

The shape of you: do people match a specific geometric figure with identity?

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Abstract

Since more than a century, psychologists have been interested in how visual information can arouse emotion. Several studies have shown that rounded figures evoke positive feelings due to their link with happy/baby-like expressions, compared with sharp angular figures, usually associated with anger and threatening objects having negative valence. However, to date, no-one has investigated the preference to associate a simple geometrical shape to one's own identity, to a close and positive person like the best friend, or to a potentially dangerous one as a stranger. Through 2 online surveys we asked participants to associate a geometric shape, chosen among a circle, a square and a triangle, to each of three identities, namely "you" (the self), "a friend" or "a stranger". We hypothesized that the circle would be more associated with the self, the square with the friend and the triangle with the stranger. Moreover, we investigated whether these associations are modulated by 3 personality traits: aggressivity, empathy and social fear. How predicted, we found that participants associate more often the circle with the self, the circle and the square with the best friend, whereas matched the angular shapes (both the triangle and the square) to the stranger. On the other hand, the possibility that personality traits can modulate such associations was not confirmed. The study of how people associate geometrical figures with the self or with other identities giving them an implicit socio-affective connotation, is interesting for all the disciplines interested in the automatic affective processes activated by visual stimuli.

Introduction

Several evidences have shown that positive stimuli with biological relevance as food and faces (Gronau et al., 2003; Sui & Liu, 2009; Vuilleumier, 2005), capture attention more than do most common objects with a lower salience (e.g., Ro et al., 2001). Furthermore, emotionally-charged expressions and baby faces draw attention more than neutral faces (Brosch et al., 2007; Palermo & Rhodes, 2007), whereas other stimuli can also strongly grasp our attention, including knives, guns, syringes and dangerous animals (e.g., snakes, spiders), namely threatening stimuli which require a rapid response. The ability to fastly recognize the geometrical patterns associated to such dangerous or rewarding objects has evolutionary meaning, since all these items automatically arouse specific emotions and behaviors that are determinant for survival (Gable & Harmon-Jones, 2008; Ohman & Mineka, 2001).

In fact, several studies have shown that curved lines and symmetrical shapes are preferred given their association with faces and particularly with the happiness expression and the infant face, containing more curvilinear elements. On the other hand, angularities and asymmetrical shapes are disliked, due to their association with the anger expression and dangerous objects as knives. In general we can assert that people prefer curved shapes to their angular counterparts (e.g., Silvia & Barona, 2009; Watson et al., 2012). While it is known that stimulus valence is central to approach and avoidance behavior, the exact nature of the relationship between curvature/angularity and the approach/avoidance pattern still needs to be tested.

In 1993 Ekman confirmed the presence of cross-cultural regularities in facial displays of emotion. In particular, anger and happiness masks used in ritual functions of different cultures, revealed that a set of geometric patterns, rather than actual facial features, convey different emotional meanings (Aronoff et al., 1992). A further step was made by Aronoff and colleagues (Aronoff, 2006). They demonstrated the power of non-representational visual patterns to produce meaning by presenting materials that included geometric shapes in a variety of line drawings, large-scale physical movement in classical ballet (e.g., body display and arm display) and configurations among individuals in 17th century Dutch art. Results across all studies suggested that for the emotions of anger and happiness, at least, meaning is conveyed by specific geometric properties of the visual display with angularities more likely associated with the anger and roundness with the happiness.

There is also a conspicuous literature investigating the subjective attitudes conveyed by simple geometric shapes. For example, in 1957 Osgood and coworkers asked to evaluate some geometric patterns on a set of subjective semantic differential scales and indicated the degree of “badness”, “potency” and “activity” of each visual stimulus (Osgood et al., 1957). It turned out that whereas sharp images conveyed negative meaning, the rounded ones elicited positive attitudes (Aronoff et al., 1992). Similar findings were found by Bar and Neta (Bar & Neta, 2006) using a like/dislike forced choice task: participants disliked neutral objects comprised of pointed features and sharp angles significantly more than curved ones (e.g., a watch with a sharp-angled contour in comparison with curved contour). Similarly Pavlova and coworkers (Pavlova et al., 2005) found a positive correlation between rated negative emotions and the perceived instability of geometric shapes such as the triangle and the oval.

Curiously, in 2012 Sui and coworkers developed a novel associative learning approach in order to demonstrate the higher salience of self-relevant over non-self relevant features. Different geometric shapes (i.e., circle, square and triangle) were associated by the experimenter to a label indicating the self (e.g., “you”), a familiar other (e.g., “friend”) or an unfamiliar other (e.g., “stranger”). Then participants had to judge, in a rapid presentation task, if the shape and the label were correctly matched. A substantial advantage in terms of faster reaction times and higher accuracy was found when participants identified the shape (whatever this was) associated with the self, relative to non-self-matched pairs. They called this advantage “self-prioritization benefit” and proposed that self-associated shapes automatically evoke the reward system increasing attention.

