



The influence of threat on perceived spatial distance to out-group members

Chiara Fini^{1,2} · Pieter Verbeke² · Sophie Sieber³ · Agnes Moors¹ · Marcel Brass² · Oliver Genschow³

Received: 30 January 2018 / Accepted: 3 September 2018 / Published online: 6 September 2018
© Springer-Verlag GmbH Germany, part of Springer Nature 2018

Abstract

A classic example of discriminatory behavior is keeping spatial distance from an out-group member. To explain this social behavior, the literature offers two alternative theoretical options that we label as the “threat hypothesis” and the “shared-experience hypothesis”. The former relies on studies showing that out-group members create a sense of alertness. Consequently, potentially threatening out-group members are represented as spatially close allowing the prevention of costly errors. The latter hypothesis suggests that the observation of out-group members reduces the sharing of somatosensory experiences and, thus, increases the perceived physical distance between oneself and others. In the present paper, we pitted the two hypotheses against each other. In Experiment 1, Caucasian participants expressed multiple implicit “Near/Far” spatial categorization judgments from a Black-African Avatar and a White-Caucasian Avatar located in a 3D environment. Results indicate that the Black-African Avatar was categorized as closer to oneself, as compared with the White-Caucasian Avatar, providing support for “the threat hypothesis”. In Experiment 2, we tested to which degree perceived threat contributes to this categorization bias by manipulating the avatar’s perceived threat orthogonally to group membership. The results indicate that irrespective of group membership, threatening avatars were categorized as being closer to oneself as compared with non-threatening avatars. This suggests that provided information about a person and not the mere group membership influences perceived distance to the person.

Introduction

Be it on a square, in a shopping center, or in a street, as soon as we are surrounded by other individuals, we immediately categorize them as similar or dissimilar to ourselves (Festinger, 1954). To categorize others, people select salient physical or social features such as race or other indicators of group membership (Fazio & Dunton, 1997; Taylor, Fiske, Etcoff, & Ruderman, 1978). Moreover, important social interactions, such as mate selection, reciprocal exchange, or negotiations, often take place within social or ethnic in-groups (Fiske, 1992; Ackerman et al., 2006). By taking a functionalist perspective social psychologists explain such

findings with the notion that people rely on mechanisms of social information to infer whether others will be helpful or harmful to them (Fiske, Cuddy, & Glick, 2007; Cuddy, Fiske, & Glick, 2008).

While contact with in-group members is often rewarded by benefits, contact with out-group members is often perceived as being outweighed by costs (Ackerman et al., 2006). Thereby, keeping spatial distance from an out-group member is a well-suited example to express social discriminatory behavior. In seminal studies, Amodio and Devine (2006), for instance, showed that White-Caucasian participants chose to sit farther away from a Black-African person than from a White-Caucasian person (see also Goff, Steele & Davies, 2008; Levy et al., 2005; Macree, Bodenhausen, Milne & Jetten, 1994 for related findings see Mooney, Cohn, & Swift, 1992). More recently, Dotsch and Wigboldus (2008) conceptually replicated this finding in a virtual reality setting and found that Dutch participants kept more distance from approaching Moroccan than from White-Caucasian avatars. While the previous research demonstrates that group membership affects how close individuals are willing to approach others, an open question is how group membership affects

✉ Chiara Fini
chiarafini@gmail.com

¹ Department of Psychology, KU Leuven, Leuven, Belgium

² Department of Experimental Psychology, Ghent University, Ghent, Belgium

³ Social Cognition Center Cologne, University of Cologne, Cologne, Germany

perceived interpersonal space. Interestingly, the previous literature offers two opposing hypotheses to this question that we label as the “threat hypothesis” and the “shared-experience hypothesis”.

Threat hypothesis

The previous research demonstrates that observing out-group members usually accompanies a sense of novelty, insecurity, and apprehension (see Park, 1928). In line with this notion, it has been found that threatening stimuli lead to increased alertness. For example, threatening stimuli are detected and recognized faster than non-threatening stimuli (e.g., Genschow, Florack, & Wänke, 2014; Lipp & Waters, 2007; Öhman, Flykt, & Esteves, 2001; Tipples, Young, Quinlan, Broks, & Ellis, 2002). When investigating event-related brain potentials Ito and Urland (2003) found that individuals direct the attention more strongly to Black targets than to White targets and that this effect is taking place very early in time (i.e., 100 ms after stimulus onset). In a related study, Phelps et al. (2000) measured amygdala activity—a neurophysiological marker of fear—while participants observed Black-African or White-Caucasian persons. The results indicate that the activation of the amygdala responds more strongly during the observation of Black-African than during the observation of White-Caucasian faces and that this difference in amygdala activity predicts implicit prejudice measured with an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998).

