



# What is a face worth? Facial attractiveness biases experience-based monetary decision-making

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There is ample evidence that attractive individuals, across diverse domains, are judged more favourably. But most research has focused on single/one-shot decisions, where decision-makers receive no feedback following their decisions, and outcomes of their judgements are inconsequential to the self. Would attractive individuals still be judged favourably in experience-based decision-making where people make iterative decisions and receive consequential feedback (money gained/lost) following each decision? To investigate this question, participants viewed headshots of four financial partners presented side-by-side and repeatedly (over 50–100 trials) selected partners that would help maximize their profits. Following every partner-selection, participants received feedback about the net monetary gains/losses the partner had conferred. Unbeknownst to participants, two partners (one attractive, one unattractive) were equally advantageous (conferred net-gains overtime) and two partners (one attractive and one unattractive) were equally disadvantageous (conferred net-losses overtime). Even though attractive and unattractive partners were equally profitable and despite receiving feedback, participants selected attractive partners more throughout the task were quicker to reselect them even when they conferred losses and judged them as more helpful. Indeed, attractive-disadvantageous partners were preferred to the same extent (or more) as unattractive-advantageous partners. Importantly, the effect of attractiveness on decision-making was fully explained by the perceived trustworthiness of the financial partners.

Imagine a scenario in which, to maximize profits, one must choose amongst multiple investment agents. Who should one choose, especially in situations where *no* prior information about the agents' profitability is available? In the absence of any objective information, one might be swayed by available social cues (e.g., agents' facial attractiveness, race, sex, etc.), as has been shown by a large literature (e.g., Fiske & Neuberg, 1989). But what happens as one acquires objective information/feedback about the agents' profitability over time? A reasonable assumption is that as agents confer monetary gains/losses, one would use this objective information to inform future decisions. Simply, if the agent one chooses yields net losses over time, one should learn from these experiences and be less likely to trust this agent with one's money in the future. Conversely, if another agent yields net gains over time, one should be encouraged to entrust one's money to her in the future. This reasoning is not only commonsense but also informed by a wealth of research showing that people learn from previous interactions,

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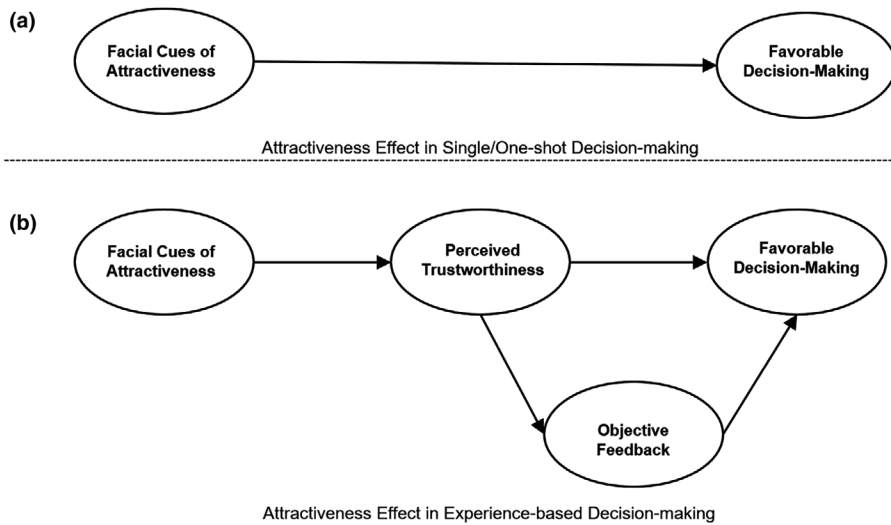
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update one's view of another, and appropriately modify future behaviour as a natural outcome of associative and reinforcement learning (Niv, 2009; Sutton & Barto, 1998).

Still, here, we ask: might such experience-based decision-making be swayed by seemingly inconsequential and irrelevant social cues? Specifically, would the investment agents' facial attractiveness colour how one evaluates something as objective and consequential as the monetary gains/losses conferred by them over time? Despite the abundance of research on how facial cues bias judgements, relatively less work has examined how facial cues shape experience-based decision-making – situations where individuals initially have no information about the optimal choice, but must learn about them over time through trial and error – that is, by making a series of decisions and relying on the feedback from their choices to make subsequent decisions. Across two experiments, we empirically tested the hypothesis that experience-based decision-making would be swayed by the facial attractiveness of the investment agents, even when attractiveness has no bearing on the agents' actual profitability. Further, we also tested the hypothesis that the biasing effect of facial attractiveness on experience-based decision-making is driven *not* simply because of the general physical appeal of the agents, but because their attractiveness cues perceived trustworthiness, which in turn affects experience-based decision-making.

At first glance, our hypothesis that facial attractiveness shapes experience-based decision-making may appear to have been addressed by decades of research documenting the effect of facial cues on decision-making. Most relevant to the present work, attractive individuals are routinely the beneficiaries of better outcomes in a variety of real-world contexts, such as hiring (Jackson, 1983), voting (Sigelman, Thomas, Sigelman, & Ribich, 1986), student assessments (Ambady & Rosenthal, 1993), criminal sentencing (Mazzella & Feingold, 1994), and financial investments (Solnick & Schweitzer, 1999). But surprisingly, most work has focused on single/one-shot decisions. In such paradigms, participants are often presented with a photograph of a target person, sometimes along with objective information about them that is relevant to the decision to be made. For example, participants are asked to sentence a defendant and are presented with a photograph of the defendant and the nature of the crime. Studies using these paradigms show that across different domains, participants are swayed by facial attractiveness (Baert & Decuyper, 2014; Stewart, 1980). Importantly, however, in these paradigms, participants only make a single decision, never receive feedback about whether their decision was correct or wrongful, and their decision often has no direct consequence for the self. Figure 1 (panel a) provides a conceptual illustration of such single/one-shot decisions.

Although findings from studies examining single/one-shot decisions have profound real-world implications, theoretically, it is perhaps unremarkable that facial attractiveness – an incidental and irrelevant social cue – can sway a single decision in situations where individuals do not receive any feedback. Literature on judgement and decision-making shows that people routinely use mental short cuts to simplify information (Chaiken & Ledgerwood, 2012; Kahneman, 2011; Shah & Oppenheimer, 2008), and facial cues can be viewed as visually cued heuristics for quick and effortless decision-making (Gutiérrez-García, Beltran, & Calvo, 2019; Rhodes & Baron, 2019). But a less oft examined issue centres around the persistent effect of facial cues of attractiveness in swaying ongoing decisions where people receive objective feedback and experience consequences that personally impact the self. Might the biasing effect of facial attractiveness on decision-making diminish in the face of objective and self-relevant consequences, such as how much money an investment agent confers?



**Figure 1.** A conceptual illustration of the effect of attractiveness in commonly used single/one-shot decision-making paradigms (panel a) and in experience-based decision wherein participants receive feedback about their decision (panel b). In single/one-shot decision-making paradigms, participants make a single decision, never receive feedback about whether their decision was correct or wrongful, and their decision often has no direct consequences for the self. In contrast, in experience-based decision-making paradigms, participants repeatedly make decisions, receive objective feedback about their decisions, and their decision has direct consequences for the self. In experience-based decision-making paradigms, facial attractiveness is expected to cue trustworthiness, and perceptions of a partners' trustworthiness are expected to colour how objective feedback is perceived and processed.

Experience-based decision-making paradigms are ideally suited for examining this question. In such paradigms, decision-makers make iterative decisions (e.g., 50–100 decisions) and receive feedback immediately following each decision. Importantly, such feedback is often objective and consequential to the self (e.g., money gained/lost) and decision-makers must learn through trial and error to make the most advantageous choices over time (Hertwig, Barron, Weber, & Erev, 2004; Kudryavtsev & Pavlodsky, 2012). Naturally, because these paradigms assess decision-making over time, they allow for examining how ongoing feedback shapes decisions (Siegel, Mathys, Rutledge, & Crockett, 2018).

Although past work on experience-based decision-making has focused on nonsocial contexts (Larrick, 2016), there is an increasing appreciation that decision-making often happens in social contexts. For example, at times, people must choose the *person* who is likely to confer profits, as illustrated in our hypothetical scenario. Several theorists have noted that in social contexts, the task of computing gains and losses over time is likely affected by one's beliefs, expectations, and social inferences about those with whom one interacts (Lee & Harris, 2013; Ruz, Moser, & Webster, 2011). Further, in social contexts, perceptions of an interaction partner's trustworthiness are particularly important. Perceiving a partner as trustworthy is expected to induce feelings of trust and prosocial behaviours towards the partner (Siegrist and Cvetkovich, 2002; Mulford, Orbell, Shatto, & Stockard, 1998; Slovic, 1999; Wilson & Eckel, 2006). Moreover, based on the risk literature, perceptions of trustworthiness are expected to shape decision-making by

colouring how people interpret objective feedback (Siegrist & Zingg, 2014), but objective feedback is not expected to shape perceptions of trustworthiness (White & Eiser, 2006).

