A POWERFUL VISION: POWER AFFECTS VISUAL SEARCH BEHAVIOR

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Abstract: Preliminary studies indicate that being in a powerful or powerless position affects the individual's ability to focus on task relevant information. In the present study, we examined which components of attention are affected by power using visual search paradigms. In three studies, participants were first primed with power or powerless, and then performed visual search tasks. In these tasks the contribution of top-down and bottom-up attentional guidance was manipulated by altering either the physical or semantic similarity between target and distracters. The results indicated that social power affects the speed of visual search. Furthermore, these effects derived from differences in top-down, but not bottom-up, components of attention, and occurred both when targets were discriminated on the basis of perceptual as well as of semantic properties.

Key-words: social power, vision, visual search, attention, social cognition.

Uma visão poderosa: O poder afecta o comportamento de busca visual (Resumo): Estudos preliminares demonstram que a posição de poder que os indivíduos ocupam afecta a sua capacidade de focalizarem a atenção em informação relevante para a tarefa. O presente artigo investiga as componentes da atenção que são afectadas pelo poder, utilizando tarefas de busca visual. Em três estudos, os participantes foram inicialmente *primados* com o conceito de poder ou de subordinação e efectuaram tarefas de busca visual. Nestas tarefas, a contribuição das influências atencionais descendentes (*top-down*) e ascendentes (*bottom-up*) foram manipuladas através da alteração da semelhança física ou semântica entre estímu-

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los alvo e estímulos de distracção. Os resultados obtidos indicam que o poder afecta a velocidade da busca visual. Além disso, as diferenças obtidas derivam de diferenças na atenção descendente e não na atenção ascendente e ocorrem face a alvos diferenciados com base em propriedades físicas ou semânticas.

Palavras-chave: poder social, visão, busca visual, atenção, cognição social.

Recent research has pointed out that basic cognitive processes are to a great extent dependent on the individual's immediate states and circumstances. For example, mood affects attention to global and local aspects of stimuli (see Gasper & Clore, 2002), stress affects cognitive control (Muller, Atzeni, & Butera, 2004), and changes in social status affect how efficiently individuals filter distracting visual information (Dumas, Huguet, Monteil, & Ayme, 2005). Social power is one such factor that affects the individual's ability to focus attention on a target and ignores task irrelevant information (Guinote, 2007-b). However, we do not know which components of attention are involved in the greater focus found in powerful individuals. In the present article we propose that power affects the top-down control of attention.

Power has been defined as the ability to influence others (Lewin, 1941) or control others' outcomes (Fiske, 1993; Thibaut & Kelley, 1959). For example, Keltner, Gruenfeld and Anderson defined power as 'the relative capacity to modify others' states by providing or withholding resources or administering punishments', (2003, p. 265). These resources can be either material (i.e. food/shelter) or social (i.e. knowledge/affection) in nature (see Fiske & Berdahl, 2007). We argue that the greater freedom from constraints that powerful individuals possess allows them to focus their undivided attention on the task at hand, whereas the constraints that powerless individuals experience absorb their cognitive resources. Therefore power facilitates, whereas powerlessness hinders, the exercise of attentional control.

Power and Attention

Since Kipnis' (1976) seminal work demonstrating that powerful people often pay poor attention to their subordinates, there has been an increased interest in understanding how power affects attentional processing. Socio-cognitive research has indicated that individuals who engage in powerful roles attend more to stereotype-consistent attributes and spend less time examining stereotype-inconsistent attributes compared to their powerless counterparts (Fiske, 1993; Goodwin, Gubin, Fiske, & Yzerbyt, 2000; see Fiske & Dépret, 1996). Other work suggested that powerful individuals pay more attention to rewards and opportunities in the environment, whereas powerless individuals pay more attention to threats (Keltner, Gruefeld, & Anderson, 2003). These perspectives have focused on the ways power affects the *content* of the information that is processed demonstrating that power leads to *biases* in attention.

Another line of research has focused on *process* related aspects of attention. In particular, the *Situated Focus Theory of Power* (Guinote, 2007-a) proposes that power promotes attentional focus in line with activated constructs and the inhibition of irrelevant information. Consistent with this claim, a series of experiments recently showed that powerful individuals are better able to resist distraction in basic cognitive tasks (Guinote, 2007-b). Participants first primed with power tended to do better than participants first primed with powerlessness at ignoring local details when judging global aspects of Navon stimuli, ignoring task-irrelevant action tendencies afforded by familiar objects, and copying lines that are embedded in distracting detail. Along similar lines, individuals who had been primed with powerlessness were less able to maintain a goal focus in a 2–back recall task, less able to inhibit pre-potent responses on the Stroop task, and more likely to find difficulty in switching between different sub-goals when performing the Tower of Hanoi task (Smith, Jossmann, Galinsky, & van Dijk, 2008). In the present article we expand our knowledge of process related effects of power on attention. In particular, we look at whether power affects attentional control using paradigms that assess the ability to direct attention across the field of view via visual search.

