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Towards the Boundaries of Self-Prioritization: Associating the Self With Asymmetric Shapes Disrupts the Self-Prioritization Effect

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Individuals tend to prioritize self-relevant information over other-relevant information. Converging empirical evidence indicates that stimuli that are arbitrarily associated with the self are processed more efficiently than stimuli that are arbitrarily associated with stranger identities. In the present study, we tested if a salient perceptual feature (i.e., presence or absence of symmetry) can modulate this *self-prioritization effect*. In particular, we wanted to know how the valence of symmetry would integrate or interfere with the self. Under one condition, participants were asked to associate the self with symmetric shapes and a stranger with asymmetric shapes, whereas, under another condition, the association was inverted (i.e., self-asymmetry/stranger-symmetry). The two conditions were manipulated within participants (Experiment 1, laboratory-based) or between participants (Experiment 2, online). Participants classified a randomly generated shape (symmetric vs. asymmetric) and a label (*you* vs. *stranger*) as either matching or nonmatching with the previously learned association. In both experiments, a clear self-prioritization effect emerged in the self-symmetry/stranger-asymmetry condition whereas, strikingly, no evidence of a self-prioritization effect emerged at all in the opposite condition. The results suggest that the self-prioritization effect is not mandatory and can be modulated by the valence of the stimuli with which self and stranger are associated.

Public Significance Statement

(a) Self-relevant information tends to be prioritized over other-relevant information, a phenomenon known as the *self-prioritization effect*. The possible influence of the valence of self- and other-related information on the self-prioritization effect remains unclear. (b) We manipulated the valence of the visual shapes with which self and stranger were arbitrarily associated by manipulating the presence or absence of symmetry. (c) Surprisingly, a self-prioritization effect occurred when the self was associated with symmetric shapes and the stranger with asymmetric shapes, whereas no evidence of a self-prioritization effect emerged for the opposite association. These results shed new light on the self-prioritization effect, showing that it is not a mandatory phenomenon and that it can reflect the tendency to keep a positive bias for the self.

Keywords: self-prioritization, symmetry, valence, perceptual matching, self-identification

Due to the limits of the cognitive system, only a small part of the incoming information can be processed efficiently. To successfully adapt to the environment, humans must prioritize important information, and empirical studies suggest that self-relevant information tends to be prioritized over other-relevant information, a phenomenon known as the *self-prioritization effect* (for reviews, see Cunningham & Turk, 2017; Sui & Humphreys, 2015a).

Sui et al. (2012) provided an elegant empirical demonstration of the self-prioritization effect. In their main experiment, there was a learning phase followed by a matching task. In the learning phase, participants were instructed to associate themselves, a friend, and a stranger with three arbitrary geometric shapes (i.e., they were provided with the following instruction: "in this experiment you are a circle, a friend is a triangle, and a stranger is a square"). Then, on each trial of the matching task, one of the three shapes (i.e., circle, triangle, or square) and one of

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The preregistered hypotheses and methods are available at the following link: https://aspredicted.org/blind.php?x=ts2m5i

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the three labels (i.e., *you*, *friend*, or *stranger*) were simultaneously presented on the screen for 100 ms. Participants had to indicate if the shape–label pair was correct (consistent with one of the learned associations; e.g., square + *stranger*) or incorrect (inconsistent with the previously learned associations; e.g., square + *you*). A remarkable pattern of results emerged. Responses were faster and more accurate on trials in which the label *you* was paired with the self-related shape (e.g., circle + *you*), than on trials in which any of the other shape–label associations were presented (e.g., square + *you*, square + *stranger*, triangle + *friend*). Control experiments showed that this pattern of results did not depend on greater familiarity, concreteness, or grammatical salience of the *you* label with respect to the other labels (Schäfer et al., 2017; Sui et al., 2012; Woźniak & Knoblich, 2019; but see Wade & Vickery, 2017). The authors suggested that self-related information is processed more efficiently—at a perceptual level—than the friend- and stranger-related information (see also Liu & Sui, 2016; Sui et al., 2015; Sui & Humphreys, 2015c; but see Stein et al., 2016). Nevertheless, the nature of the self-prioritization effect is still debated. For instance, in addition to perception, attention and memory contribute to the phenomenon, because self-related stimuli tend to attract more attentional resources (Dalmaso et al., 2019; Humphreys & Sui, 2016; Macrae et al., 2018; Sui & Rotshtein, 2019; Zhao et al., 2015; but see Siebold et al., 2015) and form more stable memory traces (e.g., Reuther & Chakravarthi, 2017) than stimuli related to both friends and strangers.

The self-prioritization effect is robust and generalizable. For instance, the effect is present in different cultures (Jiang et al., 2019), and it also emerges when only the identities of self and stranger are used in the learning and matching tasks (i.e., the identity of friend is not strictly necessary; e.g., Stein et al., 2016). Moreover, the effect occurs even when, instead of being associated with simple geometric shapes, the self and the stranger are arbitrarily associated with stimuli such as Gabor patches varying in orientation (Stein et al., 2016), motion directions (Frings & Wentura, 2014), musical instruments (Schäfer et al., 2015), sounds (Schäfer et al., 2016), vibrotactile stimulations (Schäfer et al., 2016), or even unfamiliar neutral faces (Payne et al., 2017; Woźniak & Knoblich, 2019). The effect also occurs when *self* and *stranger* are associated with conceptual categories rather than with specific objects (e.g., the broad categories of *triangles* and *circles*, which include triangles and circles varying in size or color; Schäfer et al., 2015; Sui et al., 2014).

A prioritization effect has also been documented for items that belong to the self. For instance, when different categories of items (e.g., pens and pencils) are arbitrarily assigned to either the self or another individual, the self-owned items are responded to faster than the items owned by the other (Golubickis et al., 2018, 2019; see also Constable et al., 2019; Cunningham, 2008). Interestingly, this self-ownership advantage disappears when the self-owned items are presented outside a symbolic space associated arbitrarily with the self (McPhee et al., 2021; Strachan et al., 2020), and it reverses when participants are informed that the friend-owned items are more likely to appear than the self-owned items (Falbén et al., 2020). This suggests that "… the processing advantage for owned objects is something that can be modulated by the context in which it is embedded" (Strachan et al., 2020, p. 795).

Valence and the Self-Prioritization Effect

The mechanisms underlying the self-prioritization effect have been the target of extensive empirical work and theoretical debate. Sui et al. (2012) found that stimuli associated with relatively high monetary values were prioritized with respect to stimuli associated with low monetary values. The analogy between self- and reward-related prioritization appears to suggest that the relationship with the self may act as a form of reward (i.e., self-related stimuli would be more rewarding than stranger-related stimuli; see also Humphreys & Sui, 2015). However, later studies also highlighted some structural differences between self-related and reward-related prioritization. For instance, Sui and Humphreys (2015b) found no correlation between the magnitudes of the two effects, and Sui and Humphreys (2015c) found that the relationship with the self could favor the integration of the stimuli both at a perceptual and at a conceptual level, whereas the relationship with a high reward could favor the integration of the stimuli only at a conceptual level (i.e., not at a perceptual level; see also Sui et al., 2015). This appears to suggest that the self-prioritization effect is at least partially independent from reward-related prioritization effects.

A possible key for the interpretation of the self-prioritization effect is the general advantage for the processing of positive valence stimuli over neutral or negative valence stimuli (Sui & Humphreys, 2015c; Sui et al., 2016). An otherwise neutral stimulus may acquire a positive or a negative valence because of its association with the self or with a stranger, respectively. Consistent with this hypothesis, Sui et al. (2016) hypothesized that negative mood can reduce the positive emotional response elicited by self-related stimuli, and found indeed a stronger self-prioritization effect when participants were in a neutral mood compared to when they were in a negative mood (but see Qian et al., 2020). Hu et al. (2020) had participants associate neutral shapes with the good part of the self, the good part of a stranger, the bad part of the self, and the bad part of a stranger. The results showed that the prioritization effects were driven not only by self-identification but also by valence. Indeed, the shapes associated with a good feature of the self (e.g., the morally good aspect of the responder) were prioritized over the shapes associated with a bad feature of the self, and the shapes associated with a good feature of the stranger were prioritized over the shapes associated with a bad feature of the stranger. Therefore, prioritization effects appear to be driven by positive valence above and beyond self-identification.

