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Attention Capture, Processing Speed, and Inattentive Blindness

Timothy J. Wright¹, Nelson A. Roque², Walter R. Boot², and Cary Stothart²

¹Dunlap and Associates, Inc.

²Florida State University

Abstract

Previous theories of inattentive blindness (IB; a phenomenon of observers failing to notice a salient but unexpected event when attention is already occupied) have suggested that an unexpected object reaches conscious awareness when: 1) the location of the unexpected object and attention align, and 2) the unexpected object undergoes sufficient processing. Moreover, it is expected that the same factors that influence the allocation of observers' attention in attention capture studies influence what reaches conscious awareness in IB studies. We explored the degree to which individual differences in susceptibility to attention capture and processing speed are important predictors of IB. One hundred forty-six participants (from Study 1 of Roque, Wright, & Boot, 2016) completed four classic attention (implicit) capture tasks designed to assess stimulus-driven and contingent capture. Following the completion of these capture tasks, participants completed a sustained IB (multiple object tracking) task where an unexpected event appeared during the final critical trial. Indices of stimulus-driven and contingent capture were derived from the capture tasks, and a measure of processing speed was derived from aggregating reaction times from the three speed-based capture tasks. Surprisingly, results of logistic regression analyses revealed no relationship between measures of implicit and explicit capture (noticing the unexpected event). However, consistent with a priori hypothesis, processing speed did predict IB. Findings suggest that attention capture is unrelated to the noticing of an unexpected stimulus, but efficient encoding and recognition of a stimulus is an important factor.

1. INTRODUCTION

The unintuitive finding that half of observers can fail to notice a salient event in their view while engaged in another task (inattentive blindness (IB); Simons & Chabris, 1999) sparked numerous attempts to account for this phenomenon. In one sense, selective attention is performing exactly as it evolved to do: when a task needs to be performed in the presence of non-task relevant information, it would be advantageous for distracting information to be filtered from reaching awareness and interfering with primary task performance. On the other hand, it is also important in many circumstances for novel or unique information

Corresponding Author: Timothy J. Wright, Dunlap and Associates, Inc., 110 Lenox Ave., Stamford, CT 06906, timwright167@gmail.com, Phone: 304-218-1348.

Cary Stothart is now at the U.S. Army Research Institute for the Social and Behavioral Sciences. Nelson Roque is now at Penn State University.

within the field of view to capture attention because this information could signal a meaningful change in the observer's environment (e.g., in an evolutionary context the appearance of a predator, or in a modern context the approach of a fast-moving vehicle).

The IB phenomenon highlights the interaction between bottom-up (stimulus-driven) and top-down (goal-driven) processes that constantly determine 1) what visual information attracts automatic, often implicit, shifts of attention (e.g., Folk, Leber, & Egeth, 2002; Folk, Remington, & Johnston, 1992; Jonides & Yantis, 1988; Theeuwes, 1992; Yantis & Jonides, 1984) and 2) what information reaches conscious awareness (e.g., Koivisto & Revonsuo, 2008; Most, Scholl, Clifford, & Simons, 2005; Most, Simons, Scholl, Jimenez, Clifford, & Chabris, 2001; Simons & Chabris, 1999). The interplay between these bottom-up and top-down processes have most frequently been studied in the context of the former (implicit capture). In these implicit capture studies, observers are typically presented with search displays where they are asked to search for a target among distractors. Response time (RT) or search time is compared across trials with and without critical distractors that are either unique in their visual properties from the rest of the display (e.g., unique color or motion) or consistent with an observer's goals (e.g., share a feature with the observer's target). Evidence for stimulus-driven capture is observed when search is delayed by the presence of a visually distinct distractor regardless of observers' goals (e.g., Theeuwes, 1992). On the contrary, evidence for contingent capture is observed when delays are dependent on the goal of observer (e.g., a distractor shares a feature with the target).