Empirically, work has examined how ongoing decision-making is shaped by interaction partners who either signal or cue their trustworthiness. For example, a handful of studies have examined how emotional facial expressions, which provide information about partners' intentions for enacting prosocial behaviours, shape experience-based decision-making (Averbeck & Duchaine, 2009; Delgado, Frank, & Phelps, 2005; Ma, Hu, Jiang, & Meng, 2015; Tortosa, Lupiáñez, & Ruz, 2013). In behavioural economic games, financial partners with smiling expressions were preferred and trusted more than partners with scowling expressions, even though smiling and scowling partners were equally as financially rewarding (Frith, 2009; Furl, Gallagher, & Averbeck, 2012). In a similar vein, other work has shown that experimentally manipulating perceptions of partner's trustworthiness robustly influences experience-based decision-making. For example, in a repeated Trust game, financial partners with trustworthy (vs. untrustworthy) facial appearances were preferred more and trusted more, even though partners were objectively equally as rewarding (Chang, Doll, van 't Wout, Frank, & Sanfey, 2010; Yu, Saleem, & Gonzalez, 2014).

### **Present work**

The present work focuses on how the effects of facial attractiveness on decision-making may be resilient even in the face of receiving objective feedback, and how such effects may occur by spontaneously cueing perceptions of the partners' trustworthiness (Figure 1, panel b). As such, our focus differs from past work that experimentally manipulated facial cues more directly linked with perceptions of trustworthiness. That is, whereas emotional expressions are observable communicative signals of a person's intentions, facial attractiveness is a fixed physical characteristic, and *not* a form of communication. Similarly, whereas perceptions of trustworthiness directly map on to perceptions of a person's intentions for enacting prosocial behaviours, facial attractiveness is commonly viewed as a signal of health and fertility (Foo, Simmons, & Rhodes, 2017; Żelaźniewicz, Nowak, Łacka, & Pawłowski, 2020), and not necessarily intentions. Thus, whereas emotional expressions and a person's perceived trustworthiness may be a valid basis for evaluating objective information, facial attractiveness is a seemingly irrelevant social cue for evaluating a partner's objective financial utility.

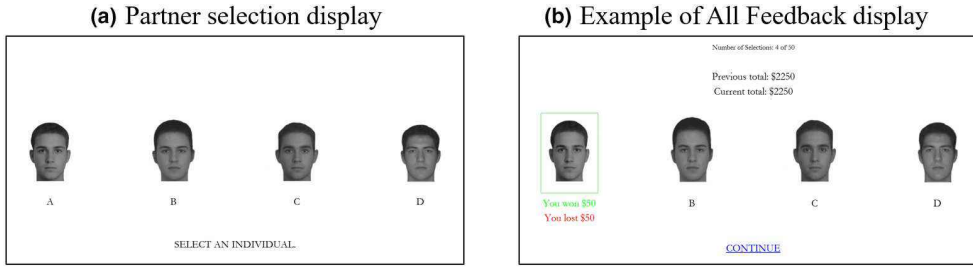
Our hypothesis that facial attractiveness may be a particularly potent social categorization cue in experience-based decision-making is based on work showing that facial attractiveness is processed efficiently, is difficult to ignore, and has a high reward value (Cloutier, Heatherton, Whalen, & Kelley, 2008). Thus, when decision-makers encounter attractive investment agents, the agents' facial attractiveness may exert its effects on decision-making in a bottom-up fashion that may be difficult to control (McConnell, Rydell, Strain, & Mackie, 2008; Olson & Marshuetz, 2005). Importantly, although physical attractiveness is a cue of physical health, it can also spontaneously elicit perceptions of trustworthiness. Indeed, several models of person perception assume that attractiveness is an observable cue that positively modulates people's perceptions of others' trustworthiness (Eagly, Ashmore, Makhijani, & Longo, 1991; Ohanian, 1991; Oosterhof & Todorov, 2008; Willis & Todorov, 2006).

Given this past work, here, we aimed to address the following questions: To what extent, does facial attractiveness bias experience-based decision-making? And, do such effects, if they occur, operate via increasing trustworthiness perceptions of a person? To

achieve these aims, we developed a novel task, which we refer to as the *Interpersonal DEcision-Making Task* (IDEM). Our task was modelled off the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994), which is a classic example of a nonsocial experience-based decision-making task because it uses neutral images – decks of cards – that do not have inherent meaning or evaluative significance. In the standard IGT, participants are hypothetically loaned \$2,000 and are instructed to maximize their gains and minimize their losses. They are presented with four decks of cards (A, B, C, and D) that appear side by side on a computer screen and are asked to repeatedly select cards from amongst the four decks. They are also instructed that some decks are more profitable than others. On each trial, participants draw a card from one of four decks and with each card choice, they win or lose money. Typically, participants make about one hundred card choices, one at a time, with the goal of maximizing profits. Unbeknownst to participants, two decks (Decks C and D) are programmed to be *advantageous* – they confer smaller immediate gains but larger net gains over time. In comparison, two other decks (Decks A and B) are *disadvantageous* – they confer larger immediate gains but net losses over time. Additionally, two decks (Decks A and C) offer frequent losses, whereas the other two decks (Decks B and D) offer infrequent losses. Because participants are unaware of each deck's likelihood of rewards and losses, they must learn over time which decks are advantageous versus disadvantageous through actively monitoring their previous choice-outcomes. In non-clinical populations, people initially select disadvantageous decks (being lured by the larger immediate reward), but over time gradually shift their card choices to the advantageous decks, a pattern that reflects learning which decks have a higher payoff (Steingroever, Wetzels, & Wagenmakers, 2013). Moreover, participants tend to avoid decks that confer frequent (vs. infrequent) losses (Carlson, Zayas, & Guthormsen, 2009; Lin, Song, Chen, Lee, & Chiu, 2013).

To create a social experience-based decision-making task, in our IDEM task, we replaced the four decks with facial photographs of four individuals described as *financial partners* (see Figure 2a). Like the IGT, participants were loaned \$2,000 (hypothetical) and told that the four financial partners could help them win or lose money and that some partners would be more helpful than others. They were instructed to maximize earnings by choosing partners that would be most profitable over 50–100 trials. Most importantly, of the two equally advantageous partners (like Decks C and D), one was attractive, and one was unattractive. Similarly, of the two equally disadvantageous partners (like Decks A and B), one was attractive, and one was unattractive. In this manner, the IDEM task examines the biasing effects of partners' attractiveness as participants received feedback following every partner selection over the course of 50–100 trials.

We predicted that at the very beginning of the IDEM task, in the absence of any information about the profitability of the financial partners, participants would use the available social category cue of partners' facial attractiveness and show an initial preference for attractive (vs. unattractive) partners (Brodt & Ross, 1998). But, importantly, our main prediction was that even after encountering feedback about the monetary gains/losses conferred by the partners – objective information that was highly consequential to the self – participants would continue to select attractive partners more. In other words, even though participants received direct and immediate feedback following each of their partner selections, and could perform a direct, side-by-side comparison of the gains and losses conferred by each of the four partners, they would still show a behavioural preference for attractive (vs. unattractive) partners. Indeed, we expected that at the end of the task, participants' self-reported judgements of partners' helpfulness would also reflect this bias.



(c) The payoff scheme of partners in the IDEM task

	Face A (Attractive Advantageous)	Face B (Unattractive Advantageous)	Face C (Attractive Disadvantageous)	Face D (Unattractive Disadvantageous)
Gain Amount	\$50	\$50	\$100	\$100
Loss Frequency	Low	High	Low	High
Gain-Loss Ratio (per 10 trials)	9:1	5:5	9:1	5:5
Loss Amount	\$250	\$50	\$1250	\$150-\$350
Long-term Outcome (per 10 trials)	+\$250	+\$250	-\$250	-\$250

**Figure 2.** (a) Partner selection display as seen by the participants at the beginning of the IDEM task, immediately following the instructions. (b) Example of the feedback display in the *all* feedback condition (see Supplementary Material S1 for examples of outcome feedback display for the global-only and specific-only feedback conditions). Type of outcome feedback did not significantly and reliably affect the results across Experiments 1 and 2 (see Supplementary Material S1). (c) The payoff scheme used for the financial partners in the IDEM task.

Additionally, we examined the extent to which the effect of facial attractiveness may be most pronounced following losses. That is, receiving feedback that a partner conferred a monetary loss should undermine confidence in the partner and lessen the likelihood that the same partner would be chosen in the future. We expected that this reluctance to return to a partner who had conferred a loss would be less pronounced for attractive (vs. unattractive) partners. But, past work has shown that people are less sensitive to unfair offers made by attractive (vs. unattractive) individuals (Ma et al., 2015). Thus, we reasoned that participants in our experience-based decision-making task would be less sensitive to monetary losses conferred by attractive (vs. unattractive) partners.

Our final aim was to examine a mechanism for the biasing effect of facial attractiveness. Specifically, in Experiment 2, we examined the extent to which facial attractiveness serves as a cue of a partner’s perceived trustworthiness, which then leads decision-makers to favour attractive over unattractive financial partners, despite both being equal in terms of their profitability.

## EXPERIMENT 1

### Method

For both Experiments 1 and 2, we obtained approval from the Institutional Review Board for human participants and written informed consent from all participants; we report all measures, manipulations, and exclusions; and provide the data and the SPSS syntax at [https://osf.io/pqhbkm/?view\\_only=dc518e134c234c7b97abce3eb26d0cd6](https://osf.io/pqhbkm/?view_only=dc518e134c234c7b97abce3eb26d0cd6).