A promising strategy for exploring of the possible relationship between valence and self-prioritization is testing whether the self-prioritization effect is modulated by the valence of the stimuli with which the self and the stranger are associated (Constable et al., 2021; Golubickis et al., 2021; McIvor et al., 2021). For instance, suppose that the self-prioritization effect is enhanced when the self-related information has positive valence and the other-related information has negative valence, compared to when the self-related information has negative valence and the other-related information has positive valence. Converging evidence indicates that healthy adults tend to have a positive bias for the self and a negative bias for the stranger (Taylor & Brown, 1988). A modulation effect of valence on self-prioritization would be functional to keep a positive bias for the self, as it would mean that self-related information with a positive valence is more strongly prioritized than self-related information with a negative valence. Moreover, if self and stimulus valence produce faster responses because of a shared underlying mechanism (i.e., faster responses for positive valence), then when they are combined, the effects should be additive. Alternatively, the self-prioritization effect might be impervious to the valence of the self- and other-related information, which would mean that the self-prioritization effect is inflexible and mandatory and that it is unrelated to the cognitive processes underlying the positive bias for the self.

In Constable et al.'s (2021) first experiment, half of the participants were asked to associate themselves with a happy face (positive valence) and a stranger with a sad face (negative valence), whereas the other half of the participants were asked to perform the opposite association. A stronger self-prioritization effect emerged for the self-happy/stranger-sad association than for the self-sad/stranger-happy association, which suggests that associating the self with a negative valence stimulus can reduce the magnitude of the self-prioritization effect. In apparent contrast with these results, McIvor et al. (2021) found that the self-prioritization effect was unaffected by the valence of emotional faces (i.e., happy, neutral, or sad) appearing inside self-related geometric shapes. However, this null effect can be due to the fact that participants had to respond to the geometric shapes rather than to the emotional faces, and therefore the valence of the emotional faces was irrelevant to the task. Support for the hypothesis that valence can modulate the self-prioritization effect also emerged from the results of Golubickis et al.'s (2021) ownership categorization task. Participants were presented with posters showing either pleasant (positive valence) or unpleasant (negative valence) scenarios. Half of the participants were informed that they owned two pleasant posters and a closely related friend owned two unpleasant posters, whereas the other half of the participants were presented with the opposite association. Then, in an ownership categorization task, participants had to classify the posters as either owned-by-self or owned-by-friend. A robust self-ownership prioritization effect emerged when the posters owned-by-self had positive valence and the posters owned-by-friend had negative valence, whereas no self-ownership prioritization effect emerged in response to the opposite association. The results of this study appear to indicate that associating the self with negative valence stimuli can disrupt the self-prioritization effect.

It is worth highlighting that, both in Constable et al.'s (2021) first experiment and in the study by Golubickis et al. (2021), the associations between stimuli and identities were probably not as arbitrary as those in the original study by Sui et al. (2012), in which the identities were associated with abstract geometric shapes. Indeed, healthy individuals tend to seek positive emotions and pleasant scenarios and avoid negative emotions and unpleasant scenarios, which means that they are probably more familiar with happy faces and pleasant scenarios than with sad faces and unpleasant scenarios (see also Constable et al., 2021). In other words, the associations between the self and pictures of happy faces/pleasant scenarios may activate strong and privileged associations stored in the long-term memory which, in turn, could explain the results obtained by Constable et al. (2021; Experiment 1) and by Golubickis et al. (2021).

Does the valence of the stimuli modulate the self-prioritization effect even when the stimuli are unrelated to previously learned associations with the self? A positive answer to this question would support the hypothesis of a deep link between valence and self-prioritization that may affect arbitrary newly learned associations. An approach that should minimize the possible effects of previously learned associations with the self would be that of associating self and stranger identities with stimuli that are not obviously related to these identities in everyday life experience. In this regard, Sui and Humphreys (2015d) presented participants with shapes related to themselves, friends, and strangers that varied in size. A stronger self-prioritization effect emerged when self-related shapes were presented as relatively large, compared to when they were medium or small. According to the authors, this may have emerged because of well-known motivational biases favoring large shapes, which reflects a positive relationship between size and valence (see also Schubert et al., 2009). In Constable et al.'s (2021) second experiment, the lightness of the stimuli was manipulated: Half of the participants associated themselves with a lighter geometric shape and a stranger with a darker geometric shape, whereas the other half of the participants performed the opposite association. The idea was that lighter and darker shapes would have positive and negative valence, respectively. The results were somewhat mixed, as an effect of association type emerged when the perceptual difference in lightness between the lighter and darker shape was small, whereas no effect of association type emerged when the difference was perceptually large. In sum, the potential role of the valence of abstract stimuli in shaping the self-prioritization effect is unclear and still largely unknown.

Self, Symmetry, and Valence: An Overview of the Present Study

In the present study, we varied the visual properties of the stimuli associated with *self* and *stranger*. Instead of size (Sui & Humphreys, 2015d) or lightness (Constable et al., 2021, Experiment 2), we manipulated a visual property that is more consistently related to valence, that is, symmetry. Indeed, several studies in experimental aesthetics suggest that visual symmetry can shape the perceived valence of otherwise neutral stimuli. For instance, Makin et al. (2012) found that symmetric figures tend to be implicitly associated with positive attributes, whereas asymmetric figures tend to be implicitly associated with negative attributes (see also Bertamini et al., 2013; Pecchinenda et al., 2014). Moreover, symmetric stimuli are generally preferred over asymmetric stimuli (e.g., Cárdenas & Harris, 2006; Eisenman, 1967), and symmetry was listed as a key principle of aesthetics by Ramachandran and Hirstein (1999; "Symmetry, of course, is also aesthetically pleasing" p. 27). All this suggests that symmetry and asymmetry are polarized concepts associated with positive and negative valence, respectively, and this recalls the polarization that can also be observed for the concepts of self (positive valence) and stranger (negative valence; e.g., Greenwald & Farnham, 2000; Taylor & Brown, 1988). To prevent the possible influence of previously learned associations with the self, the stimuli in our experiments were abstract symmetric and asymmetric stimulus configurations composed of random dots. Moreover, a different configuration of symmetric and asymmetric random dots was presented on each trial of the perceptual matching task.

We designed two experiments to explore the influence of symmetry on the self-prioritization effect. In both experiments, there were two conditions: either the self was associated with symmetric shapes and the stranger with asymmetric shapes (i.e., the *self-symmetry association)* or vice versa (i.e., the *self-asymmetry association*). We tested two specific preregistered hypotheses (see the Open Practices statement for further details), which can be summarized as follows.

1) We expected that, in matched trials, the difference between the response times for self- and stranger-related shapes (i.e., the self-prioritization effect as operationalized by Sui et al., 2012) should be larger in the self-symmetry condition (i.e., when the self is associated with positive valence stimuli and the stranger with negative valence stimuli) than in the self-asymmetry condition. In other words, consistently with the hypothesis that the self-prioritization effect is modulated by the valence of the stimuli with which self and stranger are associated, we expected a stronger self-prioritization effect in the self-symmetry condition than in the self-asymmetry condition.

2) According to the polarity correspondence principle (Proctor & Cho, 2006), stimuli characterized by similar valence would associate with each other more easily than stimuli characterized by different valence. Therefore, in matched trials, responding *correct* to stimuli of the self-symmetry association (i.e., label *you* and a symmetric shape, and *stranger* and an asymmetric shape), should be easier than responding *correct* to stimuli of the opposite association. In nonmatching trials, responding *incorrect* to stimuli of the self-symmetry association (i.e., label *you* and an asymmetric shape, or *stranger* and symmetric shape), should be easier than responding *incorrect* to stimuli of the opposite association. In sum, in matching as well as in nonmatching trials, responses should be faster and more accurate for the self-symmetry association than for the self-asymmetry association (i.e., a main effect of association type).

It is worth noting that the self-prioritization effect cannot be understood as a polarity effect, because in the self-prioritization effect there is a speeding up of responses to self-related items, not a general speeding up of responses to congruent pairs. Therefore, our two hypotheses are independent of each other. In other words, we hypothesize that the manipulation of symmetry/asymmetry can modulate the self-prioritization effect (Hypothesis 1) and/or produce a polarity effect (Hypothesis 2).