Critical differences exist between attention capture paradigms and IB paradigms. For one, the method in which capture is assessed differs across the paradigms. In capture paradigms, capture is inferred from RT differences across search trials; however, in IB paradigms, capture is assessed explicitly through participants' report that they noticed the unexpected event. Moreover, the nature of the distractors differs across attention capture and IB paradigms. In attention capture studies, distractors appear across numerous, even hundreds of trials. Consequently, in these studies, the distractor is expected to some degree. On the contrary, in IB paradigms, the distractor is unexpected and often only appears on the final critical trial.

Despite critical differences across attention capture and IB paradigms, capture in both is typically assumed to be related and determined by similar bottom-up and top-down processes (Most et al., 2005; Simons, 2000). Most and colleagues (2005) linked the attention capture literature to the conscious awareness of an unexpected stimulus in IB paradigms. These researchers noted that explicit awareness does not demarcate attention capture (performance can be influenced by unnoticed distractors), but explicit awareness does define whether or not someone is inattentionally blind (Most et al., 2005). Moreover, Most et al. (2005) posited that the critical distinction between implicit capture by a stimulus and being consciously aware of it is the length of time attention dwells on it. Attention capture (implicit) is a result of a transient shift of attention whereas noticing an unexpected object (explicit capture) is a result of delayed disengagement from a stimulus that has captured attention. This delayed disengagement hypothesis would suggest that efficient encoding and recognition of a stimulus would predict whether or not an observer notices an unexpected event. That is, processing speed, or the time required to encode a visual stimulus and make

an accurate judgment about it (Owsley, 2013), should be predictive of IB. Inconsistent with this idea, O'Shea and Fieo (2015) found that within a sample of older adults, individual differences in processing speed were not predictive of IB. However, due to the small sample size in this study ($N = 36$), further investigation is warranted regarding processing speed's ability to distinguish noticers and non-noticers.

While failing to notice an unexpected stimulus could be the result of it never attracting a transient shift of attention (see Most, 2010 for discussion), it is often likely a result of attention moving on from the critical stimulus before recognition can occur. Consistent with this idea, eye-tracking studies find that those who notice the unexpected object have just as many fixations on it than those who do not (Beanland & Pammer, 2010; Memmert, 2006). Most et al. (2005) suggested that both bottom-up stimulus properties of objects and top-down goals of the observer influence where attention is allocated, but the latter is the primary determinant of how long attention dwells on an object. More recent work is consistent with this hypothesis, as delayed disengagement of attention has been linked to goal-directed, top-down processes (e.g., Boot & Brockmole, 2010; Blakely, Wright, Dehili, Boot, & Brockmole, 2012; Wright, Boot, & Brockmole, 2015; Wright, Boot, & Jones, 2014). Most et al. (2005) further suggested that IB would be more heavily influenced by top-down mechanisms (i.e., the observer's target representation). Evidence showing that the similarity between the targets' defining feature and the feature of an unexpected event influence the rate at which the unexpected event is noticed is in line with this idea that IB is heavily reliant on top-down goal-driven factors (Koivisto & Revonsuo, 2008; Most et al., 2005; Most et al., 2001; Simons & Chabris, 1999).

This study explored whether individual differences in (bottom-up and top-down) attention capture and processing speed predicted observers' likelihood of experiencing IB. Four classic attention capture paradigms were used to measure each observer's susceptibility to both top-down and bottom-up distraction. It was predicted a priori that those with increased capture in these classic paradigms should be more likely to be captured by the unexpected event. Moreover, it was predicted a priori that those more efficient in encoding and recognizing information in attention capture paradigms (faster processing speed or RT in these classic paradigms) should be more likely to efficiently encode and recognize the unexpected event. This latter hypothesis related to processing speed is consistent with work showing individuals high in attentional control (i.e., working memory capacity) are less likely to experience IB (Hannon & Richards, 2010; Richards, Hannon, & Derakshan, 2010; Richards, Hannon, & Vitkovitch, 2012; Richards, Hellgren, & French, 2014; but see also Bredemeier & Simons, 2012; Kreitz, Furley, Memmert, & Simons, 2015; Kreitz, Furley, Simons, & Memmert, 2016).¹

This study is also informative regarding the perceptual cycle framework proposed by Most et al. (2005). Most and colleagues hypothesized that awareness is a result of 1) a transient shift of attention and 2) sustained attentional processing; however, the current study will be the

