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Purely Voluntary Spatial Orienting of Attention

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Attentional orienting has conventionally been studied with cues that direct participants' attention to a target location. Attention can then be quantified by the difference in performance between cued and uncued target related responses. Certain cue stimuli have been used routinely for examining voluntary spatial orienting, but recent evidence suggests these stimuli consist of associative properties which facilitate orienting or elicit involuntary control. In contrast to prior research, the present experiment involves arbitrary cues which have no present or prior associations with the target locations. We find that effects are decisively smaller and take longer to arise than those repeatedly reported from conventional voluntary orienting experiments. This suggests that researchers be mindful of conventionally accepted experimental properties when testing voluntary spatial orienting of attention or asserting voluntary spatial orienting differences in clinical populations, such as those with ADHD.

When shifting visual attention we typically quickly and easily move our eyes to attended objects in the environment, sometimes voluntarily. This overt voluntary orienting toward objects activates multiple systems that might not be orienting of attention to locations per se. For the current study we attempt to directly address only voluntary covert orienting of visual spatial attention. This requires attending without engaging eye or head movements toward an attended location and without using unique objects at the attended location.

Unlike prior research on spatial orienting of attention, we examine how effective covert spatial orienting can be when it is entirely dependent on cognitive control rather than external properties (*'exogenous'*). Cognitive control refers to a set of key functions which serve goal-directed actions. The conceptual framework of cognitive control follows as a capacity within the working memory system to maintain task-relevant goals/instructions to prepare for acting appropriately to upcoming events, and to adjust relevant commands in response to previous errors (Buschman & Miller, 2014; Braver, 2012). Common laboratory approaches for studying cognitive control involve scenarios where the participant has to suppress conflicting representations to respond correctly (e.g. Stroop (1935**)** test), maintain information corresponding to multiple variables (e.g. Test of Variables of Attention), or tasks which require sustained and selective attention (e.g. continuous performance task).

The Posner (1980) Cueing Paradigm has become a very common method for experimenting with covert orienting, and variations of this task have been considered apt for examining cognitive control of attention. This paradigm utilizes spatial cues (e.g. an arrow, or a brightening at a particular target location) to direct a participant's attention to an upcoming target. There are two possible target locations equidistant from the fixation point at the center of the screen. When the direction of the cue is congruent with the target location, performance is better than when the target appears in the uncued location (Posner et al., 1980). This is taken as evidence attention was shifted to the cued location.

Endogenous and exogenous orienting has typically been separated by the cue properties. A common method for inducing exogenous shifts of attention is to employ transient peripheral flashes or brightening of the target location to serve as cues (Abrams & Dobkin, 1994; Posner, 1980; Jonides, 1981). The salient properties of these cues are thought to reflexively drive the viewer's attention towards them, and enhance performance at the cued location even when they do not predict the target (Posner, 1980), or when participants are instructed to ignore the cues (Jonides, 1981). Therefore, this operation of attention appears to be at least partially automatic and independent of the participants' cognitive control. Endogenous orienting is instead considered to align with the participants' goals. This is classically performed with an arrow cue at fixation (Jonides, 1981; Müller & Rabbitt, 1989; Posner, 1980). In contrast to exogenous cues, researchers have argued that arrows require the participant to interpret the cue and to make the choice to move their attention to the target location (Jonides, 1981; Müller & Rabbitt, 1989; Posner, 1980), therefore being subject to cognitive control. In support of this argument, Jonides (1981) found that non-predictive arrows did not generate cueing effects.

Contrary to Jonides' observations, subsequent research has demonstrated that attention is reactive to uninformative arrows. It is probable that Jonides' selection of stimulus-onset asynchrony (SOA) (115 ms) was too quick for execution of this response. Although some experiments have found cueing effects at similar latencies (Ristic & Kingstone, 2006; Tipples, 2002), they are small and less consistent in comparison to the robust effects at later SOAs (see table 1). Ristic and Kingstone (2012) describe these orienting effects to be a result of a process referred to as "automated symbolic orienting", which suggests that performance can be controlled by overlearned behaviorally relevant stimuli. Even non-predictive numbers have generated cueing effects congruent with their position on a number line (Fischer et al., 2003). But historical associations of the cue are not the only important factor.