Bottom-up and Top-down Attention

Many have pointed out that the deployment of visual attention is guided, typically in unequal measure, by both stimulus-driven and goal--driven factors (see Yantis, 1993; Duncan & Humphreys, 1989, Wolfe, 1994). Salient properties of the stimulus associated, for example, with color, size, and spatial position, can capture attention in a bottom-up way, without any active effort of the individual (e.g. a blue shirt amongst green and red shirts). Under these conditions, attention is automatically and rapidly directed to the part of the visual field that contains the salient physical stimulus. This guidance reflects the operation of early perceptual segmentation processes and can occur without prior knowledge of either where the stimulus is likely to appear or how it will look. Such stimuli can usually be detected (though not identified) without attending to the particular location of the stimulus, so can be reported with a relatively broad attentional focus and little volitional control of the attentional spotlight. Very little cognitive resources are needed to accomplish this task.

However, attention is also distributed in a top-down way (also known as endogenous or goal-driven) depending on the observer's goals, needs and expectancies. Under such conditions, attention is more subject to volitional control and must be effortfully and serially moved about the visual array under the observer's active guidance – that is, the observer needs to engage active attentional control (see Wolfe, 1998). Top-down control is especially important when the target bears a close physical resemblance to background distracters and does not pop-out, as is the case when searching for a green and red shirt amongst green shirts and red shirts. Top-down searches are also affected by the semantic identities of target and distracters; targets that belong to the same conceptual category as distracters tend to be harder to find than when they belong to a different conceptual category (Brand, 1971; Jonides & Gleitman, 1972; Smilek, Dixon, & Merikle, 2006). For example, it is generally harder to find a given letter of the alphabet when it is surrounded by other letters than by digits (Brand, 1971). Given that power both decreases constraints and increases cognitive resources for the task at hand (Guinote, 2007-a; 2007-b), one might therefore expect its effects to be most apparent in searches that incorporate a strong top-down component.

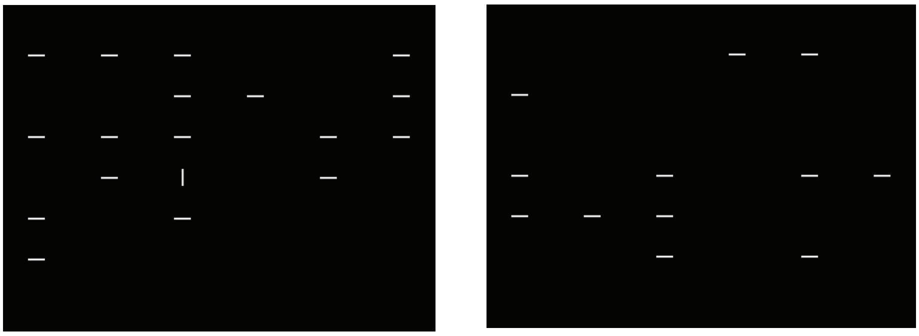
In the following sections we present three visual search experiments that seek to establish if, and if so how, social power affects attention. We hypothesize that power affects attention only when top-down control of attention is required, and thus not when the target can be identified in a bottom-up fashion. In Experiments 1 and 2 we manipulated the perceptual salience of targets amongst background distracters and, accordingly, altered the degree to which attention was likely controlled in a top-down way as opposed to a stimulus-driven way. In Experiment 3, top-down control was invoked by asking participants to search for targets that were semantically, as opposed to perceptually, defined.

Experiment 1

The main aim of Experiment 1 was to demonstrate, as proof-of-concept, that power affects visual search behavior. Specifically we expected the effects of power to become more prominent as the task became harder and required a greater degree of top-down control. To explore this issue we administered two visual search tasks in which the perceptual salience of the target differed.

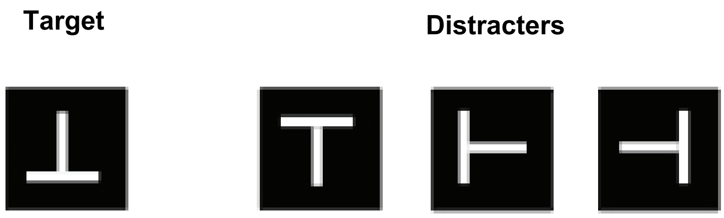
In one task (*single feature task*), participants reported the presence/absence of a vertical, white line amongst white, horizontal lines. When presented amongst these kinds of distracters, the vertical bar 'pops-out' and automatically captures attention (see Figure 1), allowing the presence/absence of the target to be rapidly detected using little focused attention.

Figure 1: Example target absent (a) and target present (b) displays from the feature search conducted in Experiment 1, showing overall display organisation.



