Courting on the beach: how team position implicitly influences decision-making in beach volleyball serves

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ABSTRACT

Masters, van der Kamp, and Jackson [2007. Imperceptibly off-centre goalkeepers influence penalty-kick direction in soccer. \textit{Psychological Science, 18}, 222–223] demonstrated that a goalkeeper in soccer penalty kicking standing marginally to one side of the goal’s centre unconsciously influences a penalty takers’ goal side selection. In two experiments, we examined whether the positions of the receiving players in beach volleyball affect a player’s decision to what area of court to play. Both experiments differed in the degree of attention participants directed to the largest court area. Results showed that participants made decisions favouring the larger court area although they were unaware of the receivers’ asymmetrical positioning. This effect was more pronounced in Experiment 1, suggesting that the degree to which attention is directed to the critical information (i.e. largest court area) can be considered an important moderator. These observations indicate that implicit effects of positioning reflect a more general phenomenon in and outside of sports that can be exploited for improving chances of success.

Deciding where to aim a ball is a critical facet in many sports. For example, in beach volleyball, the server must decide to what area of court to aim the ball. These decisions will typically arise from tactical deliberations including the strengths and weaknesses of the two opponent players. The opponent players’ positioning, which is typically such that it divides the court in three areas of equal size, is not normally taken into account purposely, except when their positioning is obviously (and in all likelihood intentionally) asymmetrical to entice the serving player to play to a particular area. In fact, this situation shares important characteristics with the penalty kick in soccer, which has come under close scrutiny in the last 10–15 years (for an overview see Memmert, Hüttermann, Hagemann, Loffing, & Strauss, 2013). During the penalty kick, players must decide to kick the ball either to the left or right side of the goal, albeit that they also can – and sometimes do – choose to direct the ball towards the goal’s centre. Once again, the position of the goalkeeper on the goal line is typically not part of deliberate considerations to what side to kick the ball, except when the goalkeeper leaves clearly more space to one side. However, even when the goalkeeper’s position is not noticeably asymmetrical, the penalty taker’s decision may still be affected (Masters, van der Kamp, & Jackson, 2007). That is, the goalkeeper can influence the penalty taker’s decision-making by placing him- or herself only a few centimetres to the left or right of the goal’s centre. In this situation, penalty takers proclaim that the goalkeeper stands in the exact centre of the goal, but, strikingly, are more likely (in approx. 60% of the attempts) to opt to direct the ball to the side with more space (Masters et al., 2007; see also Noël, van der Kamp, Weigelt, & Memmert, 2015; Weigelt & Memmert, 2012; Weigelt, Memmert, & Schack, 2012). It has been argued that this so-called off-centre effect is an instance of a more general and possibly pervasive phenomenon of implicit influences on decision-making.

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The taxonomy of conscious and unconscious processing by Dehaene, Changeux, Naccache, Sackur, and Sergent (2006) can provide a theoretical framework to understand the emergence of this off-centre effect (see Noël, van der Kamp, Weigelt, et al., 2015). According to the taxonomy, a perceiver only becomes explicitly aware of a stimulus if (i) it is of sufficient strength and (ii) attention is directed to it. If, however, a stimulus is insuffi ciently strong or salient or not attended to, then perception will be implicit: that is, subliminal (for weak stimuli) or preconscious (without attention). Finally, a stimulus that is both weak and not attended to will not be perceived. Accordingly, the off-centre effect would arise from the goalkeeper’s position, which is the stimulus of interest, being perceived preconsciously or subliminally. That is, the degree of attention to the goalkeeper’s position relative to goal’s centre and the distance between the goalkeeper position and the goal’s centre (i.e. stimulus strength) determine if perception of the goalkeeper’s position is explicit, preconscious or subliminal. It would follow that the extent of the off-centre effect depends on the magnitude of the goalkeeper’s distance from the goal’s centre (i.e. stimulus strength) and the amount of attention the kicker allocates to the goalkeeper’s position. Furthermore, subliminal perception should be restricted to smaller goalkeeper distances than preconscious perception (i.e. unattended stimuli can be stronger before a perceiver becomes consciously aware).