Another manipulation that needs to be addressed is cue-target contingency within the experiment. Manipulating the probability between the cue and the target has been a common technique for generating incentive for participants to shift attention (Enns & Brodeur, 1989; Eriksen & Yeh, 1985; Johnson & Yantis, 1995). It has been consistently found that when cue predictiveness increases, so does the magnitude of the cueing effect (See Risko & Stolz, 2010). This is referred to as the *proportion valid effect* (PVE). Recent investigations have found evidence that the PVE can be generated implicitly (Lambert et al. 1999; Lanthier, 2011; Risko & Stolz, 2010), whereby the unrecognized cue predictiveness can subconsciously bias an orienting response to the cued location in the absence of any cognitively controlled command. Even arbitrary stimuli can generate orienting due to associations between color or form and location (Dodd & Wilson, 2009; Christie, Chun, Wylie, & Klein, submitted)

Since we aspire to measure the effect of voluntary spatial visual orienting, the experiment must be absent of all cue-target contingencies as well as any location-relevant intrinsic or historical meaning of the cue. The cues must be carefully selected to not bias orienting by low-level or semantic properties. We found this neutrality to be satisfied by outlines of squares, diamonds and circles at fixation. Participants were instructed to orient in a particular direction in response to the cues as in “when you see a square attend to the left”. The circle was included as a neutral cue. We predicted that it would indicate whether participants followed the instructions. It is probable that if instructions were followed the additional effort of trying to orient in relation to directional cue should slow RTs in comparison to cues where no orienting is necessary. Evidence for this hypothesis comes from Rutherford et al. (2010), who demonstrated that previously rewarded irrelevant stimuli delayed rapid visual orienting to the cued location. Therefore it seems plausible that motivation to orient according to the instructions will increase RT.

Without a benefit of the cue, one might be reluctant to believe that participants will follow the instructions of the task. However Bonnel et al.(1986) found that participants could follow instructions when directed to shift their attention to the left or right of fixation without any cue or target related incentives. The participants were asked to bias their attention proportionately between the two sides. They then made line length discrimination judgments of pairs of lines presented simultaneously at both sides. The results showed a linear relation between the proportion of attention to a location and their d' measurement of accuracy. Although the benefits in performance were robust with a discrimination task, less complex responses like simple detection were not (Bonnel et al., 1987). Therefore we chose to implement a discrimination task. We believe Bonnel et al. (1986) to be a very strong experiment to demonstrate voluntary control. However we argue that the control was not orienting per se, but the modulation of orienting. They used arrows and allegorical spatial cues which, contrary to our selection of cues, have potent associations which would facilitate orienting or evoke exogenous processes.

Our stimuli were also selected to avoid the potential for object-based orienting (see supplemental material for information on object-based orienting.). It is likely that orienting in response to object properties rather than to a location can facilitate orienting (Christie, 2014) and may nullify the conclusions relating to the role of spatial orienting in peripheral cue/RSVP designs (Sperling & Reeves, 1986; Yantis et al., 2002). With a continuous stream of unique stimuli to attend toward, orienting can be affected by object based mechanisms as well as potentially being mediated by sensitivity to the transients that occur.

In the current experiment we included two SOAs of 350 and 1000 ms. Although it has been demonstrated numerous times that arrow cues can generate cueing effects before 350 ms (see Table 1), a majority of studies have used probability manipulations, and those that have not have found relatively small cueing effects which could be attributable to the reflexive physical properties of the arrow (Ristic et al. 2002; Ristic et al. 2009; Tipples, 2002). Therefore we selected 350 ms as a conservatively short SOA for investigating the presence of voluntary spatial orienting. If cueing is not found then the distinction between our failure to observe effects and those repeatedly reported in the literature would suggest that conventional endogenous orienting designs may not be unambiguously studying volition. Since endogenous cues require time for interpretation, the SOA of 1000 ms was also included to bolster the chance for voluntary orienting to be effective and because it is relatively common in the literature. We predict that if an effect occurs, it will be less than those reported by comparable studies that included the aforementioned experimental properties.

