The Influence of Similarity and Mimicry on Decisions to Trust

Alexa S. Clerke¹, Erin A. Heerey¹

¹ Psychology, The University of Western Ontario, London, Ontario, Canada

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Research on trust development has generally focused on how similarities between people influence trust allocation. However, similarity in interests and beliefs, which underpins trust development and may be critical to relationship success, is seldom apparent upon initial interaction and thus may not be a primary predictor of initial trust decisions. Here we ask how mimicry, a visible social cue, affects trust decisions alongside similarity. We used a "chat-room" style task to independently manipulate the degree to which participants were similar to a set of avatars and the degree to which those avatars displayed mimicry. We then assessed trust decisions in both financial and social domains. Our results show that together with similarity, mimicry is an important independent predictor of trust decisions. This work has implications for understanding how and when trust is allocated, as well as how to facilitate successful interactions.

Decisions regarding whom to trust are critical elements of the social environment. As with decisions in the cognitive domain, people rely on heuristics to make these decisions quickly, often with little information about the true trustworthiness of their social partners (Metzger & Flanagan, 2015). For example, people may use the degree to which they perceive themselves to be similar to a person when making trust-based decisions because people generally attend to similarities between themselves and others (Wood, 1996).

Researchers have examined the effects of similarity across a variety of contexts, such as negotiation outcomes (Wilson et al., 2016) and romantic partner selection (Tidwell et al., 2013). Findings from this work broadly suggest that as similarity between interaction partners increases, so does liking, cooperation, and trust (Fischer, 2009; Lui et al., 2006), and that high levels of similarity positively influence interpersonal attraction and social perceptions (Bagues & Perez-Villadoniga, 2015; Byrne & Griffin, 1975; Jamieson et al., 1987; Morry, 2007; Newcomb, 1963). For example, evidence shows that in an economic trust game, people who interact with a person of another race return less money than people who interact with a person of the same race (Glaeser et al., 2000). Thus, physical or appearance-related similarity may increase trust behaviours (e.g., DeBruine, 2002, 2005). Likewise, research indicates that people with similar interests are more likely to trust and cooperate with one another in the personal domain (Ziegler & Golbeck, 2007), and in the corporate realm, that corporations with similar business models are less likely to employ coercive negotiation strategies (Lui et al., 2006).

One possible mechanism underlying the similarity-trust relationship is the notion that interactions with similar others feel more fluent and are easier to process (e.g., Gigerenzer & Gaissmaier, 2011; Whittlesea & Leboe, 2000). Specifically, the presence of similarity may make it easier to trust someone because similar attitudes and beliefs are more easily accessible. People use their own attitudes and behaviours to interpret those of others (Gordon, 1992), leading to easier recall of similar others’ attitudes and more accurate predictions of future behaviour (Thornton et al., 2019). For example, neuroimaging evidence suggests that people use the self as a reference when inferring others’ states and traits and may attribute their own perceptions of another’s trustworthiness to shared similarity (Jenkins et al., 2008), thereby enhancing perceived trust (Krueger, 1998; Taylor & Brown, 1988). Thus, the ease or fluency with which people can interpret others’ behaviour may serve as a trustworthiness cue. Indeed, recent research has indicated that increased fluency, in the context of name perception, leads to greater trust in economic games (Zürn & Topolinski, 2017).

Similarity is often operationalized and manipulated using group membership (e.g., Chen & Kenrick, 2002; Monotya & Pittinsky, 2011; Vang & Fox, 2013). Specifically, people who are similar to the self on some experimentally salient dimension (e.g., race, sex, team assignment) are classified as in-group members and those who are dissimilar on that dimension become the out-group (e.g., Appiah et al., 2013). Evidence from this work largely shows that people are more likely to like, cooperate with, and trust in-group, relative to out-group members, primarily because they are more similar with respect to the experimental context (Balliet et al., 2014; Greenwald & Pettigrew, 2014). However, one important consideration is that there are often more differences within groups than there are between groups, which may mean that this is not the best manipulation of similarity. In addition, more trust exchanges occur between in-group members than between out-group members, making this manipulation difficult to generalize to the context of real-world trust exchanges.

Regardless of group membership, people who share interests, attitudes, and personality features are more likely to like each other than people who do not share these attributes (McPherson et al., 2001; Youyou et al., 2017). However, similarity need not be objectively present in order to achieve these effects. Rather, the mere perception of sim-
ilarity is sufficient to convey benefits. For example, one study found that greater levels of perceived similarity upon first meeting a new freshman undergraduate roommate led to more trust over time (Whitmore & Dunsmore, 2014). In addition, evidence suggests that when people perceive greater levels of similarity in others, they show higher levels of cooperation and trustworthy behaviour (DeBruine, 2002).

Although similarity is an important driver of trust decisions in the lab, these cause-effect relationships may be more complicated in the real world. For instance, one may actively seek evidence of similarity with a person after experiencing trustworthy, fair, or cooperative behaviour, which could enhance perceptions of similarity that stem from minimizing or forgetting differences. Indeed, in a computerized interaction, researchers have found that participants perceive trustworthy players as showing greater appearance similarity to themselves than untrustworthy players (Farmer et al., 2014).