Experiment 1

Method

Sample Size

The determination of the sample size was based on the following considerations. To be considered of theoretical interest, the difference between the response times (RTs) for the self-symmetry association and the RTs for the self-asymmetry association should lead, at least, to a medium effect size ($d = -.5$). The same should hold true for response accuracies. A power analysis showed that, for a paired-sample one-tailed t test with $\alpha = .05$, $\beta = .80$, and $d = -.5$, sufficient power would be reached with $N = 26.14$. For the sake of parsimony, we decided to test 30 participants.

Participants

Thirty participants (M age = 24.67 years, SD = 7.05 years, 14 males) voluntarily participated in exchange for course credits. All of them were naive to the purpose of the experiment and reported normal or corrected-to-normal vision.

Stimuli and Apparatus

The participants sat in a dimly lit room at a distance of about 57 cm from a 15.5" computer screen. The screen background was gray. The experiment was created and run through PsychoPy3 (Peirce et al., 2019). On each trial, the stimuli were randomly generated by the program. Thus, no configuration was shown more than once, avoiding any effect of familiarity (Bertamini et al., 2013; Makin et al., 2012; Pecchinenda et al., 2014). Symmetric and asymmetric shapes were patterns comprising 64 white dots (diameter = .4 cm, about .4 degrees of visual angle), randomly distributed in a 10-cm circular area (~10°), with a minimum distance of .25 cm (~.25°) between dots. For the symmetric shapes, the random dots distribution was constrained to be symmetric with respect to the horizontal and vertical axes. This constraint was absent in the case of asymmetric shapes. Examples of symmetric and asymmetric shapes are depicted in Figure 1.

Procedure

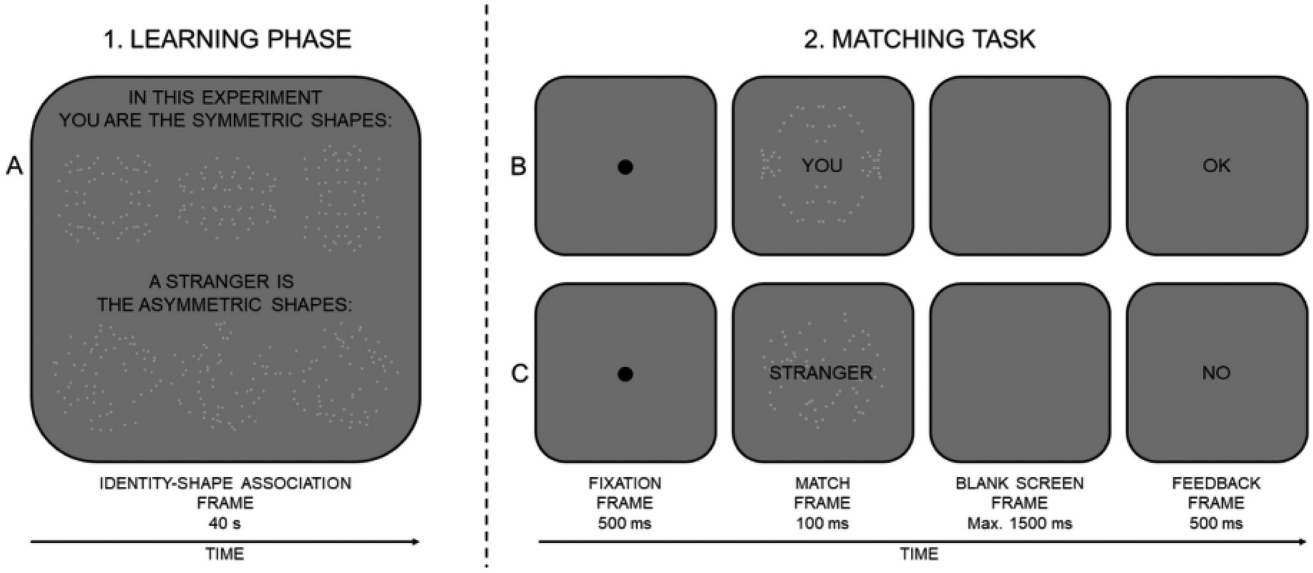
Before starting the experiment, participants read and signed the written informed consent form approved by the Ethics Committee for Psychological Research at the University of Padova (Protocol 3455; February 10, 2020).

The experiment was divided into two blocks, and the order counterbalanced across participants. The two blocks corresponded to the two types of association (i.e., self-symmetry and self-asymmetry); in each block, there was a learning phase followed by a matching task (see Figure 1). Wang et al. (2016) found that the self-prioritization effect emerges even when shape–identity associations are manipulated within participants. Therefore, participants should be able to switch from associating the self with symmetric shapes and the stranger to asymmetric shapes in one block to doing the opposite in the other block.

In the learning phase, participants were informed that they would receive instructions that they had to read and memorize. Then, a screen was presented for 40 s, showing the relevant shape–identity associations (that is, for the self-symmetry association: "In this experiment, you are the symmetric shapes, and a stranger is the asymmetric shapes"; for the self-asymmetry association: "In this experiment, you are the asymmetric shapes, and a stranger is the symmetric shapes"; see Figure 1, identity–shape association frame). Three randomly generated small-size symmetric shapes and three randomly generated small-size asymmetric shapes (diameter = 5 cm) were presented below the corresponding sentence. Then, the matching task started. Each trial started with a central black fixation dot that was presented for 500 ms (Figure 1, fixation frame). This was followed by the synchronous presentation, at the center of the screen, of a symmetric or asymmetric shape and one of two labels (black Arial font, height .5 cm), which could be *YOU* or *STRANGER* (in Italian: *TU* or *ALTRO*, respectively; these labels had been used in previous self-prioritization studies involving Italian participants; e.g., Dalmaso et al., 2019; Stein et al., 2016). The shape–label pair disappeared after 100 ms (Figure 1, match frame). After that, a blank screen appeared (Figure 1, blank screen frame), and participants had to press the *A* or the *L* key to indicate whether the shape–label association was correct or incorrect (timeout: 1,500 ms). The key-response category association was counterbalanced across participants. Visual feedback (black Arial font, height .5 cm) was then presented at the center of the screen for 500 ms, which could be the word *OK* if a correct response was provided, *NO* if an incorrect response was provided, and *TOO*

Figure 1

Procedures and Stimuli Employed in Experiments 1 and 2



Note. Panel A shows the learning phase in which participants were asked to create an association between identity (i.e., self vs. stranger) and shape (i.e., symmetric vs. asymmetric). Panel B shows a match trial in which the label *you* is presented with a symmetric stimulus, and a correct response is provided (the feedback states: *ok*). Panel C shows a match trial in which the label *stranger* is presented with an asymmetric stimulus, and a wrong response is provided (the feedback states: *no*). Please note that stimuli are not drawn to scale.

SLOW (in Italian: *TROPPO LENTO)* if participants did not respond before timeout (Figure 1, feedback frame).

Consistently with the paradigm of Sui et al. (2012), the trials in the matching task can be divided based on two orthogonal factors, that is, shape–label matching (matched vs. nonmatching) and type of shape (self-related vs. stranger-related). In the self-symmetric block, the self-related shapes were symmetric, and the stranger-related shapes were asymmetric, whereas the opposite was true in the self-asymmetric block. Each experimental block had 240 trials, according to the following design: 2 Matching [matched versus nonmatching] × 2 Shape [self-related versus stranger-related] × 60 Repetitions. Each experimental block was preceded by 24 practice trials.

Results

Missed responses (1.69% of trials) were excluded and not analyzed due to their low frequency. Errors (i.e., wrong responses; 19.17%) and the RTs of correct responses (79.14%) were analyzed separately. Correct responses with RTs faster than 200 ms (i.e., anticipated responses; 2.68% of correct responses) were also eliminated (see also Sui et al., 2012).

As shown in Figure 2, the patterns of results for RTs of correct responses (panels A and B) and for errors (panels C and D) are similar. For brevity, only the main results that emerged in RTs and errors analyses are reported, whereas the full results are reported in Appendix A (Tables A1-A4).

RTs of Correct Responses

The RTs of correct responses were analyzed through a three-way within-participant ANOVA with factors association type (self-symmetric vs. self-asymmetric), matching (matched vs. nonmatching), and shape (self-related vs. stranger-related).[1] Here and in the following analyses, bidirectional paired-sample Bayesian *t*-tests were also performed to compare the likelihood of the null hypothesis of a zero difference between the RTs for the self- and the stranger-related shapes and the likelihood of the alternative hypothesis of a positive or a negative difference. Separate JSZ tests were performed on matched and nonmatching trials using the *BayesFactor* package (Morey & Rouder, 2018), within the R environment (R Core Team, 2021). The effect size was assumed to be 0 under the null hypothesis and a Cauchy distribution centered on zero with a scale parameter of $\sqrt{2}/2$ under the alternative. Bayesian *t*-tests were performed and reported only for comparisons that were particularly important for the main experimental hypotheses.