Table 1. Cueing Effects Across Variable SOA Lengths in Endogenous Orienting Experiments.

	SOA(ms)							
Cue	**100 -200**	**200-300**	**300-400**	**400-500**	**500-600**	**600-700**	**700-1000**	**>1000**
Arrow	10% [1] 24 ms [6]	19%[1] 57 ms [3]	43 ms [6]	37 ms [2]		7% [1] 38 ms [6]	20% [1] 52 ms [4] 38 ms [6]	17% [1] 52 ms [4]
Non Predictive	9 ms [6] 18 ms [7] 5 ms [8] 2 ms [9]		9 ms [6] 16 ms [7] 18 ms [9]			12 ms [6] 16 ms [9]	12 ms [6] 11 ms [8] 14 ms [9]	
Texture							74 ms [5]	
Number	1 ms [6]		13 ms [6]			15 ms [6]	14 ms [6]	

There were meaningful distinctions between experimental properties of the reported results, such as cues type (arrow cues, texture cues, and number cues), cue predictiveness, and response (e.g. simple detection vs. discrimination). What is important to us is that the authors of these experiments considered their design sound for examining voluntary orienting. **References**: **1**. Müller & Rabbitt (1989), **2**. Posner & Cohen (1984), **3**. Brodeur & Enns (1997) (Note that this experiment included several groups of different ages. The cueing effects displayed here were from a group under the age of 22 as they most closely matched our participants), **4**. Posner, Snyder & Davidson (1980), **5**. Brignani et al. (2009), **6**. Ristic & Kingstone (2006) (Note that although the authors implemented a conventional endogenous orienting paradigm they were actually explicitly investigating reflexive properties of arrows and are therefore exempt from the above requirement of classifying their experiment as 'endogenous'.), **7**. Tipples (2002), **8**. Ristic & Kingstone, 2009, **9**. Ristic et al., 2012.

Method

Participants

40 psychology and neuroscience students were recruited from Dalhousie University to participate in this study. All participants had normal or corrected-to-normal vision. Participants were compensated with 1 class credit point or $12. Only 29 participants were included in the analysis due to failure to complete the experiment or exceeding a cut-off of making eye movements on 30% of the trials. Experiments of endogenous orienting often include samples of less than 20 (e.g. Posner et al., 1980; Ristic et al. 2006; Tipples 2002) because the effect is so consistent across participants. However we wanted to ensure that we could find an effect if it was

smaller and less consistent. A calculation of the margin of error for a sample with an estimated standard deviation of 13 ms shows that we can detect cueing effects as small as 4.7 ms.

Design

This experiment followed a 2 x 2 factorial design consisting of cue validity (levels: valid and invalid), and SOA (levels: 350 ms and 1000 ms) as independent variables and RT and accuracy were measured as dependent variables to assess the efficacy of orienting in response to the cues. The procedure is detailed in Figure 1.

