Feeling socially powerless makes you more prone to bumping into things on the right and induces leftward line bisection error

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Abstract

Social power affects the manner in which people view themselves and act towards others, a finding that has attracted broad interest from the social and political sciences. However, there has been little interest from those within cognitive neuroscience. Here we demonstrate that the effects of power extend beyond social interaction and invoke elementary spatial biases in behaviour consistent with preferential hemispheric activation. In particular, participants who felt relatively powerless, compared to those who felt more powerful, were more likely to bisect horizontal lines to the left of centre, and bump into the right-, as opposed to the left-hand, side when walking through a narrow passage. These results suggest that power induces hemispheric differences in visuo-motor behaviour, indicating that this ubiquitous phenomenon not only affects how we interact with one another, but also with the physical world.

Introduction

Power has been defined as the ability to influence others (Lewin, 1941) or control others' outcomes by providing or withholding resources, be these material (e.g. food/shelter) or social (e.g. knowledge/affection) in nature (Fiske, 1993; Keltner Gruenfeld & Anderson, 2003; Thibaut & Kelley). Social psychological research has shown that power affects the propensity to act in social situations. Less powerful people are slower than their more powerful counterparts to determine the appropriate course of action, slower to initiate goal-directed activity, are more distracted by irrelevant cues during goal pursuit, and hold more regard for the social consequences of their actions (Guinote, 2007a, 2008). These qualities are thought to arise from a greater dependency on others for external resources, which increases the sensitivity to social constraints and limits the perceived opportunities for action (Galinsky, Gruenfeld & Magee, 2003).

Intriguingly, recent data suggest that power may not only affect the willingness and motivation to act. Rather, it may also affect action in a more fundamental way, impacting basic sensori-motor processes involved in movement control. This suggestion is based on the finding that changes in social power alter the distribution of activity across the two sides of the brain, such that heightened power preferentially activates the left hemisphere and reduced power preferentially activates the right hemisphere (Boksem, Smolders & De Cremer, in press). This physiological observation is important because we know that asymmetries in hemispheric activation can directly affect how physical actions are carried out. One notable effect is a shift in behavior towards the side of space opposite the activated hemisphere (Kinsbourne, 1993). In clinical patients for whom the asymmetry arises from a unilateral brain lesion, this 'spatial neglect' can lead to near total failure to act towards stimuli on one side, causing problems in eating, dressing and navigation (Robertson & Halligan, 1999). In healthy volunteers, the 'pseudo-neglect' induced by uni-manual movement also influences, albeit to a lesser degree, which physical stimuli are selected as targets for action (Nicholls, Loftus, Mayer & Mattingley, 2007).

In the present context, it is important to establish if power induces pseudo-neglect, not only because it would lend initial support to the argument that the behavioral effects of power can be predicted by the underlying pattern of hemispheric specialisation, but also because it would raise the possibility that power impacts the performance of simple sensori-motor tasks, such as reaching and walking, that are ubiquitous to daily routine and goal pursuit. To date, the effects of power on cognitive processing have been restricted to tasks involving perceptual discrimination, memory and problem-solving that require simple button-press responses and which are insensitive to lateral spatial bias (e.g. Smith, Jostmann, Galinsky & van Dijk, 2008; Guinote, 2007b; Guinote, Reese & Wilkinson, 2009).

The idea that social power modulates hemispheric activity stems from the motivational account of Keltner et al. (2003) who proposed that high power facilitates approach-related behaviors that are sensitive to reward and positive affect, while low power facilitates inhibitory, withdrawing behaviors related to threat and punishment. Biochemical studies suggest that approach-related behaviors elicited by powerful feelings are associated with increased dopamine activity in the left hemisphere, while the inhibition-related behaviors elicited by powerlessness are associated with increased norepinephrine activity in the right hemisphere (Ashby, Isen & Turken, 1999; Davidson, 1992). Recent EEG data appears to support this distinction, demonstrating that individuals primed to feel powerful show stronger left-frontal activity than those primed to feel powerless (Boksem et al., in press). The key, unanswered questions are whether these differences in hemispheric activation are sufficient to affect outward, physical behavior, and if so, how? There are many instances from neuroimaging in which a change in hemispheric activation is not associated with a change in observable behavior, a finding taken to suggest that not all brain activity is functionally relevant (see Wilkinson & Halligan, 2004). Thus, even though high and low power has been shown to preferentially activate different cerebral hemispheres, it is not known whether either form of activation is sufficient in magnitude or type to affect overt behavior.