However, Sui and coworkers (2012) did not assess whether the different shapes associated to the identities played a role on their dependent variables. In fact, considering the preference and the positive attitudes associated with the curved lines, one might wonder whether the RTs and the accuracy to identify the circle-self pair would have been further faster compared with those to identify the triangle-self pair. Similarly, it might also be that the stranger-triangle match could be easier to recognize since both the stranger and the triangle would implicitly convey some sort of threat. The square, that is neither positive and rounded as the circle nor sharpened and negative as the triangle, might be the geometrical shape which more likely would have improved the performance when matched with the friend.

To summarize, since more than a century psychologists have been interested in how people associate visual information with emotional valence (Barrett & Bar, 2009; Lundholm, 1921). Several studies have shown that rounded figures evoke positive feelings due to their link with happy/infant-like expression, compared with sharp/angular figures, usually associated with the anger expression and threatening objects having negative valence (Bar & Neta, 2006; Carbon, 2010; Leder & Carbon, 2005; Silvia & Barona, 2009). However, to date, no investigation has been carried out to assess the preference to associate a simple geometrical shape to oneself, to a close and positive person like the best friend, or to a potentially dangerous one such as a stranger. Starting from the aforementioned literature we aimed to investigate if there is a preference for associate a geometrical shape to a specific identity. Particularly, we asked our participants to associate a figure amongst the circle, the square and the triangle, to only one identity, namely “you” (the self), “a friend” or “a stranger”. Our main hypotheses (*H*) were:

H1a: Individuals are more likely to associate the circle with the self;

H1b: Individuals are more likely to associate the square with the best friend;

H1c: Individuals are more likely to associate the triangle with the stranger.

We also propose 3 further hypotheses based on personality traits of our participants. In fact, if the link between the valence associated to geometric patterns depends on the implicit biological meaning that such shape convey (i.e., circle = happy/infant face = approach; angles = dangerous object = withdraw), we predict that personality traits such as aggressivity (i.e., an aggressive attitude), empathy (i.e., an attitude to share emotions) and social phobia (i.e., an attitude to see strangers as dangerous) could influence the geometrical shape that participants decide to associate with the self the friend and the stranger.

Particularly:

H2a: Aggressive individuals are more likely to associate with the self the triangle compared with less aggressive ones;

H2b: Empathic individuals are less likely to associate to the self the circle/more likely to associate to the friend the circle compared with lesser empathic ones;

H2c: Social phobic individuals are more likely to associate with the stranger the triangle, compared with less social phobic ones.

Experiment 1

In this experiment, besides the key question regarding the shape associated with the self, the friend or the other, we asked participants to fill 3 questionnaires to assess whether aggressivity, empathy and social fear influence the shape associated with the 3 identities. We expected that participants self-reporting higher aggressivity traits could associate the triangle more often with the self, due to the implicit association of this geometric shape with dangerous stimuli (Wrangham, 2018). On the other hand, we predicted that empathic people would more likely share the circle with the friend, compared with less

empathic individuals (e.g., Eisenberg & Fabes, 1990). Finally, we expected that individuals with high social fear would associate the triangle to the stranger more often compared to individuals with lower social fear, less prone to judge the stranger as dangerous (Stopa et al., 2013).

Materials And Methods

Participants

Three hundred forty-nine Italian participants responded to internet advertisements and filled the survey. Of them, 236 (201 female) filled the survey correctly, namely associating each and every figure with a single and exclusive identity, and vice versa (e.g., participants that associated the square with both the “self” and the “friend” were excluded). The *M* age of the sample was 26.7 (*SD* =7.1).

Procedure

The survey (written in Italian) was developed and administered with Google Forms and it was composed of 6 sections. The first one was the informed consent, in the second one participant had to fill their socio-demographic (i.e., age, sex, employment, handedness) and anthropometric data (i.e., weight and height). The third section was the figure-identity association task: particularly, the instruction was: “You have to indicate which geometric shape among those shown below, you would associate with you, your best friend and a stranger. There is only one rule to respect: a geometric shape can be associated with a single identity (you cannot associate the same shape with two different identities)”. Then 3 questions were shown: “Which of those figures is you? / Which of those figures is your best friend / Which of those figures is a stranger?”. Below each question, a circle, a square and an equilateral triangle were displayed and could be selected with a mouse click (see Figure 1). Both the order of the questions and of the geometric shapes were shown in a random order. After this section participants filled the Italian versions of the Aggression Questionnaire (Buss & Perry, 1992; Fossati et al., 2003) in section 4, the Balanced Emotional Empathy Scale (Mehrabian, 1996; Meneghini et al., 2006) in section 5 and the Social Fear Scale (Raulin & Wee, 1984) in section 6.