Taken together, past research shows that threatening/negative targets lead to a state of alertness. As visual objects that increase alertness are usually perceived as spatially close to oneself (Gogel & Tietz, 1977; Wist & Summons, 1976; Cole, Balcetis & Dunning 2013; Taffou & Viaud-Delmon, 2014; Tajadura-Jimenez et al., 2011), it is reasonable to assume that threatening targets will be perceived as relatively close to oneself as well. Indeed, threatening stimuli located near to one’s body have been shown to lead to a reduction of peripersonal space (Coello, Bourgeois, & Iachini, 2012). On the other hand, objects with a positive valence tend to be perceived as reachable also when they are outside the peripersonal space (Valdés-Conroy, Román, Hinojosa, & Shorkey 2012; for a different view, see Ferri, Tajadura-Jiménez, Väljamäe, Vastano & Costantini, 2015). In line with these findings, Ruggiero et al. (2017) showed that participants keep distance from angry rather than happy confederates. Likewise, Bailenson, Blascovich, Beall, and Loomi (2003) found that when another person invades one’s personal space, individuals tend to extend the distance to this person.

In an effort to explain the above-reviewed findings, Iannetti and De Vignemont (2015) argue that changing peripersonal space can optimize the aim to preserve the body

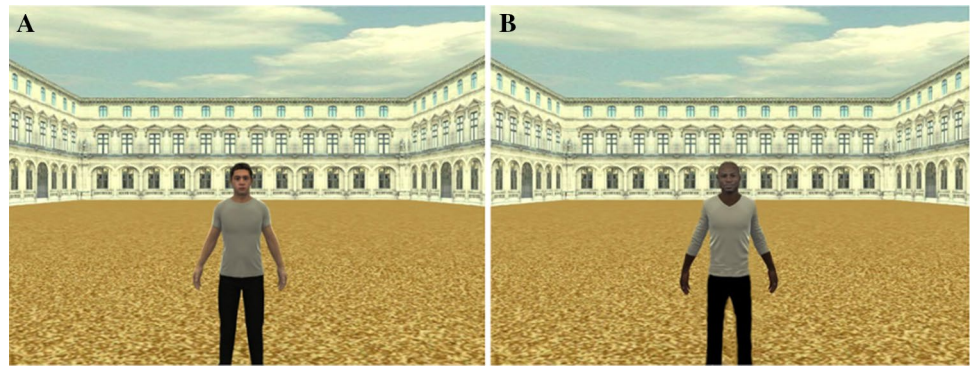
from threats. Crucially, peripersonal space and interpersonal space for interacting with con-specifics share common mechanisms and reflect the social valence of stimuli (Iachini, Coello, Frassinetti & Ruggiero, 2014; Quesque et al., 2017). Similarly, it has been argued that increasing spatial distance serves the need to restore a safety boundary between the self and another person (Coello & Iachini 2015; Coello & Fischer, 2016). At a more abstract level, the threat theory (see Xiao & Van Bavel, 2012) indicates that a stimulus that is aversive towards the collective identity of a group induces a state of alertness and consequently leads to a misperception of the stimulus as being close to oneself. Error Management Theory (EMT; Haselton & Buss, 2000) supports this claim by suggesting a motivational account. That is, EMT indicates that when judgments are made under uncertainty, there is a biased predisposition towards committing errors that are less costly. Accordingly, it may be adaptive to represent a potential threat closer to prevent costly errors (cf. Blanchard, & Blanchard, 1989; Lang, Bradley, & Cuthbert, 1997). Therefore, the threat hypothesis postulates that individuals should perceive potentially threatening out-group members as being physically closer to oneself than in-group members.

Shared-experience hypothesis

The shared-experience hypothesis is based on research investigating the mirror system—a system that allows the sharing of others’ experiences through somatosensory resonance (Bernhardt & Singer, 2012; Gallese, Keysers & Rizzolatti, 2004). Within the realm of this research, it has been shown that the observation of out-group members reduces the sharing of somatosensory experiences (Avenanti, Sirugu & Aglioti, 2010; Genschow & Schindler, 2016; Gutsell & Inzlicht, 2010). For example, when a painful stimulus is delivered to an out-group member, sensorimotor resonance in observers decreases, and this decrease correlates with participants’ implicit racial bias against that out-group (Avenanti et al., 2010). In a related study, Gutsell and Inzlicht (2010) measured electroencephalographic oscillations as an index of perception–action–coupling and found stronger activity over the motor cortex when participants observed in-group members than when they observed out-group members.

In line with the studies showing decreased sensorimotor resonance when observing out-group members, studies on imitation with adults (e.g., Genschow & Schindler, 2016; Yabar et al., 2006, Bourgeois & Hess, 2008) as well as infants (Buttelmann et al., 2013) provide evidence for weaker mapping of observed action performed by out-group members. These results can be framed within the construal-level theory (CLT; Trope & Liberman, 2010), claiming that out-group members are represented on a relative high,

Fig. 1 Stimuli used in the experiment: **a** White-Caucasian avatar, **b** Black-African avatar



abstract, construal level and are thus perceived as psychologically more distant from the self than in-group members. Therefore, in accordance with the shared-experience hypothesis, out-group members should be perceived as spatially farther away from oneself than in-group members.