Interestingly, people might infer similarity from experienced social behaviour, such as the disclosure of similar information (Sprecher et al., 2013) or nonverbal mimicry (van Baaren et al., 2009). Indeed, behavioural mimicry, defined as the inadvertent imitation of an interaction partner’s nonverbal behaviour or verbal style, predicts increased liking, cooperation, and trust (Duffy & Chartrand, 2015; Fischer et al., 2015; Lakin & Chartrand, 2003; Seibt et al., 2015). For example, in a study of interpersonal negotiations, individuals who engaged in mimicry were more likely to achieve successful outcomes than those who did not (Maddux et al., 2008). Research has also indicated that participants like and trust people and avatars, who mimic more than those who do not mimic (Chartrand & Bargh, 1999; Chartrand & Lakin, 2013; Seibt et al., 2015). Mimicry may therefore be influential in creating rapport and bolstering interpersonal connections (Seibt et al., 2015).

The term mimicry has been used by researchers to describe not only direct imitation, but also a broader class of reciprocal social behaviours that include behaviours that are tightly coupled in time (“social synchrony”) and behaviours that might be complementary rather than exact replicas of another’s behaviour, such as head nodding during an interlocutor’s explanation (“social reciprocity”); Hale et al., 2019). While there are slight variations in these behaviours, all are fast, sometimes millisecond-level, responses within interactions that likely generate perceptions of social fluency by increasing the degree to which a partner’s actions feel predictable (Delaherche et al., 2012; Wheatley et al., 2012). Specifically, high levels of mimicry likely signal a form of similarity between interaction partners, which makes it easier to anticipate and access the feelings and future behaviour of an interaction partner (Tamir & Thornton, 2018; Thornton & Tamir, 2019) by allowing one to use their own behavioural style as an archetype.

In unmanipulated face-to-face interactions, instances of direct mimicry are a subset of this broader class of reciprocal social behaviours. For example, evidence shows that people commonly mimic their interaction partners’ smiles, show complementary behaviour and language use patterns in face-to-face encounters (Heerey & Crossley, 2015; Ireland et al., 2010), and that people report greater liking for others who indicate liking for them (Montoya & Horton, 2012). This form of mimicry is strongly apparent in face-to-face social interactions (Heerey & Crossley, 2015; Heerey & Kriger, 2007), including those that culminate in trust decisions. Furthermore, it may signal a social partner’s trustworthiness by providing information about the reliability of the social environment (Behrens et al., 2008, 2009; Tamir & Thornton, 2018) and may subsequently support the development of trust and cooperation. For instance, when reciprocal behaviours are tightly coupled in time (“social synchrony”), social interactions result in greater levels of rapport, cooperation, and overall perceptions of conversational “smoothness” (e.g., Hale & Hamilton, 2016b; Kirschner & Tomasello, 2012; Valdesolo & DeSteno, 2011; Wiltermuth & Heath, 2009). Furthermore, temporal synchronization may spontaneously emerge when participants are asked to work cooperatively rather than competitively on a task (Bernieri et al., 1994), suggesting that people may treat the presence of temporal synchrony as a signal of cooperation.

Research investigating mimicry in naturalistic interactions demonstrates that when people deviate from expected frequencies of low-level behavioural reciprocity (e.g., nodding, smiling), interactions feel disfluent, awkward, and uncomfortable (Delaherche et al., 2012). This leads to poor outcomes, including reduced trust and willingness to cooperate with the social partner (Launay et al., 2015). These outcomes are considerable and understanding their causal underpinnings is important.

Many experiments have examined the effect of mimicry on trust, but the current mimicry literature suffers from several limitations that make the findings difficult to generalize. Chief among these is whether the observed mimicry is actually genuine mimicry. Specifically, mimicry is the automatic and unintentional imitation of another’s behaviour (Lakin et al., 2008) but it is not uncommon for researchers to code an instance of mimicry 10 or more seconds from the initiating behaviour and when the initiating behaviour is no longer observable (e.g., Stel & Vonk, 2010). Because interactions are extremely fast-paced and social cues may be fleeting (Yan et al., 2015), the contingency between the initiating and response behaviours may be weak, or non-existent by the time 10 seconds have elapsed. For example, in unmanipulated interactions, the likelihood of smile reciprocity reaches asymptotic levels by approximately 4 seconds (Heerey & Crossley, 2015). Furthermore, in such interactions the time lag of mimicry is approximately 600ms between the leader and follower (Hale et al., 2019), which supports the notion that mimicry is both fast and reactive and that longer time frames may not be appropriate for investigating mimicry. In addition to the overload time lapse, researchers also frequently instruct participants to mimic one another or employ Confederates to provide a more "standardized" social experience. Since mimicry is automatic, unconscious, and unintentional (Seibt et al., 2015), this may lead to artificial or contrived interactions, which differ on other characteristics besides the presence or absence of mimicry.

Although findings from the mimicry literature have generally been thought of as robust, recent work has questioned the consistency of these findings (Hale & Hamilton, 2016a, 2016b). More specifically, because most of the re-
search has focused on the mimicker rather than the reciprocal nature of mimicking within social interaction, the majority of findings within this field may not be generalizable to the process of mimicking as a whole. Furthermore, work that has focused on the reciprocal nature of mimicking and its effects on trust, rapport, and affiliation is fraught with failed replication attempts (Hale & Hamilton, 2016b). One explanation for these inconsistent findings is that mimicry is often manipulated by asking participants to interact with trained confederates rather than other naïve participants (e.g., Chartrand & Bargh, 1999; Maddux et al., 2008; Stel et al., 2011; Van Swol, 2003). While using confederates within the realm of social psychological research is common practice, it is likely to sway participant behaviour on a lab-by-lab basis because the training is inherently biased by the Principal Investigator’s beliefs and hypotheses (Kuhlken & Brennan, 2015). Results from research that employs confederates is further complicated because it is unclear whether a single confederate is able to act consistently across participants and, more generally, whether many confederates are able to act consistently within one study or a set of studies.