¹While it was hypothesized that higher attentional control (faster encoding) would be associated with less IB, a reviewer proposed an alternative hypothesis that higher attentional control might be associated with more inhibition and more IB (suppression of the unexpected event). This hypothesis is intuitive but counter to the studies that do find a relationship between attentional control (working memory capacity) and IB.

first to directly correlate measures of these cognitive processes with noticing the unexpected event. Attention capture scores from four classic attention capture paradigms served as indices of observers' transient shifts of attention, and RT from these paradigms served as an index of processing speed. If the features that influence an observer's spatial allocation of attention also determine whether or not a stimulus reaches conscious awareness, higher rates of implicit attention capture in classic attention capture tasks should predict higher rates of explicit capture (noticing the unexpected event). Furthermore, if efficient encoding of information determines what information reaches conscious awareness, individuals who notice the unexpected event should have faster processing speed than those individuals who do not notice the unexpected event.

2. METHODS

The same methods and undergraduate sample from Study 1 of Roque et al. (2016) were used for the current study. Here we present an abbreviated version of the methods.

2.1. Participants

One hundred forty-six undergraduates (M age = 20 years; SD = 2.89 years) participated in an hour experiment for course credit. All participants reported normal or corrected-to-normal color vision. In addition, at the conclusion of the session, all participants reported unfamiliarity with the specific IB task used in the current study. Three individuals were missing IB data, and one participant was missing conscientiousness data due to technical issues. Participants capture scores and processing speeds were dropped if their accuracy in the respective capture measure was less than 3 SD below the mean (see sample size statistics in Table 2).

2.2. Apparatus

A 19-inch color monitor (1024 × 768 resolution) was used to display the attention capture and inattention blindness tasks.

2.3. Overview of Approach

2.3.1 Attention Capture Measures—In order to get indices of attention capture, subjects completed two of the most common visual search paradigms used in support of both bottom-up and contingent capture. Specifically, the Additional Singleton Paradigm (Theeuwes, 1992) and the Irrelevant Singleton Paradigm (Yantis & Jonides, 1984; Jonides & Yantis, 1988) were used for indices of bottom-up capture and the Contingent Cuing Paradigm (Folk et al., 1992) and the Contingent Blink Paradigm (Folk et al., 2002) were used as indices of contingent capture. Capture scores were then calculated in a manner consistent with the literature for each task (see Roque et al., 2016). Specifically, in order to determine the relationship between these two different types of capture, attention capture scores were calculated from RT and accuracy proportion scores from each condition of the various classic attention measures. That is we divided observers' reaction time by the accuracy in each condition to create an inefficiency proportion score for that condition. These inefficiency scores that take into account both accuracy and RT are generally more reliable than scores based purely on RT (Roque et al., 2016). For search tasks involving

search for a target of a specific color, the color of the search target was held constant (i.e., green) to reduce the possibility of carryover effects. Below is more information concerning each capture task.

2.3.1.1 Additional Singleton Paradigm.: In this task, observers searched for the shape singleton in the display. On 50% of trials (72 of 144 total), a color singleton distractor was also present. This paradigm was selected to represent bottom-up capture.

2.3.1.2 Irrelevant Singleton Paradigm.: Across 180 trials, observers searched for a letter target among distractor letters (3 or 7 total letters). One letter (20% of the time the target) onset in the display. This paradigm was also selected to represent bottom-up capture.

2.3.1.3 Contingent Cuing Paradigm.: Across 360 trials, observers searched for a green target and an inconsistent (onset) or consistent (green; 50% of trials) distractor preceded the target. The distractor either occurred in a valid or invalid (50% of trials) target location. This paradigm was selected to represent top-down capture.

2.3.1.4 Contingent Blink Paradigm.: Across 165 trials, observers were rapidly presented with a series of letters where one was the green letter target. On 75% of trials, inconsistent (red or silver) or consistent (green) distractors would appear before or simultaneously with the target. This paradigm was also selected to represent top-down capture.