Our first hypothesis was that the self-prioritization effect would be stronger for the self-symmetry association than for the self-asymmetry association. The hallmark of the self-prioritization effect is the significant Matching × Shape interaction, due to faster RTs for the self- than for the stranger-related shape in matching trials only (i.e., not in nonmatching trials; see Sui et al., 2012). The results showed that the Association Type × Matching × Shape interaction was significant [$F(1, 29) = 46.17$, $p < .001$, $\eta^2_G = .035$], suggesting that, consistently with our hypothesis, the Matching × Shape interaction was modulated by association type.

Two separate ANOVAs with factors matching and shape were then conducted for the two association types. For the self-

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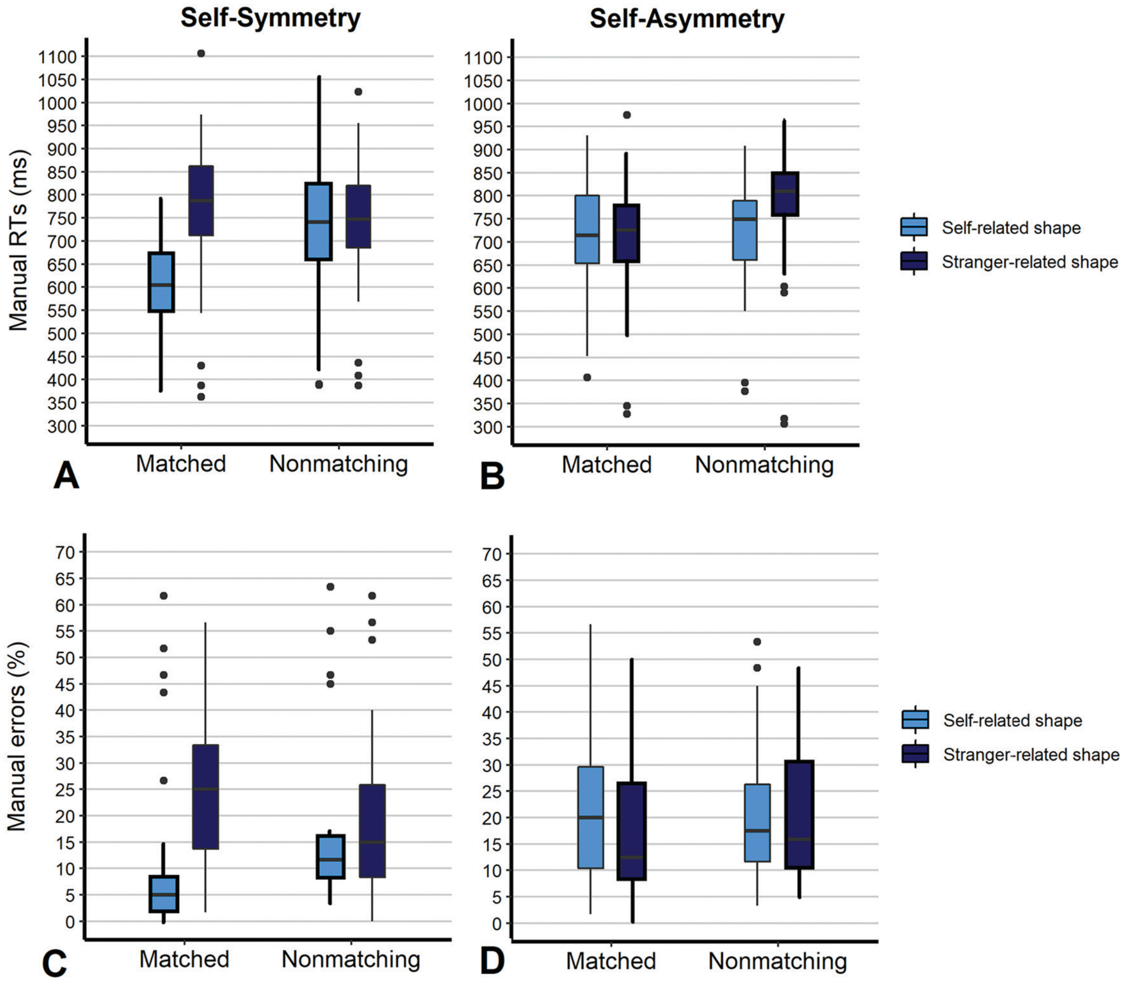
[1] Shapiro-Wilk normality tests showed that the distribution of the RTs was not significantly different from normal in five out of the eight cells of the experimental design. Only for two cells of the design the skewness coefficient was smaller than -1. Overall, the data distributions appear to be sufficiently close to normal to allow the use of ANOVA.

Figure 2
Results of Experiment 1



Note. Boxplots representing the RTs of correct responses longer than 200 ms (panels A and B) and the percentage of errors (panels C and D) for the self-symmetry association (left column) and for the self-asymmetry association (right column). Thick boxplots represent symmetric shapes, which correspond to self-related shapes in the self-symmetry association and to stranger-related shapes in the self-asymmetry association. See the online article for the color version of this figure.

symmetry association, the Shape × Matching interaction was significant [$F(1, 29) = 54.24$, $p < .001$, $\eta^2_G = .064$]. In matched trials, a large difference emerged between the RTs for the self-related shape ($M = 602$ ms, $SE = 18$ ms) and the RTs for the stranger-related shape [$M = 763$ ms, $SE = 30$ ms; $t(29) = -9.12$, $p < .001$, $d = -1.7$; $BF_{10} > 1000$]. Instead, no significant difference emerged in nonmatching trials [self-related shape: $M = 729$ ms, $SE = 29$ ms; stranger-related shape: $M = 739$ ms, $SE = 28$ ms; $t(29) = -.98$, $p = .34$, $d = .18$; $BF_{01} = 3.32 \pm .01\%$]. These results show a clear self-prioritization effect for the self-symmetry association (see also Figure 2A). On the contrary, no evidence of a self-prioritization effect emerged for the self-asymmetry association: The Shape × Matching interaction was significant [$F(1, 29) = 10.12$, $p = .003$, $\eta^2_G = .012$]; however, in matched trials, there was no significant difference between the RTs for the self-related shape ($M = 716$ ms, $SE = 22$ ms) and the RTs for the stranger-related shape [$M = 708$ ms, $SE = 26$ ms; $t(29) = .49$ $p = .63$, $d = .09$; $BF_{01} = 4.60 \pm .01\%$]. A significant difference emerged instead for nonmatching trials [self-related shape: $M = 718$ ms, $SE = 22$ ms; stranger-related shape: $M = 770$ ms, $SE = 28$ ms; $t(29) = -4.78$, $p < .001$, $d = -.89$; $BF_{10} = 511.48 \pm .0\%$]. The latter result suggests that rejecting the nonmatching self-symmetry pairs was more difficult than rejecting the nonmatching stranger-asymmetry pairs (see also Figure 2B).

Our second hypothesis was that, consistently with the polarity correspondence principle, responses would be faster for the self-symmetry association than for the self-asymmetry association. This hypothesis is not supported by the results, as the main effect of association type was not significant [$F(1, 29) = 1.9$, $p = .18$, $\eta^2_G = .005$; $BF_{01} = 2.18 \pm .01\%$].[2]

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[2] The power analysis was based on a unidirectional alternative hypothesis, namely, that the RTs for the self-symmetry association were faster than the RTs for the self-asymmetry association. However, the p value for the main effect of association type refers to a bidirectional alternative hypothesis. This p value, divided by two, corresponds to the correct unidirectional p value, which is still nonsignificant ($p = .053$).

The inspection of individual data showed that 14 out of the 20 outliers in Figures 2A and 2B (defined as the data points above the third quartile of the distribution plus 1.5 times the interquartile range, or below the first quartile of the distribution minus 1.5 times the interquartile range) were due to the responses of three participants (i.e., participants 5, 7, and 9 in the dataset on OSF), who had fast mean RTs (*M* = 421 ms, *SE* = 36 ms; sample *M* = 718 ms, *SE* = 23 ms), and high mean percentages of errors (*M* = 46.4%, *SE* = 1.6; sample *M* = 19.2%, *SE* = 2.3). All the main results were replicated by an analysis conducted after the exclusion of the data of these responders from the original dataset (see the supplementary analyses on OSF at the following link: https://doi.org/10.17605/OSF.IO/FE3JW).

