m^2) and a central dark grey (24 cd/m^2) fixation dot (0.2° × 0.2°). Eight L and T shapes moved around the display, travelling at different speeds and occasionally “bouncing” off the edges of the display window (see Figure 1a). Half the items were white (90 cd/m^2; Weber contrast 0.58) and half were black (6 cd/m^2);
Weber contrast -0.89). Each item bounced three to eight times per trial and subtended 1.6° × 1.6° visual angle.

The experiment contained six 15-second trials. Control trials contained only the expected black and white shapes. Critical inattention trials and full attention trials contained an unexpected stimulus (US), in addition to the expected items (see Figure 1b). The US was a dark grey (24 cd/m²; Weber contrast -0.58) shape (1.6° × 1.6°), which entered from the right of the display after 5 seconds and crossed the screen horizontally along the midline, exiting at 10 seconds. A + shape appeared as the US during the first critical trial (trial 3) and an X appeared during the second critical trial (trial 5). In the full attention trial (trial 6) the US was an H.

Procedure Participants were seated with their head stabilized in a chinrest, 75 cm from the display monitor. Testing sessions were conducted individually in a dark room. Participants were informed that the experiment was investigating eye movements in an object-tracking paradigm. Half the participants (n = 36) were instructed to fixate on the central fixation point, and half (n = 36) were instructed to move their eyes freely. The eye movement data have been analysed elsewhere (Beanland & Pammer, 2009) and, because there were no significant differences in rates of IB comparing eyes-fixating or eyes-moving participants, for current purposes the results were collapsed across eye movement groups.

Observers were instructed to attend to white items, count how many times they bounced and report their tally immediately following each trial. There were two critical trials, based on the design of Bressan and Pizzighello (2008), but participants were not questioned about the US until after the second critical trial. Participants who reported noticing the US were asked to describe its characteristics including shape, colour and motion. After questioning, observers participated in a final full attention trial, during which they were instructed to simply watch the display without counting any bounces. The purpose of this trial was to ensure that participants could detect and accurately describe the US under conditions of full attention; those observers who failed this criterion were excluded from subsequent analyses. Following the experiment participants were debriefed and asked a series of questions to determine their prior level of IB knowledge. These covered whether they: (1) had heard the term IB before; (2) could describe any IB research; (3) realised they were participating in an IB experiment; and (4) had participated in an IB experiment previously. Participants who answered yes to criteria 3 and/or 4 were excluded from analysis.

Results and Discussion

Primary task accuracy was assessed by calculating difference scores (i.e., Actual – Reported bounces) for each trial. Most participants underreported the number of bounces, with mean difference scores between 2 and 6 for each trial. Primary task accuracy did not vary between noticers and nonnoticers of the US on either the first, t(70) = 1.71, p = .117, CI95 [-0.4, 3.3], or the second critical trial, t(70) = -0.99, p = .342, CI95 [-3.8, 1.4]. This is consistent with previous research indicating that primary task performance does not differ systematically between noticers and nonnoticers (Koivisto & Revonsuo, 2008; Memmert, 2006; Most et al., 2000, 2001, 2005; Simons & Jensen, 2009; but see Bressan & Pizzighello, 2008).

Overall 19% of participants noticed the US (81% IB) on one or both critical trials (critical trial 1: 10% noticed, 90% IB; critical trial 2: 15% noticed, 85% IB). Most participants (58%) could describe research relating to IB and/or selective attention and 35% had heard the term IB previously (see Table 1). Nearly all (93%) who described some research mentioned the gorilla video (Simons & Chabris, 1999).

<table>
<thead>
<tr>
<th>N knew IB term</th>
<th>N noticed</th>
<th>N IB</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>24 (33%)</td>
<td>23 (32%)</td>
</tr>
<tr>
<td>Yes</td>
<td>6 (8%)</td>
<td>19 (26%)</td>
</tr>
</tbody>
</table>

Logistic regression was performed to determine whether noticing was reliably predicted by: (1) familiarity with the term IB; and/or (2) knowledge of IB research. Omnibus tests indicated that the full model with both predictors was not reliably different from a constant-only model with no predictors, indicating that neither factor reliably predicted noticing of the US (see Table 2). This suggests that possessing minimal knowledge of IB research does not influence the likelihood of experiencing IB in an experimental setting.
Experiment 2

