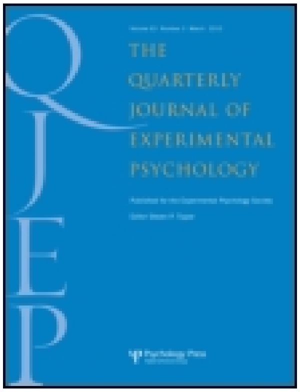

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Short article

Bend it like Beckham: Embodying the motor skills of famous athletes

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Observing an action activates the same representations as does the actual performance of the action. Here we show for the first time that the action system can also be activated in the complete absence of action perception. When the participants had to identify the faces of famous athletes, the responses were influenced by their similarity to the motor skills of the athletes. Thus, the motor skills of the viewed athletes were retrieved automatically during person identification and had a direct influence on the action system of the observer. However, our results also indicated that motor behaviours that are implicit characteristics of other people are represented differently from when actions are directly observed. That is, unlike the facilitatory effects reported when actions were seen, the embodiment of the motor behaviour that is not concurrently perceived gave rise to contrast effects where responses similar to the behaviour of the athletes were inhibited.

Humans have a tendency to nonconsciously and nonstrategically imitate the bodily states of other people (e.g., Chartrand & Bargh, 1999; Van Baaren, Holland, Kawakami, & van Knippenberg, 2004) For instance, when watching your favourite soccer team, you might find your leg muscles tensing at the moment of a penalty kick, or your arms being lifted in synchrony with the player who has just scored a goal.

The processes of mimicry seem to rely on a direct link between perception and action. Evidence is accumulating that perceiving an action activates the same representations as does the actual performance of the same action (e.g., Hommel, Müsseler, Aschersleben, & Prinz, 2001). This overlap might allow humans to "embody" the behaviour of others and to infer the internal states driving it (e.g., Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Wilson & Knoblich, 2005).

Direct evidence for the embodiment of action comes from the discovery of so-called "mirror neurons" in the macaque premotor cortex. These neurons fire not only if the monkey performs a particular action but also if it observes this action being performed by another person (DiPellegrino, Fadiga, Fogassi, Gallese, Rizzolatti, 1992; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996). As such, the mirror neurons provide a neuronal substrate for the processes that link perception to action. Imaging studies confirmed that a similar

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system is also present in humans (Buccino et al., 2001; Grèzes, Armony, Rowe, & Passingham, 2003).

Behavioural studies also supported the idea of a direct link between perception and action. Observing an action primes the production of similar actions and interferes with the production of different actions (Brass, Bekkering, Wohlschläger, & Prinz, 2000; Kilner, Paulignan, & Blakemore, 2003; Stürmer, Aschersleben, & Prinz, 2000). For instance, in a recent study (Bach & Tipper, in press) we showed that observing a person kicking a football facilitated foot responses relative to finger responses. Similarly, observing a person typing facilitated finger responses relative to foot responses.

Similar effects of motor activation have been demonstrated for actions that are heard (e.g., Kohler et al., 2002), imagined (e.g., Gerardin et al., 2000), or even read about (Glenberg & Kaschak, 2002). In this paper we pose the question of whether the roles of the human action system go beyond the representation of actions that are produced or perceived. We show that humans also use their action system during person identification, where the skilled motor behaviour associated with a person's profession is automatically encoded and represented in the observer's action system.

Consider watching the famous (for European readers at least) soccer player Wayne Rooney. Viewing such a well-known person automatically activates several of his characteristics, such as his profession (e.g., Bodenhausen & Macrae, 1998; McNeill & Burton, 2002). For Wayne Rooney, this profession involves highly skilled motor behaviour. Thus, if humans use their own action system to represent the motor skills of others, the mere identification of this athlete might suffice to activate the representations related to kicking a soccer ball, even if the corresponding actions are not actually performed.

In the experiment four individuals were to be identified. Two of them were soccer players associated with highly skilled actions with the feet, and two were tennis players, associated with highly skilled hand actions. We ensured that all participants knew who these famous British athletes were, but we never explicitly mentioned their sport. Two individuals (one soccer and one tennis player) were identified with a finger keypress response, while the other two (one soccer and one tennis player) were identified with a foot response. The key question was whether the compatibility of response and sport of the athlete (foot–soccer, hand–tennis) influenced the speed and accuracy of the responses, even though the photographs did not include any cues for the actions usually performed by the athletes.