Questionnaires

The Aggression Questionnaire (AGQ; Buss & Perry, 1992) is a self-report scale designed to measure four major components of aggressivity (physical aggressivity, verbal aggressivity, anger and hostility) and consists of 29 items which are rated on a 7-point Likert scale from 1 (extremely uncharacteristic of me) to 7 (extremely characteristic of me).

The Balanced Emotional Empathy Scale (BEES; Mehrabian, 1996) is a self-report questionnaire assessing emotional empathy, defined as an individual's tendency to vicariously share other people's emotions. It comprises 30 items, in which participants are asked to express their degree of agreement to each of the 30 statements comprising the instrument, on a 7-point Likert scale, with values ranging from +3 (“completely agree”) to -3 (“completely disagree”).

The Social Fear Scale (SFS; Raulin & Wee, 1984) is a self-report questionnaire assessing the responder's social phobia. It consists of 36 items with a dichotomous response (true-false) aimed at measuring the avoidance of interpersonal relationships, social inadequacy and the scarcity of social relationships.

Results And Discussion

Data analyses were carried out using IBM SPSS Statistics version 20 (IBM Corp). First of all, for descriptive purpose we analyzed the correlation between the scores of the 3 questionnaires. Applying the Bonferroni correction for multiple comparisons (significance threshold set at $p < 0.0083$) we found a positive correlation between the AGQ score and the SFS score ($r = 0.3735, p < 0.001$) and no other correlation.

Then, we carried out 3 Chi-square tests to evaluate whether the geometric shapes (Circle, Square, Triangle) were associated with the 3 identities (Self, Friend, Stranger) differently from what could be expected from chance. We found that the figures associated with the Self ($\chi^2_{(2)} = 14.246, p = 0.001$) and with the Stranger ($\chi^2_{(2)} = 39.941, p < 0.001$) were statistically different from chance (see Figure 2). Post-hoc comparisons (statistical significance set at $p < 0.012$ due to the Bonferroni multiple comparisons correction) showed that the shape significantly more associated to the Self is the Circle, compared with both the Square ($\chi^2_{(1)} = 9.830, p = 0.002$) and the Triangle ($\chi^2_{(1)} = 9.830, p = 0.002$). On the contrary, the Circle was the shape less associated with the Stranger compared with both the Square ($\chi^2_{(1)} = 22.781, p < 0.001$) and the Triangle ($\chi^2_{(1)} = 34.766, p < 0.001$). The frequency which each shape was associated to the Friend did not differ from chance, but there was a strong tendency ($\chi^2_{(2)} = 5.754, p = 0.056$). No other significant post-hoc was observed. All the data are reported in Table 1.

	Self		Friend		Stranger		Chance	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Circle	106	44.9	93	39.4	37	15.7	78.7	33.3
Square	65	27.5	80	33.9	91	38.6	78.7	33.3
Triangle	65	27.5	63	26.7	108	45.8	78.7	33.3

Table 1. The frequency of association of each geometric shape (Circle, Square and Triangles) to each identity (Self, Friend and Stranger) reported as observed frequency (*N*) and in percentage (%) for the Experiment 1.

These findings confirmed our hypotheses *H1a* and *H1c*. Particularly, as predicted by hypothesis *H1a*, individuals are more likely to associate the circle to the self, possibly because of the positive valence associated to curved shapes compared to angular shapes and their association with dangerous entities. On the contrary, the circle is the shape less frequently associated to the stranger, whereas the angular shapes were associated with this identity, partially confirming hypothesis *H1c*, since there was no difference between the triangle and the square. Regarding the shape associated to the friend (*H1b*), participants showed no significant preference.

We carried out 3 further Chi-square tests to evaluate if the assessed personality traits determined a different figure-identity matching. With this aim, we divided our sample according to the median score to each questionnaire, obtaining 2 groups for each independent variable (Low Aggressivity vs. High Aggressivity, Low Empathy vs. High Empathy and Low Social Fear vs. High Social Fear). We did not find any significant interaction between the figure-identity associations and the assessed personality traits.

Hence, contrary to our predictions, the figure-identity matching was not influenced by aggressivity, empathy and social fear of our participants, disconfirming our *H2a*, *H2b* and *H2c* hypotheses.