In the other task (*feature conjunction task*), participants looked for an upside down T amongst Ts presented in several other orientations (see Figure 2). This kind of search is typically slow and strongly affected by the number of distracters, as evidenced by a higher intercept and relatively steep response slope as the number of distracters increases, typically exceeding, by up to an order of magnitude, 20ms per item. Under these conditions, target present responses are usually approximately twice as fast as absent responses because, on average, only half the display must be inspected before the target is found. By contrast, the entire display must be inspected before a target absent response can be issued (Treisman & Gelade, 1980). Given the failure of bottom-up, stimulus-driven processes to signal the whereabouts of the target, this kind of search is directed in a top-down way, and therefore strongly dependent on the ability to control attention.

Figure 2: Target and distracters presented in the conjunction search of Experiment 1 and Experiment 2. In Experiment 1, all distracter types appeared. In Experiment 2, only upright T distracters appeared.



Method

Participants and Design

Forty (29 females, 11 males) undergraduates from the University of Kent with normal or corrected-to-normal vision received course credit for voluntary participation. Participants were randomly assigned to the powerful or the powerless condition. Task, target and Display size were varied within participants, resulting in a 2(Task: feature vs. conjunction) x 2(Target: absent vs. present) x 3(Display Size: 6, 12, or 18) x 2(Power: powerful vs. powerless) experimental design. The experiment was undertaken with the understanding and written consent of each participant.

Procedure

Power manipulation

Power was manipulated following a procedure by Guinote (2008). Those participants randomly assigned to the powerful condition were first given information about the role of a manager in a corporation while those randomly assigned to the powerless condition were given information about the role of an employee.

Participants in the powerful condition were told to imagine themselves as a managing director of a marketing company based on the following information:

> *The managing director in this marketing organization has 20 employees working under him. The organization promotes various products to the public, and the role of the director is to distribute the work that subordinates must complete, set priorities for the team, approve project proposals, and accept or decline new clients. The managing director knows the work well and makes all decisions within the company. He sets priorities and determines the salary and the workload of all employees.*

Participants in the powerless condition were told to imagine themselves as an employee of a marketing company based on the following information:

> *The employee in this marketing organization works in a team of 20 people. The organization promotes various products to the public, and the role of the employee is to complete any task that the manager assigns to him/her, and to follow instructions regarding priorities in this marketing organization. The employee must also keep records and prepare paperwork for projects and new clients that were approved by the manager. The employee knows the work well and follows strictly the procedures and priorities set by the manager. His or her salary and workload are determined by the manager.*

Having read their role description, participants were then asked to write an essay describing a typical day as a manager or subordinate employee. Participants were advised that there were no right or wrong answers and that they should think themselves vividly into their role. Seven minutes were given to work on this task.

Search task

In the second part of the experiment, participants took part on what was described as a separate study of visual perception. They completed the two computerized visual search tasks, the order of which was counterbalanced. All stimuli appeared white on a black screen, and each individual item appeared randomly in one of 36 locations within an illusory 6x6 matrix that spanned both visual fields. In the low attention task, participants looked for a white, vertical bar amongst white, horizontal bars (see Figure 1); in the high attention task they looked for a white, upside-down T amongst heterogeneously oriented Ts (see Figure 2). The number of distracters varied randomly but the same number of times between six, twelve and eighteen, and the target was present on fifty per cent of trials. Each distracter number x target presence/absence condition repeated 15 times making 90 trials per experiment. Participants were told to respond via button press, as quickly but as accurately as possible. Key assignment was counter-balanced across participants.

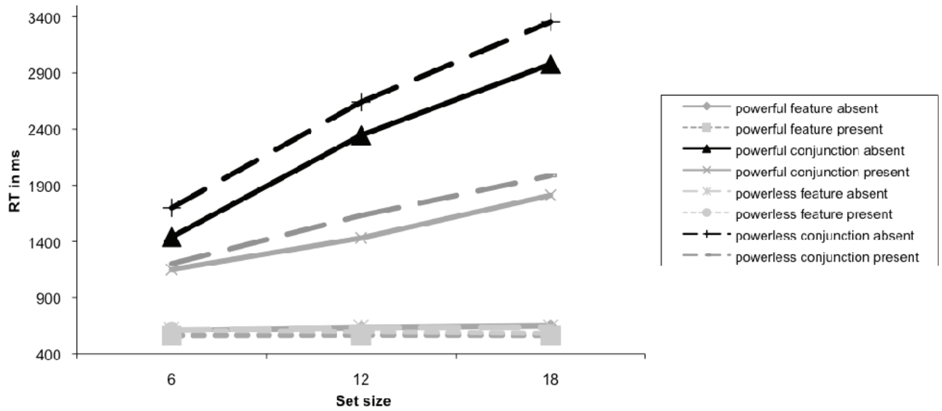
Results

Mean correct reaction times (RTs) were computed for each subject. RTs that were more than 3 standard deviations from the mean were discarded. RT scores were analyzed in a 2 (Power: powerful vs. powerless) x 2(Task: feature vs. conjunction) x 2(Target: present vs. absent) x 3(Display Size: 6 vs. 12 vs. 18) mixed effects ANOVA with Power as the between--subjects factor. The mean accuracy scores across experimental conditions exceeded 90%, and when analyzed using the same ANOVA as above showed no significant differences between the power conditions (all F ratios <1,0).