Any effects of the athletes' profession on response speed and accuracy would be evidence for the embodiment of a person's profession and the associated skilled motor behaviour. However, because this is the first study investigating this issue, it is not clear in which direction the effect will be. There are two alternatives. On the one hand, it is possible that the participants assimilate the motor behaviour of the viewed athletes, as was the case in prior studies in which the actions were actually presented (e.g., Bach & Tipper, in press). Accordingly, responses should be faster and more accurate when they are similar to the sport of the athlete (foot responses for soccer, hand responses for tennis).

On the other hand, it is also possible that a contrast effect will be observed. Prior research in social psychology (see Ferguson & Bargh, 2004, for review) has demonstrated that assimilation effects are typically only observed when a characteristic is primed directly or through a stereotype. If, however, the same characteristic is primed implicitly because it is a trait of a viewed individual, contrast effects are observed. For instance, priming the trait "intelligence" by means of the "professor" stereotype enhanced the participants' performance in subsequent intelligence tests (Dijksterhuis et al., 1998). However, presenting a specific individual of high intelligence (Albert Einstein) impaired their performance.

Such contrast effects presumably emerge when participants implicitly compare themselves with the specific individuals ("exemplars") and realize that their own performance on this trait is clearly inferior. If the skilled motor behaviour of an athlete is represented in a similar manner as are these abstract traits of a person, then such automatic comparison processes should also be invoked in the present experiment. Thus, because the participants are clearly far inferior tennis and soccer players than are the presented athletes, viewing an expert soccer or tennis player might slow down foot and hand responses, respectively.

Method

Participants

A total of 40 students (11 males) ranging in age from 18 to 42 years participated in the study. All participants were students at the University of Wales, Bangor. All had normal or corrected-to-normal vision. They received payment for their participation (£5). The response assignment was such that, for each participant, one tennis player had to be identified with a finger key (compatible) and the other tennis player with a foot key (incompatible). Analogously, one soccer player had to be identified with a foot response (compatible) and the other with a finger response (incompatible). This assignment of athletes (Rooney, Rusedski, Henman, and Owen) to response keys (foot/finger) was counterbalanced across participants.

Material and apparatus

The experiment was controlled by Presentation run on a 3.2-GHz PC running Windows XP. A total of 96 pictures made up the stimulus set. Equal numbers of these pictures were photographs of Wayne Rooney, Michael Owen, Greg Rusedski, and Tim Henman. Thus, there were 24 photographs of each of these athletes. One half of these photographs showed the athletes while carrying out non-sports-related activities—for instance, talking at a press conference or posing for a wedding photograph (outside context, lower panels of Figure 1). The other half of the pictures showed the athletes while on the soccer field or the tennis court, dressed in the corresponding clothes (within context, upper panels of Figure 1). Care was taken that in these latter images the athletes were not performing

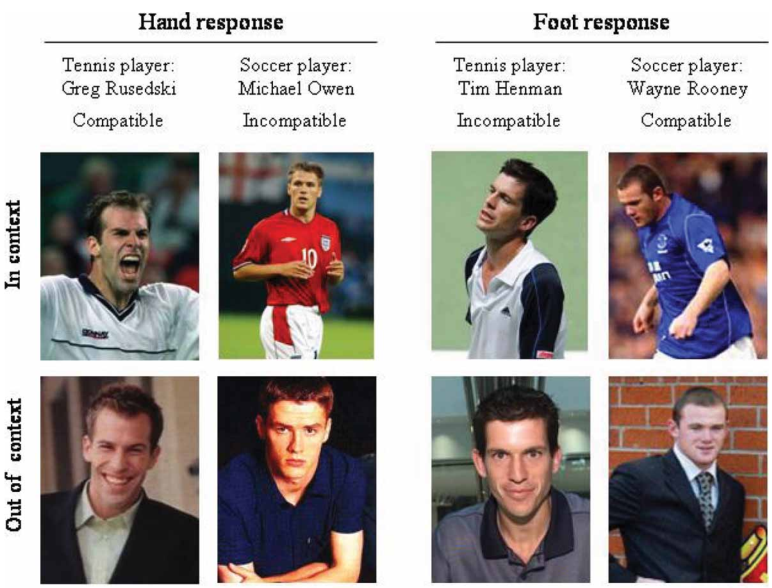

Figure 1. *Example key assignment. This participant has to identify the tennis player Greg Rusedski and the soccer player Michael Owen with a hand response and the tennis player Tim Henman and the soccer player Wayne Rooney with a foot response. The upper row shows example images of the athletes in their typical environment (in context) and the lower row shows example images of the athletes in everyday situations (out of context).*

the skilled motor behaviour of their sport. Thus, there was no image that showed a soccer player kicking a soccer ball, nor an image that showed a tennis player striking a ball with a racket.