Experiment 2

In this experiment we assessed again which geometrical shape is more likely to be associated with the three identities, and whether personality traits can influence such matching. However, in this experiment we assessed personality using a broader-bandwidth tool, the Italia Personality Inventories (Perussia, 2006), a questionnaire specifically validated for the Italian sample. Such inventory evaluates 7 personality traits/factors: dynamism, vulnerability, empathy, conscientiousness, imagination, defensiveness, introversion and was chosen for 2 main reason: i) the Italia Personality Inventories is developed and validated for the Italian population, which our sample belongs to; ii) some of the personality traits assessed by this inventory those already assessed in the previous experiment, but the inventory is not limited to them. In this way we wished to confirm the tendency to associate the self with the circle and the stranger with the angular shapes but wanted to deepen the possible interaction between figure-identity matching and personality traits related to aggressivity, empathy and social fear using another self-report instrument.

Materials and Methods

Participants

Four hundred thirty-nine Italian participants responded to internet advertisements and filled the survey. Of them, 326 (256 female) filled the survey correctly, namely associating each and every figure with a single and exclusive identity, and vice versa (e.g., participants that associate the square with both the “self” and the “friend” have been excluded). The *M* age of the sample was 27.6 (*SD* = 8.0).

Procedure

The procedure and the survey were the same as described in Experiment 1 but, in this case, the three last sections in which the AGQ, the BEES and the SFS were presented, was replaced in one section with the General Italia Personality Inventory (Perussia, 2006).

Questionnaire

The General (or Great) version of the Italian Personality Inventory (ITAPI-G) consists of 105 items, 15 items for each of the seven traits-factors which are: i) Dynamism (i.e., resourcefulness, curiosity, vivacity);

ii) Vulnerability (i.e., discomfort, fear, suffering); iii) Empathy (i.e., solidarity, sociability, sensitivity); iv) Conscientiousness (i.e., perseverance, precision, rationality); v) Imagination (i.e., creativity, feeling, fantasy); vi) Defensiveness (i.e., rigidity, materiality) and vii) Introversion (i.e., introspection, self-sufficiency, isolation). For each statement, participants are asked to report their degree of agreement on a 4-points Likert scale ranging from 1 (completely disagree) to 4 (completely agree). The higher is the score of a specific trait, the stronger is that specific trait.

As anticipated, the choice of ITAPI-G was determined by two reasons: i) such inventory is developed and validated in a Italian population which our sample represents; ii) we supposed that several factors assessed through the ITAPI correlate with the personality traits of our interest (aggressivity, empathy and social phobia) and would thus be suitable to deepen our *H2*. To better check such assumption, before carrying out Experiment 2 the ITAPI-G, AGQ, BEES and SFS were administered via Google Forms to an additional independent sample of 102 participants (90 females, *M* age = 30.8, *SD* = 9.8). Then we tested the correlation between the AGQ, BEES and SFS scores and the scores of the 7 factors of the ITAPI-G. Due to the Bonferroni correction for multiple comparisons the statistical significance threshold was set at $p < 0.0023$. All the correlations are resumed in Table 2. In particular, the AGQ score is positively correlated with the Defensiveness score ($p < 0.001$) and negatively correlated with the Empathy score ($p < 0.001$), the BEES score is positively correlated with the Empathy score ($p < 0.001$), and the SFS score is positively correlated with the Introversion score ($p < 0.001$). The vulnerability score is positively correlated with both the AGQ and the SFS scores ($p < .001$). Dynamism, Consciousness and Imagination (the latter slightly correlated with the BEES score) were not related with any trait of interest, and their potential effect on figure-identity matching was anyhow investigated for explorative purposes.

ITAPI-G factors	Aggression Questionnaire		Balanced emotional empathy scale		Social Fear Scale	
	<i>R</i>	<i>p</i>	<i>R</i>	<i>p</i>	<i>R</i>	<i>p</i>
Dynamicity	.0277	=.782	.1168	=.242	-.1698	=.088
Vulnerability	.5800	<.001*	.0666	=.506	.3827	<.000*
Empathy	-.3441	<.001*	.5182	<.001*	-.1351	=.176
Consciousness	-.1230	=.218	.1392	=.163	.0342	=.733
Imagination	.1771	=.075	.2607	=.008	.1756	=.078
Difensiveness	.5626	<.001*	-.0149	=.882	.2617	=.008
Introversion	-.1921	=.053	-.2079	=.036	.4006	<.001*

Table 2. Correlation between the score of the questionnaires used in Experiment 1 and the scores of the 7 factors of the ITAPI-G in Experiment 2. Asterisks indicate significant correlations.