## Participants

Ninety-two undergraduate students participated in exchange for course credit. One participant was excluded because of having selected the same partner on all 50 trials, leaving 91 participants in the final sample (see Supporting Information for demographic information).<sup>1</sup> Our primary hypotheses involved assessing differences in ongoing partner selections between attractive and unattractive partners, and if the effect of facial attractiveness decreases over time. To identify the minimum effect size that could be obtained using our design with 80% statistical power, we performed a sensitivity analysis using simulations (see Supporting Information). The results indicated that our experiment could detect a minimum effect size of Cohen's  $d$  of .27 for the main effect of attractiveness and  $d$  of .58 for the attractiveness x time interaction (5% alpha level, two-tailed).

## Experimental design

Our experimental design was a mixed factorial with partner attractiveness (attractive vs. unattractive), partner advantageousness (advantageous vs. disadvantageous), and time (first half vs. second half of IDEM task) as within-subject factors. The frequency with which partners offered losses (low vs. high) is a critical factor in the IGT (Steingrover et al., 2013) and was a between-subject factor. Because the manner in which feedback is presented may affect the learning of partners' profitability (Jessup, Bishara, & Busemeyer, 2008), we randomly assigned participants to receive one of three types of outcome feedback (all, global-only, and specific-only). The conclusions reported in the results section hold across the different feedback conditions. However, results involving type of outcome feedback did not replicate across the two experiments. Therefore, for the sake of simplicity, we report methods and results involving type of outcome feedback in the Supporting Information.

## Procedures

Participants completed the experimental procedures individually. All instructions and measures were administered using Inquisit 3.0.3.2 (Draine, 2009) on Windows XP-based computers with 17-inch CRT monitors with 1,024 × 768 resolution. Participants first completed two IDEM tasks – one with all male partners and another with all female partners,<sup>2</sup> followed by self-report measures, and were debriefed at the end of the experiment. None of the participants guessed the motive for the experiment.

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<sup>1</sup> Given the rich literature on sex differences on the effect of attractiveness (e.g., Desrumaux, DeBosscher, & Léoni, 2009; Palumbo, et al., 2017), we explored the potential moderating effect of participant sex and partner sex. Interactions involving participant sex or partner sex and our main focal predictor (attractiveness) did not replicate across experiments. They also did not appreciably change the conclusions drawn here. We report results from models including participant and partner sex in the Supporting Information for the interested reader.

<sup>2</sup> Each participant completed two IDEM tasks in succession: One with all male partners and another with all female partners (order was counterbalanced across participants). We found evidence for carryover effects such that learning in the first IDEM task transferred to the second IDEM task. Specifically, repetition (1st IDEM vs. 2nd IDEM) interacted with partner advantageousness ( $p = .03$ ) and loss frequency ( $p = .03$ ). The interaction with partner advantageousness reflected that participants selected disadvantageous (vs. advantageous) partners more in the first IDEM task ( $p = .003$ ), but no such preference was observed in the second IDEM task ( $p = .89$ ). The interaction with loss frequency reflected that the preference for partners offering infrequent losses was greater in the first (vs. second) IDEM task (but statistically significant in both,  $ps < .001$ ). Although the question of how learning transfers across sets of people is an interesting question, it was not the aim of the present work. Thus, we focus our analyses on data from the first IDEM task, treating partner sex as a between-subjects factor. However, it is worth noting that the effect of the IDEM task repetition did not significantly interact with partner attractiveness ( $p = .41$ ). This is consistent with our general findings that the attractiveness stereotype is resilient despite the presence of partners' profitability information.

*IDEM task*

As illustrated in Figure 2 (panel a), the IDEM task began with photographs of four faces (all male or all female) appearing one next to the other, horizontally, at the middle of the screen. Adapted from the IGT, participants were instructed to select one of the four financial partners, on each trial, using the mouse (see Supporting Information for specific instructions), and that each time they selected a partner, they would receive outcome feedback – that is, monetary gains and losses conferred by the selected partner (see Figure 2, panel b). Importantly, participants were told that their goal was to earn as much money as possible by selecting the partners that were most financially advantageous. Importantly, research assistants encouraged participants to sample all financial partners so as to gauge which partners would be most profitable. Analyses of how many times participants switched their choice of partners across IDEM confirmed that participants complied with the instructions (see Supporting Information).

Each partner's face in the IDEM task was a composite produced by averaging six real faces (DeBruine & Jones, 2017). Using an independent sample, we validated the consensual attractiveness of the composite faces (see Supporting Information). Thus, in each IDEM task, two faces were attractive, and two faces were unattractive. Importantly, two partners (one attractive and one unattractive) were programmed to be advantageous and two partners (one attractive and one unattractive) were programmed to be disadvantageous, with position of the faces counterbalanced across participants (see Supporting Information). To simulate the inherent uncertainty of real-life decision situations, as in the IGT, we also manipulated loss frequency: For half of the participants, attractive partners offered frequent losses (i.e., 5:5 loss–gain ratio/10 trials) whilst unattractive partners offered infrequent losses (i.e., 1:9 loss–gain ratio/10 trials), and for the remaining half of the participants, the opposite was true. Thus, on every trial, irrespective of which partner was selected, participants received a gain. However, losses were conferred by partners based on a pre-programmed payoff scheme (see Figure 2, panel c).

**Dependent variables***Behavioural measures of preference*

Our primary behavioural measures were (1) *partner selections over time* – that is, on how many trials participants selected attractive (vs. unattractive) partners over the course of the task, and (2) *return-to-partner index* – that is, after selecting a partner, how many trials, on average, had lapsed before participants selected the same partner again? This latter measure was used to tap into participants' willingness to forgive a partner following a loss. To compute the return-to-partner index, we first subtracted the trial number on which a partner was selected from the next trial number on which the same partner was selected.<sup>3</sup> For example, if a participant initially selected a partner on the 10th trial, and the same partner was selected again on the 11th trial, and again on the 20th trial – the participant returned to this partner on the first occasion after one trial (trial 11– trial 10) and on the second occasion after nine trials (trial 20–trial 11). Second, we computed the

<sup>3</sup> Only trials in which the partner was selected again were included in computing the return-to-partner index. That is, if a partner was selected on a certain trial but was never selected again, it was not possible to compute the number of trials it took the participant to return to a partner because the return did not occur. Such situations could reflect that a participant simply did not have the option to select the partner again (because of limited number of trials) or reflect a possible behavioural preference against the partner.



average number of trials it took participants to return to the same partner. In the above example, the return-to-partner index for this particular participant and this partner was 5 (10/2). We were interested in whether participants would be particularly forgiving when attractive (vs. unattractive) partners conferred losses. Thus, we computed the return-to-partner indices as a function of losses (how quickly participants returned to a partner that had conferred a loss; earning  $\leq 0$  profit/money) and gains (how quickly participants returned to a partner that had conferred a gain; earning  $> 0$  profit/money). Therefore, we computed, for each participant, a total of eight average return-to-partner indices (two [following loss and gain] for each of the four partners). A lower return-to-partner index represents that fewer trials had lapsed before participants selected the same partner again or in other words, the participant returned to a partner sooner.

#### *Perceived helpfulness*

After the IDEM task, participants were asked to ‘*Rank the partner you think helped you the most with a 1, helped you second most with a 2, helped you third most with a 3 and helped you least with a 4*’. To facilitate interpretation, we reverse-scored the ranks for each partner. Thus, higher scores represent greater perceived helpfulness.

#### *Perceived attractiveness*

Although photographs of partners had been independently validated on attractiveness, perceptions of attractiveness can be idiosyncratic (Mileva et al., 2019). Thus, to assess participants’ own perceptions of the partners’ attractiveness, they were asked to ‘*Rate the following individuals on how attractive you think they are*’ on a 7-point scale from 1 (*Not at all*) to 7 (*Very attractive*). Confirming our stimulus validation, attractive partners were rated as significantly ( $p < .001$ ) more attractive (see Supporting Information).

#### **Data analytic strategy**

Our main dependent variables were the two behavioural measures and one subjective measure of perceived helpfulness. Given the repeated measures structure of the data, we used multilevel models (MLM), with a restricted maximum likelihood estimation (Hayes, 2006; Kliegl, Wei, Dambacher, Yan, & Zhou, 2011). Specifically, we ran separate MLMs for each dependent variable (see Supporting Information for details of model specifications). Given the multiple factors in the experimental design, and for the sake of brevity, we focus primarily on results involving the main effects of attractiveness, advantageousness, and loss frequency. For the partner selections over time-dependent variable, we also focus on how each of the main factors interacts with time (first half vs. second half). Unless otherwise stated, two- and three-way interactions that did not replicate across the two experiments are not discussed in the main text. To compute the effect size for key results within a MLM framework, we followed the formula for deriving  $R^2$  provided by Snijders and Bosker (2012; see also Lorah, 2018; Nakagawa & Shielzeth, 2013), and converted  $R^2$  to a Cohen’s  $d$ , which we report in the results.

**Table 1.** Summary of key findings from the MLMs for each dependent variable (partner selections over time, return-to-partner index, and perceived helpfulness) for Experiment 1

	<i>df</i>	<i>F</i>	<i>p</i>	Cohen's <i>d</i>
<i>Partner selections over time</i>				
Attractiveness	1, 703	14.17	<.001	0.29
Loss Frequency	1, 703	188.08	<.001	1.03
Advantageousness	1, 703	16.40	<.001	0.29
Attractiveness × Time	1,703	.020	.889	0.00
Advantageousness × Time	1,703	1.176	.278	0.09
<i>Return-to-Partner Index</i>				
Attractiveness	1, 652	.97	.323	0.06
Attractiveness × Outcome	1, 652	1.83	.177	0.11
<i>Perceived Helpfulness</i>				
Attractiveness	1, 342	12.13	.001	0.38
Advantageous	1, 342	29.16	<.001	0.59
Loss Frequency	1, 342	45.81	<.001	0.73

## Results

Results of key findings of the MLMs (*F*, *p*, *d*) are reported in Table 1. The descriptive statistics and the full results of the MLMs are reported in the Supporting Information (see Tables S1 and S2).