If the off-centre effect indeed reﬂects particular instances of the more general phenomenon of conscious and unconscious processes in human perception and decision-making, then it should also occur in other sports situations and daily activities. One such situation may be the serve in beach volleyball. Accordingly, we asked whether beach volleyball players’ decisions for serving the ball to a particular area of the court can be implicitly influenced by the receiving team’s positioning in a similar way as kick direction in soccer penalty kicks is affected by goalkeeper position. Significantly, the beach volleyball situation is more complex than the penalty kick in soccer. Typically, in taking a neutral position (Figure 1), the two opponent receiving players divide the court in three areas of equal size. For this situation, conscious deliberations about the largest area are unlikely to contribute to a server’s decision where to aim the ball. Nonetheless, if the off-centre effect in penalty kicking reﬂects a ubiquitous phenomenon, then a marginal deviation from the neutral position by one of the receiving players would go unnoticed to the serving player but may still inﬂuence his or her decision. Hence, the main purpose of the current study was to examine whether effects like the off-centre effects in soccer penalty kicking also occur in beach volleyball.

The pervasiveness of a phenomenon not only relates to its ubiquitousness, but also to its stability. That is, for players or coaches who consider ways to exploit (or avoid) off-centre effects, it is pertinent to know how easily it can be escaped (e.g. “what if my opponent knows?”). Also theoretically, this is an important issue. It is assumed within the taxonomy of Dehaene et al. (2006) that explicit awareness is not only enhanced by increasing stimulus strength, but also by directing attention to the stimulus of interest. Hence, dependent on the processes involved, explicitly directing players to attend to the stimulus of interest may affect the manifestation of the off-centre effect. To address this issue, we examined the occurrence and extent of the off-centre effect in beach volleyball in two experiments. Experiment 1 was designed such that players would not consciously search for or attend to court measures (and thus player’s relative locations) when choosing the area to serve (cf. Masters et al., 2007, Exp. 3), while in Experiment 2 players were explicitly told to search for and hence to attend to the area that was largest when deciding where to serve (cf. Masters et al., 2007, Exp. 1). In line with Dehaene et al. (2006), we hypothesised that by directing attention to the stimulus of interest, the off-centre effect in Experiment 2 would be reduced (or even completely vanished) compared to Experiment 1.

Figure 1. A sample picture of the stimulus material for the neutral position. (To view this figure in color, please see the online version of this journal.)
**Experiment 1**

In Experiment 1, beach volleyball players were shown displays of two beach volleyball players who are preparing to receive a serve. In some displays the two players were positioned such that they divided the court in three equally sized areas (i.e. neutral positioning, Figure 1); in other displays one of the players slightly or clearly deviated from this position. Reminiscent of the landmark task in line bisection (Milner, Brechmann, & Pagliarini, 1992), participants were asked whether the receiving player stood in a neutral position (i.e. whether the court areas were of equal size) or not. Following the procedures introduced in the original off-centre study by Masters et al. (2007, Exp. 3), if the participants thought the answer was affirmative (i.e. the players indeed appeared to be positioned neutrally), they were to indicate to which area they would aim the ball. If the participants believed the answer to be negative (i.e. the players do not appear to be positioned neutrally), they did not choose an area (but proceeded with the next display). In other words, participants only made decisions where to aim the ball in situations for which they were not consciously aware that the receiving players deviated (slightly) from the neutral position and for situations in which the receiving players were actually not displaced. In the former situation, it is highly implausible that they would still explicitly search for or attend to the largest area in their subsequent decision where to aim. Consequently, any systematic implicit influence of deviations from the neutral positioning should stem from preconscious perception (Dehaene et al., 2006). We hypothesised that slight deviations from the neutral positioning would indeed go unnoticed, but that participants would still prefer to direct the ball to the largest court area above chance level (i.e. >33%).

**Methods**

**Participants**

The experiment was carried out in accordance with the World Medical Association Helsinki Declaration as revised in October 2008. Following the approval of the local ethics committee, 25 participants (of which 23 participants were male and 22 right-handed) with an average age of 25.9 years (SD = 7.9 years) volunteered to take part in the experiment. All participants played beach volleyball at least once per week, reported normal or corrected to normal vision, were naïve regarding the purpose of the study and also did not know about the existence of the off-centre effect, neither in soccer penalty kicking nor in beach volleyball (as was verified after the experiment). Participants provided written informed consent before the start of the experiment.