Present research

Taken together, the threat hypothesis suggests that people are more strongly alerted when faced with potentially threatening out-group members and may thus perceive them as closer towards themselves than in-group members. In contrast, the shared-representation hypothesis postulates that the presence of out-group members, as compared to in-group members, decreases the sharing of sensorimotor resonance leading to an increase in perceived distance. To pit against each other these two hypotheses, in two experiments, we exploited a 3D environment and asked participant to express consecutive implicit, dichotomic “Near/Far” judgments (cf. Fini, Costantini, Committeri 2014; Fini, Brass, Committeri 2015) towards a Black-African Avatar and a White-Caucasian Avatar from an egocentric reference point (Experiment 1). Moreover, to investigate whether the mere group membership is intrinsically perceived as a source of threat, we manipulated perceived threat orthogonally to group membership by providing details about a supposed criminal/moral past of the avatars (Experiment 2).

Experiment 1

To test the threat hypothesis against the shared-representation hypothesis, in the first experiment, we investigated whether participants subjectively categorize a Black-African or a White-Caucasian avatar located in a 3D environment as “Near” or “Far” using the extrapersonal space categorization task introduced by Fini et al. (2014), see also Fini et al. (2015).

Method

Participants

Twenty-five White-Caucasian healthy students recruited at Ghent University participated in this experiment (19 females, all right handed, mean age 22.2 ± 2.6 , range 18–30). Three of them were excluded, because they showed a lack of coherence¹ in the three consecutive spatial judgments required in each session. All participants had normal or corrected-to-normal vision. In return for their participation, participants received course credits. The experiment was in accordance with the Declaration of Helsinki.

Materials and procedure

Stimuli were presented in a 3D naturalistic scene: a square arena defined by a long central wing of a palace and two short lateral wings. The scene was created by means of 3D modelling software to generate static monoscopic pictures which we presented on a flat screen. In the 3D scenes, the horizon was always the same throughout the experiment and the relative proportions of the elements resembled those of a real scene. Depending on condition, we placed either a White-Caucasian or Black-African male avatar into the arena. Relative to the depicted arena, both avatars’ height was scaled to be 178 cm in the reality and the appearance of the virtual human was of a young man of about 30-year-old age. We took great care in matching the two avatars on multiple crucial dimensions, such as chest dimension, shape and length of arms and legs, and color of shirts and trousers. Moreover, for both avatars, the gaze was straight and the facial expression was neutral (cf. Fig. 1).

¹ Lack of coherence means that participants did not express three consecutive “Near” judgments or three consecutive “Far” judgments, respectively in the descending/ascending series. That is, for example a “Near” judgment in a descending series, was followed again by a “Far” judgment, in such case the shift of judgment cannot be considered as being valid, since it is not stable and consistent.

The avatars were frontally located along a central vector aligned with a central camera representing the participant's perspective at 25 different distances (in relation with the arena, these steps represent distances between 1 and 25 m). The scene was created with a vantage point of 160 cm above the horizontal line that corresponds to the average eye height of average female and male participants. We did not include non-human objects of different colors, because non-human objects are fundamentally differently perceived as compared with human stimuli. That is, human, but not non-human objects, are endowed with motor potentialities that filter our space perception leading to a reduction in distance perception (Fini et al., 2015). Thus, any comparison between human and non-human would be non-informative.

The experiment followed the same experimental procedure employed in the previous work (Fini et al., 2014, 2015) and consisted of ascending and descending series of trials. This psychophysical limit method allowed us to examine our key purpose—namely, the assessment of how approaching and avoiding individuals are perceived, which is more ecological than a random presentation of the stimuli. Each series of trials started with a white fixation cross on a black background (1.5 × 1.5 cm) for 2500 ms and consisted of a maximum of 25 trials, but was terminated when a perceptual shift occurred. Each trial lasted 2500 ms. Participants were asked to judge whether the avatar was “Near” or “Far” from them, by pressing two different buttons arranged horizontally on the computer keyboard. The location (left vs. right) of the “Near” or “Far” keys was counterbalanced across participants. In ascending series of trials, the avatar was progressively moved (in steps of a predetermined value of 1 m) away from the central position of the arena until participants provided three consecutive “Far” judgments. In descending series of trials, the avatar was progressively moved closer to the central position of the arena until participants provided three consecutive “Near” judgments. This procedure was employed to ensure judgement consistency. Then, the following series started. The point where participants expressed a transition from “Far” to “Near” (descending series) and from “Near” to “Far” (ascending series) is defined as the Near Extrapersonal Space (NES) value. The NES value, expressed in meters, was calculated in each series for each subject. NES values across all series were then averaged into a total score to obtain a mean NES value for each condition. High/low NES values indicate a categorization of space as “Near”/“Far” between a target and oneself: the more extended is the portion of space categorized as “Near” and the less extended is the represented spatial distance. Each series of trials was repeated three times for each avatar (i.e., White-Caucasian, Black-African) in random order. In total, each participant was submitted to 12 series: 2 avatars (White-Caucasian, Black-African) × 6 series of trials (3 ascending, 3 descending). Stimuli were presented at full