### *Participants' first choice*

We expected participants to select attractive partners on the very first trial. Indeed, participants were four times more likely to select an attractive partner (80%) on the very first trial. McNemar's exact test for the difference in proportion was highly statistically significant ( $p < .00001$ ) and revealed a large effect size ( $g = .30$ , where  $g$  represents the deviation from the constant probability of .5; Cohen, 1969, p. 142).

### *Partner selections over time*

Providing clear support for the resilient biasing effect of attractiveness, over the course of the 50 trials of the IDEM task, participants selected attractive (vs. unattractive) partners more often (see Figure 3, top panel).<sup>4</sup> Moreover, time (first half vs. second half) failed to moderate the effect of attractiveness, indicating that the biasing effect of attractiveness showed no evidence of weakening even as information about the partners' profitability increased over time.

Although advantageousness and loss frequency are not central to our main aims, conceptually replicating past work (e.g., Bechara, Damasio, & Damasio, 2000) provides construct validity for our newly developed IDEM task. Replicating previous work using the IGT, participants selected partners that conferred infrequent losses more than partners that conferred frequent losses. However, participants selected disadvantageous partners more than advantageous partners (Figure 3, bottom panel). Time did not

<sup>4</sup>We report raw (not estimated) means in the results sections for both Experiments 1 and 2.

significantly moderate the effect of advantageousness. We discuss these results further in the discussion section.<sup>5</sup>

One might wonder: Do people select attractive partners who are financially disadvantageous more than unattractive partners who are advantageous? Indeed, participants preferred attractive-disadvantageous partners more than unattractive-advantageous partners, as revealed by a follow-up comparison ( $t(90) = 3.090$ ,  $p = .003$ ;  $M_{\text{Diff}} = 4.48$ , 95% CI [1.60, 7.36]).

### **Return-to-partner index**

Did participants return sooner to attractive (vs. unattractive) partners that had conferred a loss (vs. gain)? When partners conferred losses, participants were quicker, though not at  $p < .05$ , to return to attractive (vs. unattractive) partners. However, when partners conferred gains, participants did not differ in how quickly they returned to attractive or unattractive partners. The interaction effect between attractiveness and outcome (i.e., gain or loss conferred by partner) was not statistically significant and nor was the main effect of attractiveness.<sup>6</sup>

### **Perceived helpfulness**

At the end of the IDEM task, participants judged attractive (vs. unattractive) partners as more helpful (see Table 1). Participants also judged advantageous (vs. disadvantageous) partners as more helpful. Although behaviourally, participants were more likely to select disadvantageous partners, this finding suggests that by the end of the task participants may have indeed learned the long-term profitability of the partners, ultimately acknowledging the profitability of advantageous partners. Participants also judged partners that offered infrequent (vs. frequent) losses as more helpful.

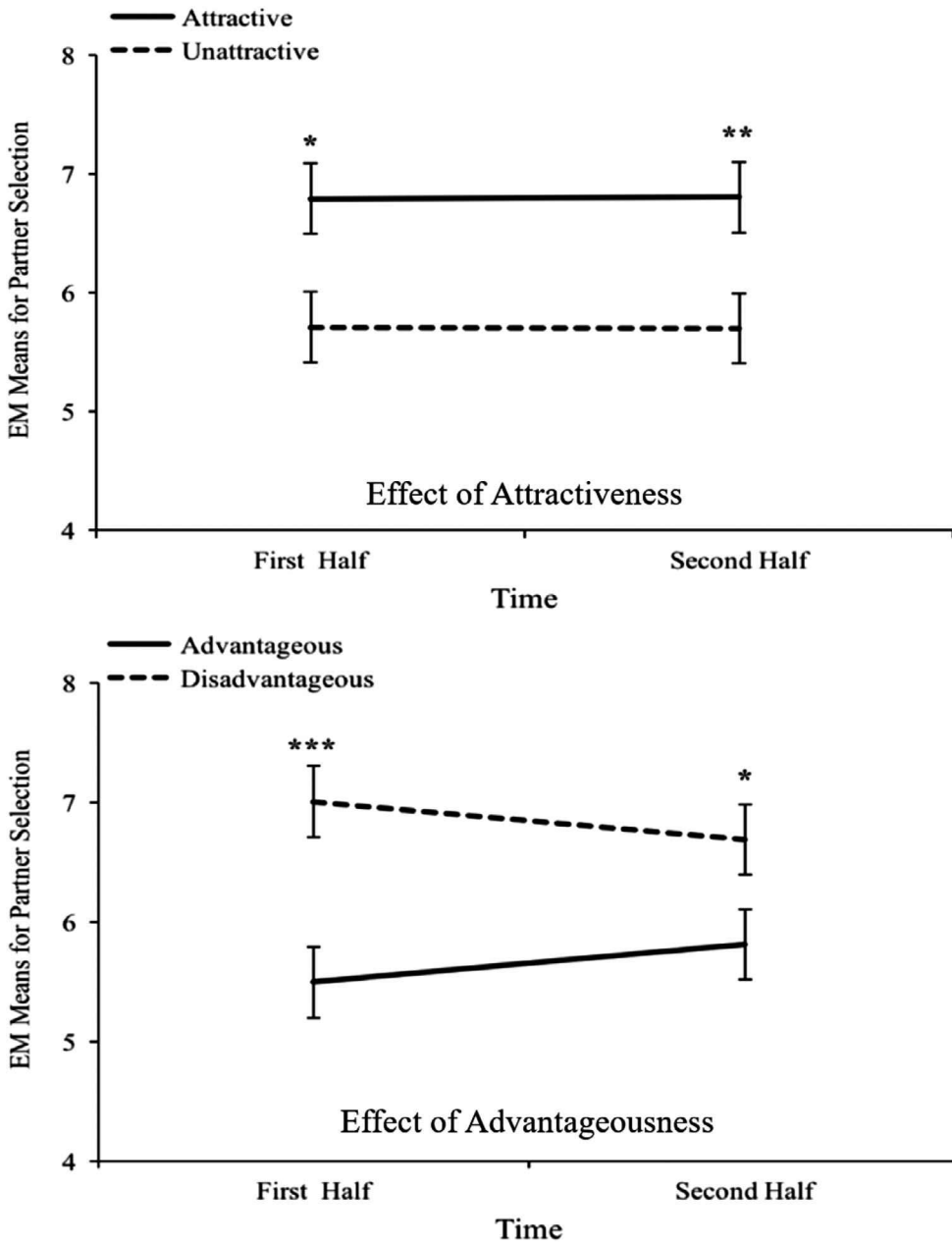
## **Discussion**

Experiment 1 provides evidence for the resilient effects of facial attractiveness on experience-based decision-making. Even though attractive and unattractive partners had the same payoffs and even after having encountered immediate and direct feedback about the partners' profitability over the course of the task, participants' ongoing behavioural choices remained swayed by partners' facial attractiveness. Indeed, participants preferred attractive-disadvantageous partners, despite them conferring worse financial outcomes, more than unattractive-advantageous partners. Finally, there was also some evidence, though not significant at conventional levels, that participants were quicker (i.e., allowed fewer trials to go by) to reselect attractive (vs. unattractive) partners after they conferred losses.

Despite the promising results, it is worth noting that unlike the findings in the standard IGT (Bechara et al., 1994), wherein healthy participants learn to choose advantageous (vs. disadvantageous) decks over time, participants tended to select more disadvantageous

<sup>5</sup> Additionally, advantageousness interacted with loss frequency ( $F(1,703) = 57.11$ ,  $p < .001$ ,  $\eta_p^2 = .075$ ), such that participants learned the profitability of the partners more quickly when they conferred frequent (vs. infrequent) losses. No other three-way interactions were statistically significant.

<sup>6</sup> Additionally, we examined the effect of frequency and advantageousness on the return-to-partner index. The results provided construct validity for our approach (see Supporting Information).



**Figure 3.** Estimated marginal (EM) means for selecting attractive and unattractive partners (top panel) and advantageous and disadvantageous partners (bottom panel) for the first and second half of the IDEM task (25 trials per half). Error bars represent  $1 \pm SE$  above or below the mean. Higher numbers represent greater behavioural selection. The asterisks indicate the level of statistical significance at each level of time between the selection of attractive and unattractive partners (top panel) and between the selection of advantageous and disadvantageous partners (bottom panel). \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

(vs. advantageous) partners. A plausible reason why the results may not have replicated past findings could be due to the shorter nature of the IDEM task. Fifty trials may not have afforded participants enough time to learn the profitability of the partners. This raises the possibility that the effect of partners' attractiveness prevailed because participants did not have ample opportunity to learn the profitability of the partners. Perhaps with more opportunity to learn the partners' profitability, the biasing effect of attractiveness would diminish. For this reason, in Experiment 2, we increased the number of trials to 100.