One solution to these problems is to use computerized avatars in lieu of confederates, which promotes more experimental control while maintaining mundane realism (e.g., Garau et al., 2005; Hale & Hamilton, 2016a). Some of the work employing this methodology suggests that even in computer-mediated communications (e.g., social media platforms) reciprocal verbal behaviour can predict liking and group cohesiveness (Gonzales et al., 2010; Niederhofer & Pennebaker, 2002). However, this research has also produced mixed findings regarding whether mimicry leads to increased trust and rapport (e.g., Ballenson & Yee, 2005; Hale & Hamilton, 2016a). Because mimicry, and more broadly, reciprocal social behaviour, is often thought of as “social glue” (Dijksterhuis, 2005; Hale & Hamilton, 2016a; Lakin et al., 2003) and a cornerstone of relationship development, it is critical to replicate these findings to test and understand the boundary conditions for these effects.

Current Research

The current research adds needed conceptual replications of these effects to the literature to enhance understanding of how mimicry influences trust in light of the limitations of past research. Here, we test the relationship between similarity, mimicry, and trust in a rigorous experimental paradigm and report three examinations of these effects using computerized avatars in lieu of confederates.

Specifically, we ask whether higher levels of both similarity and mimicry shape interpersonal perceptions and subsequent trust-based decision-making. This is an important question because, while similarity between social partners is a well-established predictor of trust (e.g., DeBruine, 2002; Fischer, 2009; Glaeser et al., 2000; Ziegler & Golbeck, 2007), research on mimicry, which may be just as important as similarity in shaping trust decisions, has generated mixed results (Hale & Hamilton, 2016a; Hale & Hamilton, 2016b). Because we treat similarity and mimicry as independent variables, we use a virtual social context that allows us to reliably manipulate both of these variables. Although nonverbal mimicry in virtual settings may be weaker than in the face-to-face domain (Hale & Hamilton, 2016b), this effect may in part reflect limited opportunities for participants to learn about one another and exchange personal information in online paradigms (see Bailenson & Yee, 2005; Hale & Hamilton, 2016a). The effects of mimicry may therefore be degraded in the absence of such conversation – i.e., for mimicry to confer genuine feelings of familiarity, some additional evidence of similarity may be necessary. Importantly, our manipulation allows the simultaneous exchange of both personal information, through which participants can gain a sense of similarity, as well as mimicry.

In each of these experiments, participants “interacted” with avatars, whom they believed to be other participants, in the context of a chat-room style “getting-acquainted” task. Importantly, our similarity manipulation evolves in the context of information exchange, as in natural interactions, rather than evoking similarity based on mere group membership. We measured decisions to trust in the context of a “centipede” game (Experiment 1; Rosenthal, 1981), an investor-trustee game (Experiment 2a/b; Berg et al., 1995), and a social decision task (Experiment 3). Across the three experiments, we hypothesized that both similarity and mimicry would be significant predictors of trust. Further, in Experiment 3, we hypothesized that mimicry might drive trust decisions to a greater degree than similarity because it appears to be highly apparent to participants.

Experiment 1 Methods

Participants. Sixty-nine participants completed this study in exchange for partial course credit and a small monetary bonus, based on their performance in the trust game. Of these 69 participants, we discarded 15 from the analysis due to deception failure (i.e., they did not believe they had played real participants). The final sample therefore included 56 undergraduates (14 male, Mage=18.45, SD=.83). All participants gave informed consent and the University’s Ethics Committee approved all study procedures (likewise for Experiments 2 & 3).

The sample size was determined a priori using power analyses based on previously published effects (e.g., Balliet et al., 2014; Vicaria & Dickens, 2016). A G*Power (v3.1) analysis revealed that, assuming a small to moderate effect size for the main effects of similarity and mimicry of $\eta^2_p = .04$, 55 participants would achieve 95% power (at $\alpha = .05$). We therefore over-recruited assuming that approximately 5 to 15 participants’ data would be removed due to deception failure (based on similar work conducted in the lab). Sample sizes for Experiments 2 & 3 were determined in similar fashion using the effect sizes obtained in the present experiment.

Procedures. Participants arrived at the lab in groups of five for a study “about how people get to know one another in an online environment.” In reality, participants interacted with computerized avatars, which allowed precise manipulation of both similarity and mimicry and ensured that the manipulation was identical across participants (Heerey, 2015; Schibach et al., 2006).

To begin the task, participants selected one of 16 possible avatar images (8 female and 8 male) to represent them for the duration of the experiment. To help maintain the
cover story, the computer told all participants that another player had already selected that avatar (we adopted this procedure based on pilot testing that suggested it enhanced believability of the cover story). They then received the second avatar they selected. Moreover, the participant’s first choice of avatar always appeared in the experiment as a highly similar avatar. The computer selected the other three avatars with which participants interacted based on pre-rated appearance similarity. One of these avatars was always similar in appearance to the participant’s own avatar. The remaining two avatars were lower in appearance similarity to the participant’s own avatar. This is based on the idea that participants choose avatars that look similar to themselves (Schultze, 2014) and likely assume that others will do the same. Importantly, we were not inherently interested in appearance similarity, however pre-testing suggested that this selection algorithm increased the believability of the manipulation.