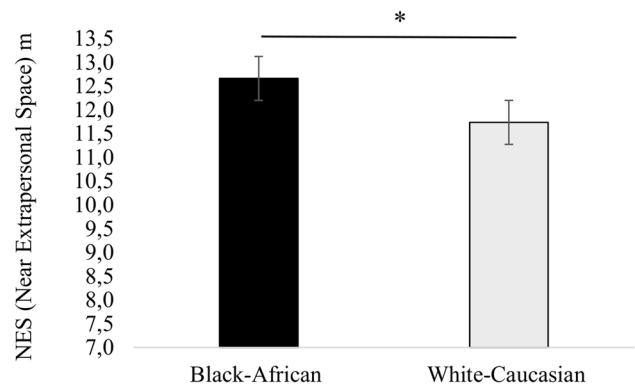


Fig. 2 Significant difference in near extrapersonal space (NES) between the Black-African and the White-Caucasian avatars

screen on a 17" computer display placed 57 cm from the subjects. The presentation of the stimuli and the recording of participants' responses were controlled by a customized script for Presentation version 14.9.08.11.

Results

A Shapiro–Wilk test confirmed the normal distribution of the data ($p < 0.001$). A t test for dependent samples revealed a significant difference between the two conditions (see Fig. 2) indicating that the Black-African avatar (NES = 12.66 m, SD = 2.23) was categorized as closer compared to the White-Caucasian avatar (NES = 11.73 m, SD = 2.14), $t(21) = 4.76$, $p < 0.001$, $d_z = 0.96$. This result supports the threat hypothesis.

Experiment 2

The results of Experiment 1 support the threat hypothesis indicating that threatening individuals are perceived as closer to oneself than non-threatening individuals. However, the experiment did not test this theoretical account directly, because other factors than threat could have potentially driven our effects. Thus, in Experiment 2, we manipulated threat orthogonally to the avatars' race by providing information about whether they are threatening or friendly. If it is indeed perceived threat and not mere group membership that drives the effect, one should expect a main effect of this threat information.

Method

Participants

Fifty White-Caucasian healthy students (25 females, all but 7 right handed, mean age 21.8 ± 2.3 , range 18–30) were

recruited at Ghent University. Seven participants were excluded, because they showed a lack of coherence (see footnote 1) in the three consecutive spatial judgments required in each session. All participants had normal or corrected-to-normal vision. Participants received course credits for their participation. The experiment was in accordance with the Declaration of Helsinki.

Materials and procedure

The procedure was similar to that of Experiment 1. However, in contrast to Experiment 1, we used four avatars, and for each avatar, a different threat information was provided. The experimenter repeated the most important information by saying: “You will see pictures of two pairs of twins who were separated after birth and grew up in different environments. While one twin of each pair has a criminal past of brutally murdering several persons, the other twin is known to be very friendly”. After this instruction, the picture of each avatar was presented on the screen. Crucially, one pair of twins consisted of two Black-African avatars and the other pair consisted of two White-Caucasian avatars. The avatars were the exact same ones that we used in Experiment 1. However, to make them distinguishable, each avatar wore a different colored shirt (i.e., blue, yellow, green, or violet). The colors of the shirts were counterbalanced in four different combinations among the four avatars. Each avatar was introduced together with a sentence describing his past. For one of the threatening avatars, it was written: “This person has been imprisoned for brutally killing several people”. For the other threatening avatar, we wrote: “This person is a convicted criminal who has brutally murdered several people”. For one of the friendly avatars, participants read: “This is a very friendly person who has never been in trouble with the law”, and for the other friendly avatar, it was written: “This is a very likeable and friendly person who has never done anything wrong”.

The experiment started with a learning phase in which participants learned to identify each avatar presented on the screen as a friendly or a criminal person by pressing the “k/f” keys. This learning phase was terminated as soon as participants correctly recognized each avatar as friendly or criminal in 30 consecutive trials. The presentation of the stimuli and the recording of participants’ responses were controlled by E-Prime 2.