Results And Discussion

Data analyses were carried out using IBM SPSS Statistics version 20 (IBM Corp). First, we carried out 3 Chi-square tests to evaluate whether the geometric shapes (Circle, Square, Triangle) were associated with

the identities (Self, Friend, Stranger) differently from chance. We found that the figures associated with the Self ($\chi^2_{(2)} = 17.933, p < 0.001$), with the Friend ($\chi^2_{(2)} = 16.276, p < 0.001$) and with the Stranger ($\chi^2_{(2)} = 53.822, p < 0.001$) were all statistically different from chance (see Figure 3). Moreover, post-hoc comparisons (statistical significance set at $p < 0.012$ due to the Bonferroni multiple comparisons correction) showed that the shape significantly more associated to the Self was the Circle, compared with both the Square ($\chi^2_{(1)} = 16.538, p < 0.001$) and the Triangle ($\chi^2_{(1)} = 7.230, p = 0.007$). Regarding the Friend, both the Circle ($\chi^2_{(1)} = 16.343, p < 0.001$) and the Square ($\chi^2_{(1)} = 6.821, p = 0.009$) were significantly more associated to this identity compared with the Triangle. Finally, the Triangle ($\chi^2_{(1)} = 53.313, p < 0.001$) and the Square ($\chi^2_{(1)} = 39.640, p < 0.001$) were the shapes significantly more associated to the Stranger compared with the Circle. No other significant post-hoc comparisons were observed. All the data are reported in Table 3.

	Self		Friend		Stranger		Chance	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Circle	143	43.9	136	41.7	47	14.4	108.7	33.3
Square	82	25.2	113	34.7	131	40.2	108.7	33.3
Triangle	191	31.0	77	23.6	148	45.4	108.7	33.3

Table 3. The frequency of association of each geometric shape (Circle, Square and Triangles) to each identity (Self, Friend and Stranger) reported as observed frequency (*N*) and in percentage (%) for the Experiment 2.

These findings confirm and extend those of Experiment 1. More specifically, as previously observed, the figure that individuals associate more often with the self is the circle. Regarding the stranger, although with no difference between the triangle and the square, the angular shapes were more often associated to it, with respect to the circle. Interestingly, increasing the sample, an effect emerged also for the friend identity: the triangle was the figure less often associated to the participant's best friend compared with both the circle and the square. Such result did not confirm our hypothesis *H1b* but can be easily explained: we asked, "Which of those figures is your best friend?" and, being the best friend someone you can trust, the choice to avoid the triangle could reflect the individual's perception of the low threat associated to his/her best friend.

In order to assess whether the 7 personality traits influence the figure-identity association, we divided our sample according to the median score to each trait, obtaining 2 groups for each independent variable (Low Dynamicity vs. High Dynamicity, Low Vulnerability vs. High Vulnerability, Low Empathy vs. High Empathy, Low Conscientiousness vs. High Conscientiousness, Low Imagination vs. High Imagination, Low Defensiveness vs. High Defensiveness and Low Introversion vs. High Introversion).

Again, contrary to our *H2*, the figure-identity matching was not influenced by any of the ITAPI-G factors. Despite that, an interesting interaction approached statistical significance. Particularly, the figure associated to the self by the high- and low-Conscientiousness participants were almost significantly

different ($\chi^2_{(2)} = 4.816, p = 0.090$; see Supplementary table 1). Therefore, also assessing the personality traits we were interested in (aggressivity, empathy and social phobia) by means of another instrument, we did not confirm our *H2a, H2b, H2c*.

General Discussions

Our *hypotheses 1* were substantially confirmed, the results appearing to be congruent with the predictions one can make based on the relevant literature. Our participants associated more often the circle with the self, the circle and the square with the best friend, whereas they used the angular shapes (both the triangle and the square) to represent the stranger. On the other hand, the possibility that personality traits modulate such associations (*H2*) was not confirmed.