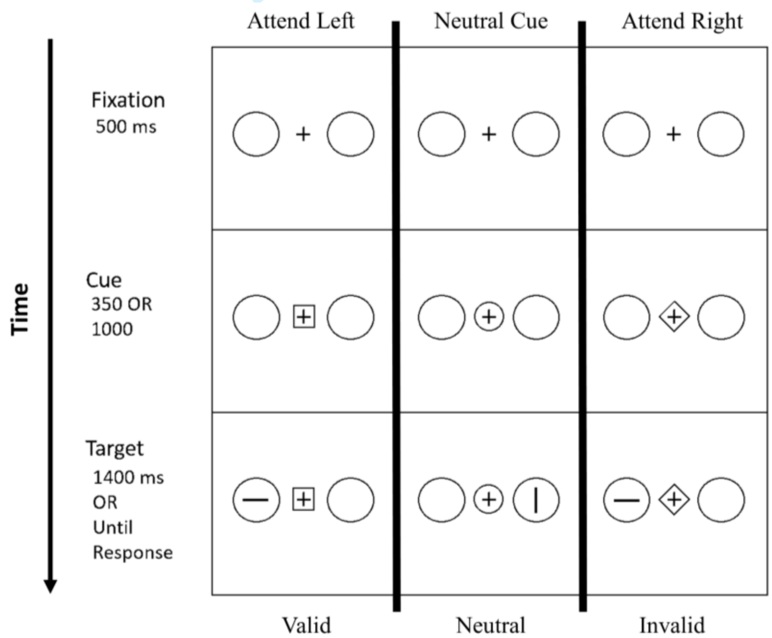

Figure 1. Example trial sequences of the task; for valid, invalid, and neutral conditions. Participants were asked to respond as quickly and accurately as possible indicating the orientation of the target line by pressing ‘0’ or ‘1’ on the numeric keypad. These keys were chosen due to their vertical alignment in order to reduce the Simon Effect (1969). Directional instructions were assigned to the cues. Half of the participants were instructed to ‘attend to the left target location when you see a square, and to the right when you see a diamond.’ The other participants received the opposite instruction. All cues were non-predictive of target location, symmetrical, and of equal stimulation (length of outlines). The cues were presented 500 ms after trial initiation, via spacebar press. Proper fixation was required for initiation, otherwise an error sound buzzed and a drift correction would be computed to update the eye-monitors reference of fixation.and preceded the target by either 300 or 1000 ms, which appeared in a constantly displayed circular marker Participants were read a carefully composed script (see supplemental material) to ensure they were knowledgeable of covert visual orienting and knew how to perform the task before initiating the experiment. Trials were terminated if eye movements were detected

or if participants failed to respond within 1400 ms of target presentation. There was a total of 600 trials (the first 7 were practice trials and were excluded from analysis), with equal amounts of each cue and target per SOA. In the experiment the colour of the stimuli and background were reversed.

Additional information regarding stimuli and apparatus is presented in supplemental material.

Results

Data Trimming

All participants who made eye movements on more than 30% of the trials were excluded from analysis. This cut-off was initially set to 25%, but due to an unpredictably high rate of eye movements we accepted a more liberal cut-off, as with a large amount of trials per condition we were confident that the quantity of our data would still be sufficient. This adjustment was set before analysis of the data and did not bias the results to reflect our predictions. Eight of the 40 participants surpassed this threshold (3 with diamond as left cue and 5 for square), 5 participants failed to complete the experiment (3 of whom also exceeded eye movement threshold), and one participant failed to follow instructions by not responding to uncued targets. Analysis included 26 complete data sets and 3 incomplete data sets, but which consisted of enough completed trials for inclusion (453, 545, 576/600). 15 participants performed the experiment with the diamond serving as the left cue and 14 participants had square left cues.

Trials with eye movements were also excluded as well as the first 7 trials for practice. A plot of mean RTs by trial number revealed a large and rapid drop in response times over the first 7 trials followed by relatively stable response patterns for the remaining duration. The first 7 trials averaged 959 ms in comparison to the following 7 trials which averaged to 752 ms. The mean RT of trial 7 was 861 ms which was comparatively very slow to trial 8 mean RT of 764 ms.

Reaction times

RTs were analyzed by generating 95% confidence intervals from bootstrapping of mean effect size. The effect size was a measurement of the difference between aggregate participant means of valid and invalid trials and were computed for both SOAs. The mean cueing effect at 350 ms was 10.3 ms, 95% CI [1.3, 19.9], and 13.8 ms, 95% CI [5.6, 22.9] at 1000 ms. The SOA x validity interaction was 3.6 ms, 95% CI [-2.9, 4.3]. These cueing effects are small compared to those obtained from arrow cues (Table 1), but the results suggest that pure voluntary cues can benefit performance of RT.