After the learning phase, the same experimental procedure of Experiment 1 was implemented with one adjustment. That is, instead of presenting one White-Caucasian and one Black-African avatar without any threat information, we presented the four avatars for which participants had learned their threat information (i.e., friendly vs. threatening). Hence, our experimental design was a 2 (group membership: White-Caucasian vs. Black-African) × 2 (threat information:

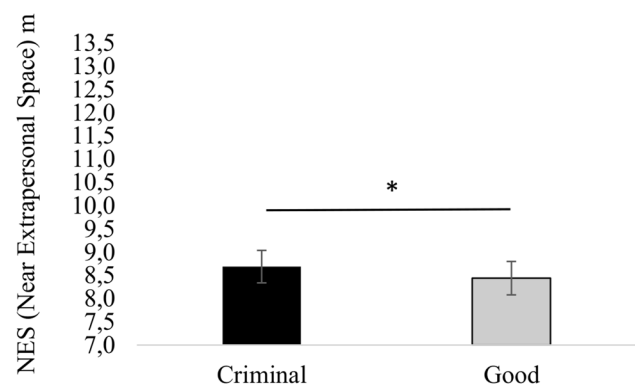


Fig. 3 Near extrapersonal space (NES) values for the criminal and the good avatars

friendly vs. threatening) within-subject design. In total, each participant was submitted to 24 series of trials: 2 types of group membership (White-Caucasian, Black-African) × 2 types of threat information (friendly, threatening) × 6 series (3 ascending, 3 descending). Stimuli were presented at full screen on a 17" computer display placed 57 cm from the subject. The presentation of the stimuli and the recording of participants’ responses were controlled by a customized script for Presentation version 14.9.08.11.

Results

A Shapiro–Wilk test confirmed the normal distribution of the data ($p < 0.001$). The results are depicted in Fig. 3. A 2 (group membership: White-Caucasian vs. Black-African) × 2 (threat information: friendly vs. threatening) repeated measures ANOVA showed a main effect of threat information, $F(1, 42) = 7.8$, $p < 0.01$, $\eta_p^2 = 0.16$, indicating that participants perceived threatening avatars as closer to themselves (NES = 8.69 m, SD = 2.34 m) than friendly avatars (NES = 8.44 m, SD = 2.39 m). Neither, the main effect of group membership, $F(1, 42) = 1.29$, $p = 0.27$, nor the interaction between group membership and threat information $F(1, 42) = 1.40$, $p = 0.24$, was significant. These results suggest that it is not group membership per se, but rather perceived threat that decreases perceived distance.

General discussion

A well-known finding in the literature is that people keep more distance from out-group members than from in-group members (Goff et al., 2008; Levy et al., 2005; Macrae et al., 1994; Dotsch & Wigboldus, 2008; Amodio & Devine 2006). Yet, the past research leaves open the question of which underlying mechanisms drive this effect. The threat hypothesis—supported by many studies (Phelps et al., 2000; Ito

& Urland, 2003)—suggests that when facing an outgroup member, alertness increases, perceived distance decreases (Blanchard & Blanchard, 1989; Lang et al., 1997), and keeping distance would serve the need to restore a safety boundary between the self and the other dissimilar (Coello & Iachini 2015; Coello & Fischer, 2016). In contrast, the shared-representation hypothesis relies on evidences demonstrating that the observation of out-group members reduces the sharing of somatosensory experiences (Avenanti et al., 2010; Genschow & Schindler, 2016; Gutsell & Inzlicht, 2010). From this perspective, keeping distance is the behavioral expression of a lack of interest towards the other dissimilar that would be considered as psychologically and physically far from the self.

In the present paper, we pitted against each other two different hypotheses on the role of group membership on perceived distance with an implicit “Near/Far” judgment task (Fini et al., 2014). No evidence was found for the shared-experience hypothesis: participants did not perceive an in-group member as spatially closer to themselves than an out-group member. Instead, results from the present experiments revealed support for the threat hypothesis: participants perceived an out-group member as spatially closer to themselves as compared to an in-group member (Experiment 1). However, while the first experiment is more consistent with the threat hypothesis than with the shared-experience hypothesis, it nevertheless did not directly test whether the effect is driven by the threatening nature of outgroup members or by other factors that characterize outgroup members.

Evidences show that transportation or absorption into a narrative story can strongly influence perception of the world, even changing people’s beliefs about what is real (Green & Brock, 2000; Green, Brock & Kaufman, 2004).

According to this assumption, in Experiment 2, we directly manipulated perceived threat of the avatars (through brief stories) orthogonally to their group membership.

The analysis yielded a main effect of threat information indicating that threatening avatars are perceived as closer to oneself than non-threatening avatars. This result indicates that threat information overwrites the information provided by mere group membership. In other words, if participants do not have any knowledge about the avatars’ background, they use group membership as information (cf. results of Experiment 1). However, as soon as additional information is provided, they neglect the group membership and focus on threat information only. This theoretical reasoning is compatible with recent results from our lab (Fini et al., 2015) demonstrating that beliefs can influence perceived space more effectively than perceived properties of the agent. Our findings show that perceptual appearance is not only overruled by mere beliefs, but also by possible behavioral intentions of the model (e.g., a threatening person may have the intention to harm).

Moreover, our results could explain the finding that White-Caucasian participants chose to sit farther away from a Black-African person (Amodio & Devine, 2006; Dotsch & Wigboldus, 2008; Goff et al., 2008; Levy et al., 2005; Macree et al., 1994). In line with the threat hypothesis, we would argue that a reduced distance perception leads individuals to increase interpersonal space to reinstall a comfortable distance. One could even argue that a reduced distance perception to a threatening stimulus is very functional, because it might be advantageous to categorize threatening stimuli as closer, so that behavior is subsequently undertaken to again increase the distance from these stimuli.

