Social Cognition, Vol. 31, No. 1, 2013, pp. 72–80

HOW SHAPES INFLUENCE SOCIAL JUDGMENTS

Ursula Hess and Orna Gryc
Humboldt University, Berlin

Shlomo Hareli
University of Haifa

In two studies we investigated the impact of shapes in the environment on social judgments and decisions. The present research focuses on the notion that early sensorimotor experiences with shapes entrain social judgments that can be applied to people and situations. In early childhood we have different experiences with differently shaped objects, and one pertinent difference is whether an object is round or sharp. Sharp objects have the potential to hurt us and to be used aggressively in a way that round objects do not. Two studies confirmed that people who are exposed to sharp versus round shapes perceive others as more aggressive and are more likely to make an aggressive decision in a task requiring effortful thinking.

In early childhood we have experiences with differently shaped objects, and one such difference is whether an object is round or sharp. Sharp objects have the potential to hurt us and to be used aggressively in a way that round objects do not.

The ability of objects to evoke an intrinsic sense of meaning, for example, for a mountain to appear threatening, is referred to as their physiognomic property (cf. Werner, 1956). Thus, in the classic Takete–Maluma experiment by Köhler (1938/1947), participants reliably associated specific shapes with these two nonsense words. Takete was associated with sharp-edged objects and Maluma with round corners. In fact, research on the physiognomic properties of perceptual stimuli points to the tendency to evaluate angular lines more negatively and consider them more threatening than shapes comprised of curved lines (Aronoff, Barclay, & Stevenson, 1988; Aronoff, Woike, & Hyman, 1992; Bar & Neta, 2006; Uher, 1991). Likewise, people prefer curved stimuli over angular ones and this preference can already be observed among 3-year-old toddlers (Jadva, Hines, & Golombok, 2010). Further, people seem to associate round shapes with peacefulness and

Correspondence concerning this article should be addressed to Ursula Hess, Department of Psychology, Humboldt-University, Berlin, Rudower Chaussee 19, 12489 Berlin, Germany; E-mail: Ursula.Hess@hu-berlin.de; or to Shlomo Hareli, School of Management, University of Haifa, Haifa, Israel 31905; E-mail, shareli@gsb.haifa.ac.il.

angular shapes with aggression (Lindauer, 1990). Conversely, metaphors depict anger, an emotion often linked to aggression, as a sharp object by describing it as sharp anger or a spike of anger (Stefanowitsch, 2006).

Uher (1991) relates sharp edges to antagonism, noting that the combination of eyes and a zigzag motif, which is reminiscent of teeth, conveys bite threat in many cultures. This symbol can also be found simplified to just the zigzag, which is then interpreted in the same way. More generally, angular shapes are associated with a variety of dangerous objects such as nails, knives, or spines and hence may become associated with responses to threat. In line with this claim Bar and Neta (2007) showed that not only were sharp stimuli rated as more threatening, but exposure to sharp stimuli as opposed to round ones, increased activity in the amygdala, congruent with a reaction to an aversive stimuli (LeDoux, 2000) and social threat (Phelps et al., 2000).

Applying evolutionary concepts to art and esthetics, Coss (2003) points to the salience of piercing forms such as teeth and horns. He also notes that the reaction to sharp forms generalizes to objects that are not dangerous *per se*, for example, pedestrians in general deflect from plants near sidewalks that have "rapier-like" leaves (p. 91). Thus, figural properties of objects seem to have an effect on the way these objects are evaluated and responded to.

However, it is also possible that the mere presence of an object characterized by certain figural properties influences judgments of other, unrelated objects. Indeed, this tendency for social judgments to be influenced by environmental stimuli has been variously demonstrated in recent years. For example, Ackerman, Nocera, and Bargh (2010) showed that holding heavy or light clipboards, solving rough or smooth puzzles, and touching hard or soft objects influenced impressions and decisions formed about people and situations that were unrelated to the tactile experience involved. Such effects are typically explained by theories linking body experiences and cognition such as embodiment theory (cf. Barsalou, 1999; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Wilson, 2002) or conceptual metaphor theory (Lakoff & Johnson, 1980).