Experiment 2 aimed to extend the findings of Experiment 1 by assessing the effects of repeated participation in IB experiments. This is relevant because in many cases potential participants will come into an experiment having some exposure to IB stimuli, or perhaps having informally attempted an experiment, such as watching the gorilla video (Simons & Chabris, 1999). The design was deliberately kept highly similar to Experiment 1, with some superficial changes, so that if participants failed to notice the US in Experiment 2 it could not be attributed to any changes in the experimental paradigm or stimuli. Observers had all participated in a previous experiment in the same lab; participants for the current experiment were recruited from the pool of past participants. Experiment 2 also assessed the impact of possessing a higher degree of knowledge, by comparing participants who had studied IB as part of their psychology coursework to those who had merely heard about the general phenomenon through their previous research participation and subsequent debriefing.

Method

Participants Thirty-six undergraduates (78% female; $M_{age} = 23.2$ years) participated voluntarily for either course credit or AU$5 payment. They were either first year psychology students with moderate IB knowledge ($n = 27$) or later-year psychology students with high IB knowledge ($n = 9$). All observers provided informed consent and had normal or corrected-to-normal vision. Eight additional participants were excluded due to: poor vision (6); and failure to report the US under full attention (2).

Stimuli and Procedure Apparatus were identical to Experiment 1. The experiment included four trials, which each contained four black and four white circles and squares moving on a light grey background (see Figure 2a). Observers were again instructed to attend to the white items only. Trials 1 and 2 contained only the expected black and white items. A dark grey diamond appeared as the US (see Figure 2b) during the critical trial (trial 3) and the full attention trial (trial 4). Trials used the same programming code as Experiment 1 (with fewer trials); therefore, although the shapes of the objects were different, the stimuli movements were identical.

All observers had recently participated in a previous IB experiment in the same lab. Overall 19% of Experiment 2 participants had been classed as noticers during their first IB experiment. Following their first IB experiment, participants were fully debriefed and given an information sheet about IB. They were later asked to return to the lab for Experiment 2 and were questioned to ensure that they had read and understood the information sheet. Later-year psychology students had also attended a 2-hour laboratory class during which they learned about theory and research relevant to IB, including details of the sustained IB paradigm used in Experiment 1. The class included details on several IB studies (Cartwright-Finch & Lavie, 2007; Koivisto, Hyönä & Revonsuo, 2004; Mack & Rock, 1998; Memmert, 2006; Most et al., 2001, 2005; Neisser, 1979; Neisser & Becklen, 1975; Newby & Rock, 1998; Simons & Chabris, 1999), stimuli examples and class discussions and activities.

Table 2: Logistic Regression of US Noticing for Experiment 1

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$\beta$</th>
<th>SE $\beta$</th>
<th>Wald $\chi^2$-test</th>
<th>$df$</th>
<th>$p$</th>
<th>Odds Ratio</th>
<th>CI$_{95}$ Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB term</td>
<td>1.55</td>
<td>0.83</td>
<td>3.47</td>
<td>.062</td>
<td>0.21</td>
<td>[0.04, 1.08]</td>
<td></td>
</tr>
<tr>
<td>IB research</td>
<td>-0.65</td>
<td>0.65</td>
<td>0.99</td>
<td>.319</td>
<td>1.91</td>
<td>[0.54, 6.77]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.75</td>
<td>9.66</td>
<td>9.66</td>
<td>.002</td>
<td>**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overall model evaluation

Likelihood ratio test: 4.62 | $p = 0.099$

| **$p < .01$** |

Figure 2: Experiments 2 and 3 stimuli.
Prior to Experiment 2, participants were informed that the purpose of the experiment was to investigate the effect of knowledge on IB. They were told that they were considered “knowledgeable” (first years) or “highly knowledgeable” (later-years) due to their previous exposure to IB. Therefore all participants were clear about the nature of the study. Nevertheless, participants were instructed to focus on the primary bounce-counting task and were not given any indication of whether or when an US would appear. Following the critical trial participants were questioned as to whether they had noticed the US.