Our results, thus, complement past research finding that the presence of threatening stimuli near the body alters the representation of peripersonal action space (Coello et al., 2012; Ferri et al., 2015; Valdés-Conroy et al., 2012), which has been shown to influence social-comfort distance (e.g., Quesque et al., 2017; Iachini, Pagliaro, & Ruggiero, 2015, Ruggiero et al., 2017). The present results might even be consistent with numerous behavioral and neuropsychological data showing more powerful effect of negative than positive stimuli (e.g., Ito, Larsen, Smith & Cacioppo, 1998; Strack & Deutsch, 2004; van Dantzig et al., 2008) and with the previous findings that participants underestimate the distance to a stimulus that symbolizes a threat to their identity, such as the stadium of a rivaling football team, for instance (Xiao & Van Bavel, 2012; Xiao, Wohl, & Van Bavel, 2016).

However, it is important to note that the categorization bias towards threatening outgroup members that has been highlighted through the “Near/Far” judgment could also be explained by a motivational component. Indeed, we cannot exclude the possibility that participants had the intention to increase their distance to threatening avatars, and that this affected their “Near/Far” judgments.

It is also crucial to point out that in our experiments, we assessed only White-Caucasian participants but no Black-African participants. Thus, an open question is whether Black-African participants would show the same pattern or a reversed pattern of results. Nosek, Banaji, and Greenwald (2002) compared IAT scores of race IATs in which respondents classified Black and White faces or names while classifying words of positive or negative valence. Overall, the observed IAT effect revealed an automatic preference for White as compared to Black faces. Interestingly, this effect was found for White-Caucasian as well as for Black-African participants, although the effects were somewhat smaller for Black-African participants. Future research may aim at testing whether similar results can be found in the implicit “Near/Far” judgment task that we have used in the present research.

Finally, a limitation of our experiments is that we assessed a majority of young female students. Thus, it would be interesting to replicate the present results in a real scenario and

to test potential moderating variables such as gender or age. This would be particularly interesting as past research has shown that gender differences affect spatial regulation mechanisms in real as well as virtual environments (see Aiello, 1987; Hayduk, 1983; Uzzell & Horne, 2006; Iachini et al., 2016).

Summary

We have demonstrated that White-Caucasian participants show a spatial categorization bias towards out-group members, such that they misperceive them as being closer than in-group members. Moreover, after manipulating the threat value of avatars orthogonally to their group membership, we found that participants perceived threatening avatars as being closer to themselves than friendly avatars, regardless of the group membership of the avatars. Thus, our research suggests that perceptual biases may not stem from mere physical appearance, but rather from information relevant to the observer's goals (e.g., safety).

Funding Preparation of this paper was supported by Research Programmes G022313N and G073317N of the Research Foundation—Flanders (FWO), Methusalem Grant BOF09/01M00209 of Ghent University, and the Research Fund of KU Leuven (C14/17/047 and GOA/15/003).

Compliance with ethical standards

Conflict of interest Authors Chiara Fini, Pieter Verbeke, Sophie Sieber, Agnes Moors, Marcel Brass, Oliver Genschow declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