Prior to the main analysis, the responses from the manipulation check were analyzed using an independent sample t-test to compare the extent to which individuals across the powerful and powerless conditions ‘felt in charge of the situation’ that they had written about in their essays. As expected, powerful people felt more in charge than powerless people, ($t(38) = 5{,}2$, $p < 0{,}01$).

Analyses of the visual search data showed that the common main effects of Task (*F* (1, 38) = 762,3, *MSE* = 294446, $p < 0{,}001$), Target (*F* (1, 38) = 371.9, *MSE* = 68887, $p < 0{,}001$) and Display Size (*F* (2, 37) = 292, *MSE* = 61959, $p < 0{,}001$) all reached significance. Responses were shorter in the single feature task, when the target was present and at smaller display sizes (see Figure 3 and Table 1).

Figure 3: Mean correct reaction times in Experiment 1.



The main effect of Power also reached significance (*F* (1, 38) = 4,2, *MSE* = 414789, $p < 0{,}05$); powerful individuals were generally faster to respond than powerless individuals. Importantly, the expected interaction between Power and Task was significant (*F* (2, 76) = 4,5, MSE = 66323, $p < 0{,}05$). Simple effects analysis showed that powerful individuals ($M = 1859$ms) were faster than powerless individuals ($M = 2087$ms) at making decisions in the conjunction task, *F* (1, 38) = 4,53, $p < 0{,}05$, whereas no effect of power was found in the feature task (powerful = 597ms; powerless = 610ms, $F < 1$). In addition, a significant three-way interaction between Task, Target and Power indicated that the differences obtained in the conjunction task were stronger for absent trials (powerful: 2255ms vs. powerless: 2565ms than for present trials (1464ms vs. 1606ms), *F*(2, 37) = 4,73, *MSE* = 66324, $p < 0{,}05$. These results support the hypothesis that power increases efficiency in tasks that require top-down attentional control.

Reliable two-way interactions were also found between Task and Target (*F* (1, 38) = 308,8, *MSE* = 66324, $p < 0{,}001$), Task and Display Size (*F* (2, 37) = 311,6, MSE = 67503, $p < 0{,}001$), and Target and Display Size (*F*(2, 37) = 91,5, *MSE* = 22740, $p < 0{,}001$). There was also a significant three-way interaction between Task, Target and Display Size (F (2, 37) = 79,6, MSE = 20599, p < 0,001) in that responses were shorter in the single feature task at display size eighteen for present compared to absent trials.

Table 1. Visual search slopes for Experiments 1, 2 and 3

	Intercept (ms.)	Slope (ms. per item)
Experiment 1		
Feature search		
Target absent		
Powerful	595	1,8
Powerless	588	2,8
Target present		
Powerful	556	0,5
Powerless	607	1,8
Conjunction search		
Target absent		
Powerful	756	132
Powerless	909	137
Target present		
Powerful	855	59
Powerless	882	65
Experiment 2		
Target absent		
Powerful	834	39
Powerless	805	50
Target present		
Powerful	650	25
Powerless	745	17
Experiment 3		
Semantically similar		
Powerful	914	16
Powerless	861	24
Semantically disssimilar		
Powerful	891	17
Powerless	1014	11

Discussion

As can be seen from the flat search slopes presented in Table 1 and Figure 1, the single feature task was performed effortlessly; the absence/presence of the target was reported rapidly regardless of how many distracters were present. By contrast, performance in the feature conjunction task was both slower, strongly affected by distracter number, and showed an absent/present ratio of approximately 2:1 indicating that attention was more focused and therefore under greater volitional (e.g. top-down) control (see Wolfe, 1998). Most important, the results showed that social power affected the speed of visual search in the more difficult feature conjunction condition. This effect was slightly greater for absent compared to present responses which we attribute to the tendency to voluntarily re-check displays to ensure that the target was not missed (see Wolfe, 1998). By contrast, there was no difference in the simpler, single feature task in which search could be directed by bottom-up processes.

The main difference between the two power groups was the overall time taken to complete the task, as indicated by the raised intercept. By contrast, the rate of search, as indicated by the effect of display size on reaction time, did not differ. These differential effects on intercept and search rate are common in visual search experiments (see Horowitz *et al.*, 2006) and allow us to begin to establish how power affected performance. In general terms, the search intercept is taken as an index of processes that both precede and follow the active search stage. These processes are involved in both the initiation of search and in subsequent short-term memory, decision and response. Search rate, on the other hand, corresponds to the speed at which the attentional focus is moved through the visual field from one item to another. Although we cannot be sure which specific processes led to the raised intercept, we note that other cognitively demanding tasks have also shown effects of power on short-term memory and response selection (e.g. Guinote, 2007-b). Power also affects the extent to which individuals prioritize task relevant information prior to responding. One can imagine that these tendencies would have been especially prominent in the conjunction task in which display items were more complex and varied, and the target less prominent. We return to these issues later.