## EXPERIMENT 2

Experiment 2 had two main aims. First, we aimed to bolster the empirical evidence to support our claim that the biasing effects of facial attractiveness persist despite repeatedly receiving direct and immediate feedback about financial partners' profitability. To do so, we aimed to replicate the results, but also doubled the number of decision-making trials from 50 to 100 so that participants had more opportunity to learn about the long-term payoffs of the four partners. We also increased the statistical power of our design by increasing the sample size. Importantly, our key hypothesis about the resilient effect of attractiveness over time is reflected by a nonsignificant ( $p > .05$ ) interaction between partner attractiveness and time. But nonsignificant  $p$ -values cannot be taken as evidence in favour of the null hypothesis (Nickerson, 2000). Thus, to quantify the evidence in favour of the null hypothesis that the effect of attractiveness does not dissipate with time, we performed equivalence testing (Lakens, 2017; Lakens, Scheel, & Isager, 2018). Equivalence testing more precisely allows us to conclude that an observed effect is smaller than the smallest effect of interest or some specified value.

Second, we aimed to explore a possible mechanism to account for the resilient biasing effect of facial attractiveness on experience-based decision-making. Given theorizing that facial attractiveness not only cues health and fertility but provides a shortcut for judging trustworthiness, we expected decision-makers to infer that attractive (vs. unattractive) individuals have prosocial intentions and motivations (Calvo, Gutiérrez-Carcia, & Beltrán, 2018; Gutiérrez-García, Beltrán, & Calvo, 2019; O'Doherty et al., 2003; Willis & Todorov, 2006). In turn, we expected the heightened perceptions of trustworthiness to account for the effect of facial attractiveness on experience-based decision-making. Thus, in Experiment 2, we also assessed the perceived trustworthiness of the financial partners and examined its mediating role.

## Method

### Participants

One hundred and forty undergraduate students participated in the experiment for course credit. Five participants had already participated in Experiment 1 and so were excluded from the sample leaving 135 participants (see Supporting Information for demographic information). Similar to Experiment 1, we performed a sensitivity analysis. The results revealed that our experiment could detect an effect size of approximately  $d = .19$  and  $d = .40$  for the test of the main effect of partner attractiveness, and the interaction effect between attractiveness and time, with 80% statistical power ( $\alpha = .05$ , two-tailed).

### **Experimental design**

Similar to Experiment 1, this experiment employed a mixed factorial design with partner attractiveness (attractive vs. unattractive), partner advantageousness (advantageous vs. disadvantageous), and time (first, second, third, and fourth quarters of the IDEM task) as within-subject factors. The frequency with which partners offered losses (low vs. high) and type of outcome feedback were between-subject factors. We focused on two types of outcome feedback (specific-only and global-only) to further test their effect, especially with increased trials. Outcome feedback did not appreciably moderate the effect of attractiveness (see Supporting Information).

### **Procedures and materials**

The procedure was similar to Experiment 1, except for the following modifications: (1) participants completed only one IDEM task with either all female or all male partners; (2) we doubled the number of trials from 50 to 100; (3) we ensured that the first three times any partner was selected, no loss was conferred. In Experiment 1, the loss/gain ratio was predetermined and equated across financial partners (see Figure 2, panel c), thus, receiving a loss early in the IDEM task would not pose a confound. Nonetheless, losses incurred early in the IDEM task may be particularly salient and diagnostic, could strongly colour impressions of the partner who conferred them (Asch, 1946; Jeong, Minson, & Gino, 2020; Sullivan, 2019), and unduly affect participants' subsequent decisions. Importantly, such primacy effects would result in noise, and decreased sensitivity for comparing selection of attractive (vs. unattractive) partners; (4) Instead of using composite faces like in Experiment 1, we used four female and four male faces from the Radboud Faces Database (Langner et al., 2010). We validated the face stimuli using the approach described in Experiment 1 and ensured that attractive partners were rated as significantly ( $p < .001$ ) more attractive than unattractive partners (see Supporting Information); And, (5) at the end of the task, we assessed partners' *perceived trustworthiness*. As in Experiment 1, we also assessed their perceived helpfulness and perceived attractiveness.

#### *Perceived trustworthiness*

Perceived trustworthiness was assessed by asking participants to '*Rate the following individuals on how trustworthy you think they are*' on a 7-point scale (1 = *Not at all*, 7 = *Very trustworthy*).

### **Data analytic strategy**

With regards to aim 1, which involved providing a replication of Experiment 1 findings, we analysed the data using the same data analytic strategy specified in Experiment 1 (see Supporting Information). Like in Experiment 1, we focus primarily on results involving the main effects of attractiveness, advantageousness, and loss frequency. Additionally, we performed equivalence testing using the two one-sided tests' (TOST) procedure (Lakens, 2017) for a dependent sample. Specifically, in the TOST procedure, upper ( $\Delta_U$ ) and lower ( $\Delta_L$ ) equivalence bounds are specified based on the smallest effect ( $\Delta$ ) size of interest (e.g., a positive or negative raw score difference or standardized difference such as Cohen's  $d$ ) and two composite null hypotheses are tested:  $H0_1: \Delta \leq \Delta_L$  and  $H0_2: \Delta \geq \Delta_U$ . When both these one-sided tests can be statistically rejected, one can conclude that  $\Delta_L < \Delta < \Delta_U$  or

that the observed effect falls within the equivalence bounds and is close enough to zero to be practically equivalent (Lakens et al., 2018; Seaman & Serlin, 1998). We used the estimated marginal means and standard deviations from the multilevel model to assess mean differences in partner selection between attractive and unattractive partners in the first and fourth quarters of the IDEM task, essentially assessing the extent to which attractiveness affects partner selection when participants encountered little objective information (first quarter) and after they had encountered maximal objective information (fourth quarter). Upper and lower equivalence bounds were specified as small, with a Cohen's  $d$  of .25 (equivalent to an  $r = .12$ ):  $\Delta_L = -.25$  and  $\Delta_U = .25$ .

Our second aim was to explore the extent to which the biasing effect of attractiveness is driven by perceived trustworthiness of the partners. We reasoned that perceived trustworthiness and perceived attractiveness of the financial partners may both be potential mechanisms through which our experimental manipulation of partners' facial attractiveness could influence behavioural outcomes and subjective perceptions. Of note, we have two variables that refer to financial partners' attractiveness: 1) the experimental manipulation, which is based on consensual judgements of the partners' attractiveness obtained from an independent sample of judges, and 2) participants' own, idiosyncratic, self-reported perceived attractiveness obtained after completing the IDEM task. In the present analyses, we tested if participants' perceptions of the partners' trustworthiness and attractiveness mediated the effect of our experimental manipulation of partner attractiveness on the three outcome variables (i.e., partner selections over time, return-to-partner index, and perceived helpfulness). We therefore used parallel mediation to statistically control for the effect of one mediator when estimating the indirect effect through the other mediator (see Montoya & Hayes, 2017). Details of the parallel mediation analyses can be found in the Supporting Information.

## Results

Results of key findings of the MLMs ( $F$ ,  $p$ ,  $d$ ) are reported in Table 2. The descriptive statistics and the full results of the MLMs are reported in the Supporting Information (see Tables S5 and S6).

### Participants' first choice

Participants were four times more likely to select an attractive partner (84%). McNemar's exact test for the difference in proportion was statistically highly significant ( $p < .00001$ ; effect size  $g = .34$ , a large effect).

### Partner selections over time

Despite increasing the number of trials from 50 to 100 and thus increasing the opportunity to learn the financial partners' profitability, over the course of the IDEM task, participants selected attractive (vs. unattractive) partners more often. Even with more opportunity to learn about partners' profitability, time did not appreciably moderate the effect of attractiveness (see Figure 4, top panel). Indeed, the TOST equivalence test procedure indicated that the observed effect size for the partner attractiveness by time interaction of  $d_z = .09$  was significantly within the lower and upper equivalence bounds

**Table 2.** Findings from the MLMs for each dependent variable (partner selections over time, return-to-partner index, and perceived helpfulness) for Experiment 2

	<i>df</i>	<i>F</i>	<i>p</i>	Cohen's <i>d</i>
<i>Partner selections over time</i>				
Attractiveness	1, 2,134	44.01	<.001	0.28
Loss Frequency	1, 2,134	240.80	<.001	0.67
Advantageousness	1, 2,134	4.43	.035	0.09
Attractiveness × Time	3, 2,134	1.272	.282	0.09
Advantageousness × Time	3, 2,134	17.719	.000	0.31
<i>Return-to-Partner Index</i>				
Attractiveness	1, 1,043	15.50	<.001	0.25
Attractiveness × Outcome	1, 1,043	5.21	.023	0.14
<i>Perceived Helpfulness</i>				
Attractiveness	1, 535	4.70	.031	0.19
Advantageous	1, 535	39.71	<.001	0.54
Loss Frequency	1, 535	30.42	<.001	0.48

of  $dz = -.25$  ( $t(134) = -4.11$ ,  $p < .001$ ) and  $.25$  ( $t(134) = 1.70$ ,  $p = .046$ ). We discuss the interpretation of these results in the General Discussion.