Procedure and design

The participants were seated in a dimly lit room facing a colour monitor at a distance of 60 cm. After the computer-driven instruction and a short training phase of 16 trials the experiment proper started. It lasted for about 15 minutes and consisted of four blocks of 96 trials each. In each block, all images appeared once in a randomized order. Thus, in one half of the trials athletes had to be identified with a compatible response (hand response for tennis players; foot response for soccer players), and in the other half they had to be identified with an incompatible response.

The course of each trial was as follows: After the participants initiated the trial by pressing the space bar with their left hand, the photograph of the athlete was presented after 500 ms. They identified the athlete by either pressing the foot pedal with their right foot or the enter button on the computer keyboard with their right index finger. Participants were instructed to give their judgement in the interval in which this photograph was on the screen (1,500 ms). If their judgement was correct, the next trial started. If they committed an error or did not react in the given response interval of 1,500 ms an error message was displayed.

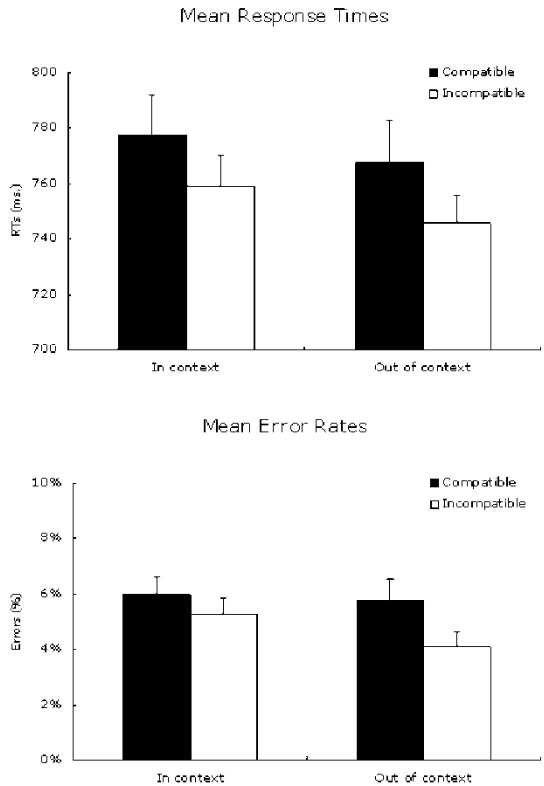

Figure 2. *RTs (upper panel) and error rates (lower panel). In each graph, the two bars on the left show the data for the identification of athletes in the inside-context images, and the two bars on the right show the data for the out-of-context images. The black bars show the data when sport and response were compatible (foot–soccer; hand–tennis), and the white bars show the data when sport and response were incompatible (foot–tennis, hand–soccer). The error bars show the standard error of the mean.*

Results

For the analysis of response times (RTs; Figure 2, top panel), trials in which the participants pressed the wrong button (5.3%) or did not react in the given reaction time interval (2.2%) were excluded. The remaining RTs were entered into a repeated measurements analysis of variance (ANOVA) with the within-subjects factors compatibility (compatible/incompatible) and context (inside/outside). There was a main effect of context, $F(1, 39) = 11.7$, $p < .001$. The athletes were identified more quickly when they were seen at everyday activities than when seen in their sporty contexts. The task was to identify the faces, and, because the face images tended to be a little larger and had gaze directed towards the viewer in the outside-context images (e.g., Macrae, Hood, Milne, Rowe, & Mason, 2002), this facilitated performance. The critical main effect of compatibility, $F(1, 39) = 5.0$, $p < .05$, was significant. Surprisingly, this effect took the form of a contrast effect. The athletes were identified more quickly when the effector required to identify them was incompatible with the action that they were usually carrying out. Context and compatibility did not interact, $F(1, 39) < 1$.

The ANOVA carried out on the error rates showed the same pattern (Figure 2, lower panel). The main effect of context, $F(1, 39) = 4.0$, $p < .06$, was marginally significant. The athletes were identified more reliably when they were seen at everyday activities than when seen in their sporty contexts. The predicted important main effect of compatibility, $F(1, 39) = 8.6$, $p < .005$, was again highly significant. The athletes were identified more reliably when the effector required to identify them was incompatible with the skilled action with which they were associated. Context and compatibility did not interact, $F(1, 39) = 1.2$.