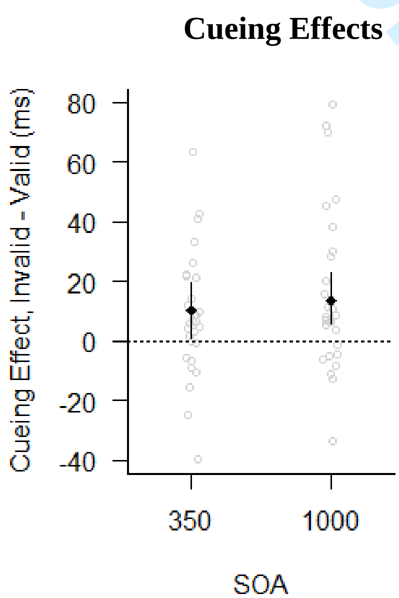

Fig. 2. 95% confidence intervals of cueing effects for correct reaction times. The confidence intervals were calculated through bootstrapping of mean reaction time scores of each participant. The mean cueing effects are 10.3, 95% CI [1.3, 19.9] at 350 ms and 13.8 ms, 95% CI [5.6, 22.9] at 1000 ms.

Following the same procedure it was found that neutral cues generally produced quicker responses than valid cues (cueing effect: 1.1 ms, 95% CI [-4.7, 7.0]). This suggests that the effort required in responding according to the directional cues delays orienting. This analysis combined RTs from both SOAs as the interaction between validity and SOA was minimal (see Fig 2).

Accuracy

Accuracy was analyzed with the same procedure as RT (see Fig. 3). Accuracy was -1.0%, CI95% [-2.1, -0.04], and therefore worse with valid cues than invalid cues at SOA 350 but there was nearly no effect at SOA 1000 (cueing effect: 0.03%, 95% CI [-1.5, 1.5]). The interaction between cue validity and SOA was 1.1%, 95% CI [-0.7, 3.0]. Neutral cues generated more accurate responses than valid cues by 0.56%, 95% CI [-0.2, 1.4].

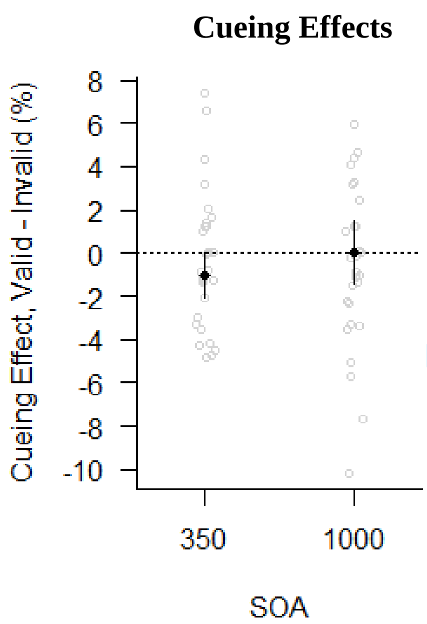

Fig. 3. 95% confidence intervals of accuracy cueing effects. The confidence intervals were calculated through bootstrapping of mean reaction time scores of each participant. The mean cueing effects are -1.0, CI95% [-2.1, -0.04] at 350 ms, and 0.03, 95% CI [-1.5, 1.5] at 1000 ms.

Although cueing effects were found at 350 ms in the form of RT, the accuracy data suggests a speed-accuracy tradeoff (SAT), which would mean that part of the reason why responses were quicker to valid targets was because participants compromised accuracy rather than genuine performance enhancement. Although the interaction between SOA and validity was small the effect sizes of validity in RT were positive and increased from 350 ms (d = 0.41) to 1000 ms (d = 0.59). When compared to accuracy a contradictory trend is observed. A negative effect (d = -0.37) was observed at 350 ms and no effect was present at 1000 ms (d = 0.01). Based on the SAT we cannot conclude that there was orienting at the 350 ms SOA.