- Ackerman, J. M., Shapiro, J. R., Neuberg, S. L., Kenrick, D. T., Becker, D. V., Griskevicius, V., et al. (2006). They all look the same to me (unless they're angry) from out-group homogeneity to out-group heterogeneity. *Psychological Science*, *17*(10), 836–840.
- Aiello, J. R. (1987). Human spatial behavior. *Handbook of Environmental Psychology*, *1*(1987), 389–504.
- Amodio, D. M., & Devine, P. G. (2006). Stereotyping and evaluation in implicit race bias: Evidence for independent constructs and unique effects on behavior. *Journal of Personality and Social Psychology*, *91*(4), 652.
- Avenanti, A., Sirigu, A., & Aglioti, S. M. (2010). Racial bias reduces empathic sensorimotor resonance with other-race pain. *Current Biology*, *20*(11), 1018–1022.
- Bailenson, J. N., Blascovich, J., Beall, A. C., & Loomis, J. M. (2003). Interpersonal distance in immersive virtual environments. *Personality and Social Psychology Bulletin*, *29*(7), 819–833.
- Bernhardt, B. C., & Singer, T. (2012). The neural basis of empathy. *Annual Review of Neuroscience*, *35*, 1–23.
- Blanchard, R. J., & Blanchard, D. C. (1989). Attack and defense in rodents as ethoexperimental models for the study of emotion. *Progress in Neuro-Pharmacology and Biological Psychiatry*, *13*, S3–S14.
- Bourgeois, P., & Hess, U. (2008). The impact of social context on mimicry. *Biological Psychology*, *77*(3), 343–352.
- Buttelmann, D., Zmyj, N., Daum, M., & Carpenter, M. (2013). Selective imitation of in-group over out-group members in 14-month-old infants. *Child Development*, *84*(2), 422–428.
- Coello, Y., Bourgeois, J., & Iachini, T. (2012). Embodied perception of reachable space: how do we manage threatening objects? *Cognitive Processing*, *13*(1), 131–135.
- Coello, Y., & Iachini, T. (2015). Embodied perception of objects and people in space. *Perceptual and Emotional Embodiment: Foundations of Embodied Cognition*, *1*, 198.
- Coello, Y. E., & Fischer, M. H. (2016). *Foundations of embodied cognition: Perceptual and emotional embodiment*. Abingdon: Routledge/Taylor & Francis Group.
- Cole, S., Balcetis, E., & Dunning, D. (2013). Affective signals of threat increase perceived proximity. *Psychological Science*, *24*(1), 34–40.
- Cuddy, A. J., Fiske, S. T., & Glick, P. (2008). Warmth and competence as universal dimensions of social perception: The stereotype content model and the BIAS map. *Advances in Experimental Social Psychology*, *40*, 61–149.
- De Vignemont, F., & Iannetti, G. D. (2015). How many peripersonal spaces? *Neuropsychologia*, *70*, 327–334.
- Dotsch, R., & Wigboldus, D. H. (2008). Virtual prejudice. *Journal of Experimental Social Psychology*, *44*(4), 1194–1198.
- Fazio, R. H., & Dunton, B. C. (1997). Categorization by race: The impact of automatic and controlled components of racial prejudice. *Journal of Experimental Social Psychology*, *33*(5), 451–470.
- Ferri, F., Tajadura-Jiménez, A., Väljamäe, A., Vastano, R., & Costantini, M. (2015). Emotion-inducing approaching sounds shape the boundaries of multisensory peripersonal space. *Neuropsychologia*, *70*, 468–475.
- Festinger, L. (1954). A theory of social comparison processes. *Human Relations*, *7*(2), 117–140.
- Fini, C., Brass, M., & Committeri, G. (2015). Social scaling of extrapersonal space: target objects are judged as closer when the reference frame is a human agent with available movement potentialities. *Cognition*, *134*, 50–56.
- Fini, C., Costantini, M., & Committeri, G. (2014). Sharing space: The presence of other bodies extends the space judged as near. *PLoS One*, *9*(12), e114719.
- Fiske, A. P. (1992). The four elementary forms of sociality: Framework for a unified theory of social relations. *Psychological Review*, *99*(4), 689.
- Fiske, S. T., Cuddy, A. J., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, *11*(2), 77–83.
- Gallese, V., Keysers, C., & Rizzolatti, G. (2004). A unifying view of the basis of social cognition. *Trends in Cognitive Sciences*, *8*(9), 396–403.
- Genschow, O., Florack, A., & Wänke, M. (2014). Recognition and approach responses toward threatening objects. *Social Psychology*, *45*(2), 86–92.
- Genschow, O., & Schindler, S. (2016). The influence of group membership on cross-contextual imitation. *Psychonomic Bulletin & Review*, *23*(4), 1257–1265.