In the present study, we therefore conducted two experiments to determine whether social power induces a lateralised spatial bias in manual activity. In the first experiment, we employed a sensitive, conventional measure of left/right bias, the line bisection task (Robertson & Halligan, 1999). Here, a tendency to mark towards one end of the line is taken to reflect the dominance of the contralateral hemisphere, whereby leftward deviation reflects stronger right hemisphere control, and rightward deviation reflects stronger left hemisphere control (Kinsbourne, 1993). In the second experiment, we looked for corresponding changes in a task requiring gross locomotory activity that might be regarded as more functionally relevant. Here, participants were instructed to walk through a narrow passage while balancing a full cup of water on a small tray. A distracter task, such as cup-balancing, is commonly used in studies of this nature to distract participants from the primary measure of left/right bumping and thus more accurately capture underlying spatial asymmetries (see Nicholls et al., 2007, 2008). As with manual line bisection, stronger activation of the right hemisphere should push attention leftwards which may lead to a neglect of right-space and increased likelihood of bumping into objects on that side.

As mentioned above, it was unclear whether high or low power (or both) would elicit a lateralised spatial bias. While many social psychological studies have shown stronger behavioural effects in individuals primed with high power (e.g. Galisnky et al., 2003; Keltner et al., 2003), cognitive studies have reported stronger effects in participants primed with low power (e.g. Guinote, 2007b; Guinote et al., 2009). As a consequence, our hypothesis was relatively generic in nature; given that high and low power are taken to activate the left and right hemispheres respectively, (Boksem et al., in press; Keltner et al., 2003), we predicted that any effect of low power would be to shift attention left, while any effect of high power would be to shift it right.

Methods

Participants: 41 female and 31 male university students, mean age 22 years, were recruited for the line bisection study (Experiment 1), and a separate group of 22 female and 13 male university students, mean age 23 years, were recruited for the cup-balancing task (Experiment 2). All participants were right handed as assessed by the Briggs & Nebes (1975) Handedness questionnaire, and had normal or corrected-to-normal vision. Each provided their written informed consent to participate and was paid for their involvement.

General procedure: Participants in both experiments were randomly assigned, in equal number, to a high, low or neutral power condition. Immediately before conducting either the bisection or cup-balancing task, participants were administered a widely-used power manipulation in which they wrote a narrative essay about a past event (see Galinsky et al., 2003). Participants assigned to the high power condition wrote about a particular incident in which they had power over another individual or individuals. It was explained that this referred to a situation in which they controlled the ability of another person or persons to obtain something they wanted, and/or were in a position to evaluate those individuals. In the low power condition, participants were asked to report an incident in which someone else had power over them. That is, to report a situation in which someone had control over their ability to obtain something they wanted or was in a position to evaluate them. In the neutral condition, participants were asked to write about an event from the previous day.