**Stimuli**

E-Prime 2.0 software (Psychology Software Tools, Pittsburg, PA) was used to present pictures of a beach volleyball scene on a 15.6-inch Fujitsu Lifebook E754. The pictures were graphic representations reworked from a picture that shows a receiving team’s courtside with one player positioned at 4 m behind the net taken from the serving player’s position (i.e. from behind the centre of the rear court boundary). The receiving player was carefully cut out and pasted in twice at different lateral locations 4 m behind the net (Figure 1). In the neutral position, the “two” players were positioned in such a way that their midsagittal bodylines divided the court in three target areas of equal width. In all other positions either the right or the left player was displaced to the left or the right, resulting in one of the three areas of the court being wider, one being smaller, and the third being of equal size as in the neutral position. The displacements were 0, 3, 6, 9, 12, 15, 18, and 71 pixels, which corresponds to, respectively, 0.00, 0.06, 0.12, 0.18, 0.24, 0.30, 0.36, and 1.42 cm on the laptop’s monitor and to 0, 2, 4, 6, 8, 10, 12, and 48 cm on a real court. The largest displacement was very obvious and served to maintain participants’ motivation. Previous work showed that participants’ performance in evaluating stimuli suffers if only hardly noticeable and unnoticeable stimuli (here: small displacements) are presented (cf. Pratte & Rouder, 2009).

**Procedure**

Participants were placed at normal seating distance of about 60 cm from the monitor (i.e. head position varied somewhat because no head rest was used) and instructed to decide to which of three areas of the court they would serve the ball (i.e. to the left side, the middle, or right from the participants’ perspective). However, they were only to decide if they perceived that the players stood in the neutral position. They were advised about this neutral position before the start of the experiment. It was described as the situation in which both players were...
positioned such that their midsagittal bodyline divides the court in three target areas of exactly the same width. A picture was used to support this explanation. To respond, the participants pressed one of four buttons on a keyboard, three of which corresponded to one of the three court areas, while the fourth served to indicate that the receiving players did not stand in the neutral position.

The experiment started with a short familiarisation session consisting of five trials, after which participants were asked if they had any problems understanding the task. The subsequent experimental session consisted of 325 randomised trials, 25 of which displayed the two receiving players in neutral position and 12 in which one of the players was obviously displaced. Each of the three areas of the court was the largest in one-third of the trials (96 trials each). That is, the receiving players were twice as often displaced to the inner side of court than to the outer side.

**Data analysis**

We first determined whether participants had a preferred target area by submitting the number of times an area (left, middle, right) was chosen when the receiving players were in neutral positions to a one-way ANOVA with repeated measures. Because this did not return a significant effect of area, $F(2, 48) = 0.54, p > .5$, this factor was left out in subsequent analyses. We then examined how often participants refused to serve as function of the magnitude of displacement using another one-way ANOVA with repeated measures. Subsequently, we conducted a similar ANOVA with repeated measures for the percentage of decisions that were aimed for the largest area of court. Subsequently, separate one-sample $t$-tests were used to test whether the largest court area was chosen more often than chance level (test value 33%, Bonferroni corrected). Either partial eta-squared ($\eta_p^2$) or Cohen’s $d$ was reported to determine the proportion of total variability attributable to each (combination of) factor(s) or the standardised differences between means, respectively.

**Results**

As can be seen in Figure 2, participants almost always (i.e. >97% of trials) refused to “serve” when the displacement of one of the receiving players was obvious, that is, 71 pixels. For the remaining displacements, participants refused to serve in less than 10% of trials; this included six participants who always refused to serve at displacements of 15 and 18 pixels. This was confirmed by a main effect of displacement, $F(6, 144) = 2057.95, p < .0001$, $\eta_p^2 = .99$. Bonferroni corrected pairwise comparisons indicated that the number of refusals did only differ between the 71 pixel condition and all the other conditions ($p < .0001$), whereas the remaining conditions did not significantly differ from each other ($p > .08$).