- Goff, P. A., Steele, C. M., & Davies, P. G. (2008). The space between us: Stereotype threat and distance in interracial contexts. *Journal of Personality and Social Psychology, 94*(1), 91.
- Gogel, W. C., & Tietz, J. D. (1977). Eye fixation and attention as modifiers of perceived distance. *Perceptual and Motor Skills, 45*(2), 343–362.
- Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology, 79*(5), 701.
- Green, M. C., Brock, T. C., & Kaufman, G. F. (2004). Understanding media enjoyment: The role of transportation into narrative worlds. *Communication Theory, 14*(4), 311–327.
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*(6), 1464.
- Gutsell, J. N., & Inzlicht, M. (2010). Empathy constrained: Prejudice predicts reduced mental simulation of actions during observation of outgroups. *Journal of experimental social psychology, 46*(5), 841–845.
- Haselton, M. G., & Buss, D. M. (2000). Error management theory: A new perspective on biases in cross-sex mind reading. *Journal of Personality and Social Psychology, 78*(1), 81.
- Hayduk, L. A. (1983). Personal space: Where we now stand. *Psychological Bulletin, 94*(2), 293.
- Iachini, T., Coello, Y., Frassinetti, F., & Ruggiero, G. (2014). Body space in social interactions: A comparison of reaching and comfort distance in immersive virtual reality. *PLoS One, 9*(11), e111511.
- Iachini, T., Coello, Y., Frassinetti, F., Senese, V. P., Galante, F., & Ruggiero, G. (2016). Peripersonal and interpersonal space in virtual and real environments: Effects of gender and age. *Journal of Environmental Psychology, 45*, 154–164.
- Iachini, T., Pagliaro, S., & Ruggiero, G. (2015). Near or far? It depends on my impression: Moral information and spatial behavior in virtual interactions. *Acta Psychologica, 161*, 131–136.
- Ito, T. A., Larsen, J. T., Smith, N. K., & Cacioppo, J. T. (1998). Negative information weighs more heavily on the brain: The negativity bias in evaluative categorizations. *Journal of Personality and Social Psychology, 75*(4), 887.
- Ito, T. A., & Urland, G. R. (2003). Race and gender on the brain: Electrocortical measures of attention to the race and gender of multiply categorizable individuals. *Journal of Personality and Social Psychology, 85*(4), 616.
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). *International affective picture system (IAPS): Technical manual and affective ratings* (pp. 39–58). NIMH Center for the Study of Emotion and Attention.
- Levy, S. R., West, T. L., Bigler, R. S., Karafantis, D. M., Ramirez, L., & Velilla, E. (2005). Messages about the uniqueness and similarities of people: Impact on US Black and Latino youth. *Journal of Applied Developmental Psychology, 26*(6), 714–733.
- Lipp, O. V., & Waters, A. M. (2007). When danger lurks in the background: attentional capture by animal fear-relevant distractors is specific and selectively enhanced by animal fear. *Emotion, 7*(1), 192.
- Macrae, C. N., Bodenhausen, G. V., Milne, A. B., & Jetten, J. (1994). Out of mind but back in sight: Stereotypes on the rebound. *Journal of Personality and Social Psychology, 67*(5), 808.
- Mooney, K. M., Cohn, E. S., & Swift, M. B. (1992). Physical distance and AIDS: too close for comfort? *Journal of Applied Social Psychology, 22*(18), 1442–1452.
- Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Harvesting implicit group attitudes and beliefs from a demonstration web site. *Group Dynamics: Theory, Research, and Practice, 6*(1), 101.
- Öhman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 130*(3), 466.
- Park, R. E. (1928). Human migration and the marginal man. *American Journal of Sociology, 33*(6), 881–893.
- Phelps, E. A., O'Connor, K. J., Cunningham, W. A., Funayama, E. S., Gatenby, J. C., Gore, J. C., et al. (2000). Performance on indirect measures of race evaluation predicts amygdala activation. *Journal of Cognitive Neuroscience, 12*(5), 729–738.
- Quesque, F., Ruggiero, G., Mouta, S., Santos, J., Iachini, T., & Coello, Y. (2017). Keeping you at arm's length: modifying peripersonal space influences interpersonal distance. *Psychological Research, 81*(4), 709–720.
- Ruggiero, G., Frassinetti, F., Coello, Y., Rapuano, M., Di Cola, A. S., & Iachini, T. (2017). The effect of facial expressions on peripersonal and interpersonal spaces. *Psychological Research, 81*(6):1232–1240.
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*(3), 220–247.
- Taffou, M., & Viaud-Delmon, I. (2014). Cynophobic fear adaptively extends peri-personal space. *Frontiers in Psychiatry, 5*, 122.
- Tajadura-Jiménez, A., Pantelidou, G., Rebacz, P., Västfjäll, D., & Tsakiris, M. (2011). I-space: the effects of emotional valence and source of music on interpersonal distance. *PLoS One, 6*(10), e26083.
- Taylor, S. E., Fiske, S. T., Etofff, N. L., & Ruderman, A. J. (1978). Categorical and contextual bases of person memory and stereotyping. *Journal of Personality and Social Psychology, 36*(7), 778.
- Tipples, J., Young, A. W., Quinlan, P., Broks, P., & Ellis, A. W. (2002). Searching for threat. *The Quarterly Journal of Experimental Psychology: Section A, 55*(3), 1007–1026.
- Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review, 117*(2), 440.
- Uzzell, D., & Horne, N. (2006). The influence of biological sex, sexuality and gender role on interpersonal distance. *British Journal of Social Psychology, 45*(3), 579–597.
- Valdés-Conroy, B., Román, F. J., Hinojosa, J. A., & Shorkey, S. P. (2012). So far so good: Emotion in the peripersonal/extrapersonal space. *PLoS One, 7*(11), e49162.
- Van Dantzig, S., Pecher, D., & Zwaan, R. A. (2008). Approach and avoidance as action effects. *Quarterly Journal of Experimental Psychology, 61*(9), 1298–1306.
- Wist, E. R., & Summons, E. (1976). Spatial and fixation conditions affecting the temporal course of changes in perceived relative distance. *Psychological Research Psychologische Forschung, 39*(2), 99–112.
- Xiao, Y. J., & Van Bavel, J. J. (2012). See your friends close and your enemies closer: Social identity and identity threat shape the representation of physical distance. *Personality and Social Psychology Bulletin, 38*(7), 959–972.
- Xiao, Y. J., Wohl, M. J., & Van Bavel, J. J. (2016). Proximity under threat: The role of physical distance in intergroup relations. *PLoS One, 11*(7), e0159792.
- Yabar, Y., Johnston, L., Miles, L., & Peace, V. (2006). Implicit behavioral mimicry: Investigating the impact of group membership. *Journal of Nonverbal Behavior, 30*(3), 97–113.