A manipulation check was then performed in which all participants were asked to rate, on a scale of 1(not at all) to 9 (very much), how much in control they felt during the incident that they had written about. For participants in the line bisection experiment, a one-way ANOVA, ($F(2,69)=88.8$, $p<0.01$), confirmed that different levels of perceived power were reported by the low power (M=2.6, S.D.=2.4), high power (M=7.0, S.D.=2.1) and neutral ((M=4.7, S.D.=0.5) conditions. In the cup-balancing experiment, the same one-way ANOVA also reached significance, ($F(2,32)=14.0$, $p<0.01$), again showing that the low power (M=2.1, S.D.=0.7) high power (M=7.4, S.D.=0.7) and neutral (M=4.8, S.D.=0.5) participants differed in their levels of perceived of power. In the cup-balancing task, a 4-item, 6 point mood questionnaire was also administered to establish whether the power manipulations induced changes in mood that might also contribute to any effects (see Guinote, 2007). The questionnaire asked participants to report how they felt at that current moment (sadder-happier; more discontent-more content; more tense-more relaxed; worse-better), and showed no reliable relationship between the level of perceived power and mood, ($F(2,30)=0.7$, $p=0.54$).

Experiment 1: Line bisection. Participants bisected 30 black lines that were 0.1cm thick and measured 15cm to 23cm in length. Each line was printed individually on a separate sheet of A4 paper, the centre of which was aligned with the mid-sagittal plane. Participants were instructed to 'in their own time, place a mark in the middle of the line', and were given each sheet of paper by the experimenter who was sat directly opposite.

Experiment 2: Cup-balancing. A narrow passage was created by suspending two, floor-length, black curtains from the ceiling. The passage was 150cm long and had a width that was individually adjusted for each participant to allow 2.5cm clearance either side. The balancing task required them to 'in their own time, walk through the passage while balancing a full cup of water on a small tray'. They were required to place their hands on opposite sides of the tray and told that any spillages would later be measured. Once through the passage, participants continued for a few more meters to the end of the room where they picked up a new cup of water and began a new trial. Participants made ten, video-taped passes through the passage, during which time an assessor who was blind to power assignment recorded how many times they bumped into the left or right side of the curtain. The number of left/right collisions recorded by the assessor was later corroborated using a frame-by-frame analysis of the video-footage. Spillages were not measured, although (thankfully) nobody spilt an entire cup of water.

Results

Bisection task: Bisection accuracy was measured to the nearest millimetre, with a negative sign used to denote leftward errors and a positive sign to denote rightward errors. Linear contrasts showed that low power participants produced a greater mean leftward bisection error (-1.24cm) than high power participants (0cm), (*t*,(46) = 2.0, p=0.03, d_2 = 5.4). There was also a non-significant tendency for this leftward bias to distinguish low power participants from the neutrals (-0.02cm), (*t*,(46) = 1.4, p=0.09, d_2 = 4.9). No difference was found between the high power and neutral participants, (*t*,(46) = 0.5, p=0.63, d_2 = 0.1), (see Figure 1a). To determine whether the mean bisection error of each group differed significantly from zero, one-sample *t*-tests were also performed. These revealed that while low power participants erred significantly from zero (*t*(23) = 2.5, p>0.05), the high power (*t*(23) = 0.7, p>0.05) and neutrals (*t*(23) = 0.6, p>0.05) did not.

Cup-balancing task: The number of times that each participant bumped into the left and right curtain was entered into a 3(Power: high power vs. low power vs. neutral) x 2(Collision Side: left vs. right) mixed effects ANOVA, which showed the expected interaction between Power and Collision Side, (*F*(2,32) = 4.7, p=0.02, partial η^2 = 0.3). Within-group pair-wise comparisons revealed that, on average, low power participants made a significantly greater number of right- than left-sided collisions across the ten trials (*t*(11) = 3.02, p<0.05), while the high power (*t*(11) = 0.7, p<0.05) and neutral (*t*(10) = 1.9, p<0.05) participants showed no significant left/right difference. Between-group comparisons showed that the asymmetric left/right ratio observed in the low power group was significantly different to that seen in the high power (*t*(22) = 2.25, p>0.05) and neutral (*t*(21) = 3.61, p>0.05) groups. By contrast, the high power and neutral groups produced comparable left/right collision ratios (*t*(21) = 0.46, p<0.05). Finally, the main effects of Power and Collision failed to reach significance, (*Fs* <1.0), indicating that the three groups produced the same number of total collisions, with no overall tendency for experimental participants to collide more frequently with the left or right curtain (see Figure 1b).