Embodiment theories propose that the simulation of sensory, motor, and introspective experiences form the foundation of conceptual representations. In this context, Williams, Huang, and Bargh (2009) posit that early sensorimotor experiences serve as the foundation for the later development of more abstract concepts and goals, in a process they call scaffolding. For example, people base their understanding of (more abstract) temporal relations on (more concrete) thinking about motion in space (Boroditsky & Ramscar, 2002). This idea follows the related theoretical proposals of conceptual metaphor theory (Lakoff & Johnson, 1980) and perceptual symbols system theory (Barsalou, 1999).

From an embodiment perspective, Niedenthal et al. (2005) suggest that conceptual knowledge is formed by storing sensory, motor, and introspective states that co-occur with the experience of events or the interaction with objects. Parts of this pattern can become activated through an inference process called pattern completion. Thus, when activating one aspect of the pattern others will be activated as well. An example for the notion that activation of an abstract concept activates a bodily representation is the finding that people who think about social exclusion literally feel colder (Zhong & Leonardelli, 2008). Similarly, individuals who think about disappointment reduce their posture in height (Oosterwijk, Rotteveel, Fischer, & Hess, 2009).

This process also allows for the underlying sensorimotor concept to activate associated more abstract concepts. These theories posit that early experience involving sensory, motor, and introspective experiences form the foundation of conceptual representations that help people make sense of more abstract concepts of their environment. Based on these theories and the findings presented above concerning the evaluation of shapes, the present research tests the possibility that the mere presence of sharp and round shapes affects unrelated social judgments and decisions.

Specifically, the present research investigated the hypothesis that in the presence of sharp shapes people will judge others as being more aggressive and respond to them in kind than when the same judgment and decision is made in the presence of round shapes. Specifically, Study 1 aimed at showing that handling sharp versus round shapes has an influence on social judgments about a person and Study 2 focused on testing how being in the presence of such shapes impacts on social decisions.

STUDY 1

The goal of Study 1 was to assess whether handling round versus sharp shapes has an impact on social perception. Specifically, participants were asked to first assemble a puzzle showing a human face. The pieces of the puzzle were either rounded or sharp (see Figure 1). Participants then were asked to make a series of personality judgments about the person shown in the assembled puzzle. We predicted that when the puzzle was composed of sharp shapes the target would be evaluated as more aggressive but as more warm when the puzzle was composed of round shapes.

METHOD

Participants. A total of 58 women and 54 men with a mean age of 33 years (*SD* = 8.9) participated individually.

Stimulus Material. Black and white photos of one man and one woman were taken from the FERET database (www.itl.nist.gov/iad/humanid/feret/feret_master.html). Two copies of each photo were mounted on wood and laser cut into round or sharp edged puzzle pieces respectively (see Figure 1), resulting in four puzzles. For round-shaped puzzle pieces the edges are easier to discern than for sharp-edged pieces. Hence to assure that the two puzzles were equally difficult the outer edge of each puzzle was already assembled.

Procedure. Participants who had signed a consent form were instructed to assemble a puzzle. The purported reason for this was that the gradual familiarity with the face would help them with the following judgment task. After completion of the puzzle, they were asked to rate on scales anchored with 0 (not at all) and 10 (very much), the degree to which the person whose photo they had assembled, was thoughtful, courteous, assertive, aggressive, irritable, caring, threatening, gentle, scary, tolerant, and hot tempered. A principal component analysis confirmed two factors, which explained 66% of the variance. The first factor, aggressive, con-

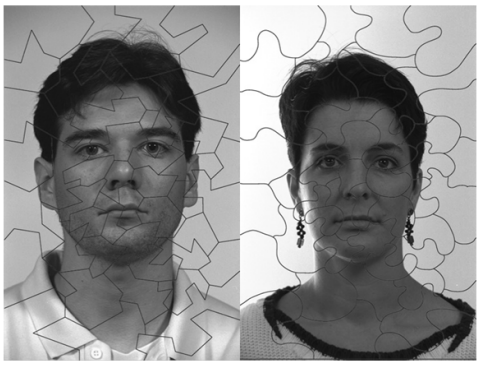

FIGURE 1. Example of the puzzle layouts used in Study 1.

sisted of the items aggressive, irritable, assertive, threatening, hot tempered, and scary ($\alpha = .86$), the second factor, warmth, consisted of the items caring, courteous, thoughtful, tolerant, and gentle ($\alpha = .87$).