Figure 3 shows the percentage of decisions for the largest area. Clearly, when participants decided to serve, and thus did not consciously notice that the receiving players were not positioned in a neutral position, they decided for the largest area in approximately half of their choices (i.e. 53.1%). The analysis of variance on the percentage of decisions for the largest area revealed a main effect of displacement, $F(5, 90) = 9.2, p < .0001$, $\eta_p^2 = .34$. Bonferroni corrected pairwise comparisons indicated that the largest area was chosen less often in the smallest three pixel displacement than in the other displacement conditions, which did not differ among each other.

Finally, Bonferroni corrected one-sample $t$-tests (one-sided) showed that percentages of decisions for the largest court area exceeded chance for displacement conditions of six pixels (and larger, $t > 4.71, ps < .001, d > .0001$). However, for the smallest three pixel displacements the difference did not reach significance ($p > .02$).

**Discussion**

Masters et al. (2007) reported that in soccer penalty kicking a goalkeeper who, unknowingly to the penalty taker, stands marginally off-centre entices
a penalty taker to kick to the side with more space. Experiment 1 examined if similar (seemingly) implicit (preconscious) involvement in decision-making also occurs in the beach volleyball serve. Specifically, it was investigated if with marginal displacements from a neutral positioning of the two receiving players that go unnoticed, beach volleyball players still tend to choose the largest court area more frequently.

With a displacement of one of the opponent players that corresponds to almost half a metre on court, the participants were clearly aware that the receiving team was not positioned neutrally. However, smaller deviations from the neutral position generally went unnoticed, except in a few participants who also perceived displacements corresponding to 10 and 12 cm. In other words, for displacements smaller than 10 cm (i.e. <15 pixels) participants believed the opposing team was positioned neutrally; and hence they had to decide to what area they would serve the ball. We found that even though they seemed not consciously aware that the defending players were not neutrally positioned and hence that the court areas were not of equal size, they systematically favoured serving to the area that was slightly larger than the two others. This indicates that implicit (preconscious) perceptual processes are actively involved in decision-making. The effect was not ubiquitous, however. For the smallest displacement, which corresponds to 2 cm on a beach volleyball court, the largest area was not chosen more often than expected by chance. Likely, the displacement is so small that stimulus strength stays below the objective threshold of perception. Consequently, the off-centre effect in beach volleyball was only reliably observed for spatial deviations that correspond to distances between 4 and 10 cm on a real court. In fact, this corresponds rather well with the 5–10 cm bandwidth reported for the off-centre effect in penalty kicking (Masters et al., 2007). This indicates that implicit perception is sufficiently pervasive to generalise to slightly more complex environments in which also other than spatial factors are likely to affect decision-making. For instance, the two receiving players together can more easily defend or reach the middle area than a same-sized outer area if they coordinate their actions. Future works needs to verify whether these action-related factors override implicit perception in more representative situations. We guess not, since the off-centre effect in penalty kicking also holds in the real environment (Noël, van der Kamp, & Memmert, 2015).

The instructions in the current experiment aimed to discourage the participants to attend to the court area that was largest while making their decision. As such, it tried to capitalise on preconscious rather than subliminal processing (Dehaene et al., 2006). This is important, because many studies that purportedly demonstrated implicit involvement in perception and decision-making have been criticised for directing participants’ attention to the critical dependent variable (e.g. Newell & Shanks, 2014). In the current experiment, however, the participants were in no way hinted that the size of the court area was of significance in deciding between the three areas. In fact, they were only required to make a decision when they explicitly perceived that the areas were of equal size. Nonetheless, Dehaene et al. (2006) argued that implicit influences in decision-making can be sustained even with attention directed at the critical stimulus, that is, by invoking subliminal processing. This would depend on whether the stimulus went unnoticed because it was not attended or because it was of insufficient strength. To explore this issue in further detail, Experiment 2 assessed the involvement of implicit (subliminal) processes when participants are intentionally looking for the largest area.