2.3.2 Processing Speed Measure—A measure of processing speed was also calculated from the attention capture measures that emphasized speed. The Contingent Blink Paradigm was not included as it emphasized accuracy over speed. For this processing speed measure, we wanted as pure of a measure as possible that was distinct from other cognitive operations, particularly attention capture as we were deriving the index from tasks classically designed to assess this construct. (See Cepeda, Blackwell, & Munakata, 2013 for processing speed measurement issues.) Accordingly, we did not include the Irrelevant Singleton Paradigm as an onset was present on every trial, and capture typically occurs by this object that would likely result in biased processing speed scores for those who were more susceptible to capture. In an effort to only include trials in which typically no capture is observed or no distractor was present, we used 1) RT from the onset cue trials in the Contingent Capture Paradigm, 2) RT from Additional Singleton Trials in which no distractor was present.² The trials from these paradigms were expected to provide a valid measure of processing speed, as efficient encoding and recognition of targets occurs with minimal influence of capture.

2.3.3 IB Measure—In addition to the implicit capture tasks, participants also completed an IB task similar to the one in used in Most et al. (2000). Figure 1 provides an illustration of this task. In this task, 4 white letters (2 Ts and 2 Ls) and 4 black letters (2 Ts and 2 Ls)

²Note that limiting the measure to no distractor trials was a recommendation from a previous reviewer in order to derive a purer measure of processing speed. When average RT from the Irrelevant Singleton paradigm is included in this pure measure, results below are identical. Moreover, when average RT across distractor and no distractor trials for all three speed based attention capture paradigms (Contingent Cuing, Irrelevant Singleton, and Additional Singleton) is used to derive the processing speed scores, results below are again identical to what is reported with the more conservative measure.

float along random trajectories within a confining window on the screen. As observers maintained fixation at the center of the screen, they were asked to track the movements of the white letters while ignoring the movements of the black distractor letters. Specifically, observers monitored the number of times the target white letters crossed a central boundary line within the window on the screen. Following each trial, participants were probed for this count. After 5 trials (1 practice), a critical trial occurred in which an unexpected gray cross followed a linear path of motion from right to left along the boundary line. This unexpected object was unique in color, shape, and path of motion from the rest of the display. Following the unexpected object's exit, observers were probed for their awareness of the unexpected event's presence. This probe involved an initial yes or no question asking if the individual noticed anything unusual on the final trial. Subsequent items were multiple choice where the individual was asked to guess or select the correct unexpected object attribute from the available choices. Individuals were classified as noticing the unexpected event if they 1) indicated they noticed something unusual during the critical trial and 2) were able to correctly identify the unexpected object's shape, color, or path of motion. After being probed for awareness of the unexpected event, participants were asked if they were familiar with the specific task that was just used to measure IB to ensure no false positives (e.g., an observer who noticed the unexpected event because they expected it). Instead of including a full-attention trial at the end of the session where the unexpected object was presented in the absence of the primary task, participant's error rate was used as a check to ensure that participants were appropriately on-task and engaged in the primary task both in the experimental and critical trials (see White, Davies, & Davies, 2018). Note, while the order of the first four (implicit capture) tasks were counterbalanced, with participants always completing the IB task (explicit capture) task last. This ordering was done to avoid any negative effects on performance from the deception in the IB task.

2.3.3 Conscientiousness Measure—After completing the primary five tasks, participants completed a short survey assessing awareness of the unexpected event and some demographic questions, including the Ten Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003). The TIPI provides a very brief measure of the Big Five Personality domains. Conscientiousness was of particular interest to the current study as one might view individual differences in RT to reflect individual differences in motivation rather than some intrinsic ability to process information rapidly (processing speed). Thus, this measure was included to tease apart motivation and processing speed's respective relationship to noticing an unexpected event.

3. RESULTS

3.1. IB Results

Table 1 presents the participants' responses for each of the IB measure's items. As evident in the Table 1, seventy-three participants indicated they noticed something unusual on the final trial and seventy indicated they did not. Of the seventy-three participants who indicated they noticed something unusual, sixty-four were classified as noticing the unexpected event (45% noticing rate) as they were able to correctly identify the unexpected object's color ($n = 58$), shape ($n = 55$), or direction of movement ($n = 56$).