Similar to Experiment 1, participants selected partners that offered infrequent (vs. frequent) losses. However, unlike in Experiment 1, participants learned about partners' advantageousness, as reflected by a statistically significant interaction between advantageousness and time (see Figure 4, bottom panel). Specifically, participants selected disadvantageous (vs. advantageous) partners more often in the first quarter but selected advantageous (vs. disadvantageous) partners more in the second, third, and fourth quarters of the IDEM task. The main effect of advantageousness was statistically significant.<sup>7</sup>

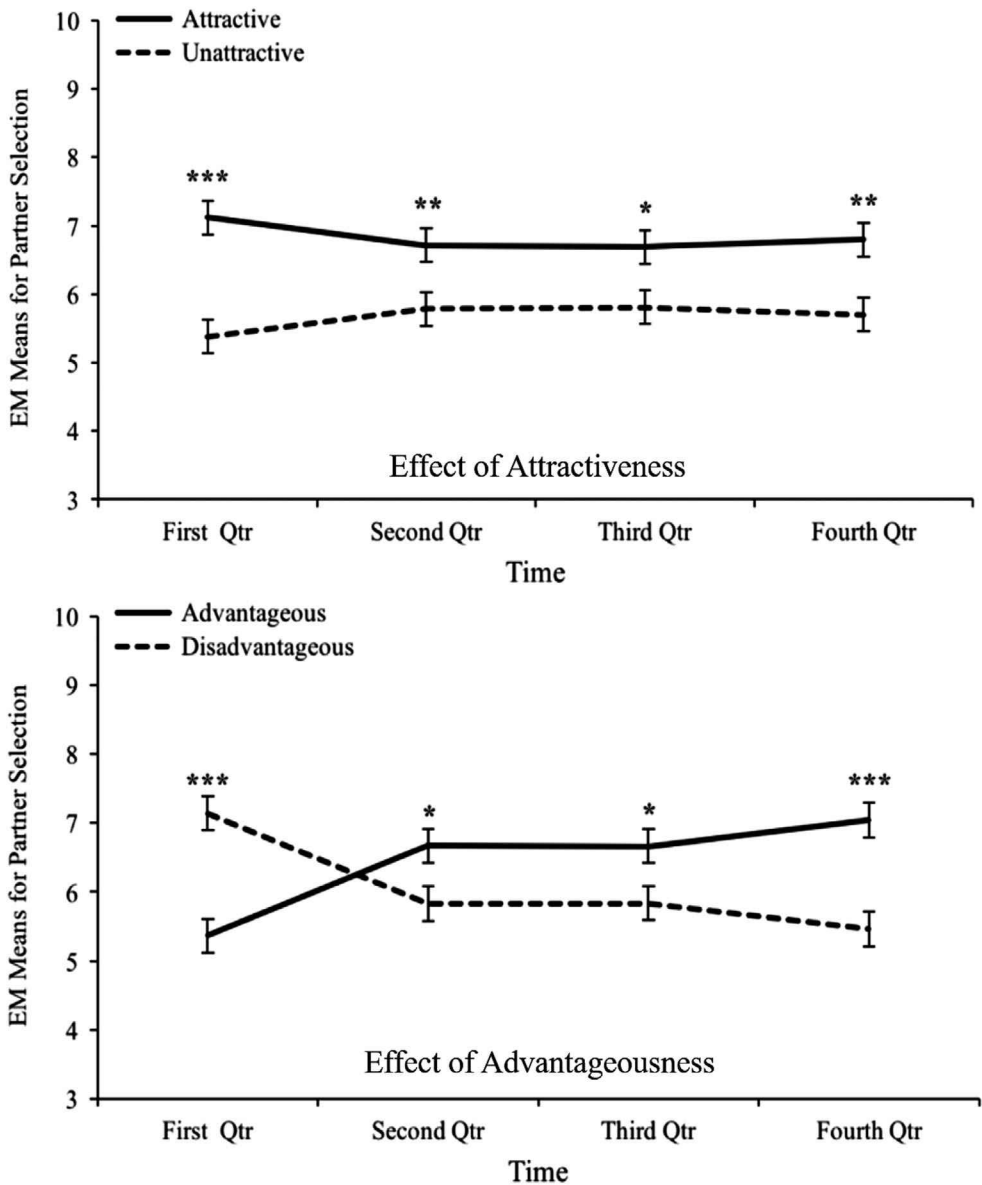
Finally, we again examined whether attractive-disadvantageous partners were favoured over unattractive-advantageous partners. Participants showed a marginally significant trend of preferring attractive-disadvantageous partners over unattractive-advantageous partners, as revealed in a follow-up comparison,  $t(134) = 1.850$ ,  $p = .066$ ;  $M_{\text{Diff(AttrDisadv-UnattrAdv)}} = 3.40$ , 95% CI [-0.23, 7.03]).

### **Return-to-partner index**

The interaction between attractiveness and outcome was statistically significant. As shown in Figure 5, when partners offered losses, participants took fewer trials to return to attractive (vs. unattractive) partners. But when partners offered gains, there was no statistically significant difference. Partner attractiveness also yielded a statistically significant main effect.

<sup>7</sup> Advantageousness also significantly interacted with loss frequency ( $F(1, 2134) = 44.72$ ,  $p < .001$ ,  $\eta_p^2 = .021$ ), such that participants learned the information about the partners' profitability (i.e., advantageousness) more readily when they conferred frequent (vs. infrequent) losses. Lastly, no other three-way interactions were statistically significant.





**Figure 4.** Estimated marginal (EM) means for selecting attractive and unattractive partners (top panel) and advantageous and disadvantageous partners (bottom panel) as a function of time. Time is represented by four quarters of 25-trials each. Error bars represent  $1 \pm SE$  above or below the mean. Higher numbers represent greater behavioural selection. Pairwise comparisons are Sidak corrected. The asterisks indicate the level of statistical significance at each level of time between the selection of attractive and unattractive partners (top panel) and between the selection of advantageous and disadvantageous partners (bottom panel). \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

### Perceived helpfulness

Participants were more likely to perceive partners as helpful if the partner was attractive, advantageous, and conferred losses infrequently.

### Does perceived trustworthiness mediate the resilient effect of facial attractiveness?

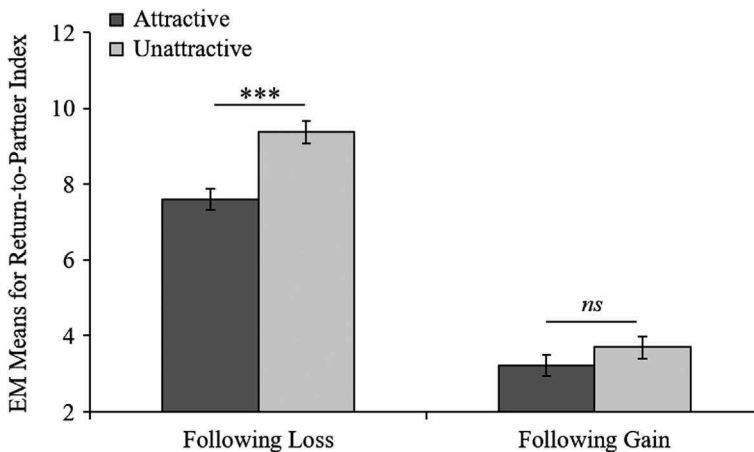
As shown in Figure 6, results of the parallel mediation analyses indicated that attractive (vs. unattractive) partners affected both perceived trustworthiness (mediator 1) and perceived attractiveness (mediator 2).

### Partner selections over time

Importantly, the perceived trustworthiness of the financial partners accounted for the biasing effect of facial attractiveness on partner selections over time. As shown in Figure 6a, the effect of perceived trustworthiness (mediator 1) on partner selection was statistically significant, whereas the effect of perceived attractiveness (mediator 2) did not reach conventional levels of statistical significance. Moreover, providing evidence of mediation, the 95% CI for the indirect effect of partner attractiveness through perceived trustworthiness did not include zero ( $b = 6.99$ , 95% CI [0.67, 13.00]). However, the indirect effect through perceived attractiveness did include zero ( $b = 7.73$ , 95% CI [-1.58, 17.41]).

### Return-to-partner index

Perceived trustworthiness of the financial partners also accounted for the biasing effect of facial attractiveness on the return-to-partner index following loss as well. As shown in



**Figure 5.** Estimated marginal (EM) means for the return-to-partner index for attractive and unattractive partners following loss and gain outcomes. Error bars represent  $1 \pm SE$  above or below the mean. Higher numbers represent greater number of trials passed before participants returned to the partner. Sidak correction was applied to adjust alpha for multiple comparisons. \*\*\* $p < .001$ . ns = not statistically significant.

Figure 6b, the effect of perceived trustworthiness (mediator 1) on the return-to-partner index was statistically significant but the effect of perceived attractiveness (mediator 2) was not. Again, providing evidence of mediation, the 95% CI for the indirect effect of partner attractiveness through perceived trustworthiness did not include zero ( $b = -1.66$ , 95% CI  $[-2.85, -0.56]$ ). However, the indirect effect through perceived attractiveness did include zero ( $b = 0.18$ , 95% CI  $[-1.52, 1.62]$ ).