Discussion

The present study demonstrated for the first time that viewing persons of high motor skill—in the present case famous soccer and tennis players—affects the action system of the observer. When identifying famous athletes in various situations, the participants' motor responses were influenced by their similarity to the skilled motor behaviour of the athletes.

These effects were similar when the athletes were presented in their typical environments and when they were presented out of context at non-sports-related activities. If anything, the action-compatibility effects were a little larger in the out-of-context condition (see Figure 2). As such, the data reflected the automatic activation of a viewed person's profession (cf. Bodenhausen & Macrae, 1998) and the skilled motor behaviour associated with it, irrespective of contextual cues that could have primed this behaviour. Thus, the present study suggests that people use their own action system to represent knowledge about other persons.

Intriguingly, the activation of the action system took the form of a contrast effect. Responding with the effector that was also involved in the skilled motor behaviour of the athletes was slower and less accurate than responding with a different effector. Hand responses were faster and more accurate when identifying soccer players. Conversely, foot responses were faster and more accurate when identifying tennis players. In other words, perceiving a highly skilled athlete inhibited similar motor behaviour in the observer.

This result is opposite to the pattern observed in prior research. Typically, facilitatory effects of the priming of motor behaviours on the production of similar responses have been reported, irrespective of whether behaviours were seen (e.g., Bach & Tipper, in press), heard (e.g., Kohler et al., 2002), or even read about (e.g., Glenberg & Kaschak, 2002). The main difference between these studies and the present experiment was, of course, that in our current experiment the critical motor behaviours were not directly activated but were implicit properties of the viewed famous athletes.

Therefore, our new findings suggest that the representation of the skilled motor behaviour possessed by other people shows a similar pattern as the representation of more abstract personal characteristics, such as intelligence or old age (for a review, see Dijksterhuis & Bargh, 2001). It has been demonstrated that when such characteristics are primed directly or by means of a stereotype, they give rise to assimilation effects; that is, the participants act as if they would exhibit the characteristics themselves (Dijksterhuis et al., 1998). However, if the same traits are activated because they are characteristics of a specific well-known person ("exemplars"), the assimilation effects turn into contrast effects. For instance, priming participants with the "professor" stereotype enhanced their performance in subsequent intelligence tests but priming them with the highly intelligent specific exemplar "Albert Einstein" impaired their performance (Dijksterhuis et al., 1998). The present findings suggest that a similar reversal also occurs for the representation of skilled motor behaviour that is not actually perceived, but which is an implicit characteristic of a well-known individual.

Presumably, such contrast effects occur because observers automatically compare themselves with the presented individuals (Dijksterhuis & Bargh, 2001). Similarly, in the present study, perceiving a person of high motor skill impaired the performance of similar actions of the lesser skilled participants. It is noteworthy that the paradigms used in the prior studies only allowed the measurement of these effects after considerable time had passed since the first presentation of the exemplar person. The present study showed that the effects can be detected very early after the presentation of the athletes, and that they persist even after repeated presentation. As such, the present findings suggest that the comparison processes are very quick and automatic, or that the outcomes of prior comparisons have become associated with the individuals and become reactivated when they are seen (Barsalou et al., 2003).

In future studies, we will investigate the influence of social comparisons on the action system of the observer more directly. Dijksterhuis and colleagues (1998) showed that being primed with Albert Einstein not only reduced the intellectual performance of the participants but also induced them to see themselves as comparatively stupid. If the contrast effects in the present experiment are due to social comparisons, one would expect that the size of the contrast effect correlates with the perceived skill difference between the participant and the athletes encountered in the experiment. Participants that perceive their own skill level to be similar to that of the athletes should show less contrast effect (or even facilitatory effects) than should participants that perceive themselves as comparatively unskilled.

In summary, our study shows that the activation of a person's profession—and the skilled motor behaviour associated with it—directly affects the action system of the observer at the time of the perception of the individuals. These embodiment effects were observed even though the motor characteristics were task irrelevant, and there were no observable cues for action in the stimuli. The present results support embodied views of social knowledge (e.g., Barsalou et al., 2003). Accordingly, the roles of the human action system extend beyond action production and perception, being also involved in social perception: specifically representing the motor skills of people, even when they are not observed acting.

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