Experiment 2

In Experiment 2 we sought further support for the finding from Experiment 1 that searches with a strong stimulus-driven component are not affected by power. As can be seen in Figure 1, the presence of the target in the single feature task of Experiment 1 could be inferred from the appearance of an ‘odd man out’ that disrupted an otherwise global, uniform texture. This kind of search can support very rapid responses on both present and absent trials and is not commonly associated with highly focused attention (see Treisman & Gelade, 1980).

In Experiment 2, we again presented targets that were physically salient, but this time detection could not be based so easily on the presence/absence of simple textural cues. As in the conjunction condition of Experiment 1, participants looked for an inverted T. However, this time the distracters all appeared as upright Ts. Under such conditions, early grouping routines that precede attention can combine distracters into a single perceptual unit, which allows them to be rejected as non-targets simultaneously in a bottom up fashion (Duncan & Humphreys, 1989). The net effect is that attention can be directed by early stimulus-driven processes to the remaining target stimulus far more efficiently than in an undirected item by item search in which the individual must actively inspect individual items until the target is found. The fact that present/absent differences in reaction time typically emerge is taken as evidence that participants are not responding on the basis of a local emergent property that can be detected with a very broad attentional focus, as is the case in 'pop-out' search (Humphreys, Quinlan, & Riddoch, 1989). Absent trials often generate longer responses because the evidence needed to make a response is less definitive – since the target does not pop-out when present, there is always the chance that the target was present but was missed. This concern can motivate individuals to re-visit parts of the display in a goal-directed manner before responding (Humphreys *et al*., 1989). Note then, that the presence or absence of the target automatically changes the configural properties of the set, which in turn places different demands on top-down and bottom-up guidance. This was not the case in the conjunction conditions of Experiment 1 in which both present and absent trials relied strongly on top-down, as opposed to bottom--up control.

In sum, if the effects of power on search are determined by the level of top-down attentional control then there should be little or no effect when the target can be distinguished via stimulus-driven perceptual grouping. Given that top-down control is required on absent trials, an effect of power might however emerge here.

Method

Participants, Design and Procedure

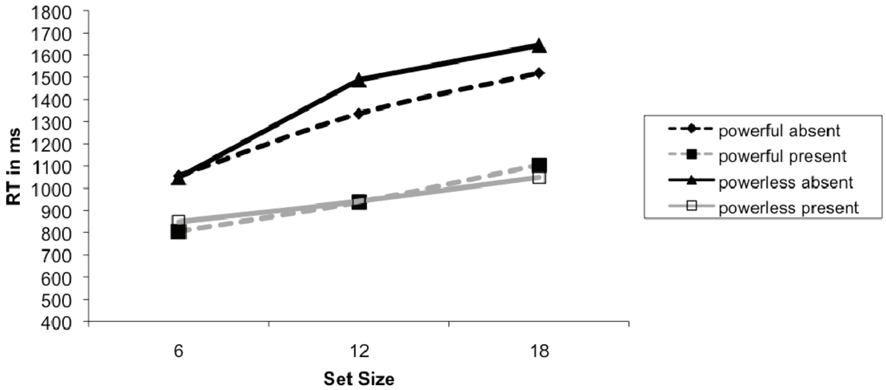
Stimuli were the same as for the conjunction task in Experiment 1, except that distracters now all appeared upright (see Figure 2). The target remained an upside down T. A new group of 42 participants from the University of Kent were recruited (9 males, 33 females), all with normal or corrected-to-normal vision. Power was manipulated as in Experiment 1. The study used a 2(Target: absent vs. present) x 3(Display Size: 6, 12, or 18) x 2(Power: powerful vs. powerless) experimental design, with the power being varied between subjects.

Results

Prior to the main analysis, the responses from the manipulation check were analyzed using an independent sample t-test to compare the extent to which individuals across the powerful and powerless conditions 'felt in charge of the situation' that they had written about in their essays. As expected, powerful people felt more in charge than powerless people, ($t(40) = 5{,}0$, $p < 0{,}01$).

A 2(Power: powerful vs. powerless) x 2(Target: present vs. absent) x 3(Display Size: 6 vs. 12 vs. 18) mixed effects ANOVA was conducted, with Power as the between-subjects factor. Once again, mean accuracy levels exceeded 90%, and there were no significant differences between the power conditions (all *F* ratios < 1).

Figure 4: Mean correct reaction times in Experiment 2.



Analyses of the reaction time data showed that the expected main effects of Target (*F* (1, 40) = 93.9, *MSE* = 107648, *p* < 0,001) and Display Size (*F* (2, 80) = 124,8, *MSE* = 25941, *p* < 0,001), as well as the interaction between Target and Display Size (*F* (2, 80) = 25,63, *MSE* = 19193, *p* < 0,001) reached significance; responses were slower in the absent condition and at increasing display size. Importantly, there was a significant interaction between Target, Display Size and Power, (*F* (2, 80) = 4,4, *MSE* = 19193, *p* < 0,05). As predicted, there were no effects of power in the present condition (946ms vs. 949ms, *F* < 1), when attention could be guided in a bottom-up fashion. However, in the absent condition (i.e., when top-down control of attention was required) powerless participants (*M* = 1393) tended to take longer to respond than powerful participants (*M* = 1303), descriptively increasing with larger display sizes (see Figure 4; Table 1).