#### *Perceived helpfulness*

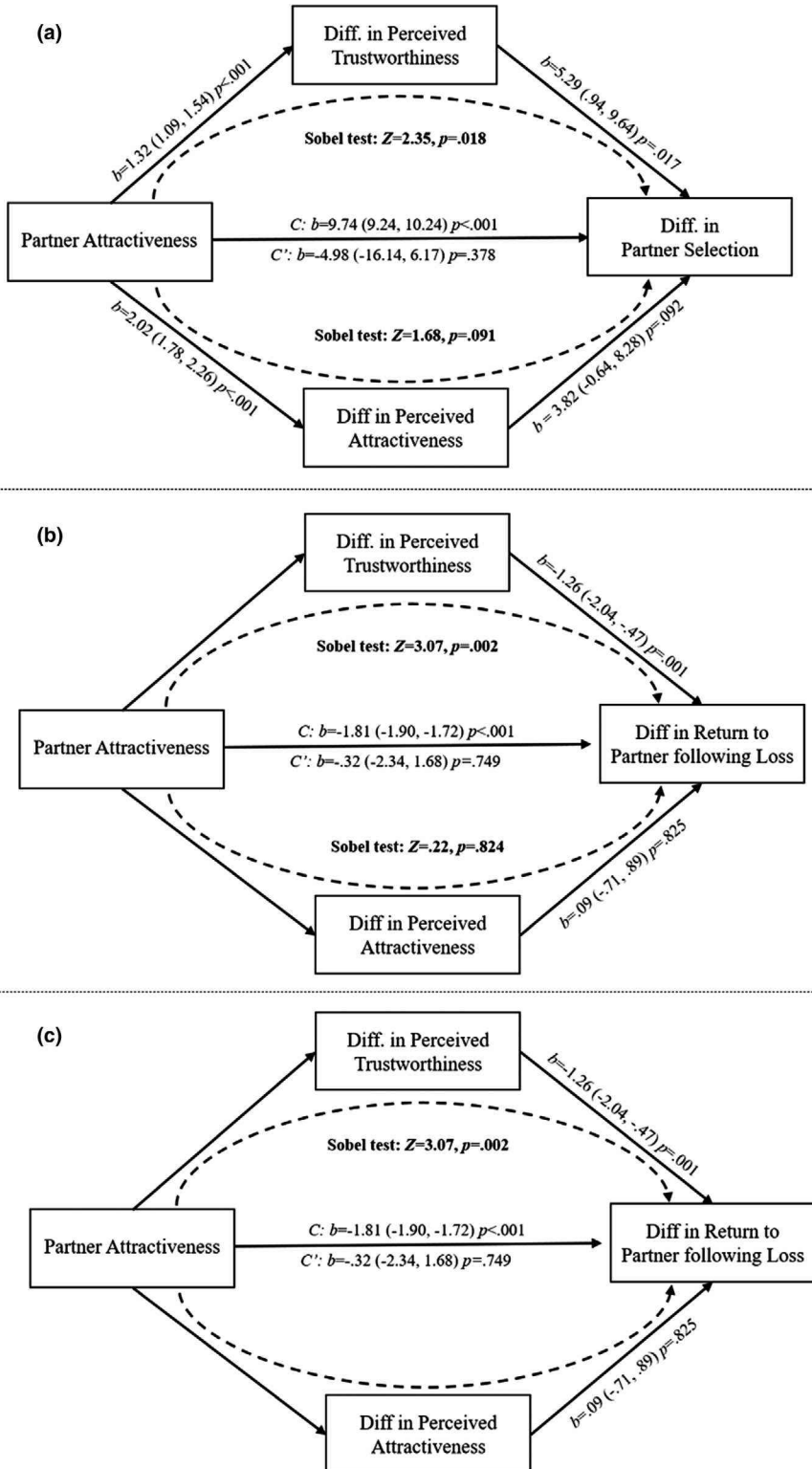
Although attractive partners were perceived as more helpful, neither perceived trustworthiness nor perceived attractiveness significantly mediated this effect (see Figure 6c). Although speculative, these findings suggest that the effect of partners' attractiveness via cueing trustworthiness are less pronounced in self-reports of partners' helpfulness, than in behavioural tendencies, such as the partners that one chooses over time.

## GENERAL DISCUSSION

When one's goal is to maximize profits, the optimal strategy would be to simply choose financial partners that maximize gains and minimize losses. But in two experiments, we show that people's decision-making is not simply a matter of calculating the profits conferred by the financial partners. Instead, facial attractiveness biased experience-based decision-making at the very outset of the task, when participants lacked any objective information about the partners' profitability on which to base their decisions. Critically, facial attractiveness continued to bias experience-based decision-making, even as participants received objective feedback following each decision and thus gained more information about partners' profitability over time (Experiments 1 and 2). Moreover, when partners conferred losses, participants were quicker to forgive attractive (vs. unattractive) partners, reflected by returning to them sooner (Experiment 2). Ultimately, participants judged attractive partners to be more helpful (Experiment 1 and 2). Indeed, attesting the power of facial attractiveness to colour even experience-based decision-making, attractive partners who were financially disadvantageous (who conferred large immediate gains, but smaller long-term profits) were preferred more (Experiment 1) or about the same (Experiment 2) as unattractive partners who were advantageous (who conferred small immediate gains, but larger long-term profits). Thus, the effect of attractiveness did lead to less optimal decision-making. Finally, perceived trustworthiness of the financial partners accounted for the biasing effect of facial attractiveness on partner selections over time and return-to-partner index.

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**Figure 6.** Within-subject parallel mediation models showing direct effects of partner attractiveness, the mediating effects of perceived trustworthiness and perceived attractiveness on partner selections over time (panel a), on return-to-partner index following loss (panel b), and on perceived helpfulness (panel c). Sobel tests for indirect effects, 95% Confidence Intervals (CI) and  $p$ -values for all beta coefficients are shown. \* = Experimental manipulation of financial partners' attractiveness. Diff = Difference between attractive and unattractive partners.



**Contributions to the literature on facial attractiveness and decision-making**

The present findings extend the work on the enduring effect of facial attractiveness by examining its effect in an experience-based decision-making task wherein decision-makers made iterative decisions and received direct and immediate self-relevant feedback following each decision. Most studies examining the incidental effects of facial attractiveness on decision-making have used single/one-shot decision tasks that are not iterative (e.g., selecting a job candidate), do not provide feedback following a decision (e.g., was the selected candidate an effective or ineffective worker), and have outcomes that are *not* directly relevant to the self (e.g., loss/gain of productivity). Therefore, in these single/one-shot paradigms, if decisions are tainted by bias (e.g., preferring an attractive job candidate), decision-makers do not receive feedback about whether decisions were right/beneficial or wrong/harmful and thereby have no opportunity to alter them. Although feedback is essential to learning (Hattie & Timperley, 2007; Lhyle & Kulhavy, 1987), especially if encountered repeatedly over time (Roediger, Putnam, & Smith, 2011), here we show that the effect of attractiveness was relatively immune to feedback. That is, even in the face of objective and self-relevant feedback about the partners' profitability and even having the opportunity to alter their choices based on such feedback, partners' facial attractiveness continued to bias experience-based decision-making.

How might facial attractiveness exert a robust influence on such experience-based decision-making? We found support for the hypothesis that the effect of the partners' facial attractiveness on experience-based decision-making occurred via the perceived trustworthiness of the partners and not simply because of their physical aesthetics. Specifically, Experiment 2 showed that participants judged attractive partners as more trustworthy. Importantly, in the parallel mediation analyses, perceived trustworthiness of the financial partners, and *not* their perceived attractiveness, fully accounted for participants' behavioural preference for attractive partners over the course of the IDEM task, and for being less affected by the losses attractive partners conferred. These findings are in line with the emerging view that the benefits that attractive people reap are due in part because attractiveness cues perceptions of the moral trait of trustworthiness (Calvo et al., 2018; O'Doherty et al., 2003), and perceptions of trustworthiness underlie basic, yet powerful, predispositions for approach, trust, and cooperative behaviours (Chang et al., 2010; Stirrat & Perrett, 2012).

Our account for how facial attractiveness via heightening perceptions of trustworthiness biased experience-based decision-making is distinct from the two most prevalent accounts for how attractiveness leads to beneficial downstream interpersonal consequences: self-fulfilling dynamics and cognitive confirmation. From a self-fulfilling dynamics perspective (for a review see Jussim & Harber, 2005), we might expect that the resilient effect of attractiveness would occur because decision-makers perceive attractive agents as good (and trustworthy), which then leads decision-makers to behave more positively towards the attractive agents. The decision-makers own differential treatment of the agents then would elicit an objective reality that confirms their initial (biased) perceptions – that is, attractive agents end up actually behaving more positively than unattractive counterparts. Likewise, from a cognitive confirmation perspective (Mynatt, Doherty, & Tweney, 1978), we might expect the resilient biasing effect of attractiveness would occur because decision-makers perceive attractive agents as more trustworthy and then engage in information-seeking strategies in which they select and attend to information that supports this belief (e.g., information about monetary gains) and failing to select and attend to disconfirming information that does not (e.g., information about monetary losses). Thus, the decision-makers' own information-seeking

behaviours end up producing biased sampling of objective evidence – oversampling positive objective information when it comes to attractive partners and oversampling negative objective information when it comes to unattractive partners. In this manner, the biased evidence confirms their initial (biased) perceptions. But these two accounts are clearly *not* possible given that in our IDEM task, the monetary outcomes associated with the partners were completely experimentally controlled, thus ensuring that the monetary outcomes associated with attractive and unattractive partners were equated. Thus, participants were neither able to shape the feedback that they received via their own behaviours (self-fulfilling dynamics) or bias the sampling of the feedback that they received via their own information selection strategies (cognitive confirmation).<sup>8</sup>

Of course, another possibility is that the effect of facial attractiveness on experience-based decision-making is not a bias at all. That is, it could be that the bias exerted by facial attractiveness may not be a bias after all *if* attractive individuals are truly trustworthy. But we believe that this possibility is unlikely. There is substantial evidence that judgements of trustworthiness based on a photograph are mostly inaccurate. For example, Rule et al. (2013) had participants complete a snap judgement task wherein they viewed headshots of men and made judgements of trustworthiness. Unbeknownst to participants, the men either had a history of untrustworthy acts (e.g., military criminals, corporate criminals) or not (e.g., military heroes, corporate noncriminals). Participants showed no evidence of being able to detect who was trustworthy based simply on a photograph. The relative difficulty of accurately assessing trustworthiness from facial cues may reflect that personality factors (i.e., trustworthiness) are not strong predictors of behaviours across situations (Mischel, 1968), and are highly dependent on the situation (see Todorov, Funk, & Olivola, 2015 for a similar argument). Nonetheless, some other work has found a small degree of accuracy in detecting others' likelihood of cooperation at a given exchange (Bonafon, Hopfensitz, & De Neys, 2017). Although resolving these inconsistencies is beyond the scope of the present work, it is possible that momentary facial expressions reflecting a person's in-the-moment intentions for cooperation can be detected, but to the extent that such motivations (and facial cues) are dependent on the situation, they are not necessarily detected in stable, trait-like facial cues, such as attractiveness which is the central focus of the present work.