Errors

Figures 2C and 2D show that the distribution of the percentage of errors tended to be positively skewed. Shapiro-Wilk normality tests confirmed this impression: the distributions were significantly different from normal in seven out of the eight cells of the experimental design. A skewness coefficient larger than one was observed for four cells of the experimental design. Due to these deviations from normality, the percentage of errors was analyzed through a mixed-effect logit model (Jaeger, 2008) with association type, matching, shape, and the interactions as fixed effects and the by-subject intercept as random effect.

The main effect of association type was statistically significant [$\chi^2(1) = 71.15$, $p < .001$; $BF_{10} = 28.6 \pm .0\%$], due to a smaller percentage of errors for the self-symmetry association (*M* = 17.4%, *SE* = 2.4) than for the self-asymmetry association (*M* = 20.9%, *SE* = 2.2). This appears to suggest a polarity correspondence effect for errors, although the effect was not observed for the RTs. The association Type × Matching × Shape interaction was significant [$\chi^2(1) = 43.29$, $p < .001$], therefore we applied two separate mixed-effect logit models on the two association types, with matching, shape, and the interaction as fixed effects and the by-subject intercept as random effect. For the self-symmetry association, the Shape × Matching interaction was significant [$\chi^2(1) = 51.6$, $p < .001$]. Pairwise comparisons for the mixed-effect logit model showed that the percentage of errors was significantly smaller in matched trials with the self-related shape (*M* = 11.2%, *SE* = 3.1) than in matched trials with the stranger-related shape (*M* = 25.2%, *SE* = 2.5; $z = 11.59$, $p < .001$; $BF_{10} > 1000$). No significant difference emerged in nonmatching trials [self-related shape: *M* = 17.3%, *SE* = 3.0; stranger-related shape: *M* = 19.6%, *SE* = 3.0; $z = 1.89$, $p = .23$; $BF_{01} = 2.11 \pm .01\%$]. These results confirm the self-prioritization effect in the case of the self-symmetry association (see also Figure 2C). On the contrary, no evidence of a self-prioritization effect emerged for the self-asymmetry association: The Shape × Matching interaction was significant [$\chi^2(1) = 4.57$, $p = .03$]; however, the differences between the self- and the stranger-related shape were not significant, neither in matched trials (self-related shape: *M* = 20.8%, *SE* = 2.5; stranger-related shape: *M* = 18.1%, *SE* = 2.4; $z = -2.26$, $p = .11$; $BF_{01} = 2.99 \pm .0\%$) nor in nonmatching trials (self-related shape: *M* = 20.3%, *SE* = 2.6; stranger-related shape: *M* = 20.9%, *SE* = 2.5; $z = .75$, $p = .88$; $BF_{01} = 4.35 \pm .0\%$). This pattern of results confirms the lack of a self-prioritization effect for the self-asymmetry association (see also Figure 2D). All the main results were replicated by an analysis conducted after the exclusion of the data from participants 5, 7, and 9 (see the supplementary analyses on OSF).

In sum, the results of Experiment 1 show a clear self-prioritization effect in the case of the self-symmetry association, and the complete lack of the effect in the case of the self-asymmetry association. Experiment 2 will test the robustness and generalizability of these results using a between-participants manipulation of the type of association.

Experiment 2

Method

Sample Size

Using the same logic as in Experiment 1, we hypothesized at least a medium effect size ($d = -.5$) for the difference between the response times (RTs) for the self-symmetry association and those for the self-asymmetry association. Unlike Experiment 1, here the type of association was manipulated between participants. A power analysis showed that, for an independent-sample one-tailed *t* test with $\alpha = .05$, $= .80$, and $d = -.5$, sufficient power would be reached with $n = 50.15$ per group. For the sake of parsimony, we decided to test 52 participants per group (i.e., 104 participants in total).

Participants

One hundred and four participants (*M* age = 22.72 years, *SD* = 6.28 years, 14 males) voluntarily participated in exchange for course credits. All of them were naive to the purpose of the experiment and reported normal or corrected-to-normal vision. None of them had participated in Experiment 1.

Stimuli and Apparatus

Everything was identical to Experiment 1, with the following exceptions. The experiment was delivered online through Pavlovia, which is known to provide reliable behavioral data (Bridges et al., 2020). For technical reasons we could not use the online procedure of Experiment 1 to randomly generate symmetric and asymmetric shapes. Instead, an offline procedure was used to pregenerate a large number of pictures of symmetric and asymmetric random dot patterns with labels *YOU* (in Italian: *TU*) or *STRANGER* (in Italian: *ALTRO*) appearing at the center. On each trial of the matching task, one of these pictures was randomly presented at the center of the screen. Picture size (900 × 500 pixels) was adapted to the size and the resolution of the screen. From the observer's perspective, these stimuli were virtually identical to those of Experiment 1.

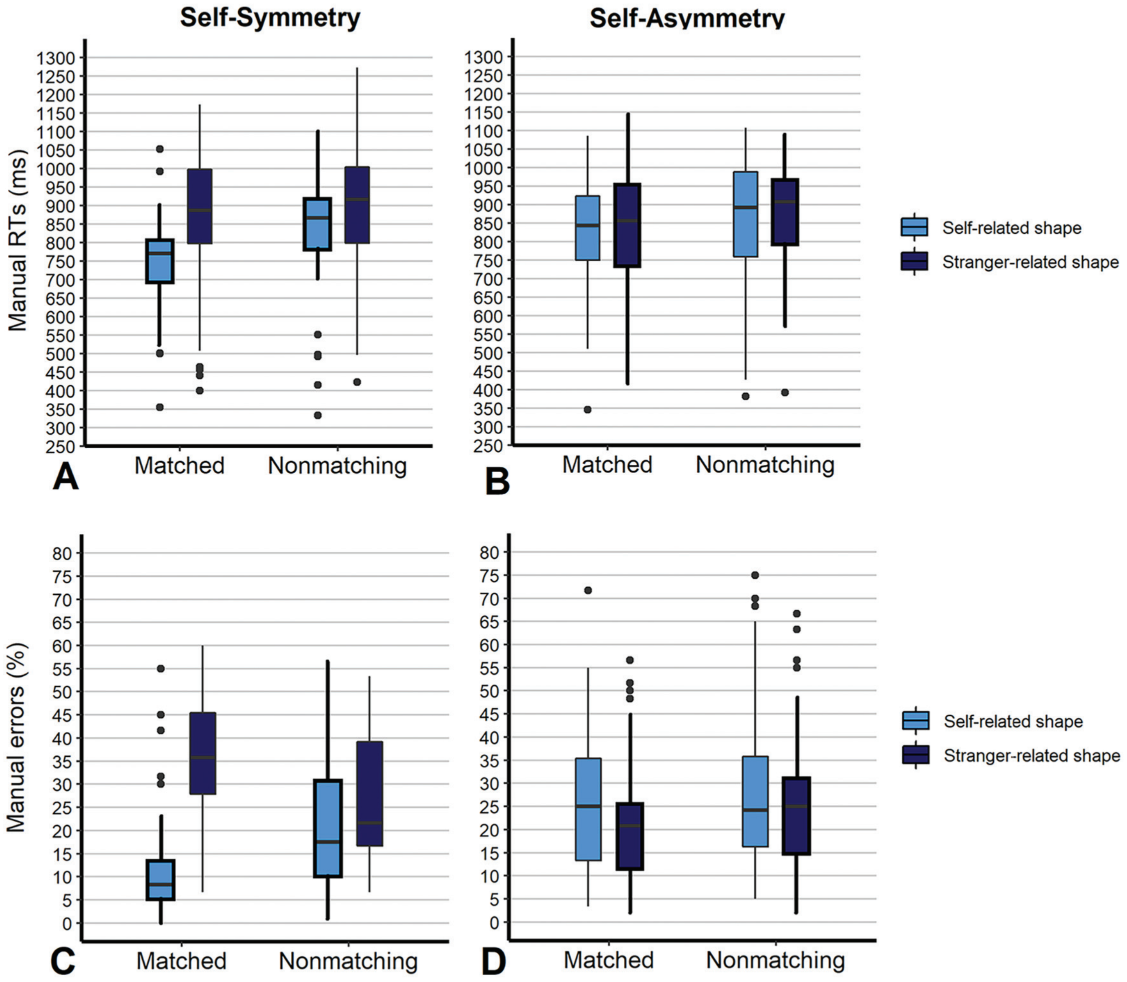
Procedure

Before starting the experiment, participants read the informed consent form approved by the Ethics Committee for Psychological Research at the University of Padova (Protocol 3455; February 10, 2020), and then gave their consent to participate through a response key.