**Results and Discussion**

As in Experiment 1, primary task accuracy did not vary between noticers and nonnoticers on the critical IB trial, $t(34) = -1.71$, $p = .099$, CI$_{95}$ [-3.8, 0.3]. Overall 39% of participants noticed the US (61% IB). Logistic regression was performed to determine whether noticing was reliably predicted by: (1) past experience in an IB experiment (noticing vs. nonnoticing); and/or (2) level of IB knowledge (moderate vs. high). Omnibus tests revealed that the full model with both predictors was not reliably different from a constant-only model, indicating that neither past noticing in IB research, nor IB knowledge is a significant predictor of noticing (see Table 3). However, the overall rate of noticing was significantly higher than in Experiment 1, $\chi^2 (1, N = 108) = 4.73$, $p = .037$, suggesting that simply having participated in IB research may be sufficient to reduce IB regardless of whether the observer noticed the US during their first IB experiment.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$\beta$</th>
<th>SE $\beta$</th>
<th>Wald $\chi^2$-test</th>
<th>$df$</th>
<th>$p$</th>
<th>Odds Ratio</th>
<th>CI$_{95}$ Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous noticing</td>
<td>-1.71</td>
<td>1.18</td>
<td>2.12</td>
<td>.145</td>
<td>.18</td>
<td>0.18</td>
<td>[0.02, 1.81]</td>
</tr>
<tr>
<td>IB knowledge</td>
<td>1.06</td>
<td>0.84</td>
<td>1.60</td>
<td>.206</td>
<td>2.88</td>
<td>2.88</td>
<td>[0.56, 14.81]</td>
</tr>
<tr>
<td></td>
<td>0.19</td>
<td>1.59</td>
<td>0.02</td>
<td>.903</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overall model evaluation

Likelihood ratio test

$\chi^2 = 4.14$, $p = .126$

$\chi^2 = 1.38$, $p = .502$

Prior to Experiment 2, participants were informed that the purpose of the experiment was to investigate the effect of knowledge on IB. They were told that they were considered “knowledgeable” (first years) or “highly knowledgeable” (later-years) due to their previous exposure to IB. Therefore all participants were clear about the nature of the study. Nevertheless, participants were instructed to focus on the primary bounce-counting task and were not given any indication of whether or when an US would appear. Following the critical trial participants were questioned as to whether they had noticed the US.

**Experiment 3**

Experiment 2 suggested that past participation in IB research and even extensive knowledge does not significantly affect rates of IB in subsequent experiments. However, overall IB rates were significantly lower in Experiment 2 compared to Experiment 1, despite the similarity of the stimuli, which may have resulted from participation in the prior IB experiment. Further, there was a period of several weeks between knowledge acquisition and retesting for the high knowledge group, which may have resulted in a degradation of knowledge. To address these issues Experiment 3 directly manipulated knowledge in a sample of psychology undergraduates, who had not previously studied IB and had limited anecdotal knowledge (comparable to knowledge levels in Experiment 1) prior to testing. Half the participants were given detailed information on IB, and half were given comparable information on an unrelated topic. If IB knowledge makes no difference whatsoever, then there should be no difference in rates of IB between groups. Alternatively, if the results of Experiment 2 were due to sample characteristics such as the passage of time between learning about IB and participation in the subsequent IB experiment, then the IB knowledge group should exhibit higher noticing rates (lower IB) compared to the unrelated knowledge group.

**Method**

**Participants** Forty-six undergraduates (85% female; $M_{age} = 19.5$ years) participated voluntarily for course credit and were evenly distributed across the two experimental conditions. All had normal or corrected-to-normal vision and provided informed consent. Five additional participants were excluded due to: poor vision (2); failure to report the US under full attention (2); and equipment failure (1).

**Stimuli and Procedure** Apparatus and stimuli were identical to Experiment 2. All observers had participated in a similar IB experiment the same day. Overall, 22% of participants in Experiment 3 had been classified as noticers in their first IB experiment. They were given a break of 5 to 15 minutes after their first experiment and asked to read an information sheet about IB. They were then given a short (approximately 15 minutes) presentation on either IB (high IB knowledge; $n = 23$) or eye movement (moderate IB knowledge; $n = 23$) research. The IB presentation included details of several IB-related studies (Haines, 1991; Mack & Rock, 1998; Mack et al., 1992; Most et al., 2001; Neisser & Becklen, 1975; Rock et al., 1992; Simons & Chabris, 1999) and focused particularly on research with direct relevance to the current study. Participants were randomly allocated to presentation condition.
Results and Discussion

Approximately half the high knowledge participants noticed the US (48% noticed, 52% IB), which was nearly triple the rate of noticing for the moderate knowledge group (17% noticed, 83% IB). This difference was significant, $\chi^2 (1, N = 46) = 4.85, p = .029$, suggesting that possessing a high degree of IB knowledge decreases subsequent likelihood of experiencing IB in experimental settings.