Biases toward visual objects can be induced not only by their semantic meaning (e.g., food, or cutting object) but also by low-level perceptual properties: we can associate a positive or negative valence to an object (also presented as a picture) with a single gaze, depending on the presence of sharp-angled or curved features. For example the group of Velasco and Salgado-Monteiro, reported that positive words and judgments are more often associated with rounded shapes and negative ones with angular ones (Salgado Montejo et al., 2015; Velasco et al., 2016). In line with this literature, we confirmed (*H1a*) that individuals prefer the circle to represent themselves compared with the angular shapes. On the other hand, we proposed (*H2a*) that aggressive individuals, namely individuals that report enacting toward others with the intention to cause harm (Anderson & Bushman, 2002), would have preferred to associate the triangle with the self, due to its link with threatening object shapes and with angry facial expressions (Aronoff, 2006; Osgood et al., 1957). This effect did not occur, neither when we divided our sample according to the score of the AQ (Buss & Perry, 1992) nor when we used the Vulnerability and the Defensiveness (both positively correlated with the AQ score) factors of the ITAPI-G (Perussia, 2006). We point out that we preferred to use an upward-pointing equilateral triangle instead of a downward-pointing one, to be consistent with the other 2 classical geometrical shapes, since also the typicality of a figure can play a role in its associated valence (Reber et al., 2004). Despite that, the research has often demonstrated that, although the angular figures are liked less than curved ones, the downward-pointing triangle, maybe due to the link with the shape drawn by the eyebrows when we are angry, is further disliked and associated with threat (e.g., Larson et al., 2012; Ro et al., 2001). Hence the equilateral triangle, although negatively valenced, could be not so “threatening” to the point of becoming associated with aggressivity.

Probably for the same reason, we found no difference between the angular shapes associated with the stranger and no interaction with the personality traits of social phobia, as assessed with the SFS in Experiment 1 (Raulin & Wee, 1984) and with the Vulnerability and Introversiveness factors of the ITAPI-G in Experiment 2 (Perussia, 2006). Particularly, we had predicted that the triangle would be matched more frequently compared with the other figures to the stranger (*H1c*) being it the most threatening among the identities proposed. Actually, although the circle was the figure less matched with the stranger, there was no difference in the frequency with which the triangle and the square were associated with this identity.

We had also predicted that such matching would be further stronger for social phobic individuals (*H2c*), since social phobia is defined as the persistent fear of one or more social situations in which a person is exposed to unfamiliar people. Particularly, the phobic person fears that he/she will act in a way or show anxiety symptoms that will be embarrassing and humiliating due to the stranger response/judgment (Bögels et al., 2010). Such fear for the stranger did not emerge as predicted as an increased triangle-stranger matching.

Lastly, we had proposed that the square, which has not a clear emotional connotation compared to the other 2 figures, would be frequently associated with the friend (*H1b*), being this identity not “positive” as the self but also not negative as the stranger. Whereas in Experiment 1 we found no significant differences (albeit a tendency was present), with the larger sample of Experiment 2 we found a preference to associate both the circle and the square with the friend, as compared with the triangle. This finding can be easily explained by the peculiar question that we formulated: “Which of those figures is your best friend?”. Obviously for most of us, the best friend elicits positive attitudes, thus deserving to be associated with the circle, other than with the square. On the contrary, one’s best friend certainly would not be a threat, and this could be the reason why the triangle was less matched with this identity. This explanation can hold true also regarding the lack of evidence supporting hypothesis *H2b*, in which we had predicted a role of empathy in figure-identity matching. Empathy refers to sensitivity to, and understanding of, the mental states of others. From an emotional point of view it is “an affective response more appropriate to someone else's situation than to one's own” (Hoffman, 1987) or, as affirmed by Eisenberg and Strayer (Eisenberg & Strayer, 1987) “an emotional response that stems from another's emotional state or condition and that is congruent with the other's emotional state or situation”. Such statement has led us to hypothesize that more empathic individuals would be more prone to “share” the circle with the friend, in a similar manner they shared affective feelings due to their positive relationship. We did not observe such effect independently of the instrument used to assess empathy (i.e., the BEES in Experiment 1 and the ITAPI-G in Experiment 2) probably because, let aside empathy, our participants were prone to “share” the circle with their best friend as observed in Experiment 2.

Our study confirms that the three most common geometrical shapes, the circle, the square and the triangle, are characterized by an expressive halo that influences our decision to associate them with ourselves, our best friend or a stranger with a non-random pattern. More specifically, the circle appears to be the most positive shape: with its symmetry, regularity and curvilinearity, it is the figure most frequently associated with the self and the best friend. The square, that is an angular shape but with a conformation not as sharp as the triangles frequently associated to the friend and to the stranger. With this latter identity, the triangle is the figure most frequently chosen together with the square: indeed, according to the relevant literature the triangle is the most negative and threatening shape amongst the geometrical shapes used in our experiments. Although our hypotheses involving the interaction between personality traits as aggressivity, empathy and social phobia seemed consistent with the literature, we did not confirm any. As said, a reason can lie in the use of the prototypical equilateral triangle instead of the downward-pointing version that is described as the most threatening of all geometrical shapes. Secondarily, the frequent matching circle-friend might have overshadowed the empathy effect.