To manipulate objective similarity, we first asked participants to respond to 20 “getting-acquainted” style multiple-choice questions. Four of these items were designated as “attitude” questions, based on an independent participant sample’s ratings (i.e., “Would you consider yourself a feminist?”, “What would you most like to be someday?”, “Would you tend to see yourself as more liberal or more conservative?”, and “Do you have a religious affiliation?”). The remaining items were related to interests/hobbies/preferences (e.g., “What’s your favourite cuisine?”). Participants saw and responded to the questions in random order.

After participants responded to these questions, they “exchanged” answers with each of the other avatars (Figure 1a). They viewed responses of all 20 questions for each avatar individually, in fully randomized order (80 trials total). The computer manipulated similarity based on the participant’s responses to the 20 questions. Two avatars were “high” in similarity. These avatars always matched participants’ responses on the four attitude questions, along with a random set of eight other items. The two avatars that were low in similarity matched on fewer of the participant’s own responses to the 20 questions. These avatars did not match on any of the attitude questions but did match on a random set of four of the interest items.

The mimicry manipulation occurred conjointly with the similarity manipulation. Participants gave like/dislike feedback after viewing each avatar’s response to the similarity items using an emoji-style rating scale (Figure 1b) similar to those in some social media applications. After participants indicated their feedback response, they saw a screen that simultaneously displayed both their own feedback and that of the avatar (Figure 1c). The avatar’s responses could either mimic the participant’s response (matching) or not mimic (non-matching) the participants’ response. Two avatars (one high in similarity and one low in similarity, randomly assigned) were low-mimicry, and provided matching emojis on only 20% of trials. The remaining two avatars were high-mimicry avatars and provided matching feedback on 80% of trials. Importantly, the computer selected non-mimicked feedback that was either 1-level more positive or 1-level more negative on the emoji scale than participants’ own responses, such that the average discrepancy in the feedback positivity between each avatar and a participant was zero.

To enhance the believability of the cover story that participants were interacting with real people, the computer inserted brief, random-length (range: 0ms to 1200ms) delays (e.g., “waiting for data…”) in between the response collection (Figure 1b) and result display (Figure 1c).

After this interaction phase of the game, participants played a “centipede” economic game (Rosenthal, 1981) to measure trust. In a traditional centipede game, two players take turns passing pools of money, until one of them chooses to defect or until some number of exchanges has occurred. On any given turn, the active player receives two pools of points, one large and one small. The player then chooses to either take the larger of the two pools (giving the smaller to the other player) or to pass both pools to the other player. If a player chooses to pass the pools, then both pools double in size (Figure 1d). We selected this game because, unlike the prisoner’s dilemma and similar games (e.g., Kanazawa & Fontaine, 2013; Sparks et al., 2016), it is designed as an iterated game wherein the incentive to defect increases with each pass.

The dominant strategy in this game is for the first player to defect on round one (McKelvey & Palfrey, 1992). However, people rarely adhere to the dominant strategy in simple economic games (Mailath, 1998). Indeed, if one trusts one’s partner not to defect, one’s payout is likely to be significantly larger with a cooperative strategy. Therefore, the number of rounds participants choose to pass the pools indicates trust behaviour. In our game, the task ended when either the participant defected or when the game had reached ten rounds with a given avatar. Participants re-

Figure 1. Experimental design. (a) Answer exchange in similarity manipulation. (b) Feedback decision screen for mimicry manipulation. (c) Feedback exchange for mimicry manipulation. (d) Centipede game used in Experiment 1.
ceived their game earnings as bonus money at the end of the experimental session. Participants played each avatar in random order with pool values organized in ascending order for each avatar. The dependent variable in this experiment was the number of rounds participants passed to each avatar. The data for this experiment may be accessed at: https://osf.io/ehpuf/ (likewise for Experiments 2a/b and 3 below; Heerey & Clerke, 2021).

To examine perceptions of avatar similarity, participants rated each avatar after the getting-acquainted task on the following item: “I see [avatar] as similar to me.” Participants rated each item on a 7-point Likert scale (1 = Disagree strongly; 7 = Agree strongly) and rated the avatars in random order. To mask the fact that we were interested in similarity ratings, we embedded this rating in the Ten-Item Personality Inventory (TIPI; Gosling et al., 2005), which participants completed for each avatar. Question order was randomized within avatar. The additional TIPI items were not analyzed.¹

**Experiment 1 Results and Discussion**

To ensure that our similarity manipulation appropriately enhanced perceptions of similarity, we conducted a 2 x 2 repeated measures ANOVA with similarity (low or high) and mimicry (low or high) as within-subjects factors and the degree to which participants rated avatars as “similar to me” as the dependent variable. Results revealed that participants rated high similarity avatars as more similar to themselves than low similarity avatars, F(1,55)=54.05, p<.001, η² = .52 (Figure 2a). Participants had a tendency to rate high mimicry avatars as more similar to themselves, although this effect was not statistically significant, F(1,55)=3.89, p=.054, η² = .07. There was no interaction between similarity and mimicry, F(1,55)=.045, p=.818, η² = .001. These results suggest that our similarity manipulation achieved its desired effect.