Primary task accuracy on the critical IB trial did not vary between experimental groups, $t(44) = 1.01, p = .316, CI_{95} = [-0.8, 2.3]$. However, contrary to Experiments 1 and 2, noticers reported significantly fewer bounces (i.e., lower primary task accuracy) than nonnoticers on the critical IB trial, $t(44) = -3.45, p = .002, CI_{95} = [-4.1, -1.0]$. There was also a nonsignificant trend whereby noticers performed worse than nonnoticers at bounce-counting on both the first, $t(44) = -1.52, p = .142, CI_{95} = [-2.3, 0.4]$, and second, $t(44) = -1.40, p = .176, CI_{95} = [-3.2, 0.6]$ control trials leading up to the critical trial. This suggests that noticers in Experiment 3 may have adopted a dual task approach and “watched” for a possible appearance by the US, rather than attending fully to the primary task.

Comparison of Experiments 1-3

Data from Experiments 1, 2 and 3 were pooled in order to compare results across experiments and four knowledge groups were identified. No knowledge ($n = 24$) consisted of Experiment 1 participants who were completely naive regarding IB. Minimal knowledge ($n = 48$) participants from Experiment 1 had some anecdotal knowledge of IB but had not previously participated in an IB experiment. Moderate knowledge ($n = 50$) participants from Experiments 2 and 3 all had prior experience participating in an IB experiment and possessed general information about IB. High knowledge ($n = 32$) participants had participated in a prior IB experiment and then learned detailed information about IB research and theory, either in a lab class (Experiment 2) or an experimental setting (Experiment 3). There was a significant difference in rates of IB across groups, $\chi^2 (3, N = 154) = 10.45, p = .014$. High knowledge participants experienced significantly lower rates of IB (see Figure 3); there were no significant differences between the no knowledge, minimal knowledge and moderate knowledge groups, $\chi^2 (2, N = 122) = 0.78, p = .717$.

As mentioned previously, IB was significantly higher in Experiment 1 compared to Experiment 2. Overall noticing rates in Experiment 3 (33% noticed, 67% IB) were not significantly different to either Experiment 1, $\chi^2 (1, N = 118) = 2.62, p = .127$, or Experiment 2, $\chi^2 (1, N = 82) = 0.35, p = .644$. When compared with Experiment 1, participants in Experiment 2 performed significantly better at bounce-counting on both the first, $t(106) = 3.99, p < .001, CI_{95} = [1.1, 3.2]$, and second control trial, $t(106) = 3.21, p = .002, CI_{95} = [0.6, 2.6]$, but not the critical trial, $t(106) = 1.45, p = .158, CI_{95} = [-0.3, 2.1]$. The same pattern was observed in Experiment 3. Participants were significantly better at bounce-counting in Experiment 3 compared to Experiment 1 on both trial 1, $t(116) = 4.69, p < .001, CI_{95} = [1.4, 3.4]$, and trial 2, $t(116) = 3.70, p < .001, CI_{95} = [0.9, 3.0]$, but not the critical trial, $t(116) = 1.54, p = .126, CI_{95} = [-0.2, 1.8]$.