**Experiment 2**

In the original study, Masters et al. (2007) also demonstrated the off-centre effect using a design that resembles forced-choice comparative visual

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**Figure 3.** Percentages of decisions for the largest area as a function of displacement relative to neutral position (Experiment 2). Error bars indicate standard errors. This figure leaves out the displacement condition of 71 pixels, because participants almost never made a “serve”. They were clearly aware that the receiving players were not positioned neutrally.
search tasks (e.g. Pomplun et al., 2001). Participants were shown displays with a goalkeeper positioned (marginally) off-centre and were instructed to identify which half of the goal is the bigger one, necessitating the participants to compare both sides of the goal. In addition, they were asked to rate their confidence in the correctness of the choice. Implicit involvement was attested for by the observation that for small displacements relative to the goal’s centre, participants performed above chance (i.e. >50% correct), but reported they were guessing, that is, had no confidence that their response was correct. We adopted the forced-choice task for the beach volleyball serve to examine whether intentionally attending to the size of the court affects implicit influences on decision-making. Similar to Experiment 1, in Experiment 2 participants were again shown displays of two beach volleyball players waiting to receive a serve. However, they were now told to judge the court area that was largest and to rate how confident they were that their judgement was accurate. Because participants’ attention was now directed at the dependent variable of interest (i.e. size of the target areas), implicit involvement in decision-making, if any, can only follow from stimulus strength being too weak to access consciousness (i.e. subliminal processing) and not from attention being diverted away from the stimulus of interest (i.e. preconscious processing). Hence, we anticipated that – relative to Experiment 1 – the implicit influences would be limited to smaller displacements (i.e. weaker stimuli).

**Method**

**Participants**

The experiment was carried out in accordance with the World Medical Association Helsinki Declaration as revised in October 2008. After the local ethics committee approved the experiment, 37 participants (26 male, 11 female, 36 right-handed) with an average age of 26.4 years (SD = 5.1 years) took part in this experiment. All participants played beach volleyball regularly, that is, at least once per week. They reported normal or corrected to normal vision, were naïve regarding the purpose of the study and had no prior knowledge about the off-centre effect in penalty kicking in soccer (or beach volleyball).

**Stimuli**

The same pictures of two receiving beach volleyball players as in Experiment 1 were shown on a 15.6-inch Fujitsu Lifebook E754 using E-Prime 2.0 software (Psychology Software Tools, Pittsburg, PA). However, fewer displacement conditions were included: 0, 6, 12, 18, and 71 pixels, corresponding to, respectively, 0.00, 0.12, 0.24, 0.36, and 1.42 cm on the screen and 0, 4, 8, 12, and 48 cm on a real court.

**Procedure**

Participants were seated at normal seating distance from the monitor (about 60 cm) and free to move their head. They were instructed to identify the largest of the three areas of the court (i.e. outer left, mid, or outer right area) or guess if they felt unable to decide. They provided their response by pressing one of three buttons that each corresponded to a court area. After each response they had to indicate how confident they were that the response was correct by marking a location on a continuous scale that ranged from “0” (complete guess) to “100” (totally sure). There were no time restrictions for responding. As per Experiment 1, the experiment started with a short familiarisation session of five trials after which participants were asked if they had any problems understanding the task requirements. The subsequent experiment session consisted of 325 randomised trials, in 25 of which the two receiving players actually stood in the neutral position so that the three areas were of the same size. Each of the three areas of the court was the largest in one-third of the remaining 300 trials, resulting in players being displaced to the inner side of the court twice as often than to the outer side. The obvious displacement condition was used in 30 trials.

**Data analysis**

First, we submitted the number of times an area (left, middle, and right) was chosen as the largest to a one-way ANOVA with repeated measures to verify if participants perceived one area as larger than the two others. This included the 25 no displacement trials only. Because no significant effect of area was found, $F(2, 72) = 2.45$, $p = .10$, area was not taken into account in subsequent analyses. Afterwards, we calculated the percentage of trials in which the largest area was correctly identified for each of the four displacement conditions (6, 12, 18, and 71 pixels) and submitted these percentages to a one-way ANOVA with repeated measures. We also tested whether these percentages exceeded chance levels using one-sample t-tests (test value $= 33.3\%$, Bonferroni corrected). Finally and following
the procedure of Masters et al. (2007), who assumed that rating scores for the neutral position (i.e. zero displacement) reflect guessing, we used one-sample t-tests (Bonferroni corrected) to assess if the average confidence ratings for the four displacement conditions exceed ratings for the neutral position (i.e. guessing level). Either partial eta-squared ($\eta^2_p$) or Cohen’s $d$ was reported to determine the proportion of total variability attributable to each (combination of) factor(s) or the standardised differences between means, respectively.