To examine trust behaviour, we conducted an ANOVA with similarity (low or high) and mimicry (low or high) as within-subjects factors and the total rounds played (see Table 1) with each avatar as the dependent variable. Results revealed main effects of similarity, F(1, 55)=7.42, p=.009, η² = .11, and of mimicry, F(1,55)=11.75, p=.001, η² = .17. In both cases, consistent with hypotheses, higher levels of similarity and mimicry led to greater trust. The similarity by mimicry interaction was non-significant, F(1,55)=1.59, p=.213, η² = .03.

These results suggest that both similarity and mimicry shape decisions to trust. Specifically, people are more trusting of those whom they perceive to be high in similarity as well as those whose behaviour demonstrates greater mimicry. These results suggest that manipulated attitude similarity enhances trust, as in previous research, and that mimicry independently contributes to trust decisions.

**Experiment 2**

The aim of Experiment 2 was to replicate Experiment 1 using a different economic game. Here, we chose an “investor-trustee” game (Berg et al., 1995). In the typical version of an investor-trustee game (see Berg et al., 1995), the “investor” receives an endowment and must then choose how much of the endowment to invest with a “trustee.” If money is invested, the trustee receives a “matured” investment (typically triple the initial investment; see King-Casas et al., 2005; Kosfeld et al., 2005; Shore & Heerey, 2013). The trustee then chooses how much of the investment to return to the investor. The amount invested indicates the degree to which the investor trusts the trustee. The investor-trustee game is frequently used to operationalize trust in experimental contexts (e.g., Bailey et al., 2015; Kosfeld et al., 2005; Shore & Heerey, 2015).

As above, we predicted significant main effects of both similarity and mimicry on trust behaviour, such that greater levels of each would enhance trust, as measured by investment amounts (Experiment 2a). We also conducted a direct replication of the results using the exact same methods with an independent sample (Experiment 2b). The purpose of this replication was to increase our confidence in our results while engaging in open science practice. As such, Experiment 2b was pre-registered on the Open Science Framework (OSF; osf.io/dv7np).

**Experiment 2 Methods**

**Participants.** Seventy-four participants completed Experiment 2a in exchange for partial course credit and a small monetary bonus, which was based on their performance in the investor-trustee game. Of these 74, nine were discarded from the analysis due to deception failure. The final sample therefore included 65 undergraduates (19 male, Mage=18.63, SD=.86). Our sample size for Experiment 2b was 72 participants (19 male, Mage=18.70, SD=1.14), after excluding 15 individuals for deception failure.

**Procedure.** Here, we used the same protocol as above to manipulate similarity and mimicry. After the manipulation, participants played a 10-round version of the investor-trustee game in which each participant played 5 rounds as the investor and 5 rounds as the trustee with each avatar. Asking participants to play both game roles allowed us to maintain the deception that participants played real partners, however we did not analyze trustee behaviour. Participants played avatars individually and all game rounds occurred in random order without feedback, to ensure that the presence of investment feedback did not influence results.

In the investor role, participants received a 10-point endowment and chose what proportion to invest with their partner on that round using a key press (allowing the full endowment range; 0–10 points). Participants played 40 trials of the game in random order, with 10-rounds being

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¹ Additional personality measures were collected in these paradigms as part of a Master’s thesis but are not analyzed for the purposes of this project.
played with each avatar. To ensure that participants’ behaviour when they played the trustee role was not affected by differential investment amounts across the avatars (i.e., one avatar being more “trusting” than another), each avatar invested 3, 4, 5, 6 and 7 points over the course of the five trials in which participants served as trustees. Trial order was fully randomized, and debriefing confirmed that no participant guessed this manipulation. Finally, participants knew that they would receive their game earnings as a monetary bonus at the end of the experimental session.

**Experiment 2 Results and Discussion**

To test whether our manipulation effectively altered perceptions of similarity we examined their ratings of the avatars on two items, how “similar to me” and “in sync with me” they thought each avatar was. To examine the reliability of this 2-item scale, we used the Spearman-Brown coefficient (see Eisinga et al., 2013). Across Experiments 2a and 2b, this correlation averaged .775, suggesting that these items likely measured a general “similarity” construct. We therefore averaged the two items within these datasets (and in Experiment 3 below). To examine these ratings, we conducted a pair of 2 x 2 repeated measures ANOVAs with similarity (low or high) and mimicry (low or high) as within-subjects factors and avatar ratings as the dependent variables for Experiment 2a and 2b (Figure 3a and 3b). Results revealed that participants rated high similarity avatars as more similar to themselves than low similarity avatars (Experiment 2a: \( F(1, 64)=15.19, \ p=.001, \ \eta^2=.192 \); Experiment 2b: \( F(1, 71)=48.97, \ p<.001, \ \eta^2=.408 \)). As in Experiment 1, they also rated high mimicry avatars as more similar to themselves than low mimicry avatars, though this result did not quite reach threshold for statistical significance in Experiment 2b (Experiment 2a: \( F(1, 64)=28.725, \ p=.001, \ \eta^2=.310 \); Experiment 2b: \( F(1, 71)=3.91, \ p=.052, \ \eta^2=.052 \)).

There was no interaction between these variables (Experiment 2a: \( F(1, 64)=2.09, \ p=.153, \ \eta^2=.032 \); Experiment 2b: \( F(1, 71)=5.1, \ p=.047, \ \eta^2=.070 \)). These results suggest that our manipulation of similarity generally achieved its predicted effect.