Table 2. Means and Standard Deviations of Correct Reaction Time (RT) and Accuracy as a function of Cue Validity and Stimulus-Onset Asynchrony (SOA).

SOA	Cue Validity	Mean RT (ms)	SD	Accuracy	SD
350	*Invalid*	628.2	101.6	0.965	0.026
	Valid	617.9	95.7	0.955	0.029
	Neutral	615.3	92.7	0.961	0.030
1000	*Invalid*	604.2	84.2	0.959	0.037
	Valid	590.4	87.7	0.969	0.037
	Neutral	590.7	82.6	0.964	0.030

Additional figures are presented in the supplemental material.

Discussion

Recent research on visual attention has revealed experimental issues that need to be addressed. These concerns include 1) the common selection of cues that contain historical spatial associations, 2) probability associations between the cue and target location, and 3) the presence of unique peripheral features. Contrary to their traditional use, these experimental properties all have the potential to facilitate spatial visual orienting (1: Ristic et al., 2012; 2: Lambert et al. 1999; 3: Christie, 2014) by incorporating additional systems that interact or interfere with the voluntary component. We have found that using cues, which have no prior or experimental spatial relationship with the targets, have constructed circumstances where an individual's attentional shifts would be mediated only by the instructions assigned to the cues. These instructions must be accessed in working memory, thus attentional shifts are initiated exclusively by the participants own intentions. We argue that this is a much more unambiguous measure of cognitive control than previous endogenous orienting studies.

The cueing effects of the present study are small compared to similar experiments that use an arrow cue, a probability manipulation, or both (see Table 1). Further, although cueing effects appeared by 350 ms (10.3 ms), impaired accuracy at that SOA created a sufficiently large

SAT to negate any conclusive evidence of cue effectiveness at short cue-target intervals. This suggests that spatial visual orienting is less rapid than previously believed when constrained to cognitive control. This contrasting patterns of results supports the aforementioned arguments against the common endogenous spatial orienting experimental designs where larger and faster effects are likely due to processes outside cognitive control.

The amount of eye movements which occurred in this experiment was relatively high. With a cut-off of 30% eye movements we still had to exclude 8 of the 40 participants' data from analysis, which is a lot of eye movements for a simple covert orienting procedure (See note 3 in supplemental material). A post hoc analysis of eye movements revealed that eye movement averages were little different between the short (16.2%) and long (19.2%) SOA, which indicates that the propensity for eye movements did not arise from equipment noise or the duration of the task, such as refraining from blinking and/or maintaining fixation for up to 2 seconds, as both these possibilities would increase eye movements over time. Instead, the propensity for eye movements could be linked to the nature of the task itself. When we tried the study we found it very difficult to covertly spatially orient. This is very unlike our feeling of ease when trying covert orienting in natural environments. Our constrained design eliminates all of the motivating objects and associations that make such tasks easier in the natural environment and isolates voluntary spatial orienting. We hypothesize that in this experiment the eye movement system may be strongly involved in generating, but not maintaining, covert spatial orienting and that explains the large number of eye movements. Future studies might specifically examine the relationship between voluntary cueing effects and the rate of eye movements to investigate if suppression of the oculomotor system counteracts voluntary orienting. It would also be worthwhile to compare these results with conditions that promote object orienting to determine if oculomotor suppression difficulty is ameliorated.