Of the sixty-four participants who were classified as noticing the unexpected event, forty-five (70%) correctly identified all three of the event's features, and on average, these noticers correctly identified 2.64 features. Only one non-noticer (1.4%) was able to correctly guess all three features, and on average, these non-noticers correctly guessed .56 features. In sum, these descriptive results suggest the IB classification method was successful.

Moreover, both noticers and non-noticers were equally on-task as there was no significant difference in performance in the primary task: across all four primary task trials, $\chi^2(1) = 1.04$, $p = .31$, $OR = 0.989$, and on the critical trial, $\chi^2(1) = 0.70$, $p = .40$, $OR = 0.991$. This suggests it is unlikely that any participants who failed to report noticing the unexpected event did so because they did not follow instructions.

3.2. Attention Capture and IB

Critically, we were interested in the extent to which implicit capture is predictive of explicit detection of an unexpected stimulus. In order to determine the relationship between these two different types of capture, attention capture scores were calculated from RT and accuracy proportion scores from each condition of the various classic attention measures (see Roque et al., 2016). The attention capture scores were each entered into separate logistic regressions to predict the likelihood of noticing the unexpected event. Table 2 presents the results of these logistic regressions.

3.3. Processing speed and IB

Our indices of observers' transient shifts of attention were uncorrelated with IB; however, Most et al. (2005) did suggest that differences between noticers and non-noticers may come after the unexpected event has been attended. Considering this, it is still reasonable to expect efficient encoding of information (processing speed) to predict IB. Thus, observers' processing speeds were entered into a logistic regression to predict noticing status. Results of these analyses were consistent with hypotheses, as processing speed significantly predicted noticing the unexpected event, $\chi^2(1) = 7.49$, $p < .01$. Specifically, for every 1ms slowing in processing speed, individuals were 1.006 times more likely to miss the unexpected event. See Figure 2. In sum, results suggest slower processing speed is detrimental to noticing unexpected events and their features. This is consistent with Most and colleagues (2005) who suggested that efficient encoding of information is critical in determining whether a stimulus reaches conscious awareness.

3.4. Conscientiousness, Processing Speed, and IB

Critically, participants' self-reported conscientiousness shared no relationship with their processing speed, $r(134) = .09$, $p = .28$. Moreover, a hierarchical logistic regression analysis with conscientiousness entered into the first step and processing speed entered into the second step revealed that conscientiousness significantly predicted IB in the first step of the regression model, $\chi^2(1) = 4.09$, $p = .04$ ($OR = 1.40$). However, this measure seemed to distinctly predict IB, as a second step of the regression model revealed that when controlling for conscientiousness, processing speed was still a significant predictor $\chi^2(1) = 6.40$, $p = .01$ ($OR = 1.006$) and conscientiousness still predicted IB to a similar extent as it did in the first step, $\chi^2(1) = 2.86$, $p = .09$ ($OR = 1.34$).

4. DISCUSSION

Inconsistent with Most et al. (2005), the current study found effectively no relationship between classic attention capture measures and noticing the unexpected event, even among those capture measures associated with top-down processes. This is particularly surprising when considering that Most et al. (2005) suggested that observers' goals (or attention sets) that modulate sustained attentional processing are critical in determining what an observer will notice.

While it is surprising that implicit capture was almost completely unrelated to noticing the unexpected event, it is possible that the lack of relationship is due to reliability issues of the tasks themselves (see Roque et al., 2016). In addition to reliability issues, participants may have different strategies and approaches to performing attention capture tasks, meaning that capture effects may be measuring something different for different participants. For example, bottom-up capture in the Additional Singleton paradigm has been shown to depend on the strength of an observer's top-down set. Specifically, the target is always the unique item in the display, so observers adopt an attention set for uniqueness (see Leber & Egeth, 2006). The strength of this attention set determines the degree to which the unique distractor captures attention (Leber, 2010). It follows that a null result may be due to ambiguities in the tasks themselves that allow for inconsistent strategies that dictate capture. Still, differences across capture and IB tasks in measurement of capture (implicit vs. explicit) and expectation of the distractor likely accounts to some degree for the lack of relationship between implicit and explicit capture that we found in this study.