To examine participants’ trust decisions, we calculated the average number of points that participants invested with each avatar (see Table 2). These data served as the dependent variable in our analyses. As above, repeated-measures ANOVAs with similarity (low or high) and mimicry (low or high) as within-subjects factors and the average number of points invested with each avatar as the dependent variable revealed both main effects of similarity (Figure 3c and 3d; Experiment 2a: \( F(1, 64)=6.59, \ p=.013, \ \eta^2=.093 \); Experiment 2b: \( F(1, 71)=13.46, \ p<.001, \ \eta^2=.159 \)) and mimicry (Experiment 2a: \( F(1, 64)=6.28, \ p=.015, \ \eta^2=.089 \); Experiment 2b: \( F(1, 71)=8.10, \ p=.006, \ \eta^2=.102 \)). In both cases, consistent with our hypotheses, higher levels of similarity and mimicry led to greater trust. As above, the similarity x mimicry interactions were not significant (Experiment 2a: \( F(1, 64)=.53, \ p=.570, \ \eta^2=.005 \); Experiment 2b: \( F(1, 71)=.10, \ p=.749, \ \eta^2=.001 \)).

As in Experiment 1, we found that people trust those who are more similar and who mimic more frequently than people who are lower in similarity and mimicry. These results
Table 2. Average Amount Invested with Each Avatar

| Experiment Avatar Characteristic         | 2a              | 2b              |
|-----------------------------------------|-----------------|-----------------|
| Low similarity, low mimicry            | 4.86 (SD = 2.00) | 4.55 (SD = 2.16) |
| Low similarity, high mimicry           | 5.26 (SD = 1.95) | 4.89 (SD = 2.15) |
| High similarity, low mimicry           | 5.21 (SD = 1.99) | 5.08 (SD = 2.27) |
| High similarity, high mimicry          | 5.47 (SD = 1.63) | 5.39 (SD = 2.03) |

Experiment 3

The purpose of this experiment was to test the robustness of similarity and mimicry as predictors of trust behaviour in decision-making, as it relates to social scenarios. In addition, this experiment sought to disentangle the contributions of similarity and mimicry to trust decisions. Because each avatar has both a similarity value (low or high) and a mimicry value (low or high) in a fully crossed design it is difficult to examine the degree to which these variables might be related. We therefore apply an idea from utility theory (von Neumann & Morganstern, 1947) to test this question. Specifically, we ask how participants apportion their choices across pairs of avatars, depending on how these avatars differ in similarity and mimicry. Participants make repeated choices with each possible avatar pairing.
Based on how much they prefer high similarity or high mimicry avatars relative to low, we can estimate the degree to which similarity and mimicry independently and jointly determine participants’ avatar preferences across a set of social trust decisions. This type of design is a common method for examining the degree to which particular variables contribute to preferences within a decision space (e.g., Glimcher & Rustichini, 2004; Kandasamy et al., 2014). As above, we predicted that greater levels of both similarity and mimicry would enhance trust and that they would do so independently.

We further hypothesized that mimicry might be a more important predictor of choices than similarity because in real-world interactions, partner mimicry may be apparent before information about that partner’s attitudes and beliefs is known. Thus, after appearance similarity, mimicry may be the first interpersonal cue that people send. These hypotheses were pre-registered on the OSF (osf.io/dv7np) prior to data-collection.

**Experiment 3 Methods**

**Participants.** Ninety-seven participants completed this study in exchange for partial course credit. Of these 97, we discarded a total of 12 participants: seven due to deception failure, three due to inattentive task performance, and two for both deception failure and inattentive task performance. Inattentive performance on the decision task was defined as having made a choice in less than 350 ms on 25% or more of the test trials. This data exclusion decision was based on research suggesting that 350-400 ms is necessary for people to read and understand short phrases, like those in our decision task (Kutas & Federmeier, 2011; Kutas & Hillyard, 1980). Thus, responses shorter than 350 ms in this task are likely to be anticipatory responding that is not representative of deliberate decision-making. The final sample therefore included 85 undergraduates (23 male, Mage=18.68, SD=1.29).

**Procedures.** As in Experiments 1 and 2, the task began with our manipulation of similarity and mimicry. However, here we measured trust using a social decision task in which participants identified a preference for one of two avatars for a hypothetical trust scenario (e.g., “who would you ask to be your designated driver”). The trust items were selected using pre-ratings from an independent set of participants. For each of 14 trust items (84 test trials), the placement of the avatars within each choice pair was counterbalanced so that each avatar appeared on the left and on the right side of a pairing with equal frequency. How participants apportion their choices in this task, depending on the relative differences between the avatars within a pairing, demonstrates the degree to which similarity and mimicry guide their choices. For example, when selecting between avatars with equal similarity values, do participants show a preference for the avatar that displays mimicry to a greater degree? If a participant consistently prefers avatars that demonstrate greater mimicry, this indicates that mimicry is an important driver of trust decisions to that participant.