In summary, this experiment demonstrates that participants can orient their attention to generate cuing effects in the absence of bottom-up information. However, orienting is not as rapid or as robust as when found in traditionally used experimental designs. This suggests that the bulk of many previously observed effects were at least partially, if not largely, facilitated by exogenous processes. Many of said processes are included in experiments examining voluntariness in clinical populations such as ADHD (Huang-Pollock & Nigg, 2003; McDonald et al., 1999; Novak et al., 1995; Pearson et al., 1995), dyslexia, (Jonkman et al., 1992; Facoetti et al., 2000), Huntington's Disease (Couette et al., 2007) , and schizophrenia (Mushquash et al, 2011; Klein, 2005). It is therefore unclear whether the differences found in these sub-populations are due to cognitive control differences or due to variables outside cognitive control. We encourage researchers to be mindful of these experimental properties when they are designing experiments to investigate endogenous orienting of attention, especially when results are used to describe attentional impairments.

Author contributions

A.K. Fraser was the main author, sole data collector and primary data analyst. J. Christie developed the study concept and supervised every process of design, analysis, and writing and provided critical revisions.

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Supplemental Material

Stimuli and apparatus

Participants were tested under dim lighting conditions while viewing the presentation of stimuli from a viewing distance of 57 cm. Stimuli were presented on a 19″ ViewSonic Optiquest Q95 CRT monitor (Q95-3) which was connected to an Intel "Core 2 Duo" (T7200) processor. An SR Research EyeLink II head-mounted eye tracking system was used to monitor eye movements. Each participant completed a 9-point calibration and validation procedure to ensure that the precision of the eye tracking was within half a degree of visual angle. The host computer updated feedback on eye positioning at a rate of 250 Hz.

All stimuli were white, and of equal luminance, and were presented on a black background. The stimulus array at the start of each trial (see Figure 1) consisted of a fixation cross, with a width and height of 0.4 degrees visual angle (DVA), and two circular markers of 2 DVA in diameter, placed 3 DVA to the left and right of fixation. The cues were the outlines of circles, diamonds, and squares which were equated for perimeter. The cue widths in degrees visual angle were 1.28, 1.01, 1.42 for circles, squares, and diamonds respectively. The cues had transparent centres and were presented at fixation with sufficient width as to not occlude the fixation cross. The targets were horizontal and vertical lines of 1 DVA in length, appearing in the center of one of the two markers (4 DVA from fixation). The cues were not removed until the end of a trial and the initial stimulus array was never removed during the experiment.

Figure S1. Scatterplot matrix displaying correlations in reaction time across all conditions. V = valid, I = invalid, N = neutral. 350 and 1000 stimulus-onset asynchronies (SOA).

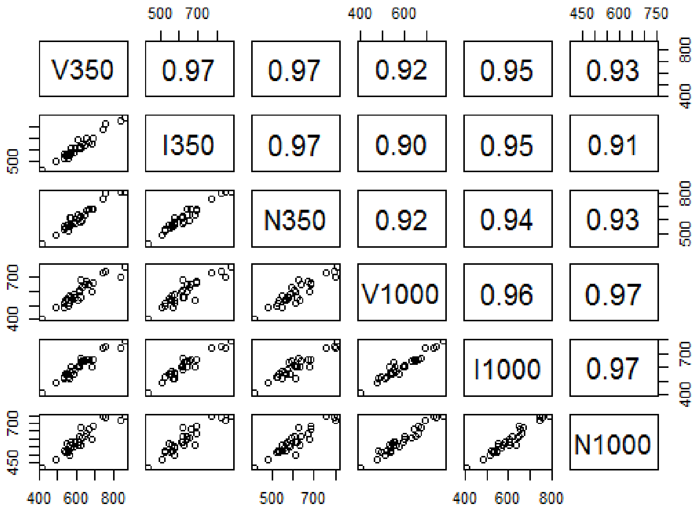
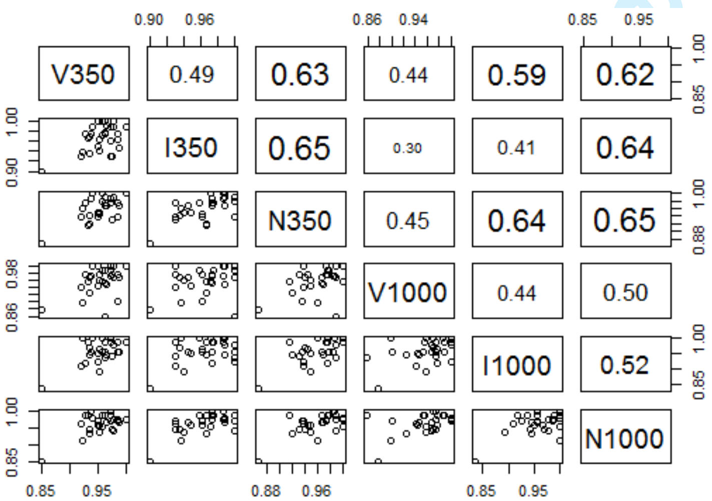