Everything was identical to Experiment 1, except that the type of association was manipulated between participants. Half of the participants were randomly assigned to the self-symmetry association, and the other half to the self-asymmetry association. As in Experiment 1, the key-response category association was counterbalanced across participants. Participants were presented with 240 experimental trials (2 Matching [matched vs. nonmatching] × 2

Figure 3

Results of Experiment 2



Note. Boxplots representing the RTs of correct responses longer than 200 ms (panels A and B) and the percentage of errors (panels C and D) for the self-symmetry association (left column) and for the self-asymmetry association (right column). Thick boxplots represent symmetric shapes, which correspond to self-related shapes in the self-symmetry association and to stranger-related shapes in the self-asymmetry association. Overall, both the percentage of errors and the RTs are higher and more dispersed than in Experiment 1. This might be due to the between-subject manipulation of association type (i.e., the practice effects were probably reduced compared to Experiment 1), and to the fact that experiment 2 was an online study rather than a laboratory study. See the online article for the color version of this figure.

Shape [self-related vs. stranger-related] × 60 Repetitions), which were preceded by 24 practice trials.

Results

Data were analyzed as in Experiment 1. Missed responses (3.67% of trials) were excluded and not analyzed due to their low frequency. Errors (i.e., wrong responses; 24.88%) and the RTs of correct responses (71.45%) were analyzed separately. Correct responses with RTs faster than 200 ms (1.49% of correct responses) were also eliminated.

As shown in Figure 3, the patterns of results for RTs of correct responses (panels A and B) and for errors (panels C and D) are similar. For brevity, only the main results of the RTs analysis and the percentage of errors analysis are reported, whereas full results are in Appendix B (Tables B1-B4).

RTs of Correct Responses

The RTs of correct responses were analyzed through a three-way mixed ANOVA with association type (self-symmetric vs. self-asymmetric) as a between-participants factor and matching (matched vs. nonmatching) and shape (self-related vs. stranger-related) as within-participant factors.[3]

The results replicate those of Experiment 1. The main effect of association type was not significant [$F(1, 102) = .22$, $p = .64$, $\eta_G^2 =$

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[3] Shapiro-Wilk normality tests showed that the distribution of the RTs was significantly different from normal in seven out of the eight cells of the experimental design. However, a closer inspection of the distributions showed that these were similar to those of Experiment 1. A skewness coefficient smaller than $-1$was observed for only two cells of the experimental design.

.002; BF_{01} = 4.37 ± .02%], whereas the Association Type × Matching × Shape interaction was significant [F(1, 102) = 5.93, p = .017, η^2_G = .001]. As for the self-symmetry association, the Shape × Matching interaction was significant [F(1, 51) = 22.46, p < .001, η^2_G = .009]. For matched trials, a large difference emerged between the RTs for the self-related shape (M = 750 ms, SE = 17 ms) and the RTs for the stranger-related shape [M = 867 ms, SE = 24 ms; t(51) = −9.52, p < .001, d = −1.3; BF_{10} > 1000]. A significant difference also emerged in nonmatching trials [self-related shape: M = 834 ms, SE = 21 ms; stranger-related shape: M = 891 ms, SE = 24 ms; t(51) = −6.07, p < .001, d = −.84; BF_{10} > 1000], but the magnitude of this difference was clearly smaller as compared to matched trials (i.e., 57 ms vs. 117 ms; see also Figure 3A). As for the self-asymmetry association, the Shape × Matching interaction was not significant [F(1, 51) = .83, p = .37, η^2_G < .001], indicating no self-prioritization effect (see also Figure 3B). Despite the nonsignificant interaction, for the sake of comparison with the results of Experiment 1, the results of the pairwise comparisons between the RTs for the self- and stranger-related shapes are also reported. These were not significant, neither in matched trials (self-related shape: M = 820 ms, SE = 20 ms; stranger-related shape: M = 835 ms, SE = 22 ms; t(51) = −1.32, p = .19, d = −.18; BF_{01} = 2.92 ± .0%) nor in nonmatching trials (self-related shape: M = 869 ms, SE = 21 ms; stranger-related shape: M = 872 ms, SE = 21 ms; t(51) = −.31, p = .76, d = −.04; BF_{01} = 6.33 ± .0%).

The inspection of individual data showed that 13 out of the 15 outliers in Figure 3A were due to the responses of five participants (i.e., participants 1, 7, 18, 19, and 41 in the dataset on OSF). These participants had fast mean RTs (M = 478 ms, SE = 26 ms; sample M = 835 ms, SE = 21 ms), and high mean percentages of errors (M = 46.3%, SE = 1.3; sample M = 24.4%, SE = 1.7). The three outliers in Figure 3B were due to the responses of one participant (i.e., participant 56), who also had fast mean RTs (384 ms; sample M = 849 ms, SE = 20 ms) and high mean percentages of errors (M = 51.7%; sample M = 25.4%, SE = 1.7). All the main results were replicated by an analysis conducted after the exclusion of the data from participants 1, 7, 18, 19, 41, and 56 (see the supplementary analyses on OSF).

Errors

The percentages of errors were analyzed through a three-way mixed ANOVA with association type (self-symmetric vs. self-asymmetric) as a between-participants factor and matching (matched vs. nonmatching) and shape (self-related vs. stranger-related) as within-participant factors.[4]

The main effect of association type was not significant [F(1, 102) = .17, p = .68, η^2_G = .001; BF_{01} = 4.46 ± .02%]. The Association Type × Matching × Shape interaction was significant [F(1, 102) = 30.0, p < .001 η^2_G = .026]. As for the self-symmetry association, the Shape × Matching interaction was significant [F(1, 51) = 86.65, p < .001, η^2_G = .030]. For matched trials, there was a significant difference between the self-related shape (M = 13.4%, SE = 2.0) and the stranger-related shape [M = 35.6%, SE = 1.6; t(51) = −11.59, p < .001, d = −1.6; BF_{10} > 1000]. A smaller but significant difference also emerged in nonmatching trials [self-related shape: M = 22.0%, SE = 2.1; stranger-related shape: M = 26.5%, SE = 1.9; t(51) = −4.37, p < .001, d = −.61; BF_{10} = 360 ± .0%]. As for the self-asymmetry association, the Shape × Matching interaction was not significant [F(1, 51) = .83, p = .37, η^2_G < .001], indicating no self-prioritization effect (see also Figure 3D). No significant differences emerged between self- and stranger-related shapes, neither in matched trials (self-related shape: M = 25.3%, SE = 1.9; stranger-related shape: M = 22.4%, SE = 1.9; t(51) = 1.32, p = .23, d = .18; BF_{01} = 2.92 ± .0%) nor in nonmatching trials (self-related shape: M = 27.9%, SE = 2.5; stranger-related shape: M = 25.9%, SE = 2.0; t(51) = 1.05, p = .30, d = .15; BF_{01} = 3.95 ± .0%). All the main results were replicated by an analysis conducted after the exclusion of the data from participants 1, 7, 18, 19, 41, and 56 (see the supplementary analyses on OSF).

General Discussion

In this work, we explored whether the self-prioritization effect (Sui et al., 2012) is modulated by the valence of the shape to which identities (self vs. stranger) are associated with. In particular, we presented participants with shapes differing in terms of the presence or absence of symmetry (i.e., symmetric shapes vs. asymmetric shapes). According to our preregistered hypotheses, different claims were tested (see the Open Practices statement for further details).