Figure 1 about here

Discussion

The data from both tasks show a leftward attentional shift in the low, compared to high, power participants. In the bisection task, those primed with low power bisected lines significantly more to the left than their powerful counterparts, and in the cup-balancing task, low power participants collided more frequently with the right side. These patterns are consistent with an increased spatial bias to the left-side following preferential activation of the right hemisphere, and show for the first time that a change from high to low power can induce a systematic spatial bias in visuo-motor performance.

From a broader perspective, our findings may hold interest because they extend the idea from social psychology that social disempowerment affects the ability to set and implement social goals (Lewin, 1941; Overbeck & Park, 2006). As mentioned above, studies have shown that powerless individuals act less upon opportunities and affordances provided by the environment, procrastinate before acting and are less good at identifying opportunities to act in a goal consistent manner (see Guinote, 2008). Here we show that power not only affects if and when we choose to act, but also downstream sensori-motor processes involved in the physical control of both fine, uni-manual (i.e. line bisection) and gross locomotory behaviour (i.e. walking while cup balancing).

Although the main focus of the study was to compare the performance of the high and low power groups, some clues as to which group carried the effect may be gleaned from the neutral condition. No discernible differences between the high power and neutral participants were observed. At the risk of over-determining a null finding, this absence of effect may indicate that heightened power does not shift the balance of attentional control from the right to left hemisphere. This could partly reflect the natural dominance of the right hemisphere (in right-handed participants) in controlling attentional deployment (see Kinsbourne, 1993) which must be overcome before any notable shift in bias can occur.

On a more compelling note, there was some evidence that the low power group performed differently to the neutrals. In the cup-balancing task, only low power participants collided more with the right than the left side, while in the bisection task, the low power but not neutral participants produced a lateral deviation that was significantly different from zero (low power deviation = 6.5% of mean line length; neutral deviation = 1%). This departure from zero is commonly taken as the defining criterion for pseudo-neglect (e.g. Braun & Kirk, 1999; Nicholls & Roberts, 2002), and exceeds the threshold (6.1% of mean line length) at which the clinical condition of right hemi-spatial neglect, a sequelae of left hemisphere damage, is diagnosed (Wilson, Cockburn & Halligan, 1987). That said, it is not uncommon for non power-primed individuals to show pseudo-neglect (Jewell & McCourt, 2000), so it may be premature to draw a firm division between the low power and neutral participants. In line with this cautionary note, although the mean bisection error of the two groups fell either side of the cut-off for pseudo-neglect, they differed from one another only marginally ($p=0.09$). When all three experimental conditions are considered, the picture that emerges is, perhaps unsurprisingly, that the effects of social power are most apparent when comparing individuals at opposite ends, as opposed to intermediate parts, of the spectrum.

In sum, our data suggest that the relatively high-order manipulation of social power can penetrate spatial processes that are commonly considered low-level. On a speculative note, if a sense of powerlessness really does preferentially activate lateralised, cognitive processes in the right cerebral hemisphere, then might other types of visual process be affected? Face recognition and visual-spatial memory are both known to rely heavily on the right hemisphere (see Hellige, 1986; Wilkinson, Ko, Wiriadjaja, McGlinchey, Kilduff & Milberg, 2009) and the intriguing, albeit conjectural, question is whether tasks that engage these capacities are performed more efficiently by individuals with low perceived power. If true then a curious pattern would emerge in which powerless individuals are better than their powerful counterparts at recognising objects yet worse at interacting with them.