Results are consistent with Most et al. (2005) in that our metric of efficient encoding of information (processing speed) predicted IB. The relationship between processing speed and IB appears to reflect a relationship between an intrinsic cognitive process and noticing the unexpected event and not a mere artifact of individual differences in motivation affecting performance across tasks. That is, no relationship between individual differences in processing speed and conscientiousness was observed. Moreover, the relationship between processing speed and IB remained significant even after accounting for individual differences in conscientiousness. Thus, efficient encoding and recognition of a stimulus is the most critical determinant of what information reaches conscious awareness. This is the first time this cognitive ability has been demonstrated to distinguish noticers and non-noticers. It is likely that O'Shea and Fieo (2015) failed to elucidate this relationship due to the small sample size utilized in that study.

It is important to note that the current study only included classic attention capture measures and not a pure measure of sustained attentional processing or a measure of attentional disengagement. If observers' attention sets and sustained attentional processing are truly critical in determining the likelihood an observer will notice an unexpected event, individual differences in delayed attentional disengagement should predict noticing the unexpected event. Consistent with this idea, top-down attention sets determine both the likelihood of noticing an unexpected distractor (Most et al., 2005) and how long attention dwells on a distractor item within fixation (Boot & Brockmole, 2010; Wright et al., 2014). Furthermore, these disengagement delays have been associated with greater depth of processing (Wright

et al., 2015), critical to both recognizing and remembering a stimulus. Future work should examine the relationship between delayed attentional disengagement and noticing an unexpected stimulus.

The processing speed measure used in this study was not sensitive to our proxy for observers' motivation (conscientiousness). Still, conscientiousness and motivation showed some sensitivity to IB. Those individuals who rated themselves higher in conscientiousness were significantly less likely to notice the unexpected event, and while the relationship was no longer significant after controlling for individual differences in processing speed, the same trend between conscientiousness and IB persisted. This relationship between conscientiousness and IB is in contrast to our own work that used a similar sustained IB task (Wright, Boot, & Morgan, 2013) and other work that used a static IB task (Kreitz, Schuerch, Gibbons, & Memmert, 2015). Kreitz and colleagues (2015) suggest that demands of the primary task may account for differences in findings across studies. That is, the sustained IB task in this study is likely more demanding than the static IB task used in Kreitz et al. (2015), and thus, motivation and conscientiousness are more critical to the completion of the task and the noticing of an unexpected event. We propose that the location of the observer's attention relative to the location of the unexpected event may also be a factor explaining differences across studies (see Most, 2010 for discussion on central and spatial IB). In the current study, the observer can successfully keep an accurate count of all the letter crossings in a narrow field of view at the center of the screen: the location where the unexpected object traverses. In the tracking task used in Wright et al. (2013), the observer is required to diffuse their attention to the periphery to keep an accurate count and attention may not ever arrive at the unexpected object's location by chance. In sum, the use of a reduced portion of the display may reduce noise and increase power to elucidate successful individual difference predictors. Future work should attempt to replicate the conscientiousness and IB relationship across various IB tasks and task demands to test this theory.

It is well understood under which situations IB is likely to occur, but relatively little is still known about what individual traits are predictive of IB. That is, conscientiousness and processing speed are not the only traits that have mixed support in the literature regarding their utility for predicting IB. For instance, some studies find that individuals high in working memory capacity are less likely to experience IB (e.g., Hannon & Richards, 2010; Richards et al., 2014; whereas, others find no relationship between working memory capacity and IB (e.g., Bredemeier & Simons, 2012; Kreitz et al., 2016). In fact, even the reliability of IB measures are in question, as sustained and static IB are not even predictive of each other (Kreitz et al., 2015). It follows that any potential method, such as the one discussed for conscientiousness above, that reconciles contradictory findings and overall improves the reliability of IB measures might aid in elucidating stable traits that predict this phenomenon.