The matching task was not easier overall in the case of the self-symmetry association than the self-asymmetry association. Based on the general principle of polarity correspondence (Proctor & Cho, 2006), one of our hypotheses predicted that the type of association would have affected RTs and errors in matching as well as in nonmatching trials. Specifically, it could be predicted that, in matched trials, responding *correct* to stimuli of the self-asymmetry association (i.e., label *you* and an asymmetric shape, or *stranger* and a symmetric shape), could be more difficult than responding *correct* to stimuli of the opposite association (i.e., *you*-symmetric shape and *stranger*-asymmetric shape). The results (see Tables C1 and C2 in Appendix C) showed that it was indeed more difficult responding *correct* to incongruent *you*-asymmetry pairs than to congruent *you*-symmetry pairs; however, at odds with polarity correspondence, the results also showed that it was more difficult responding *correct* to congruent *stranger*-asymmetric pairs than to incongruent *stranger*-symmetric pairs. Moreover, based on the principle of polarity correspondence, it could also be predicted that, in nonmatching trials, responding *incorrect* to stimuli of the self-asymmetry association (i.e., label *you* and a symmetric shape, or *stranger* and an asymmetric shape), could be more difficult than responding *incorrect* to stimuli of the opposite association (i.e., *you*-asymmetric shape and *stranger*-symmetric shape). However, the results showed that this was not the case (see Tables C3 and C4 in Appendix C).

The type of association had, instead, a surprisingly strong influence on the self-prioritization effect. Whereas a standard self-prioritization effect emerged for the self-symmetry association, the effect did not emerge in the case of the self-asymmetry association. Therefore, even if the results of previous studies suggest that the self-prioritization effect is a robust phenomenon that occurs across a range of stimuli and experimental situations (e.g., Frings & Wentura, 2014; Fuentes et al., 2016; Payne et al., 2017; Schäfer et al., 2015, 2016; Stein et al.,

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[4] The distribution of the percentage of errors tended to be positively skewed. Shapiro-Wilk normality tests showed that the distributions were significantly different from normal in seven out of the eight cells of the experimental design. However, a skewness coefficient larger than 1 was observed for only one cell of the experimental design. Therefore, the distributions appear to be sufficiently close to normal to allow the use of ANOVA.

2016; Woźniak & Knoblich, 2019), the results of our two experiments suggest that there are definite boundaries and constraints to the phenomenon itself (see also Constable et al., 2021; Falbén et al., 2020; Golubickis et al., 2021; McPhee et al., 2021; Strachan et al., 2020).

Previous studies suggest that symmetry and asymmetry are polarized concepts characterized by positive and negative valence, respectively (Bertamini et al., 2013; Makin et al., 2012; Pecchinenda et al., 2014). The different pattern of results emerging for the self-symmetry and the self-asymmetry associations suggests that the self-prioritization can be disrupted when the self-relevant information has negative valence, and the stranger-relevant information has positive valence. Importantly, the effects of valence on self-prioritization do not appear to be bounded to associations that recall (or that are in conflict with) previously learned long-term associations with the self (Constable et al., 2021, Experiment 1; Golubickis et al., 2021), but would also extend to arbitrary newly learned associations involving unfamiliar stimuli. Through an analysis of RTs performed with a drift diffusion model, Golubickis et al. (2021) have recently concluded that positive valence stimuli associated with the self are processed more efficiently, at a perceptual level, than stranger-related stimuli. Based on these results, it can be speculated that self-related symmetric shapes are processed faster, at a perceptual level, than symmetric or asymmetric stranger-related shapes. The processing advantage for self-related stimuli characterized by positive valence may facilitate learning and recalling new associations between the self and stimuli with positive valence, with respect to new associations between the self and stimuli with negative valence. This flexibility of the self-prioritization effect may have an important adaptive value. Indeed, not prioritizing negative valence self-relevant information might be functional to keeping a positive bias for the self, which would favor subjective well-being (Taylor & Brown, 1988). For instance, if a student fails to pass an exam in which most other students succeed, avoiding the association with this negative valence information might be useful in keeping negative emotions under control.

It is also worth mentioning that valence typically covaries with several perceptual and conceptual properties of the stimuli. Symmetric and asymmetric shapes make no exception. Besides having more positive valence, symmetric shapes are also processed more fluently at a perceptual level and are perceived as simpler and more arousing compared to asymmetric shapes (Bertamini et al., 2013; Makin et al., 2012; Pecchinenda et al., 2014). Additionally, symmetry and asymmetry also differ in terms of conceptual specificity, in that symmetry refers to a specific and well-defined property, whereas asymmetry generically refers to the lack of this property. Lastly, symmetry is more salient than asymmetry at a perceptual level (e.g., Bertamini et al., 2013). Therefore, although converging evidence indicates that valence plays a crucial role in self-prioritization (Constable et al., 2021; Golubickis et al., 2021; Hu et al., 2020; Sui & Humphreys, 2015d; Sui et al., 2016), it cannot be excluded that, in our two experiments, the self-prioritization effect could be (also) modulated by any of these features of the stimuli. Future studies should seek to disentangle the valence from these correlated dimensions. For instance, to disentangle valence from perceptual salience, researchers may reverse the typical relationship between these two variables, testing if highly salient stimuli characterized by negative valence are prioritized over less salient stimuli characterized by positive valence.

As a final note, we also point out that a third, nonpreregistered hypothesis, could be the presence of a systematic advantage for the processing of symmetric shapes. If true, this would lead to faster and more accurate responses to all symmetric shapes, than to asymmetric shapes, independently of self-prioritization and polarity correspondence. This hypothesis would be consistent with the idea that symmetry is salient at a perceptual level (e.g., Bertamini et al., 2013). The results of both experiments are inconsistent with this additional hypothesis. Had the hypothesis been correct, then, independently of identity (i.e., self or stranger) trials showing symmetric shapes would have been responded faster and more accurately than trials showing asymmetric shapes. However, a facilitation effect of symmetry emerged in matched trials but not in nonmatching trials (see Appendix C).

To conclude, the results of our two experiments indicate that the self-prioritization effect can be flexibly modulated by specific features of self- and other-relevant information. We suggest that valence might play a key role for the self-prioritization effect, as negative self-relevant information would not be prioritized over positive other-relevant information. This would reflect a general tendency of the cognitive system to keep a positive bias for the self and a negative bias for the stranger (see also Taylor & Brown, 1988).

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Appendix A

Experiment 1: Response Times

Table A1

Results of the 2 (Association Type) × 2 (Matching) × 2 (Shape) ANOVA on the Response Times of Correct Responses of Experiment 1

Effect	*F* value	*p*	η^2_G
Association type	*F*(1, 29) = 1.9	.178	.005
Matching	*F*(1, 29) = 36.51	<.001*	.022
Shape	*F*(1, 29) = 33.81	<.001*	.036
Association Type × Matching	*F*(1, 29) = 4.52	.042*	.001
Association Type × Shape	*F*(1, 29) = 31.65	<.001*	.013
Matching × Shape	*F*(1, 29) = 13.56	<.001*	.006
Association Type × Matching × Shape	*F*(1, 29) = 46.17	<.001*	.035

Note. Symbol * indicates a statistically significant effect ($p < .05$).

Table A2

Results of the 2 (Matching) × 2 (Shape) ANOVAs on the Response Times of Correct Responses of Experiment 1, for the Self-Symmetry and the Self-Asymmetry Associations

Self-symmetry association				Self-asymmetry association			
Effect	*F* value	*p*	η^2_G	Effect	*F* value	*p*	η^2_G
Matching	*F*(1, 29) = 39.29	<.001*	.031	Matching	*F*(1, 29) = 15.11	<.001*	.014
Shape	*F*(1, 29) = 66.30	<.001*	.082	Shape	*F*(1, 29) = 3.72	.06	.006
Matching × Shape	*F*(1, 29) = 54.24	<.001*	.064	Matching × Shape	*F*(1, 29) = 10.12	.003*	.012

Note. Symbol * indicates a statistically significant effect ($p < .05$).

(*Appendices continue*)

Experiment 1: Percentage of Errors

Table A3

Results of the Mixed-Effect Logit Model for the Percentage of Errors in Experiment 1

Effect	χ^2 value	*p*
Association type	χ^2 (1) = 71.15	<.001*
Matching	χ^2 (1) = .35	.55
Shape	χ^2 (1) = 5.35	.02*
Association Type × Matching	χ^2 (1) = 20.61	<.001*
Association Type × Shape	χ^2 (1) = 97.71	<.001*
Matching × Shape	χ^2 (1) = 4.65	.03*
Association Type × Matching × Shape	χ^2 (1) = 43.29	<.001*

Note. Symbol * indicates a statistically significant effect ($p < .05$).

Table A4

Results of the Mixed-Effect Logit Model for the Percentage of Errors in Experiment 1, for the Self-Symmetry and the Self-Asymmetry Associations

Self-symmetry association			Self-asymmetry association		
Effect	χ^2 value	*p*	Effect	χ^2 value	*p*
Matching	χ^2 (1) = 31.39	<.001*	Matching	χ^2 (1) = .32	.57
Shape	χ^2 (1) = 134.29	<.001*	Shape	χ^2 (1) = 5.1	.02*
Matching × Shape	χ^2 (1) = 51.6	<.001*	Matching × Shape	χ^2 (1) = 4.57	.03*

Note. Symbol * indicates a statistically significant effect ($p < .05$).

Appendix B

Experiment 2: Response Times

Table B1

Results of the 2 (Association Type) × 2 (Matching) × 2 (Shape) ANOVA on the Response Times of Correct Responses of Experiment 2

Effect	*F* value	*p*	η^2_G
Association type	*F*(1, 102) = 0.22	.64	.002
Matching	*F*(1, 102) = 115.92	<.001*	.025
Shape	*F*(1, 102) = 68.98	<.001*	.025
Association Type × Matching	*F*(1, 102) = 1.59	.21	<.001
Association Type × Shape	*F*(1, 102) = 45.37	<.001*	.016
Matching × Shape	*F*(1, 102) = 14.47	<.001*	.004
Association Type × Matching × Shape	*F*(1, 102) = 5.93	.017*	.001

Note. Symbol * indicates a statistically significant effect ($p < .05$).

Table B2

Results of the 2 (Matching) × 2 (Shape) ANOVAs on the Response Times of Correct Responses of Experiment 2, Separately for the Self-Symmetry and the Self-Asymmetry Associations

Self-symmetry association				Self-asymmetry association			
Effect	*F* value	*p*	η^2_G	Effect	*F* value	*p*	η^2_G
Matching	*F*(1, 51) = 86.65	<.001*	.030	Matching	*F*(1, 51) = 38.77	<.001*	.020
Shape	*F*(1, 51) = 93.51	<.001*	.074	Shape	*F*(1, 51) = 1.56	.22	.001
Matching × Shape	*F*(1, 51) = 22.46	<.001*	.009	Matching × Shape	*F*(1, 51) = 0.83	.37	<.001

Note. Symbol * indicates a statistically significant effect ($p < .05$).

(*Appendices continue*)

Experiment 2: Percentage of Errors

Table B3

Results of the 2 Association Type × 2 Matching × 2 Shape ANOVA on the Percentage of Errors of Experiment 2

Effect	F value	p	η^2_G
Association type	$F(1, 102) = 0.17$	.68	.001
Matching	$F(1, 102) = 2.22$	.14	.002
Shape	$F(1, 102) = 31.35$	$<.001$*	.034
Association Type × Matching	$F(1, 102) = 3.07$	.08	.003
Association Type × Shape	$F(1, 102) = 66.37$	$<.001$*	.070
Matching × Shape	$F(1, 102) = 24.12$	$<.001$*	.020
Association Type × Matching × Shape	$F(1, 102) = 30.0$	$<.001$*	.026

Note. Symbol * indicates a statistically significant effect ($p < .05$).

Table B4

Results of the 2 Matching × 2 Shape ANOVAs on the Percentage of Errors of Experiment 2, Separately for the Self-Symmetry and the Self-Asymmetry Associations

Self-symmetry association				Self-asymmetry association			
Effect	F value	p	η^2_G	Effect	F value	p	η^2_G
Matching	$F(1, 51) = 0.04$	.84	$<.001$	Matching	$F(1, 51) = 4.40$	.04*	.010
Shape	$F(1, 51) = 160.84$	$<.001$*	.20	Shape	$F(1, 51) = 2.30$	.14	.007
Matching × Shape	$F(1, 51) = 62.44$	$<.001$*	.094	Matching × Shape	$F(1, 51) = 0.14$	.71	$<.001$

Note. Symbol * indicates a statistically significant effect ($p < .05$).

Appendix C

Further Comparisons Across Experimental Conditions

Table C1

Results of the t-Tests Exploring the Effects of Association Type on the Response Times of Matched Trials in Experiments 1 and 2

Experiment 1				Experiment 2			
Comparison	t value	p	d	Effect	t value	p	d
(you, symmetric) vs. (you, asymmetric)	$t(29) = -6.78$	$<.001$*	-1.24	(you, symmetric) vs. (you, asymmetric)	$t(98.9) = -2.69$	.008*	-0.75
(stranger, symmetric) vs. (stranger, asymmetric)	$t(29) = -3.26$	.003*	-0.6	(stranger, symmetric) vs. (stranger, asymmetric)	$t(101.1) = -0.96$	.34	-0.27

Note. Here and in the following tables, for Experiment 1 the results refer to paired-sample two-sided *t*-tests, whereas for Experiment 2 they refer to independent-sample two-sided *t*-tests with Welch's correction for the degrees of freedom. Positive (negative) *t*s and *d*s indicate that the response times (RTs) for the first pair in the column *condition* were slower (faster) than the RTs for the second pair. The symbol * indicates a statistically significant effect ($p < .05$). The results show that, in matched trials of both experiments, the RTs for the congruent (you, symmetric) pair were significantly faster than the RTs for the incongruent (you, asymmetric) pair. However, inconsistently with a polarity correspondence principle, in Experiment 1 the RTs for the incongruent (stranger, symmetric) pair were significantly faster than the RTs for the congruent (stranger, asymmetric) pair, whereas no significant difference emerged in Experiment 2.

(*Appendices continue*)

Table C2

Results of the t-Tests Exploring the Effects of Association Type on the Percentage of Errors of Matched Trials in Experiments 1 and 2

Experiment 1				Experiment 2			
Comparison	t value	p	d	Effect	t value	p	d
(you, symmetric) vs. (you, asymmetric)	$t(29) = -3.31$	.003*	−0.6	(you, symmetric) vs. (you, asymmetric)	$t(101.9) = -4.33$	<.001*	−1.2
(stranger, symmetric) vs. (stranger, asymmetric)	$t(29) = -2.77$	.009*	−0.51	(stranger, symmetric) vs. (stranger, asymmetric)	$t(100) = -5.27$	<.001*	−1.46

Note. Positive (negative) ts and ds indicate that the percentage of errors for the first pair in the column *condition* were larger (smaller) than the percentage of errors for the second pair. The symbol * indicates a statistically significant effect ($p < .05$). The results show that, in matched trials of both experiments, the percentage of errors for the congruent (you, symmetric) pair was significantly smaller than the percentage of errors for the incongruent (you, asymmetric) pair. However, inconsistently with a polarity correspondence principle, in both experiments, the percentage of errors for the incongruent (stranger, symmetric) pair was significantly smaller than that for the congruent (stranger, asymmetric) pair.

Table C3

Results of the t-Tests Exploring the Effects of Association Type on the Response Times of Nonmatching Trials in Experiments 1 and 2

Experiment 1				Experiment 2			
Comparison	t value	p	d	Effect	t value	p	d
(you, symmetric) vs. (you, asymmetric)	$t(29) = 1.63$	.12	0.3	(you, symmetric) vs. (you, asymmetric)	$t(100.3) = -0.62$	.54	−0.09
(stranger, symmetric) vs. (stranger, asymmetric)	$t(29) = 0.56$	.58	0.1	(stranger, symmetric) vs. (stranger, asymmetric)	$t(101.9) = -1.2$	.23	−0.17

Note. The results show that, inconsistently with a polarity correspondence principle, there was no difference between the response times (RTs) for congruent and incongruent pairs in the nonmatching trials of both experiments.

Table C4

Results of the t-Tests Exploring the Effects of Association Type on the Percentage of Errors of Nonmatching Trials in Experiments 1 and 2

Experiment 1				Experiment 2			
Comparison	t value	p	d	Effect	t value	p	d
(you, symmetric) vs. (you, asymmetric)	$t(29) = 0.66$	.52	0.12	(you, symmetric) vs. (you, asymmetric)	$t(101.6) = -0.23$	.82	0.03
(stranger, symmetric) vs. (stranger, asymmetric)	$t(29) = -1.55$	.13	−0.28	(stranger, symmetric) vs. (stranger, asymmetric)	$t(99.1) = -1.76$	.08	−0.24

Note. The results show that, inconsistently with a polarity correspondence principle, there was no difference between the percentage of errors for congruent and incongruent pairs in the nonmatching trials of both experiments.

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