**Data Analysis.** To examine the degree to which avatar similarity and mimicry shaped choice behaviour, we individually modeled each participant’s choices using a logistic model. The model estimated the likelihood that a participant would select the avatar on the left, given relative differences in avatar characteristics. The model included terms for avatar similarity and mimicry, coded as the difference between the left and right avatar for each variable. We used a standard logistic model to fit the choice data.

\[
P_{\text{Left Avatar}} = \frac{1}{\left(1 + e^{\theta - \beta_0 - \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3}\right)}
\]

In this equation, the \(\beta\)s are the estimated regression weights for each model term. \(\beta_0\) refers to the intercept; \(\beta_1\) is the degree to which similarity influenced choice behaviour; \(\beta_2\) is the estimated regression weight for mimicry; and \(\beta_3\) is the similarity x mimicry interaction. The \(X\)s in the equation represent the difference between the avatar on the left and the avatar on the right. \(X_1\) coded similarity. For example, if the left avatar in a pairing was high in similarity and the avatar on the right was low, we coded this as 1. If these values were reversed, this was coded as -1. If the similarity values were identical, the trial received a code of 0. We used a similar coding system for mimicry (\(X_2\)). The similarity x mimicry interaction (\(X_3\)) was the product of the coded differences. The model used an iteratively re-weighted least squares algorithm to obtain the maximum likelihood estimate for each of the terms (O’Leary, 1990). The more the estimated regression weights differ from zero, the greater the influence of each term on a participant’s decisions. Importantly, we determined the model coefficients on a subject-by-subject basis because that allowed us the opportunity to estimate the distribution of these preferences across individual participants, rather than generating a single coefficient for the entire sample as a whole. The model coefficients were subsequently used as dependent variables in additional analysis.

**Experiment 3 Results and Discussion**

As in Experiments 1 and 2, we conducted a repeated measures ANOVA with similarity (low or high) and mimicry (low or high) as within-subjects factors and participants’ ratings of the avatars as the dependent variable. Results (Figure 4a) revealed that participants rated highly similar avatars as more similar to themselves, \(F(1, 84)=30.22, p<.001, \eta^2_{\text{ Kes}}=.265\), and also rated high mimicry avatars as more similar to themselves, \(F(1, 84)=25.65, p<.001, \eta^2_{\text{ Kes}}=.234\) (Figure 4a). The similarity x mimicry interaction was not significant, \(F(1, 84)=1.32, p=.254, \eta^2_{\text{ Kes}}=.015\).

Figure 4b shows the proportion of choices participants allocated to a particular avatar, given relative differences in avatar characteristics within a given pair. For example, when choosing between avatars that were identical in similarity (e.g., both low or both high) but different in mimicry, results show that participants selected the high versus the low mimicry avatar about 63% of the time (Figure 4b, top...
Likewise, when choosing between avatars with identical mimicry rates participants preferred the high versus the low similarity avatar significantly more often than chance. When they chose between the avatar that was low on both similarity and mimicry and the avatar that was high on both variables, they selected the high similarity/mimicry avatar about 77% of the time. Interestingly, participants demonstrate indifference when choosing between the low similarity/high mimicry avatar, and the high similarity/low mimicry avatar, meaning that they do not have a significant preference for one avatar over the other in this pairing (bottom bar). This suggests that participants weigh similarity and mimicry approximately equally when making trust decisions. To test whether similarity and mimicry influenced trust decisions, we conducted a set of one-sample t-tests (against a test value of 0) with the individually estimated unstandardized regression weights as the test variables. Results revealed that both similarity, t(84)=6.10, p<.001, and mimicry, t(84)=4.46, p<.001, were significantly greater than zero indicating that both influenced trust decisions such that avatars higher in both traits were preferred across the sample (Figure 4c). The interaction between the two variables was not significant, t(84)=1.72, p=.090, suggesting that these effects may be additive, rather than interactive. A paired-samples t-test with the regression weights of similarity and mimicry as the test variables revealed that, contrary to our expectation the two variables were not significantly different from one another, t(84)=.72, p=.47, meaning that their effects on trust decisions are likely to be similarly important. These results support two of our three hypotheses. As in Experiments 1 and 2, people trust those who are more similar and demonstrate greater mimicry than people who are lower in similarity and mimicry. However, contrary to prediction, both similarity and mimicry made equal contributions to participants’ trust decisions. Thus, mimicry did not contribute more significantly to trust decisions than similarity, even though it may be apparent in real-world decisions before interaction partners have enough information to judge attitude similarity.

**General Discussion**

Results from Experiments 1 and 2 demonstrate that the presence of mimicry made an important contribution to both financial and social trust decisions, over and above the contribution of similarity. Interestingly, the magnitude of the mimicry effect was quite comparable to that of similarity but did not interact with it. These results suggest that mimicry explains important and unique variance in social outcomes and suggest it as a central element in trust decisions. This is significant given that previous work has conceptualized similarity as one of the largest contributors to trust decisions (e.g., DeBruine, 2002; Williams, 2001; Ziegler & Golbeck, 2007).

We have argued that mimicry is an equally important contributor to social decisions because it is evident before people gain knowledge of another’s attitudes and beliefs. As people become acquainted, they exchange not only personal information but also contingent social cues (Cialdini & Goldstein, 2004; Heerey & Crossley, 2013). As relationships deepen, so does disclosure depth (Collins & Miller, 1994), suggesting that only after a suitable acquaintance-ship might someone disclose highly personal views and at-

![Figure 4. Experiment 3 Results. (a) Manipulation check ratings across the avatars (violin plot interpretation as in Fig 2). (b) Choice data. The vertical line positioned at .5 on the graph denotes indifference to avatar differences. Error bars show the 95% CI. (c) effects of similarity and mimicry on trust decisions.](http://online.ucpress.edu/collabra/article-pdf/7/1/23441/462689/collabra_2021_7_1_23441.pdf)
titudes. Thus, after visual cues, such as whether someone looks trustworthy, knowledge of mimicry has temporal precedence over knowledge of attitude similarity in the real-world and may help to explain its contribution to decisions.