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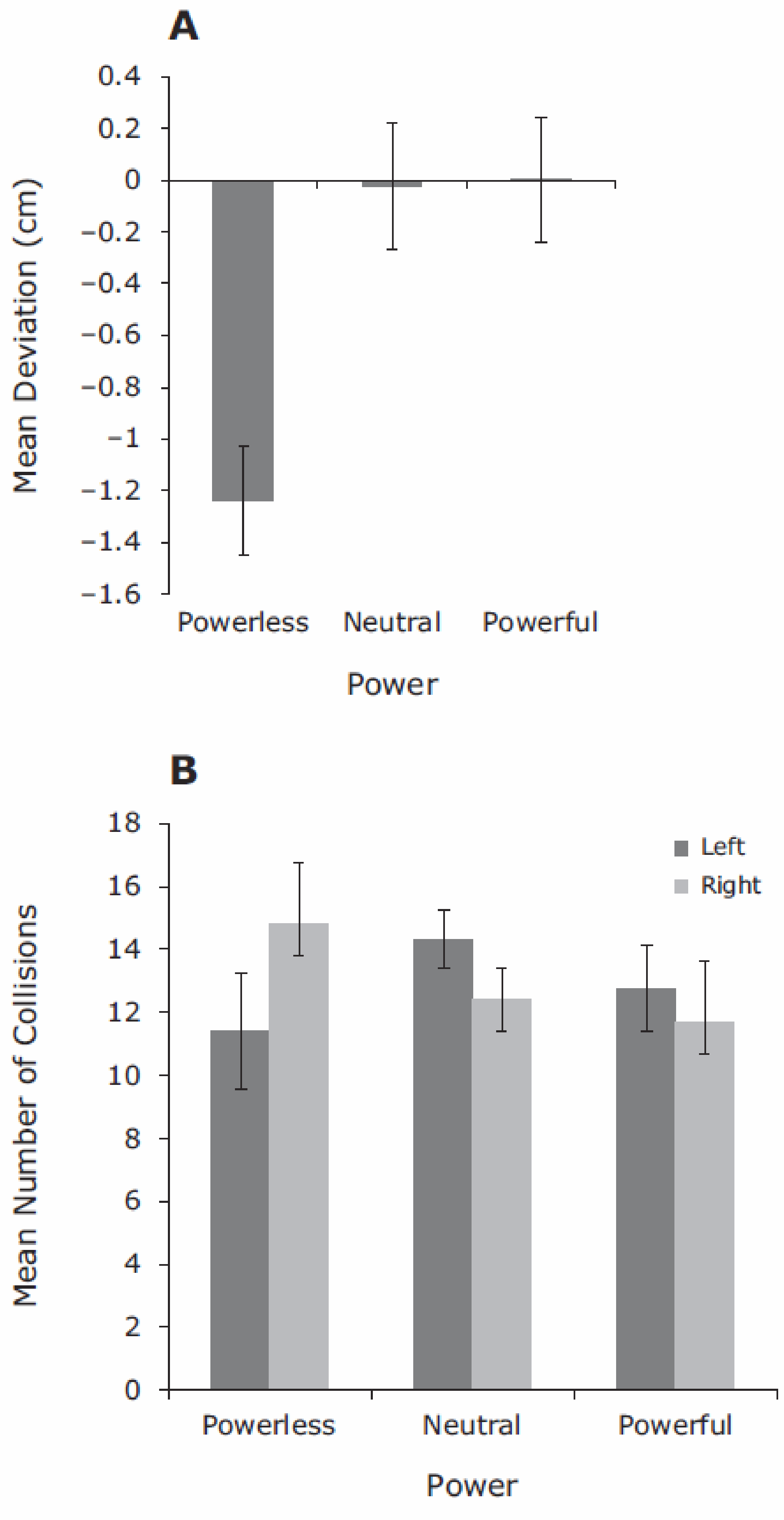
Figure legends

Figure 1. The effect of power (with standard error bars) on (a) line bisection accuracy and (b) the mean number of left/right collisions during the cup-balancing task.


A
0.4
0.2
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−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
Mean Deviation (cm)
Powerless
Neutral
Powerful
Power
B
18
16
14
12
10
8
6
4
2
0
Mean Number of Collisions
Left
Right
Powerless
Neutral
Powerful
Power