RESULTS

No main effect or interactions involving target gender emerged. Hence, 2 (participant gender) × 2 (shape: round vs. sharp) analyses of variance were conducted on the composite variables aggression and warmth. For aggression, a significant main effect for participant gender emerged, $F(1, 108) = 8.68$, $p = .004$, $d = .52$, such that men overall rated the individual on the photo as more aggressive than did women (see Table 1). As predicted, when the photo was assembled from round shapes, participants rated the individual on the photo as significantly less aggressive than when the photo was assembled from sharp shapes, $F(1, 108) = 4.04$, $p = .047$, $d = .34$. For warmth as well, a significant main effect of shape emerged, $F(1, 108) = 3.89$, $p = .051$, $d = .36$, such that, as predicted, participants rated the individual on the photo as significantly more warm when the photo was assembled from round shapes, rather than sharp shapes. No further significant main effects or interactions emerged.

DISCUSSION

The results of Study 1 support the notion that being exposed to sharp versus round shapes activates the more abstract concepts of aggression and warmth. These concepts, once activated, then have a direct influence on social judgments of people. However, the participants had to manipulate the shapes, that is, it is possible that the influence stems from the haptic experience—similar to the results by Ackerman et al. (2010) rather than from the shape *per se.* We therefore conducted a second study in which participants saw sharp and round shapes, but did not have to handle them.

TABLE 1. Means and Standard Deviation as a Function of Participant Gender and Puzzle Piece Shape (Study 1) or Room Decoration Shape (Study 2)

Puzzle pieces	Sharp edges		Rounded edges	
Participant gender	Mean	SD	Mean	SD
	Aggression (Study 1)			
Men	5.09	1.57	4.92	1.53
Women	4.65	1.58	3.65	1.46
	Warmth (Study 1)			
Men	4.86	1.51	5.14	1.45
Women	5.08	1.54	5.92	1.46
Room decoration		Sharp		Round
	Aggressiveness Index (Study 2)			
Men	19.42	66.03	-35.31	38.80
Women	5.33	53.67	-34.90	33.78

Also, one could argue that participants in Study 1 were only moderately invested in the task. The puzzle was not very difficult to solve and the person perception task required only a few judgments. Hence, their judgment might have been easily influenced by the effects of incidental information, such as the shape of the puzzle pieces. In fact, Maglio and Trope (2012) recently suggested that embodiment effects are stronger when people think concretely rather than abstractly.

This raises the question of whether the effect of shape is still observable in a context where participants have to carefully think about their behavior, as other automatic effects—such as those involved in stereotyping—also are eliminated when effortful thought is brought to bear (Devine, 1989). To assess the impact of shapes on decisions that are taken with care and effort, in Study 2, participants had to make a decision whether to behave in a more cooperative or a more aggressive manner toward another person, which impacted on their own gain.

STUDY 2

In Study 2, participants were asked to play an economic trust game designed to assess the tendency to engage in cooperative, individualistic, and competitive modes of behavior. Under the pretext that the room was part of an art event later that day, either round or sharp shapes were placed on the walls and table (see Figure 2). We predicted that participants would be more likely to choose the aggressive game option when placed in a room with sharp shapes and the cooperative option when placed in a room with round shapes.

METHOD

Participants. A total of 26 men and 21 women with a mean age of 35 years (*SD* = 7.2) participated individually. Data from 3 participants had to be excluded because

FIGURE 2. Photos of the room used in Study 2.

they did not follow the instruction by allocating either more or fewer total points than allowed.

Procedure. Participants were invited individually to a room, which was decorated with round or sharp shaped objects of different materials (see Figure 2). Participants played a game with a "partner" that was modeled on a game by Hornstein and Deutsch (1967). Participants were told that their decisions would be paired with the decisions made by an unknown other participant at a later time. They were asked to pretend to be a plant manager and decide which types of objects their plant should produce. Participants were asked to strive to get more than 70 points in order to get additional course credit (in fact, all participants received this credit regardless of their choices).

They had three choices. The first choice was an individual option—for each object produced they would receive half a point. This decision is neither aggressive nor cooperative but rather a conservative choice that does not demand trust in the game partner. However, in this manner only 49 points can be obtained, which falls short of the 70 supposedly required for extra course credit. The second choice was the collaborative option, for each object produced they would receive 1.5 points, provided the "other" participant chose to produce a matching object. For those objects that do not match only .25 points would be received. This option is similar to the cooperation option in a prisoner's dilemma, as it requires trust in that the other game partner will also cooperate. The third choice was the aggressive option. Choosing this option would enable the participants to take points from the "other" player. For each object they chose to produce and for which the other did *not* produce a matching object, the participant would get three points and the other player would lose three points. By contrast, for each matching object they would get zero points. This option can be compared to the defect option in a prisoner's dilemma, as it is based on gaining an advantage over another who cooperates. Also, as in a prisoner's dilemma, both game partners loose when both chose this option. Participants could allocate their 98 objects across all three choices. By

including an individual option it is possible to distinguish disengagement from the game partner from aggression toward the game partner.