Discussion

Consistent with a facilitative effect of grouping, the response slopes in Experiment 2 were much shallower than in the feature conjunction task of Experiment 1 in which distracters were heterogeneous. Once again power did not affect search when the target could be segmented from distracters via these early visual processes. On the other hand, power did affect responses when the target was absent and either 12 or 18 distracters appeared. The elevated reaction times associated with these trials indicate that they were generally harder than all others, thus placing a greater demand on top-down control. In particular, the likelihood of having missed the target increases at larger display sizes which in turn can elicit serial re-checking. Together these results once again suggest that the effects of power are most apparent when attention is guided by top-down as opposed to bottom-up factors.

Experiment 3

In Experiments 1 and 2 participants looked for targets that could be distinguished from distracters on the basis of their physical appearance. However, in many everyday situations visual search is guided by conceptual constructs rather than by physical appearance. In Experiment 3, we examined whether power affects the search for targets that can also be distinguished by their semantic identity. Studies have shown that the ease with which a semantically-defined target can be found partly depends on its semantic similarity to background distracters; targets are typically easier to find when they are placed amongst distracters that belong to a different semantic category than the same category (Jonides & Gleitman, 1972). Given that these conceptual effects are inherently top-down in nature, the results of Experiments 1 and 2 suggest that 'semantic' searches will interact with manipulations of perceived social power.

A persistent problem that has pervaded the manipulation of semantic property in search experiments is the failure to control for the accompanying changes in physical appearance. For example, it might be easier to find a dog amongst sheep than a dog amongst other dogs not only because of the semantic differences, but also because of the aesthetic differences. A solution was recently devised by Smilek *et al.* (2006) who trained their participants to associate verbal labels with meaningless stimuli composed of circles that contained bars of varying orientation. In this way, it was possible to vary the semantic similarity between targets and distracters while counterbalancing their visual similarity. Smilek and colleagues found that at the largest (but not smallest or intermediate) display sizes, the search for a predefined target (e.g. elephant) was faster when the distracters belonged to a different (e.g. pencil) as opposed to the same (e.g. elephant) semantic category. This was taken as evidence that object meaning can influence target detection.

In the present context, if social power facilitates the top-down application of stored semantic information then powerful individuals may better inhibit the effect of semantically similar distracters, compared to powerless individuals, who should be less able to restrict their attention to targets, and thus less able to resist irrelevant but overlapping conceptual information. These individuals should therefore show greater interference when targets and distracters belong to the same category compared to powerful individuals.

Method

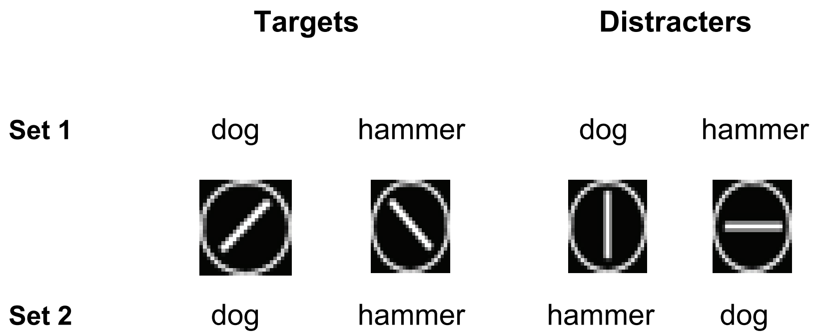
Participants and Design

Thirty-four participants (27 females, 7 males) were recruited, all with normal or corrected-to-normal vision. They were randomly assigned to the powerful or the powerless condition. Display size and target-distracter identity were manipulated within participants, resulting in a 3(Display size: 6, 12, or 18) x 2(Target-Distracter Identity: Same vs. Different) x 2(Power: powerful vs. powerless) experimental design.

Material

The stimulus set contained four items, each of which appeared as an encircled oriented bar. Bars were oriented at 450, 900, 1800 or 3150. The 900 and 3150 bars were assigned the label ‘hammer’, and the 450 and 1800 bars were assigned the label ‘dog’. To counterbalance the physical differences of the two target-distracter pairings, the identity of each distracter was reversed for half of the participants, such that a horizontal line was named ‘dog’ for half of all participants and ‘hammer’ for the remainder (see Figure 5).

Figure 5: Target and distracters presented in Experiment 3.