General Discussion

Our results demonstrate that preexisting knowledge of IB does not necessarily affect rates of IB in experimental settings. Overall the results suggest that preexisting knowledge of IB is only influential if it leads to participants forming specific and accurate expectations about the experiment. Experiments 1 and 2 both demonstrated that knowledge of IB does not predict whether a participant will notice the unexpected stimulus. Further, Experiments 2 and 3 deliberately used participants who had previously participated in a similar IB experiment and found that it is possible for participants to experience IB in multiple experiments, suggesting that the phenomenon is more robust than previously believed. In Experiment 3, IB was significantly reduced and noticing increased when participants were given detailed information on IB research immediately prior to the experiment. This was accompanied by a drop in primary task performance for noticers, but not nonnoticers, suggesting that noticers adopted a dual-task approach and sacrificed primary task performance in order to deliberately watch for the US. Although gaining a high degree of IB knowledge significantly lowered rates of IB in Experiment 3, it is worth noting that IB still occurred.
Across Experiments 2 and 3, nearly half of the high knowledge participants still failed to report the US, despite their awareness that they were participating in an IB experiment. Interestingly, the drop in IB for the high knowledge group is comparable in magnitude to the drop in IB between critical trials and divided-attention trials in previous sustained IB research (Bressan & Pizzighello, 2008; Most et al., 2000, 2001, 2005). Divided-attention trials occur immediately after critical trials, when the observer has been questioned about the US but not explicitly told that it will appear again. Thus observers in a divided-attention trial have less expectation about the US than high knowledge participants in our experiments, who could accurately predict when and how the US would appear based on their knowledge. If knowledge truly invalidated IB then high knowledge IB should have dropped even further, beyond what has been found in divided-attention trials. This suggests that it may be possible to engage nonnaïve participants in future IB experiments, although this will depend on the experimental aims. In particular, nonnaïve participants would be ideally suited for investigating why observers fail to notice particular stimuli. They would be less useful for investigations regarding what does capture attention, since for many nonnaïve observers this would depend on their IB knowledge, choice of task strategy and the specificity of their attentional set.

Though our results seemingly contradict established IB literature, they are not particularly surprising. An obvious real-world correlate of IB is magic tricks, where magicians deliberately misdirect the audience’s attention to induce IB (Kuhn & Tatler, 2005). In the case of magic, informing observers that they will witness a magic trick does not increase detection of the trick methods (Tatler & Kuhn, 2007). Similarly, several IB researchers have anecdotally reported experiencing IB themselves, particularly when their expectations about unexpected stimulus were incorrect (i.e., they expected the wrong shape, color or trial). Although expectation is clearly central to many instances of IB, it is not intrinsically linked to knowledge of IB. Expectations influence IB if they allow the observer to adopt a specific attentional set and accurately predict subsequent events: they will see three items rather than two (White & Aimola Davies, 2008), or they will see only black and white items (Most et al., 2001). However, possessing general knowledge about IB paradigms does not create a specific attentional set; it merely suggests that something unexpected will happen at some point. By contrast, high IB knowledge can allow a specific attentional set, if participants know that an unexpected item will likely appear five seconds into the third trial and cross the screen along the horizontal midline. The latter case occurred for our high knowledge participants, whereas moderate knowledge participants simply had the general suggestion that something else may appear on the screen at some point.

When considering implications for future research, it is worth noting that the primary tasks used in our experiments placed moderate to high demands on perceptual load, as evidenced by rates of both primary task accuracy and IB. Less demanding tasks may be more susceptible to effects of IB knowledge, if the primary task does not adequately sustain attention. Nevertheless, our data suggest that the time and effort devoted to recruiting completely naïve experimental participants may not be necessary. A more effective strategy would be to devise a greater variety of experimental paradigms; particularly paradigms that are clearly distinct from the most widely publicized experiments such as the gorilla video (Simons & Chabris, 1999).

Expanding IB research in this way will enable more research into individual differences, which has been problematic to date (Simons & Jensen, 2009). Individual differences research could help further the theoretical understanding of IB by revealing individual factors that contribute to increasing or decreasing the likelihood of noticing unexpected objects. IB also has important practical implications, such as understanding human error in motor vehicle accidents. “Looked but failed to see” accidents account for at least 5% of police-reported crashes (Stutts, Reinfurt, Staplin, & Rodgman, 2001). Further, many collisions involve objects that drivers are aware may appear suddenly, including other vehicles, bicycles, pedestrians, or animals such as kangaroos. This may be analogous to having a vague expectation that something unexpected might happen during an IB experiment. Accordingly, based on insights from the current experimental series, we are beginning work in our lab to investigate the role of inattentive blindness in road accidents.

Acknowledgments

We thank Anne Aimola Davies for running the laboratory class mentioned in Experiment 2 and for allowing participant recruitment for Experiments 1 and 2 in class. We also thank Kayla Tulloch for assistance in data collection.

References


Citation details for this article: