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Accentuate the positive: Evidence that context dependent self-reference drives self-bias

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ABSTRACT

There is abundant evidence of a self-bias in cognition, with prioritised processing of information that is self-relevant. There is also abundant evidence of a positivity-bias in cognition, with prioritised processing of information that is positively valenced (e.g., positive emotional expressions, rewards). While the effects of self-bias and positivity-bias have been well documented in isolation, they have seldom been examined in parallel, so it is unclear whether one or other of these stimulus classes is prioritised or whether they interact. Addressing this gap, the current research aimed to establish the relative primacy of self-bias and positivity-bias using a classification task that paired self-relevant information with emotional expressions (i.e., Expt. 1) or reward information (i.e., Expt. 2). When the self was paired with relatively more positive information (i.e., smiling faces or high reward) we found evidence of a self-bias but no evidence of a positivity-bias. Whereas when the self was paired with relatively less positive information (i.e., neutral faces or low reward) we found evidence of a positivity-bias but no evidence of a self-bias. These results suggest the relative primacy of prioritised processing is flexible, context dependent and might be caused by a drive towards self-enhancement and the self-positivity bias.

1. Introduction

The aim of the current research was to examine the relative primacy between self-biases and positivity-biases – does one form of bias exert a greater influence than the other? To successfully navigate the complex human environment people must selectively orient their spotlight of attention and appropriately allocate their limited cognitive resources. This means prioritising some aspects of the environment more than others. There are multiple convincing demonstrations of a self-bias whereby people show prioritised processing towards self-related stimuli such as own names (Moray, 1959), faces (Sui & Humphreys, 2013; Tong & Nakayama, 1999) and objects (Golubickis, Ho, Falbén, et al., 2021; Turk et al., 2011). There is also abundant evidence of a positivity-bias whereby people show prioritised processing towards positively valenced stimuli such as smiling faces (Hugdahl, Iversen, & Johnsen, 1993), positive words (Stenberg, Wiking, & Dahl, 1998), and high rewards (Anderson, Laurent, & Yantis, 2011). The current research used a classification task that paired self-related information with positive and neutral emotional expressions (i.e., Experiment 1) or rewarding information (i.e., Experiment 2), to determine the relative primacy between self-biases and positivity-biases.

Biases for self-related information are pervasive across multiple aspects of cognition, from memory (Rogers, Kuiper, & Kirker, 1999) to attention (Alexopoulos, Muller, Ric, & Marendaz, 2012), perception (Keyes & Brady, 2010) and decision making (Scheller & Sui, 2022). Self-biases are so universal across cultures (Jiang & Sui, 2022) and ages (Maire, Brochard, & Zagar, 2020; Sui & Humphreys, 2017) that they are present even after stimuli only recently gained self-association (Sui, He, & Humphreys, 2012); and once formed are difficult to abolish (Wang, Humphreys, & Sui, 2016) and persistent over time (Stolte, Humphreys, Yankouskaya, & Sui, 2017). Therefore, in the current design it could be expected that self-biases will occur irrespective of the relative positivity of stimulus pairings and hence will dominate prioritised processing.

While there is abundant evidence of self-bias in cognition, there is also evidence of a pervasive bias for positive information across multiple aspects of cognition (Stolte et al., 2017). For example, positive emotional expressions bias attention (Schupp, Flaisch, Stockburger, & Junghöfer, 2006) and enhance memory (Buchanan & Adolphs, 2002). Similarly, highly rewarding stimuli facilitate visual search (Kristjánsson, Sigurjónsdóttir, & Driver, 2010) and enhance memory (Madan, Fujiwara, Gerson, & Caplan, 2012). Therefore, it could be predicted that the positivity-bias will be uninfluenced by pairings and thus would

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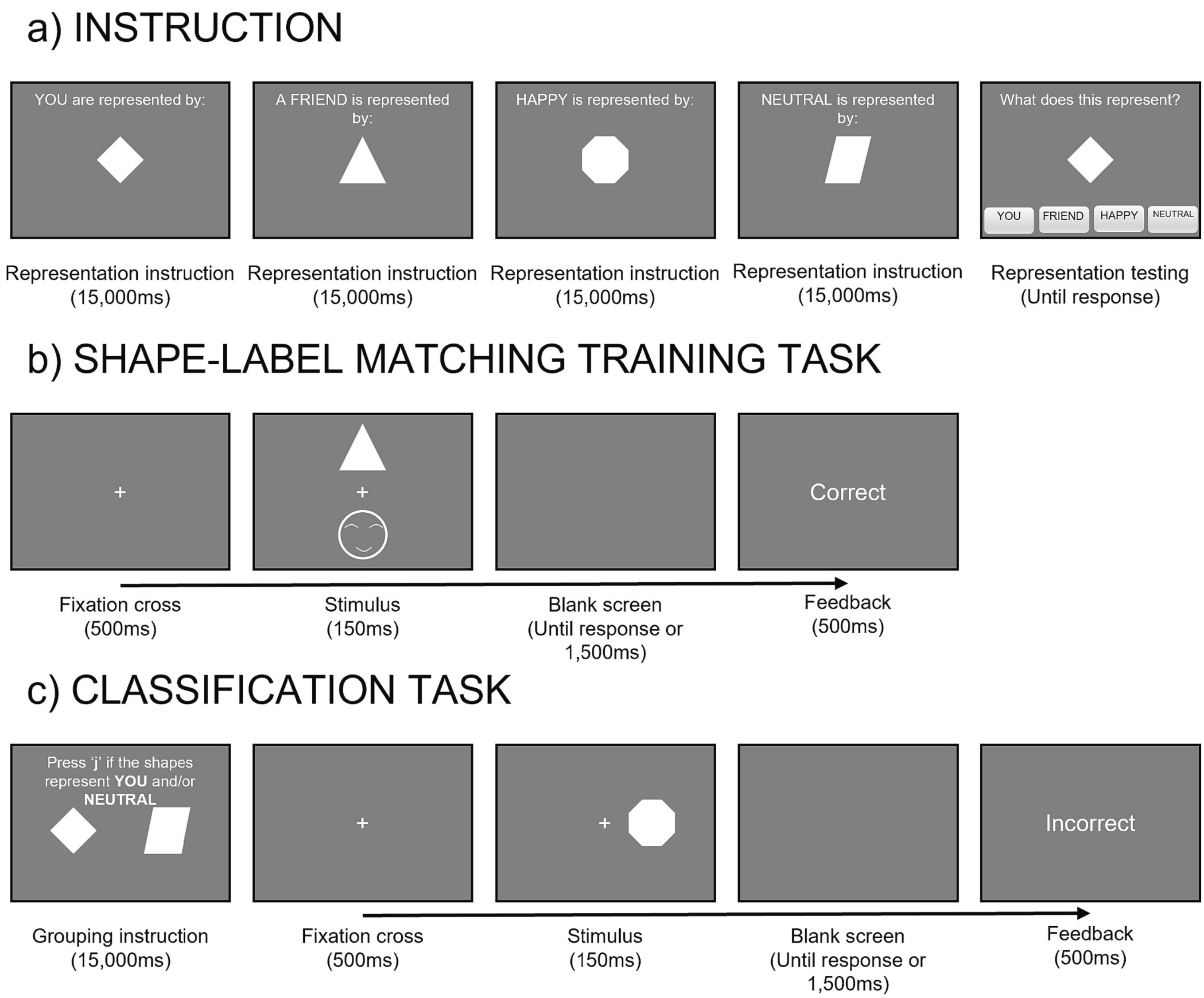

Fig. 1. Example of procedural stages from Experiment 1.
Note. a) an example of the instruction stage. b) an example of a single trial during the shape-label matching training task. c) an example of a pairing instruction and a single trial from Condition 2 (Pairings: self-neutral/friend-happy) in the experimental classification task.

dominate prioritised processing.

Another consideration is that there may be an additive effect on self-biases when the self is paired with the more positive stimuli. It has been demonstrated that larger self-biases are present when the self-related stimuli are positive (Constable, Becker, Oh, & Knoblich, 2021; Hu, Lan, Macrae, & Sui, 2020; Vicovaro, Dalmaso, & Bertamini, 2022). For example, associating the self with a positively valanced stimuli or aspect of the self in comparison to a negatively valanced concept leads to larger self-biases (Constable et al., 2021; Hu et al., 2020; Vicovaro et al., 2022). These results may be driven by an implicit association between the self and positivity as indicated by better performances in implicit association tasks when the self and positivity are grouped (Orellana-Corrales, Matschke, Schäfer, & Wesslein, 2022; Yankouskaya & Sui, 2021). These effects are likely influenced by the self-positivity bias (viewing the self positively and others more negatively) (Chen et al., 2014). It is believed that sustaining a self-positivity bias is critical in maintaining healthy mental wellbeing (Alicke & Sedikides, 2009) and the self-enhancement theory suggests that incoming information is filtered and distorted to maintain this bias (Sedikides & Gregg, 2008). In the present study this may result in self-biases being larger; or present uniquely, in conditions conforming to the self-positivity bias. To date, research has focused unidirectionally on the influence of pairing positive and negative stimuli with the self. Therefore, it remains unknown whether the self-positivity-bias will also influence positivity-biases.

Across two experiments, the current research sought to address the previously presented questions to establish the relative primacy between self-biases and positivity-biases by adapting a speeded classification task (Sui & Humphreys, 2015). Experiment 1 examined the relationship between self and positive/neutral facial expressions. During an initial shape-label matching (Sui et al., 2012) training phase, participants learnt associations between four geometric shapes and four labels. During the classification task, participants were instructed that shapes would be paired together onto a single response key (e.g., Self/Happy lefthand-key Friend/Neutral righthand-key), and that when a shape appeared they should press the corresponding key as quickly and accurately as possible. The response mappings were switched halfway through the experiment (e.g., Self/Happy & Friend/Neutral switched to Self/Neutral & Friend/Happy). Experiment 2 examined the relationship between self and high and low reward; the procedure was identical to Experiment 1, except that the happy and neutral labels were replaced with high and low reward labels (i.e., £9 and £1 respectively). Thus, the current research sought to establish whether:

1. Self-bias occurs irrespective of the relative positivity of stimulus pairings (i.e., context independent self-bias)
2. Positivity-bias occurs irrespective of the relative self-relevance of stimulus pairings (i.e., context independent positivity bias)
3. Self-bias will be larger, or uniquely present, when the self is paired with more positive stimuli (i.e., context dependent self-enhancing bias)

Predictions 1 and 2 are not mutually exclusive, if both occur this will indicate that there is no relative primacy in the processing of self-related and positive stimuli.

2. Experiment 1

2.1. Methods

2.1.1. Participants

A priori power analysis was conducted using G*Power (Erdfelder, Faul, & Buchner, 1996) based on a pilot study ($n = 8$) using the same design as Experiment 2 with self and reward stimuli. Effect size, f(U), was calculated for the critical effect of paired self-reward interactions in RT (using paired data which will be examined in an alternative manuscript). A sample size of 34 participants was determined to obtain a medium effect size of 0.39 with a power of 0.90 at the standard 0.05 alpha. This was increased to 48 to allow for full counterbalancing. Participants were replaced if their performance in the Condition 1 and/or Condition 2 shape-label matching training task was below the chance level cut-off (average accuracy <55% and/or mean RT < 200 ms).

57 participants were recruited from SONA, with 10 excluded due to performance at chance level. The average age of the 47 participants was 20.23 years (SD = 1.92, range = 18–28).

All participants had normal or corrected-to-normal vision and were fluent in English. Informed consent was acquired from all participants following procedures approved by a local ethics committee.

2.1.2. Procedure

The experiment was conducted online using Testable software (Rezlescu, Danaila, Miron, & Amariei, 2020) (test material can be viewed online at (tstbl.co/624–731).

Participants were told that shapes would represent themselves, a previously named best friend, a happy face and neutral face and were tested on these associations (Fig. 1a). The faces were line drawings representing the expression. Sui et al. (2012) matching task was used to train these associations (Fig. 1b). The task led to successful learning (>70% accuracy for each association) in less than 20 trials for each association therefore the 'tagged' shapes were used in the classification task. Further detail about the matching task is provided in the Supplementary Material.

Experiment 1 was a within-subjects 4 (Individual association: Self, Friend, Happy, Neutral) X 2 (Condition: 1-Self & Happy/Friend & Neutral pairings vs. 2-Self & Neutral/Friend & Happy pairings) design. In the classification task participants were instructed to respond to which pairing the factors belong to (Fig. 1c). Each pair was then presented for 15 s. In Condition 1, the pairs were: Self and Happy, Friend and Neutral. In Condition 2, the pairs were: Self and Neutral, Friend and Happy. Trial timings are presented in Fig. 1c. Following fixation, shapes were presented (singularly left or right of the fixation cross, or two shapes both left and right). Subsequently participants made a speeded judgment as to which pairing the shape/s belong to. Key allocation was counterbalanced across participants. Feedback (correct, incorrect, too slow) followed each trial. Trial order was pseudorandomly allocated by Testable software. Average reaction time (RT) and accuracy were reported at the end of each block. There were three practice blocks (identical timing of stimuli and instruction as the matching task practice blocks – see Supplementary material). For the experimental task participants completed three blocks of 60 trials resulting in 30 trials in each factor equally presented to the left and right (i.e., Individual association: self, friend, happy, neutral; and Paired: self and happy/neutral, friend and happy/neutral). The current work focused on individual association trial types, the paired trials were present to ensure pairings were retained, but are not analysed in this manuscript. See Table S1 in supplementary material for information about experimental manipulations.

The procedure was repeated in the subsequent condition. Order of condition completion was counterbalanced across participants. Between conditions participants completed questionnaires which will be used in future research and are not reported here.

Table 1
Generalised Linear Mixed Effects Model Output and Posthoc Pairwise Comparisons for RT in Experiment 1.

Fixed Effects

	β	SE	95% CI	t	*p*
Intercept	582.97	8.63	566.05–599.90	67.52	<0.01**
Self vs. Friend	2.56	4.03	−5.34–10.47	0.64	0.53
Happy vs. Neutral	13.99	4.11	5.92–22.05	3.40	<0.01**
Self vs. Happy	17.08	4.57	8.11–26.04	3.73	<0.01**
Condition 1 vs. 2	−2.51	9.30	−20.74–15.72	−0.27	0.79
Self vs. Friend X Condition 1 vs. 2	−47.58	6.76	−60.84–34.32	−7.03	<0.01**
Happy vs. Neutral X Condition 1 vs. 2	28.47	7.22	14.31–42.62	3.94	<0.01**
Self vs. Happy X Condition 1 vs. 2	40.39	7.35	25.99–54.79	5.50	<0.01**

Random Effects

	Variance	SD	Correlation
Participant (intercept)	905.70	30.10	
Participant X Condition (slope)	1905.00	43.65	0.03

Model Fit

Marginal R^2	AIC	BIC
0.06	122,391.8	122,478.0

Model equation: RT ~ Association * Condition + (1 + condition | participant)

Posthoc Pairwise Comparisons

	Estimate	SE	CI	z. ratio	*p*
Condition 1: Self - Friend	−24.79	4.65	−33.91–-15.67	−5.33	<0.0001***
Condition 2: Self - Friend	2.59	4.58	−6.39–11.57	0.57	0.57
Condition 1: Happy - Neutral	−1.32	4.82	−10.76–8.13	−0.27	0.78
Condition 2: Happy - Neutral	−9.58	4.84	−19.08–-0.09	−1.98	0.05*
Condition 1: Self - Happy	−10.18	4.71	−19.4–-0.95	−2.16	0.03*
Condition 2: Self - Happy	−12.55	4.66	−21.69–-3.41	−2.69	0.01**
Self: Condition 1–2	−1.08	10.15	−20.97–18.81	−0.11	0.92
Friend: Condition 1–2	26.30	9.99	6.73–45.87	2.63	0.01**
Happy: Condition 1–2	−3.45	10.08	−23.2–16.3	−0.34	0.73
Neutral: Condition 1–2	−11.72	9.81	−30.95–7.51	−1.19	0.23

Note. For fixed effects comparisons the reference condition is the one to the left of the 'vs'.

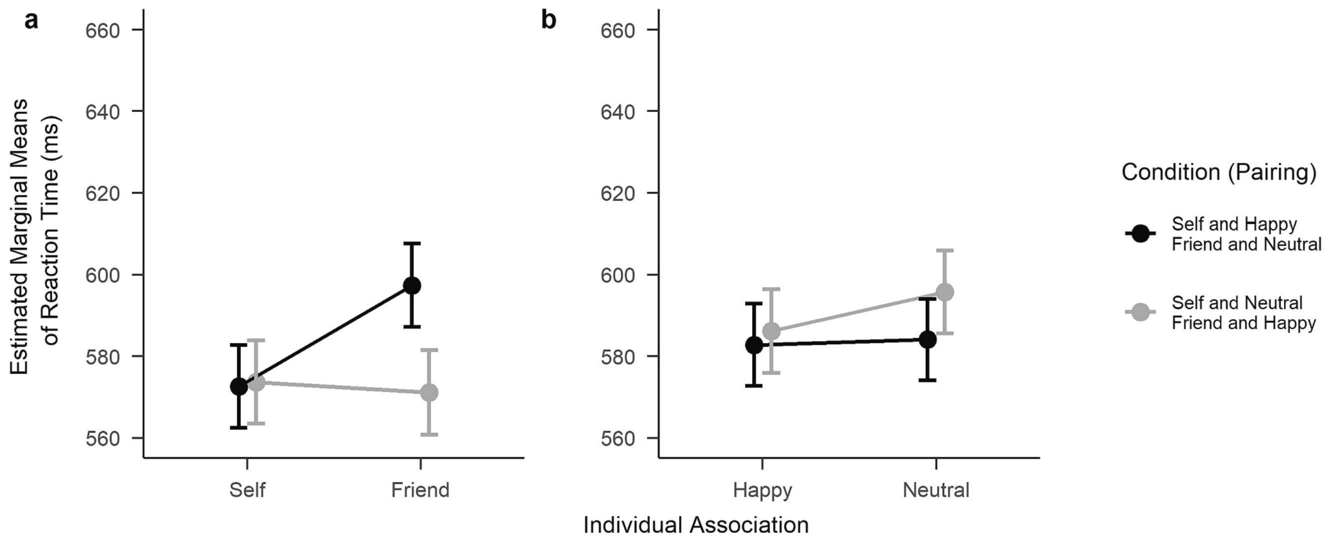

Fig. 2. Estimated Marginal Mean of RT as a function of Individual Association across Conditions in Experiment 1.
Note. a) shows the individual association self-bias across conditions. b) shows the individual association emotional positivity-bias across conditions. Error bars represent standard error.

2.1.3. *Data analysis*

Responses shorter than 200 ms were excluded from all analysis, eliminating 0.91% of the trials. Trials in which no response was made within 1650 ms were classified as incorrect trials, eliminating 0.32% of the trials. RT analysis included only correct response trials.

Generalised linear mixed effect models (GLMM) were used to account for the large variability within participants from online data and the non-normally distributed data (i.e., long tail in distribution due to slow RTs). Two-way interactions between fixed effects: individual association (self, friend, happy, neutral), and condition (i.e., keypress pairings) (Condition 1: Self/Happy, Friend/Neutral pairings vs. Condition 2: Self/Neutral, Friend/Happy pairings) were tested using GLMMs, the dependent variable was RT or accuracy. Due to high overall task accuracy ceiling effects were present so accuracy analysis is provided in Supplementary Material (Table S2 – Experiment 1 and S3 – Experiment 2). Non-orthogonal contrast coding was used for individual association comparisons: Self vs. Friend (self-bias); Happy vs. Neutral (positivity-bias) and Self vs. Happy. Self-biases occur when RTs are faster to the self than friend. Positivity-biases occur when RTs are faster to the happy than neutral stimuli.

RT models were conducted using the inverse gaussian family with the identity link function to account for the long tail in the distribution (Lo & Andrews, 2015). Accuracy models were conducted using the binomial family with the default logit link function. The bound optimization by quadratic approximation with a set maximum of 200,000 iterations was used. Fixed effects structures were selected based on experimental design and hypotheses therefore no model comparisons against simpler fixed effect model structures were conducted. The maximal random effect structure was chosen (Barr et al., 2013) and simplified when convergence or singularity issues occurred. The RT model equation was:

RT ~ Association * Condition + (1 + condition | participant).

This includes fixed effects of individual association, condition and association*condition interaction. Within random effects, each participant's intercept and slopes can be influenced by the condition.

Posthoc pairwise comparisons of estimated marginal means were used to investigate any significant interactions.

2.2. *Results & discussion*

Full RT model outputs are provided in Table 1, data is plotted in Fig. 2.

A significant two-way interaction indicated differences across the conditions between self-bias magnitudes (β = −47.58, 95% CI [−60.84 to −34.32], $p < .001$). Posthoc analysis revealed a significant self-bias in individual associations in Condition 1 when the self was paired with the happy face (friend with neutral) (β = −24.79, 95% CI [−33.91–−15.67], $p < .0001$). But no self-bias was observed in individual associations in Condition 2 when the self was paired with the neutral face (friend with happy) (β = 2.59, 95% CI 95% CI [−6.39–11.57], $p = .57$). The difference in bias across the conditions was likely driven by changes in response to the friend rather than the self. No significant differences were observed in responses to the self between conditions (β = −1.08, 95% CI [−20.97–18.81], $p = .92$), whereas responses to the friend were significantly quicker in Condition 2 (β = 26.30, 95% CI [6.73–45.87], $p < .01$).

Like self-bias, a significant two-way interaction indicated changes in emotional positivity-bias magnitudes across conditions (β = 28.47, 95% CI 95% CI [14.31–42.62], p < .001). However, in contrast to self-bias findings, posthoc analysis revealed no emotional positivity-bias in individual associations in Condition 1 when the happy emotion was paired with the self (friend with neutral) (β = −1.32, 95% CI [−10.76–8.13], $p = .78$), but a significant emotional positivity-bias was observed in Condition 2 when the happy emotion was paired with the friend (self with neutral) (β = −9.58, 95% CI [−19.08–−0.09], $p = .05$).

The results indicate that manipulating pairings of self and positivity alters individual association biases. However, the biases alter in opposite directions. Self-biases were observed when the self was paired with positivity but eliminated when the self was paired with neutrality. Whereas the emotional positivity-bias was observed when positivity was paired with the friend but not with the self. Experiment 2 repeats the current design whilst examining the rewarding rather than emotional positivity-bias.

3. Experiment 2

3.1. *Methods*

3.1.1. *Participants*

Target sample size was identical to Experiment 1. 65 participants were recruited from Prolific (www.prolific.co), 13 were excluded due to performance at chance level and one excluded due to stimuli testing error. The average age of the 51 participants was 28.98 years (SD = 10.36, range = 18–67).

Table 2
Generalised Linear Mixed Effects Model Output and Posthoc Pairwise Comparisons for RT in Experiment 2.

Fixed Effects	β	SE	95% CI	t	p
Intercept	617.88	12.36	593.65–642.10	49.99	<0.01**
Self vs. Friend	11.97	3.82	4.48–19.45	3.13	<0.01**
£9 vs. £1	3.53	3.70	−3.73–10.80	0.95	0.34
Self vs. £9	−1.14	4.23	−9.43–7.14	−0.27	0.79
Condition 1 vs. 2	16.37	30.34	−43.10–75.83	0.54	0.59
Self vs. Friend X Condition 1 vs. 2	−27.15	6.46	−39.80 −14.49	−4.21	<0.01**
£9 vs. £1 X Condition 1 vs. 2	25.90	6.32	13.52–38.29	4.10	<0.01**
Self vs. £9 X Condition 1 vs. 2	20.39	7.26	6.15–34.62	2.81	0.01**

Random Effects	Variance	SD	Correlation
Participant (intercept)	1038.00	32.22	
Participant X Condition (slope)	2229.00	47.21	−0.1

Model Fit		
Marginal R^2	AIC	BIC
0.06	136,854.2	136,941.9

Model equation: RT ~ Association * Condition + (1 + condition | participant)

Posthoc Pairwise Comparisons	Estimate	SE	CI	z. ratio	p
Condition 1: Self - Friend	−19.87	4.09	−27.88–-11.86	−4.86	<0.0001***
Condition 2: Self - Friend	−2.92	4.27	−11.29–5.46	−0.68	0.49
Condition 1: £9 - £1	3.75	4.10	−4.29–11.79	0.91	0.36
Condition 2: £9 - £1	−11.96	4.44	−20.67–-3.25	−2.69	< 0.01**
Condition 1: Self - £9	−6.14	4.15	−14.28–1.99	−1.48	0.14
Condition 2: Self - £9	0.00	4.36	−8.56–8.55	0.00	1.00
Self: Condition 1–2	−19.75	30.96	−80.43–40.94	−0.64	0.52
Friend: Condition 1–2	−2.79	31.20	−63.94–58.35	−0.09	0.93
£9: Condition 1–2	−13.61	29.27	−70.98–43.76	−0.47	0.64
£1: Condition 1–2	−29.32	30.64	−89.37–30.74	−0.96	0.34

Note. For fixed effects comparisons the reference condition is the one to the left of the 'vs'.

3.1.2. Procedure

The procedure was identical to Experiment 1, except the emotional faces were replaced with reward values: happy - £9 and neutral - £1. Participants received 9 tokens for every correct response to £9 and 1 token for correct £1 responses. Tokens earned led to bonus payments. So, Experiment 2 was also a within-subjects 4 (Individual Association: Self, Friend, £9, £1) X 2 (Condition: 1-Self & £9, Friend & £1 pairings vs. 2-Self & £1, Friend & £9 pairings) design.

3.1.3. Data analysis

Data analysis was identical to Experiment 1,[1] with happy being replaced by £9 and neutral being replaced by £1. 0.48% of the trials were < 200 ms and eliminated and 0.16% of the trials were > 1650 ms and eliminated.

The model equation used was:

RT ~ Association * Condition + (1 + condition | participant).

This includes fixed effects of association, condition and association*condition interaction. Within random effects, each participant's intercept and slopes can be influenced by the condition.

3.2. Results & discussion

Full RT model outputs are provided in Table 2, data is plotted in Fig. 3.

A two-way interaction indicated significant differences in in self-bias magnitudes across conditions (β = −27.15, 95% CI [−39.80 to −14.49], $p < .001$). Posthoc analysis revealed a significant self-bias, in individual associations in Condition 1, when the self was paired with high reward (friend-low reward) (β = −19.87, 95% CI [−27.88–-11.86], $p < .0001$). But no self-bias was observed, in Condition 2, when the pairings were reversed (self-low reward and friend-high reward) (β = −2.92, 95% CI [−11.29–5.46], $p = .49$). These results conceptually replicate those observed in Experiment 1, however here the difference appears largely driven by changes in responses to the self.

A significant two-way interaction indicated changes in reward positivity-bias across conditions (β = 25.90, 95% CI [13.52–38.29], p < .001). Replicating emotional positivity-bias results from Experiment 1, posthoc analysis revealed no high-reward positivity-bias, in individual associations in Condition 1, when high reward was paired with the self (low-reward with friend) (β = 3.75, 95% CI [−4.29–11.79], $p = .36$), but a significant high-reward bias, in Condition 2, when high-reward was paired with the friend (self-low reward) (β = −11.96, 95% CI [−20.67–-3.25], $p < .01$).

The results observed in Experiment 2 mirrored those of Experiment 1. Pairing influenced biases such that the individual association self-bias was exclusively observed when the self was paired with high reward and the reward positivity-bias was solely observed in individual associations the other pairing (when high-reward was paired with the friend). Despite similar overall results in self-biases (self-bias solely when self was paired with positive stimuli) the mechanism driving the effect appear distinct. Whereas similar patterns are observed in emotional and reward positivity-biases. These differences are discussed in greater detail in the General Discussion.

4. General discussion

The current research examined the relative primacy of self-biases and positivity-biases by manipulating pairings of self and positivity in classification tasks. Individual association self-biases were present when the self was paired with the positive stimuli but under these pairings no individual association positivity-biases were observed. Whereas, when the self and positive stimuli were in separate pairings, the individual association self-bias was eliminated, and the individual association positivity-bias was present. This suggests that the relative primacy of biases changes dependent on contextual pairings.

[1] Due to the large range in ages in Experiment 2 a reviewer suggested considering whether age influenced results. GLMMs were run with the same model equation as above with the addition of age as a random effect. No differences were observed in the main results of interest (see Supplementary Material).

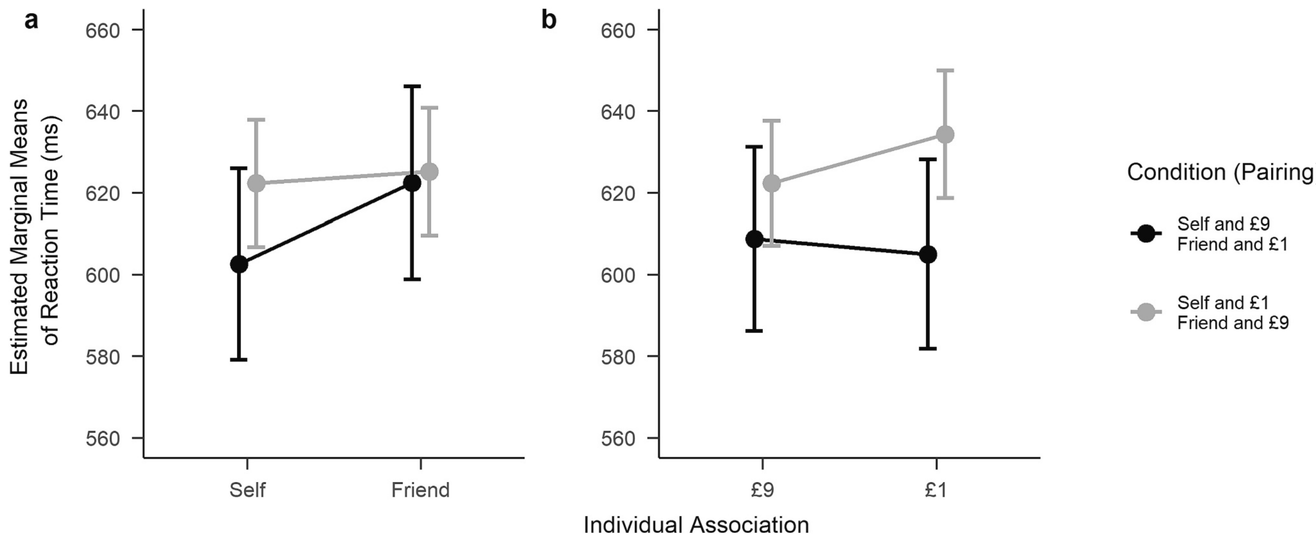

Fig. 3. Estimated Marginal Mean of RT as a function of Individual Association across Condition in Experiment 2.
Note. a) shows the self-bias across conditions. b) shows the reward positivity-bias across conditions. Error bars represent standard error.

The current results demonstrate that self-processing varies dependent on paired information. Self-biases were observed under self-positive and self-rewarding conditions but not self-neutral or self-low reward ones. Despite similarities in self-bias changes across the experiments the mechanisms driving the results appear distinct.

In Experiment 1 the absence of self-bias when the self was paired with neutrality and the friend was paired with positivity was driven by a significant improvement in response times to the friend in this condition in comparison to the other, indicating that pairing the friend with positivity led to facilitated responses. This may result from positive connotations often being held about friends hence leading to greater processing for the friend when it conforms to this viewpoint and is paired with positivity (Chavez, Heatherton, & Wagner, 2017). Previous research has also found advantages for self-positive information, but within these experiments the self-related stimuli were positive (e.g., smiley face) (Constable et al., 2021; Hu et al., 2020; Vicovaro et al., 2022). In contrast the current design had distinct self and positive-related stimuli but examined the effects of pairing. Recent research has shown that newly learnt self-associations are implicitly positively valenced as indicated by better performances in self-positive grouping in implicit association tasks (Orellana-Corrales et al., 2022). Therefore, in the current design the self was likely already carrying a positive valence and hence pairing with a separate positive valence did not impact responses.

In Experiment 2, the absence of self-bias when the self was paired with low reward (friend-high reward) appears to be driven by deteriorated performances to the self. These results support prediction 3 that self-positivity bias and self-enhancement will limit self-biases to self-positive contexts. So, the elimination of self-bias may result from the conflict of pairing the self with a perceived negative factor such as low reward (Alicke & Sedikides, 2009; Ma & Han, 2010; Sedikides & Gregg, 2008). This mirrors previous results of eliminated self-face advantages in self-recognition tasks following pairing the self-concept with negative personality traits (Ma & Han, 2010). Alternatively, it could be argued that self-positive advantages led to self-biases and the absence of self-biases in the self-neutral conditions was typical. However, due to the usual observation of self-biases and previous demonstrations of self-bias extinction under self-negative contexts (Sui, Ohrling, & Humphreys, 2016) the former explanation appears more likely.

It was predicted that the results between the experiments would be conceptually similar, however, this was not the case. One potential difference between the experiments which may explain the varied results is the relative overlap between the representations of stimulus types. In Experiment 1 participants could create a relatively concrete mental representation of each grouping (e.g., a smiling image of their friend, or a neutral image of themselves). This variation may explain why a friend-positivity bias was observed in Experiment 1, but not in Experiment 2. The mental representation of a smiling friend is likely to be concrete and reflect the view one holds of a friend. Whereas the relatively more abstract nature of the reward stimulus means that it is not possible to generate such a concrete mental representation (i.e., how would one imagine a £9 friend). On the other hand, the observation of self-bias extinction under self-negative contexts solely in Experiment 2 may relate to stimuli outcomes. In Experiment 2 participants received bonus payments corresponding with the reward values likely enhancing the difference between positive (£9) and neutral (£1) stimuli, in contrast in Experiment 1 the emotional facial expressions used did not lead to explicit differences based on performance.

The emotional and reward positivity-bias showed similar behavioural patterns, the biases were larger when in separate pairs to the self. The changes to positivity-bias appear predominantly driven by changes to the comparative 'neutral' variable (neutral emotion, low-reward). When the comparative variables are in the same pair as the friend, these variables may access prioritised processing due to being an 'anchor' point as they are the 'most negative' variables (Self > Happy/High reward > Friend > Neutral/Low reward). Past research using the shape-label matching task demonstrated that when five reward values were used both the highest reward and lowest reward were prioritised (Yankouskaya, Lovett, & Sui, 2022). The current results may therefore suggest a sequential hierarchy across both motivational factors (e.g., Self > Happy/High Reward > Friend > Neutral/Low reward).

4.1. Conclusion

In conclusion, self-biases are present when there are positive associations with self, but biases shift towards positive aspects of the external environment when there are more neutral associations with self. These differences may stem from context dependent self-reference processing occurring to maintain self-positivity biases, such that self-related stimuli only receive prioritised processing when coupled with positive information in valenced contexts.

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CRediT authorship contribution statement

Naomi A. Lee: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Visualization, Writing – original draft. **Douglas Martin:** Supervision, Writing – review & editing. **Jie Sui:** Conceptualization, Funding acquisition, Methodology, Supervision, Writing – review & editing.

Declaration of Competing Interest

None.

Data availability

All data and analysis code are available at: https://osf.io/4k56b/?view_only=6575952710034f5b867f83aebdca9112

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cognition.2023.105600.

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