Procedure

Upon arrival participants were asked to participate in two separate studies. The first study was introduced as focusing on the perception of past events, and consisted in the power manipulation following Galinsky *et al.* (2003). An instruction booklet asked participants in the powerful condition to write a narrative essay about a particular incident in which they had power over another individual or individuals. It was explained that by power we meant a situation in which they controlled the ability of another person or persons to obtain something they wanted or were in a position to evaluate those individuals. In the powerless condition, participants were asked to recall an incident in which someone else had power over them: A situation in which someone had control over their ability to obtain something they wanted, or was in a position to evaluate them. Participants described the past event at their own pace. After completing this task they rated, on a 9-point scale, how much they were in charge in that situation.

The experimenter then introduced what ostensibly was a second study. Participants engaged in a training phase in which they learned to associate each of the four stimuli with its pre-determined verbal label. The training phase consisted of 20 trials in which each of the four stimuli and their verbal label appeared in random order 5 times. Participants were asked to remember each shape-label pair. A separate phase then followed in which the shapes appeared without their labels. The search experiment proper followed when participants were able to correctly name unlabelled stimuli for 40 consecutive trials (i.e., accurately name each stimulus 10 times).

In the search experiment proper, participants were presented with displays that contained one of the two distracter types and one of the targets. They were instructed to indicate, by means of button press, which of two targets were present, 'dog' or 'hammer'. Distracter identity was randomized across trials, with semantically same and different distracters appearing the same number of times overall. Each target-distracter pairing appeared 15 times in each of the three display size conditions, generating 180 experimental trials in each power condition.

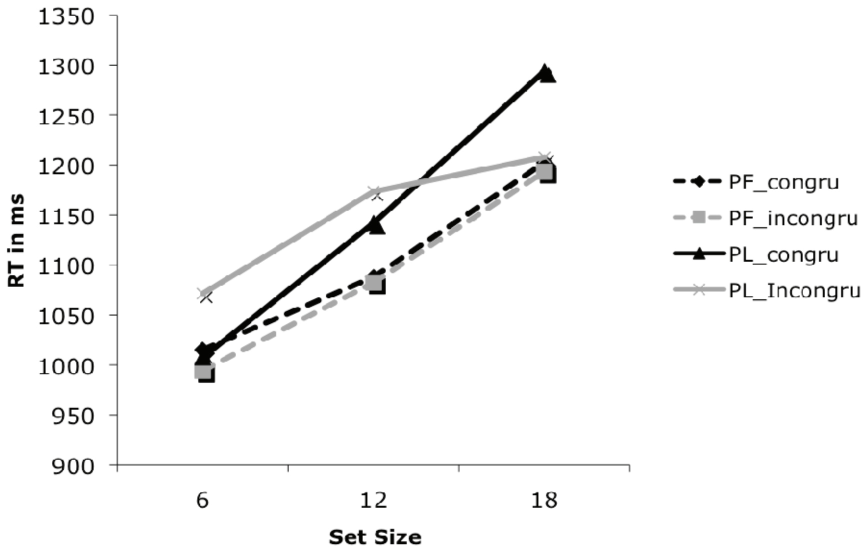
Results

Prior to the main analysis, the responses from the manipulation check were analyzed using an independent sample t-test to compare the extent to which individuals across the powerful and powerless conditions 'felt in charge of the situation' that they had written about in their essays. As expected, powerful people ($M = 7{,}50$) felt more in charge than powerless people ($M = 2{,}81$), $t(32) = 10{,}23$, $p < 0{,}001$.

RT scores were analyzed in a 3(Display Size: 6 vs. 12 vs. 18) x 2(Target-Distracter Identity: Same vs. Different) x 2(Power: powerful vs. powerless) mixed effects ANOVA, with Power as between subjects factor. The mean accuracy level across participants exceeded 90%, and there were no significant differences between the power conditions (all *F* ratios < 1.0).

The main effect of Display Size was significant (F (2, 62) = 68,1, MSE = 13630, $p < 0{,}001$), in that responses became generally slower as display size increased (see Figure 6). This effect was moderated by a two-way interaction with Target-Distracter Identity (F (2, 62) = 3,8, MSE = 6480, $p < 0{,}05$). More importantly, this analysis yielded a significant three-way interaction between Power, Target-Distracter Identity, and Display Size (F (2, 62) = 4,3, MSE = 28387, $p < 0{,}05$). For powerful people, responses tended to become slower at larger display sizes in both target-distracter conditions. For powerless people, responses in the semantically same condition also slowed at larger display sizes. However, responses in the semantically different condition did not show the same increase in response times. Simple effects analysis conducted on the powerless group showed evidence of a cross-over interaction; at the smallest display size, semantically different displays generated longer latencies than same displays, $F(1, 31) = 5{,}3$, $p < 0{,}05$, while at the largest display size this pattern was reversed, $F(1, 31) = 14{,}44$, $p < 0{,}001$. For the powerful group, no effects between Target-Distracter Identity were found, all *F*s < 1. Importantly, these results indicate that, as expected, powerless individuals were responding to the target-distracter similarity whereas powerful individuals were not.