**Results**

Figure 4 shows the percentage of trials in which the correct area was identified as largest together with the corresponding confidence ratings as a function of displacement condition. A main effect for displacement was found, $F(3, 108) = 245.9, p < .001, \eta^2_p = .87$, indicating that accuracy of identifying the largest area increased with the size of the deviation from the neutral position. Bonferroni corrected pairwise comparisons showed that the displacement conditions differed significantly from each other ($ps < .001$). Importantly, the percentage of trials in which the largest area was correctly identified exceeded chance level in each displacement condition including the smallest, $t(36) > 19.01, ps < .0001, ds > 6.36$.

Finally, confidence ratings exceeded participants’ confidence rating for the zero displacement condition (i.e. guessing level) at displacements as small as 12 pixels (corresponding to 8 cm on a court), $t(36) > -3.19, ps < .005, ds > 1.06$. However, participants did not show increased confidence in their decisions for the six-pixel displacement condition (i.e. 4 cm on a court), $t(36) = -1.3, p > .19$ (Figure 4).

**Discussion**

Experiment 2 scrutinised whether marginal displacements of beach volleyball players relative to a neutral positioning that are not consciously perceived can still influence a server’s decision to aim for the largest area of the court implicitly (subliminally), if the server intentionally searches and attends to the largest area. We found, analogous to the off-centre effect in soccer penalty kicking (Masters et al., 2007, Exp. 1), that irrespective of the magnitude of the displacement of one of the receiving players, participants were able to identify the largest area above chance. Even for the smallest displacement, which corresponded to 4 cm on court, participants reliably chose the largest area. However, unlike for the larger displacements they were not aware of the magnitude of the displacement because they were guessing when faced with the smallest displacement condition. We take this as an indication that the participants were aware of the displacement and that the receiving team stood not in a neutral position.

As expected, participants were aware of smaller differences between the court areas than in Experiment 1 (i.e. they were increasingly certain that their choice was correct for displacements that correspond to 8 cm or more on court). This suggests that directing attention towards the measures of the court areas reduces the impact of the implicit processes but does not completely annihilate it. One inference would be that part of the implicit involvement in Experiment 1 reflects preconscious perception, which only contributes if attention is diverted away from the stimulus of interest and a stimulus is strong enough to enter consciousness. The implicit involvement that remains when attention is directed to the stimulus of interest must be subliminal processing, and stems from stimuli that are too weak to be noticed consciously. Accordingly, the implicit involvement was much more limited in Experiment 2. Yet, these inferences are necessarily tentative, because the procedure of the two experiments differs in more aspects than focus of attention only (e.g. other displacement conditions were used, criteria for implicitness were not identical).