REFERENCES

- Beanland V, & Pammer K (2010). Looking without seeing or seeing without looking? Eye movements in sustained inattention blindness. *Vision Research*, 50(10), 977–988. [PubMed: 20206648]
- Blakely DP, Wright TJ, Dehili VM, Boot WR, & Brockmole JR (2012). Characterizing the time course and nature of attentional disengagement effects. *Vision Research*, 56, 38–48. [PubMed: 22306925]

- Boot WR, & Brockmole JR (2010). Irrelevant features at fixation modulate saccadic latency and direction in visual search. *Visual Cognition*, 18(4), 481–491.
- Bredemeier K, & Simons DJ (2012). Working memory and inattention blindness. *Psychonomic Bulletin & Review*, 19(2), 239–244. [PubMed: 22222359]
- Cepeda NJ, Blackwell KA, & Munakata Y (2013). Speed isn't everything: Complex processing speed measures mask individual differences and developmental changes in executive control. *Developmental Science*, 16(2), 269–286. [PubMed: 23432836]
- Folk CL, Leber AB, & Egeth HE (2002). Made you blink! Contingent attentional capture produces a spatial blink. *Perception & Psychophysics*, 64(5), 741–753. [PubMed: 12201333]
- Folk CL, Remington RW, & Johnston JC (1992). Involuntary covert orienting is contingent on attentional control settings. *Journal of Experimental Psychology: Human Perception and Performance*, 18(4), 1030. [PubMed: 1431742]
- Gosling SD, Rentfrow PJ, & Swann WB, Jr. (2003). A Very Brief Measure of the Big Five Personality Domains. *Journal of Research in Personality*, 37, 504–528.
- Hannon EM, & Richards A (2010). Is inattention blindness related to individual differences in visual working memory capacity or executive control functioning?. *Perception*, 39(3), 309–319. [PubMed: 20465168]
- Jonides J, & Yantis S (1988). Uniqueness of abrupt visual onset in capturing attention. *Perception & Psychophysics*, 43(4), 346–354. [PubMed: 3362663]
- Koivisto M, & Revonsuo A (2008). The role of unattended distractors in sustained inattention blindness. *Psychological Research*, 72, 39–48. [PubMed: 16821049]
- Kreitz C, Furley P, Memmert D, & Simons DJ (2015). Inattention blindness and individual differences in cognitive abilities. *Plos One*, 10(8), e0134675. [PubMed: 26258545]
- Kreitz C, Furley P, Simons DJ, & Memmert D (2016). Does working memory capacity predict cross-modally induced failures of awareness?. *Consciousness and Cognition*, 39, 18–27. [PubMed: 26658847]
- Kreitz C, Schnuerch R, Gibbons H, & Memmert D (2015). Some see it, some don't: Exploring the relation between inattention blindness and personality factors. *PloS one*, 10(5), e0128158. [PubMed: 26011567]
- Leber AB (2010). Neural predictors of within-subject fluctuations in attentional control. *The Journal of Neuroscience*, 30(34), 11458–11465. [PubMed: 20739567]
- Leber AB & Egeth HE (2006). It's under control: Top-down search strategies can override attentional capture. *Psychonomic Bulletin & Review*, 13 (1), 132–138. [PubMed: 16724780]
- Memmert D (2006). The effects of eye movements, age, and expertise on inattention blindness. *Consciousness and Cognition*, 15(3), 620–627. [PubMed: 16487725]
- Most SB (2010). What's "inattentional" about inattentional blindness?. *Consciousness and Cognition*, 19(4), 1102–1104. [PubMed: 20181502]
- Most SB, Scholl BJ, Clifford E, & Simons DJ (2005). What you see is what you set: Sustained inattention blindness and the capture of awareness. *Psychological Review*, 112, 217–242. [PubMed: 15631594]
- Most SB, Simons DJ, Scholl BJ, & Chabris CF (2000). Sustained inattention blindness: The role of location in the detection of unexpected dynamic events. *Psyche*, 6 (14).
- Most SB, Simons DJ, Scholl BJ, Jimenez R, Clifford E, & Chabris CF (2001). How not to be seen: The contribution of similarity and selective ignoring to sustained inattention blindness. *Psychological Science*, 12(1), 9–17. [PubMed: 11294235]
- O'Shea DM, & Fieo RA (2015). Individual differences in fluid intelligence predicts inattentional blindness in a sample of older adults: A preliminary study. *Psychological Research*, 79(4), 570–578. [PubMed: 25001000]
- Owsley C (2013). Visual processing speed. *Vision Research*, 90, 52–56. [PubMed: 23231958]
- Richards A, Hannon EM, & Derakshan N (2010). Predicting and manipulating the incidence of inattention blindness. *Psychological Research*, 74(6), 513–523. [PubMed: 20058156]