Figure 6: Mean correct reaction times in Experiment 3.



Discussion

Unlike before, powerful and powerless participants did not differ in the overall time (e.g. intercept) taken to complete the search. As indicated by the relatively shallow slopes, this may be because the task was quite easy and did not require items to be inspected one by one in the same way as before. As expected, power did however affect the sensitivity to distracter identity. This sensitivity was dependent on display size. As is the case in non-power primed individuals (see Smilek *et al*., 2006) at the largest display size powerless participants were faster at detecting targets that were surrounded by semantically dissimilar compared to similar targets. In other words, they showed the usual Category effect. By contrast, powerful participants were unaffected by semantic identity. They instead filtered out the background information conveyed by distracters and seemed better able to focus on task relevant information[4]. Once again, the results support the claim that power affects searches that are strongly dependent on top-down elements.

General Discussion

Visual search is an elementary routine that forms part of the cognitive toolbox that we bring to most daily tasks. Whether the challenge is to find a book on a shelf or find a face in a crowd, the same capacity to focus attention and ignore distracting information is required. Computerized visual search tasks mirror these everyday activities. By manipulating the relationship between target and distracter, these tasks allow us to control the level of bottom-up and top-down guidance. In the present article we carried out three visual search experiments and showed, for the first time, that the effects of power on attention occur only for the volitional components of attention and not for stimulus-driven aspects of attention. The major contribution of the present findings is, therefore, to point out boundary conditions that constrain the effects of social power on attention.

In Experiment 1, power affected the overall speed when targets bore a close physical resemblance to background distracters. Under such conditions, search was effortful and required the focused application of attention. By contrast, power did not affect responses when the target was physically salient and could be detected on the basis of textural discontinuity. Searches of this nature are primarily stimulus-driven and need not rely on an effortful, focused inspection of the display.

In Experiment 2, power again failed to affect performance when attention could be automatically summoned to the target on the basis of early perceptual grouping processes. This guidance was less helpful on trials where the target was absent, leading to a greater likelihood that background distracters would be voluntarily inspected in a serial manner. As before, power raised the search intercept for these more difficult responses.

In Experiment 3, power affected the extent to which participants were influenced by the category membership, or meaning, of background distracters; search slopes became non-linear in powerless but not powerful participants when the target and distracters belonged to different semantic catego-

[4] One question that arises is why was the slope not similarly affected in Experiments 1 and 2? We point out that the distracters in these experiments did not elicit the same conceptual associations as the target, so would have interfered less at the stages of target identification and response selection.

ries. This indicates that power can affect the influence of irrelevant background information when this elicits the same conceptual associations as the target. Together these results indicate that power affects the efficiency of search when top-down guidance becomes important in segmenting the target from distracter – be this via the serial application of goal-directed attention or the activation of stored conceptual information.

More broadly, the present findings have implications for the understanding of the effects of power on judgment and behavior. For example, a number of studies demonstrated that power leads to action (Keltner *et al*., 2003, Galinsky *et al*., 2003; Guinote *et al*., 2002), and facilitates goal directed behavior in all phases of goal pursuit (Guinote, 2007-c; see also Guinote, 2008). This ability is particularly important during goal pursuit. During goal initiating and goal striving individuals need to attend to information selectively. They need to more readily detect cues in the environment that are goal relevant compared to other cues (Foerster, Liberman, & Higgins, 2005; see also Gollwitzer, 1996; Gollwitzer & Moskowitz, 1996). This selectivity facilitates seizing good opportunities to act in a goal consistent manner, and facilitates ultimately goal fulfillment. Powerful individuals' greater readiness to act in a goal consistent manner found in prior research may therefore derive, at least in part, from their more efficient ability to voluntarily deploy attention and ignore irrelevant background stimuli.

The top-down control of attention may also affect social perception. For example, Overbeck and Park (2001) found that powerful individuals recalled more information of their subordinates that was relevant to the task at hand (e.g., arranging an appointment with the subordinate) compared to irrelevant information. Their judgments about the subordinates were also more accurate compared to the judgments of powerless individuals. It is plausible that these differences in memory and judgment derive from differences in attentional focus during the social interactions that preceded judgment.

One question that arises is whether the present effects derive from having power or from being in a powerless position. Experiment 3 is informative in this regard as it revealed conditions in which the common semantic category effect (e.g., Gleitman & Jonides, 1972; Smilek *et al*., 2006) was altogether eliminated in powerful participants. This result parallels the finding that power eliminates common interferences from irrelevant distracters (Guinote, 2007-b), and suggest that the current effects derived from having power. However, future research needs to address under more controlled conditions the relative contributions of power and powerlessness for the present results.

One general implication of the current findings is that the subordinate role typically adopted by research participants during laboratory experiments may change certain aspects of their visual behavior relative to other situations in which they hold more power. From a broader perspective, these findings highlight the role of the position in the social structure in guiding visual search strategy, and indicate that even elementary mental processes must be studied with respect to the physical and social environment in which they are situated.

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