RESULTS

Overall women chose to allocate more points to the individual option (M = 29.95, SD = 20.82) than did men (M = 13.76, SD = 19.46), $F(1, 40) = 7.03$, $p = .011$, $d = .80$, but no main effect or interaction with shape emerged. We therefore calculated an aggressiveness index from the three choices, which weighted the individual option with 0, the cooperative option with -1 and the aggressive option with 1, such that larger values reflected the choice to produce a larger number of aggressive objects. A smaller value, by contrast, reflects the choice to produce a larger number of cooperative objects. A 2 (participant sex) × 2 (shape: round versus sharp) analysis of variance was conducted on this index. A main effect of shape emerged, $F(1, 40) = 7.70$, $p = .008$, $d = .88$. As predicted, when the room was decorated with sharp objects, the aggressiveness index was higher indicating that the participants chose the aggressive option relatively more than when the room was decorated with round shapes (see Table 1). No other significant main effects or interactions emerged.

DISCUSSION

The results of Study 2 confirm that being exposed to different shapes influences social judgments. In this case, participants were more likely to decide against the cooperative option and to produce more aggressive objects, which could potentially harm their game partner's success. This effect was quite strong as in the sharp shapes condition, the mean of the decisions was actually positive, suggesting that not only were participants less cooperative, but in fact, their decisions tended to clearly favor the aggressive option. This is noteworthy since more generally a bias toward choosing cooperation is observed, thus, for example, the mean rate of cooperation in prisoner's dilemma type games (which can include more than two choices) is 47% (Sally, 1995).

It is further noteworthy, that the presence of shapes influenced the participants' behavior such that an environment with more aggressive shapes entrained the increased use of a more aggressive game strategy. This means that the shapes themselves did not elicit more fear or apprehension in the participants—which would have arguably resulted in the use of either an ingratiating strategy or an increased use of the individual option. Rather, the affordances of the shapes had a guiding influence on the participants' cognitive strategy, as predicted by embodiment theory.

GENERAL DISCUSSION

Together, the two studies provide strong evidence that the shapes of objects around us can influence unrelated social judgments. Whereas in Study 1 participants ma-

nipulated the shapes, allowing for the possibility of haptic influences as well, in Study 2 the shapes were simply present in the room. Thus, early sensorimotor associations between sharpness and its potential for aggressive harm and roundness and warmth or pleasantness, seem to evoke more abstract concepts, which are then applied to social situations.

In fact, whereas the social judgment in Study 1 was fairly simple and one may assume that participants were not greatly invested in the task, in Study 2 participants had to think carefully about their choices and do some mental arithmetic in an effort to reach the 70 points supposedly needed to get extra course credit.

Effortful thought frequently does prevent automatic processes from influencing social judgments. As noted above, Maglio and Trope (2012) found embodiment effects to wane when participants were made to think at a higher level of mental construal. Similarly stereotyping effects can be eliminated when effortful thought is brought to bear (Devine, 1989) and semantic priming effects on social judgments are stronger when people construe the to-be-judged objects in more concrete terms (Henderson & Wakslak, 2010). It is noteworthy that this was not the case in the present study. Our findings are thus more in line with studies showing that effortful thinking is more liable to the effects of another automatic process—the use of the availability heuristic (Dijksterhuis, Bos, van der Leij, & van Baaren, 2009). Thus, the present findings demonstrate the potential of environmental stimuli to elicit the abstract concept, with which they are associated and by that route to influence even social decisions of some complexity.

These findings have considerable implications for everyday life. Social judgments are made in varying situational contexts and numerous decorative options such as plants, wall-paper designs, or art objects, potentially surround the decision maker. Further, artifacts that people buy can have different shapes. The present research suggests that the decision to opt for aggression versus cooperation or the perception of the other as aggressive may well be in part a function of the surroundings in which this judgment was made. From this perspective, it may be a good thing that the oval office is oval and not triangular.

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