Hence, future studies could replace the equilateral triangle with a differently shaped or a differently oriented triangle and particularly with a sharper triangle (e.g., isosceles triangle) than the equilateral or with a downward-pointing triangle, the most “threatening” among the tested triangles. If this kind of triangle would arouse more negative emotion due to its similarity with dangerous objects or with the anger expression, maybe also the personality traits could interact with the figure-identity matching. Moreover, it is possible that personality traits actually do not influence the figure-identity associations using a self-reported/explicit task but that they could do it by using more implicit tasks as the Implicit Association Test, or paradigms such as flanker and priming, or the associative learning approach proposed by Sui and coworkers (Sui et al., 2012). Finally, it would be interesting to replicate this study using clinical scales (e.g., Minnesota Multiphasic Personality Inventory or the Symptom Checklist-90) to evaluate whether psychiatric symptoms modulate the figure-identity associations. We point out that the Conscientiousness factor of the ITAPI-G, describing the perseverance, precision, rationality of the responder, has modulated the matching, although not in a statistically significant way (see supplementary material). This personality trait is strongly expressed in several clinical conditions (e.g., obsessive-compulsive personality, anorexic patients, high functioning autism) and deserves to be deepened using clinical populations. Finally, we point out that, due to the online distribution of the survey, our samples were not balanced for sex, with a high preponderance of female participants. Despite that the tendency between male and female in the figure-identity association task were very similar, with a slight sex-difference regarding the shape associated with the friend (see Supplementary table 2). We think, thus, that deepen such sex differences could be suitable and interesting, also considering personality traits as empathy and aggressivity usually differently expressed by women and men.

The study of how people associate geometric figures with the self or with other identities giving them an implicit socio-affective connotation, is interesting for both marketing purposes (Salgado Montejo et al., 2015; Salgado-Montejo et al., 2015), for clinical assessment (Wells, 1950) and in general for all the disciplines interested in the affective processes triggered by visual stimuli.

Declarations

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Authors' contributions

VM conceived, designed the experiment, and collected, analyzed and interpreted the data. VM wrote the manuscript and LT provided critical revisions and contributed to the final version of the manuscript by reviewing and revising the text. All authors approved the final version for submission and agreed to be accountable to for all aspects of the work.

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Figures

Figure-Identity

You have to indicate which geometric shape among those shown below, you would associate with you, your best friend and a stranger. There is only one rule to respect: a geometric shape can be associated with a single identity (you cannot associate the same shape with two different identities)

Which of those figures is you?	Which of those figures is your best friend?	Which of those figures is a stranger?
 <input type="radio"/> Square	 <input type="radio"/> Square	 <input type="radio"/> Triangle
 <input type="radio"/> Circle	 <input type="radio"/> Triangle	 <input type="radio"/> Circle
 <input type="radio"/> Triangle	 <input type="radio"/> Circle	 <input type="radio"/> Square

Figure 1

The third section of the survey, in which participants were asked to choose a geometric shape to associate with the self, the best friend and the stranger (figure-identity association task). Both the order of the questions (identities) and the order of the answers (figures) were randomized.

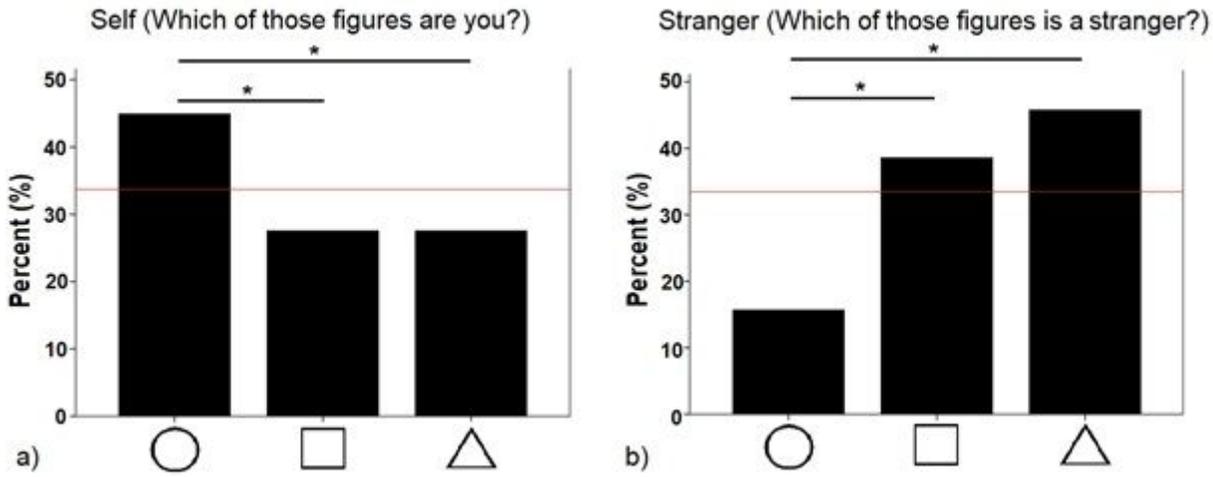


Figure 2

Association of the different geometric shapes with Self and Stranger, expressed in percentage. Asterisks indicate frequency different from chance indicated by the red line ($p < 0.012$).