- Richards A, Hannon EM, & Vitkovitch M (2012). Distracted by distractors: Eye movements in a dynamic inattention blindness task. *Consciousness and Cognition*, 21(1), 170–176. [PubMed: 22001769]
- Richards A, Hellgren MG, & French CC (2014). Inattention blindness, absorption, working memory capacity, and paranormal belief. *Psychology of Consciousness: Theory, Research, and Practice*, 1(1), 60.
- Roque NA, Wright TJ, & Boot WR (2016). Do different attention capture paradigms measure different types of capture?. *Attention, Perception, & Psychophysics*, 1–17.
- Simons DJ (2000). Attentional capture and inattention blindness. *Trends in Cognitive Sciences*, 4(4), 147–155. [PubMed: 10740279]
- Simons DJ, & Chabris CF (1999). Gorillas in our midst: Sustained inattention blindness for dynamic events. *Perception*, 28, 1059–1074. [PubMed: 10694957]
- Theeuwes J (1992). Perceptual selectivity for color and form. *Perception & Psychophysics*, 51(6), 599–606. [PubMed: 1620571]
- White RC, Davies M, & Davies AMA (2018). Inattention blindness on the full-attention trial: Are we throwing out the baby with the bathwater?. *Consciousness and Cognition*.
- Wright TJ, Boot WR, & Brockmole JR (2015). Functional fixedness: The functional significance of delayed disengagement based on attention set. *Journal of Experimental Psychology: Human Perception and Performance*. 41(1), 17–21. [PubMed: 25384235]
- Wright TJ, Boot WR, & Jones JL (2014). Exploring the breadth of the top-down representations that control attentional disengagement. *The Quarterly Journal of Experimental Psychology*, 1–14. [PubMed: 25283723]
- Wright TJ, Boot WR, & Morgan CS (2013). Pupillary response predicts multiple object tracking load, error rate, and conscientiousness, but not inattention blindness. *Acta Psychologica*, 144(1), 6–11. [PubMed: 23743340]
- Yantis S & Jonides J (1984). Abrupt visual onsets and selective attention: Evidence from visual search. *Journal of Experimental Psychology: Human Perception & Performance*, 10, 601–621. [PubMed: 6238122]

Figure 1.
An illustration of the IB task used in the current study.

Figure 2. Graph illustrating average processing speeds for both noticers and non-noticers. (Error bars represent standard error of the mean.)

Table 1.

Responses on Inattentional Blindness (IB) Measure.

Notice Anything Unusual (Participant Response)?	Correct Path of Motion n (%)	Correct Color n (%)	Correct Shape n (%)
Yes (N = 73)	56 (76.7%)	58 (79.4%)	55 (75.3%)
No (N = 70)	19 (27.1%)	16 (22.9%)	9 (12.9%)
TOTAL (N = 143)	75 (52.4%)	74 (51.7%)	64 (44.8%)

Table 2.

Results of Logistic Regression Analyses Using Attention Capture Scores as Predictors of Noticing of the Unexpected Object.

Capture Score	N	Wald Statistic	Odds Ratio	r-squared	p-value
<i>Top-Down Measures</i>					
Contingent Cuing	139	0.09	0.70	.001	.77
Contingent Blink	137	0.16	0.81	.002	.69
<i>Bottom-up Measures</i>					
Irrelevant Singleton	133	0.06	1.00	.001	.80
Additional Singleton	138	3.09	26.81	.031	.08