**General discussion**

To examine the pervasiveness of the implicit involvement in decision-making in dynamic situations such
as sports, the current study investigated whether phenomena similar to the off-centre effect in the soccer penalty kick (where marginal differences in positioning influence penalty takers’ decision without them being consciously aware of these spatial differences) can also be found in a beach volleyball scenario, the service to start a rally. The present experiments indicate that marginal variations in the receiving team’s players positioning can indeed systematically affect decision-making of the serving player implicitly, that is, when the spatial variations go unnoticed either because the server does not explicitly attend to the players’ relative position or because the differences in position are too small to be recognised. Accordingly, the off-centre effect is not a phenomenon that is restricted to soccer penalty kicking (or the accompanying centre effect) but reflects a more general implicit involvement in decision-making arising in complex environments, possibly also outside sports. Nonetheless, it must be acknowledged that the current experiments were lab-based, implying that some of the rich dynamics of real-world beach volleyball matches are missing – as was the case in the original penalty kick off-centre studies (Masters et al., 2007; Weigelt & Memmert, 2012; Weigelt et al., 2012). Yet, it was recently shown experimentally that the off-centre effect holds for penalty kicking on the field involving players taking the penalty kick from penalty marks and goalkeepers actively trying to stop the ball (Noël, van der Kamp, & Memmert, 2015). This suggests that the lab-based results can in fact be representative for the real-world sport environments, although this still needs to be verified experimentally for the current beach volleyball scenario. Also video-analysis from competitive matches may be helpful in this respect (see also Masters et al., 2007). Admittedly, there remain some doubts regarding the practical value of the current findings compared to the practical value in penalty kicking, because there may be even more factors influencing choice for a target area in beach volleyball serves than in penalty kicking, such as a server’s tactical deliberations about the ensuing rally, which may or may not overrule any effect of marginal positions on decision-making. It also remains unclear to what degree beach volleyball players would genuinely benefit given their reception is general successful (i.e., unlike goalkeepers in a penalty kick, receivers have generally sufficient time to anticipate ball flight). However, deliberate displacements from the neutral position by the receiving team’s players are not uncommon in beach volleyball.3 Typically, however, receiving players adopt relatively large displacements to elicit a serve to a particular area on court for tactical reasons (e.g., getting players to serve away from the weaker attacking player). Because the strategy is easy to recognise for the serving player, it introduces strategic counter-responses as predicted by game-theory: The serving player’s decision is likely affected by the recognition that the receiving player is trying to lure him or her to play to a particular target area, and possibly the receiving player takes into account that the serving player knows, and so on. In sports, this kind of strategic decision-making is most thoroughly studied for soccer penalty kicking (see Chiappori, Levitt, & Groseclose, 2002; Palacios-Huerta, 2003). In brief, the findings suggest that when adopting this kind of deliberate strategies, sport players tend to maximise their chances for success while making sure that their decisions remain unpredictable. The advantage of marginal displacements from normal position is that they lure the serving players into a particular choice, without the players being aware that this happens. Consequently, game-theory does not apply. That is, it seems therefore worthwhile for future research to examine if receiving players would prefer more from marginal displacements than from relatively large displacements. In fact, Experiment 2 suggests that for a narrow range of displacements, serving players can be lured into a particular decision, even if they consciously try to prevent that it befalls them (i.e., when they are on the lookout for the largest area). The serving player is unlikely to completely suppress the effect of marginal variations in positioning, because humans have been found unable to learn to counteract (subliminal) implicit influences on their behaviour (Bressan & Pizzighello, 2008; Tsushima, Seitz, & Watanabe, 2008). In other words, explicitly attending to the marginal displacements helps reducing the effect, as was demonstrated in Experiment 2, but if the stimulus is of insufficient strength to be perceived consciously, then its influences cannot be intentionally overturned, simply because the player is not aware of it. In this regard, it is worthwhile to identify other scenarios that are subject to implicit influences. Other sports like ice-hockey and tennis that include set plays come to mind easily. Moreover, similar effects possibly occur in daily life, for instance, a car driver choosing among two parking spaces, a pedestrian walking in a crowded shopping area, or a butcher selling halve a sausage.
To sum up, the current study demonstrates that the off-centre effect is not unique to soccer penalty kicking. Marginal spatial differences that go unnoticed also occur in beach volleyball, indicating that implicit involvement in decision-making may be a more general phenomenon in sports. The current study shows that these implicit influences can be exploited to influence another person’s or sport player’s decision-making. The effect persists (although significantly reduced) even if the other person deliberately pays attention to it, underlining that attention is an important mediator – as predicted by Dehaene et al. (2006) – but cannot fully annihilate the implicit influences.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. Supplementary analyses verified that percentages of decisions for the two other areas (i.e. smallest and neutral) did not exceed chance level (ps > .34).
2. We again verified that percentage decision for the other areas did not exceed chance levels (ps > .28).
3. To make sure, these arguments are based upon the knowledge and experience of the second author, who is playing beach volleyball competitively on the international level.

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