### **Contributions to the literature on perceived trustworthiness and decision-making**

The present findings corroborate work examining the effect of first impressions and experiences on the development of trust and cooperation. Using a repeated Trust Game, Yu et al. (2014) have shown that initial trustworthiness inferences based on partners' facial appearances continue to positively influence competence, benevolence, and integrity judgements of partners, even after encountering information that is contradictory to the initial trustworthiness beliefs over the course of the games. Also, Chang et al. (2010) have shown that initial trustworthiness judgement of a partner as well as subsequent experience with that partner *both* collectively influence behaviour in terms of how much money one is willing to entrust to their partner.

Noteworthy, models of cooperation assume that both perceiving a partner as trustworthy and competent promotes prosocial behaviour, but only perceptions of

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<sup>8</sup> Descriptive statistics confirmed that participants did sample all four financial partners. Further, we also examined the effect of selecting an attractive (vs. unattractive) partner on the first selection, as it might affect willingness to sample, and the results were inconsistent across the two experiments (see Supporting Information).

competence, and not of trustworthiness, is informed by past performance (Siegrist & Zingg, 2014). The present work is highly consistent with this theoretical framework. In Experiment 2, attractive partners were perceived as more trustworthy, which led to them being selected more often over the course of IDEM. At the same time, advantageous partners who conferred greater monetary net gains were also selected more often. However, despite the financial advantageousness, they were not judged as trustworthy.

Importantly, our work advances past work in several respects. First, our experiments focus on the effect of facial attractiveness – an invariant facial feature and an incidental cue – on experience-based decision-making. Unlike the above-mentioned work which focuses on the direct effect of trustworthiness, facial attractiveness is the main focus of our work and perceived trustworthiness is examined as the underlying mechanism. Attractiveness as a physical characteristic has garnered over a century's worth of attention amongst psychologists. The present work is in line with a growing body of research that the effects of attractiveness arise, at least in part, because attractive people are perceived as being trustworthy. As such, they appear to obtain the benefits observed by those who are deemed trustworthy – that is, they are approached, entrusted with valuable possessions, and forgiven when there has been a harm. Although attractiveness and perceptions of trustworthiness often co-occur, they are not one and the same. For example, feelings of familiarity triggered by a stranger's facial resemblance to one's significant other may affect trust, independently of objective attractiveness (e.g., Gunaydin, Selcuk, & Zayas, 2016; Gunaydin, Zayas, Selcuk, & Hazan, 2012). Likewise, attractiveness need not always trigger perceptions of trust (e.g., McGloin & Denes, 2018). Second, much of the work on experience-based decision-making has relied on the 'repeated' Trust Game. In this game, decision-makers encounter individuals, and the outcomes associated with them sequentially over time. Our IDEM task differs from the repeated Trust Game in that decision-makers interact with four financial partners simultaneously. Because the partners and their outcomes are presented side by side, our IDEM task provides decision-makers opportunities for direct, immediate, and parallel comparisons of the losses/gains offered by partners. Such parallel comparison is expected to reduce or even eliminate biases (Correll, 2017).

Still, the findings beg the question: by what mechanism did the perceived trustworthiness of attractive financial partners colour the objective feedback about their profitability? Increasingly, research has shown that perceptions of a person's trustworthiness colour one's expectations, which in turn serve as filters by which people interpret and respond to objective information (Delgado et al., 2005; Siegrist & Zingg, 2014). Thus, in our studies, facially cued expectations that attractive partners are trustworthy may have promoted more approach and trusting behaviours in general, but also minimized or downplayed loss feedback that was incongruent with the expectation. Indeed, in Experiment 2, participants returned sooner to attractive (vs. unattractive) partners who had conferred losses, indicating that participants were less affected by losses conferred by attractive (vs. unattractive) partners. This finding is also consistent with a brain event-related potential (ERP) study by Ma et al. (2015), wherein participants playing the Ultimatum Game showed less feedback-related negativity (FRN) to unfair offers made by attractive (vs. unattractive) proposers, and were more likely to accept them.

### ***Contributions to the literature on experience-based social decision-making***

More broadly, the present findings corroborate and extend previous works showing that even when people have access to diagnostic information about target individuals and

believe that facial cues are less valid than economic payoffs, facial appearance can still affect decision-making (Reslescu et al., 2012; Li et al., 2017; Jaeger et al., 2019). Indeed, it is noteworthy that participants simultaneously encoded both task-relevant objective information (partners' profitability) and task-irrelevant social information (partners' attractiveness). Specifically, over the course of the task, participants shifted their initial preference from disadvantageous partners (who conferred large immediate gains, but smaller long-term profits) to advantageous partners (who conferred small immediate gains, but larger long-term profits; Experiment 2); and towards partners that conferred losses infrequently (Experiments 1 and 2). The incorporation of objective information about the financial partners' profitability along with the maintenance of socially cued biases during decision-making is in line with previous work (Averbeck & Duchaine, 2009; Hackel, Doll, & Amodio, 2015).

### ***Unanswered questions and future directions***

The present work highlights the persistent effects of facial attractiveness in experience-based decision-making. Still, there are several constraints on the generality (Simons, Shoda, & Lindsay, 2017). For one, in the present work, participants made decisions involving hypothetical money. Although the conclusions should hold when real money is at stake (Johnson & Bickel, 2002; Kang, Rangel, Camus, & Camerer, 2011; Locey, Jones, & Rachlin, 2011), this is a question for future work. Additionally, participants were college students from a northeastern university. Future work should examine whether these effects would generalize to nonstudent populations, including for lower socioeconomic status individuals who may be more sensitive to profitability, amongst economists and marketing/business professionals who are trained in making optimal financial decisions. Further, the present work demonstrated the persistent biasing effect of facial attractiveness using a relatively small number of Caucasian-looking faces. Future work might use a greater number of faces as stimuli to establish the generalizability of the findings (Zayas, Sridharan, Lee, & Shoda, 2019). Additionally, in our experiments, participants were faced with targets who were similar on the social categories of race (i.e., Caucasian) and gender (i.e., all male or all female), and differed only on facial attractiveness. An interesting route for future studies is to examine how cueing different social categories within the same task (e.g., deciding amongst Caucasian- and African American-looking partners) shapes decision-making. Finally, although the present experiments did not find empirical evidence that, with increasing objective information, the effect of partner attractiveness dissipates over time, a few points are noteworthy. Specifically, the results of the equivalence test indicated that the interaction effect of partner attractiveness and time is smaller than  $d = .25$  ( $r = .12$ ), which was identified as the upper bound of the effect. Thus, the effect size of the observed interaction is considered small by conventional standards. Nevertheless, it is possible that the effect of attractiveness does dissipate over time, but the effect is likely smaller than what our experiments were able to detect. Although such small effects may appear trivial, they may be consequential as they accumulate over time and across many individuals. Additionally, increasing the number of trials or decreasing the uncertainty of the feedback could better attune decision-makers to the objective information and minimize the biasing effect of attractiveness. Thus, although in our experiments, it was remarkable that the effect of attractiveness persisted, future research could examine the boundaries of such effects.

Evaluating the persons that can help one increase profits seems straightforward – simply involving the calculation of the monetary net gains they confer. However, often



bias is assumed to arise when information is ambiguous, and no feedback is available. Yet, the present work shows that even though decision-makers received objective feedback about the monetary gains/losses conferred by financial agents, they continued to perceive attractive agents as more profitable.

### Conflicts of interest

All authors declare no conflict of interest.

### Author contributions

Gayathri Pandey (Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Resources; Software; Writing – original draft) Vivian Zayas (Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Resources; Software; Supervision; Writing – original draft; Writing – review & editing).

### Data availability statement

The data and the materials are available from the Open Science Framework database. Complete data and the SPSS syntax for the two experiments are made available at [https://osf.io/pqhbm/?view\\_only=dc518e134c234c7b97abce3eb26d0cd6](https://osf.io/pqhbm/?view_only=dc518e134c234c7b97abce3eb26d0cd6) for independent researchers to reproduce the reported results.

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### Supporting Information

The following supporting information may be found in the online edition of the article:

Supplementary Material