Figure S2. Scatterplot matrix displaying correlations in RT across all conditions. V = valid, I = invalid, N = neutral. 350 and 1000 denote the given stimulus-onset asynchronies (SOA).



Notes

1) Error rates as a function of response time were analyzed to assess extreme responses. Although a speed-accuracy tradeoff (SAT) was displayed, faster RTs did not fall

consistently below 80% and therefore a low cut-off for RT was not selected. There was no long RT cutoff because maximum trial duration was 1400 ms and accuracy stayed pretty consistent out to that time.

2) The present experiment was constructed to avoid the potential for object-based orienting. When the task requires a participant to locate a peripheral stimulus on the basis of a specified property, orienting is facilitated and also differentiated from spatial orienting. If location information is conveyed by the shapes of markers surrounding the target locations (e.g. a square marker and a circle marker presented simultaneously. The square marker cues the likely target location), the response patterns are very different than when target information is conveyed through the *meaning* of identical markers (Christie, 2014). When peripheral markers are identical and they cue a particular side, (e.g. both markers are squares means target probability is on the right; both markers are circles means target probability is on the left) they then denote particular locations, which requires orienting to particular points in space rather than to an object. Therefore, we argue that target locations be either identically marked or unmarked when assessing spatial attention.

3) When participants committed an eye movement a warning message urging them not to make eye movements was immediately presented lasting 4 seconds. Originally the feedback duration was only 2 seconds and was included for 7 of the remaining data sets. It seemed the prolonged time was necessary for participants to understand the message as it was effective in reducing the number of eye movements. Four of the 10 participants were excluded with 2s feedback and 7 of the 30 participants were excluded with 4s feedback.

Instruction script:

"I am experimenting with how people shift their attention to locations in space. Commonly you might think that where your eyes are placed is where your attention is at, and that your attention follows your eyes as you scan from location to location. However it is also possible for people to shift their attention away from the center of their vision. A common example of this is in sports: you often see a basketball player with the ball, who is staring at their defender, but is really focused on her teammate out of the corner of her eye to make the swift pass. This experiment is an attempt to simulate this kind of attention, where you will be encouraged to keep your eyes still on the center of the screen, but to simultaneously shift your focus to a specific location."

Participants were then asked if they comprehended and if they felt they had the ability to perform this type of process. They were asked to look at the experimenters palm while trying to bias their attention to the experimenter's finger in their peripheral vision. They all responded yes. Then speaking specifically about the experiment:

"You will be required to keep your eyes placed still on the fixation cross at center throughout each trial. When you feel your eyes are focused on the cross you can begin the trial by pressing the spacebar. You must keep your eyes still until the trial is over or the trial will be aborted and you will receive a warning message. Shortly after the trial begins there will be 1 of 3 cues placed around the fixation cross. If it's a square it is instructing you to shift your attention to the circle on the left (the marker). If it is a diamond it is instructing you to shift your attention to the right. There will be a target appearing in either the left or right circles shortly after the cue appears. It will be either a horizontal line or a vertical line, your objective is to respond as fast and accurate as you can by reporting the correct orientation of the line."

Note that the use of square and diamond cues and their respective attentional instructions were mentioned only for an example, these were reversed for half of the participants.

All participants reported a clear understanding of the procedure.