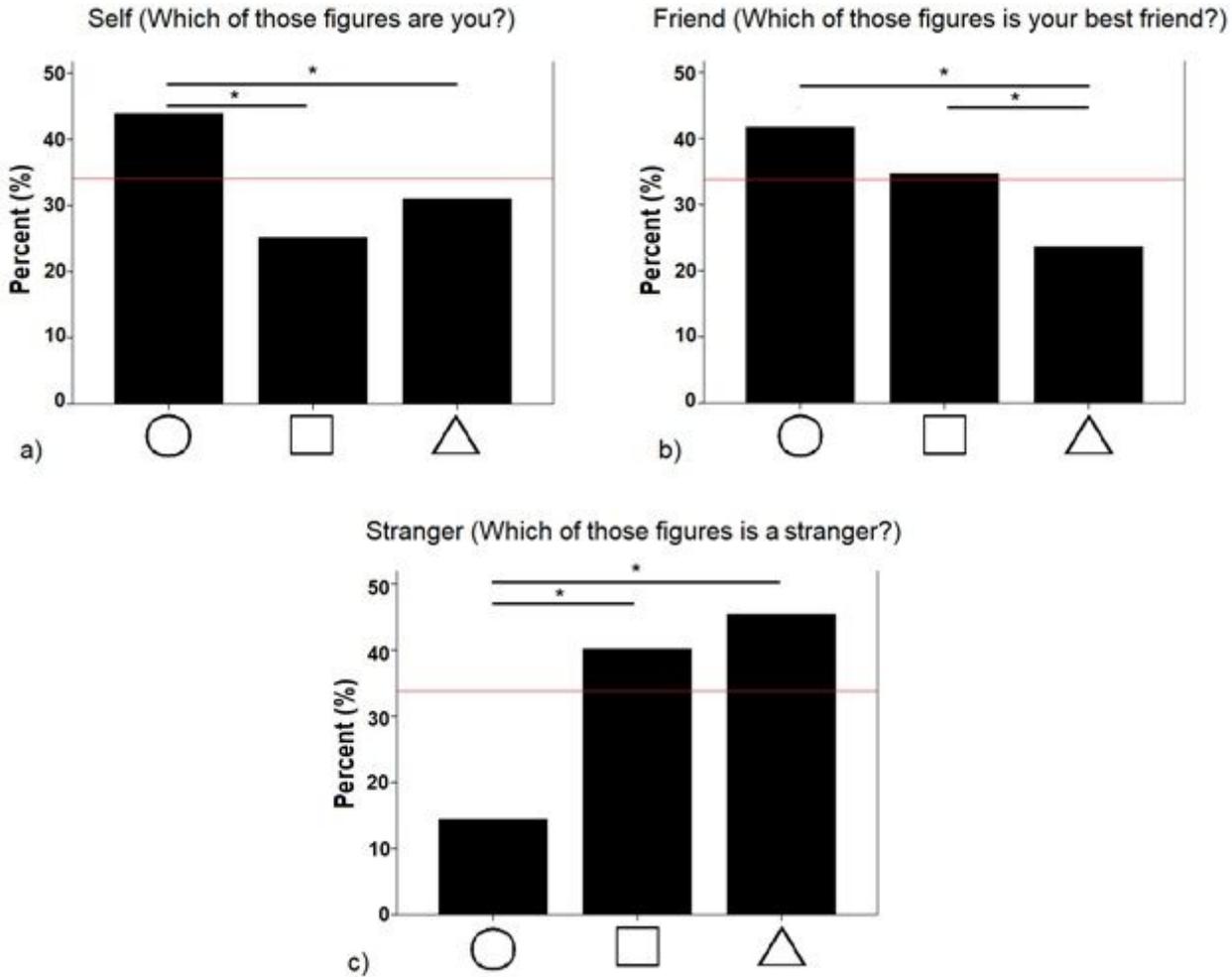


Figure 3

Association of different geometric shapes with the Self, the Friend and the Stranger, expressed in percentage. Asterisks indicate difference from the chance level indicated by the red line ($p < 0.012$).

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