Both interpersonal similarity and mimicry have been linked to the perception of interaction smoothness, which appears to be necessary for successful interactions (Byrne, 1971; Delaherche et al., 2012). Because mimicry is so frequent (Oullier et al., 2008), people may come to expect its presence (Heerey, 2015; Heerey & Crossley, 2013). Without expected levels of mimicry and other contingent social behaviours (e.g., Hale et al., 2019), people may perceive greater disfluency and awkwardness during interactions, leading to perceptions of dissimilarity. Indeed, interaction disfluency is associated with negative social judgments and subsequent dislike (Heerey & Kring, 2007). Thus, mimicry may indeed be a subtle but important aspect of social interaction.

Mimicry may also change the way people actively acquire social information. If mimicry is high and initial interactions feel coordinated people may experience this as positive or rewarding (Delaherche et al., 2012), thereby enhancing the likelihood that they actively seek out points of similarity between themselves and their interaction partners. This may mean that people perceive interaction partners who engage in more mimicry as more similar to themselves, even when objective similarity levels are low. This is consistent with the notion that similarity need not be objective to enhance trust (Sanders et al., 2015; Whitmore & Dunsmore, 2014). Thus, mimicry may underpin similarity perception and consequently shape trust decisions. Our research speaks to the need to include mimicry as an important predictor of trust behaviour.

Despite these interesting findings, this work has several limitations. One obvious limitation of this set of experiments is that it describes "interactions" that were completely computer controlled. Although this is the only way to perfectly control and manipulate social cues and information (Böckler et al., 2014; Schilbach et al., 2006), such interactions lack elements of ecological validity. For example, this design made participants’ experiences of mimicry less automatic than they might be in face-to-face interactions. Specifically, participants deliberately chose emoji feedback, reducing the spontaneity of this process relative to real-time interactions. Even though evidence from studies of naturalistic interactions suggests that mimicry may be a conscious process at least some of the time (e.g., Hale et al., 2019; Heerey & Crossley, 2013), mimicry in face-to-face interactions is generally considered to be automatic (Chartrand & Lakin, 2013). The present procedures brought this type of mimicry into the more deliberate realm. In addition, participants had no control over the types of information they exchanged, as they would in any natural interaction. Nonetheless, even though these avatar interactions were not as realistic as true interactions, all the participants we included in our analyses genuinely believed they had interacted with other people (for a comparison of those included in the analysis and those excluded for deception failure on age, gender, and personality traits see Supplementary Materials). The fact that we observed such consistent results even in the minimal social context of the present research, suggests that these interactions are an excellent proxy for real face-to-face behaviour.

A second limitation of this design is that participants liked avatar responses that were more "similar" to their own more than they liked dissimilar responses (see Figure S2 in Supplementary Materials). This meant that the highly similar avatars received and returned more positive feedback than those low in similarity. Although we note that over 75% of the feedback across all three experiments was positive, the low-similarity avatars returned sad emojis somewhat more frequently. However, this avatar behaviour was a consequence of our methodology that we anticipated. We opted to allow this aspect of the experimental design to occur naturally because pretesting suggested that avatars that were uniformly positive were simply not believable because they did not respond in the same manner as real humans. Interestingly, evidence suggests that even sad emojis might be viewed positively (Kralj Novak et al., 2015). We therefore opted to avoid specific instructions to participants indicating that they should interpret the emojis in any particular way (e.g., mood indicators) and allowed the avatars to provide more human-like feedback. Despite this procedure, the low-similarity/high-mimicry avatars were preferred at a similar rate to the high-similarity/low-mimicry avatars, suggesting that this design decision was unlikely to have substantially affected results.

Finally, although the manipulation we used allows us to conclude that similarity and mimicry are important and independent predictors of trust decisions, it does not allow us to make strong conclusions about the relationship between them. We have argued that mimicry may precede perceptions of similarity and trust and that it may act to enhance interaction "fluency," such that people perceive similarity even when it is low in an objective sense. This idea suggests an interesting future research direction. As Hale & Hamilton (2016b) note, the effects of mimicry are reduced under the tight control of the virtual environment, perhaps because these settings limit objective evidence of similarity (see Bailenson & Yee, 2005; Hale & Hamilton, 2016a). We saw rather stronger effects when examining mimicry in the context of the exchange of personal information, suggesting that the effects of mimicry may be attenuated in the absence of disclosure. Evidence shows that disclosure (and the reciprocity of disclosure) is a natural part of social behaviour, even online (Barak & Gluck-Ofri, 2007; Collins & Miller, 1994). Thus, some element of personal disclosure may be important in catalyzing feelings of similarity, even when mimicry is present.

Conclusions

Trust is a crucial aspect of interpersonal relationships as it underpins successful relationship develop. Therefore, understanding how trust develops and which factors predict it is important. Similarity and mimicry have been frequently investigated and found to be predictors of trust; however, the relationship between mimicry and trust may not be as robust as was once thought (Hale & Hamilton, 2016b). Our work tested the reliability of these effects in three tightly controlled experimental designs in an effort to add some
clarity to the existing literature. The data from these experiments demonstrate that people trust others more when they are highly objectively similar and when they engage in high levels of mimicry, meaning that both variables are likely to be important precursors to the feelings of trust that underpin relationship development.

**Contributions**

Contributed to conception and design: ASC, EAH
Contributed to acquisition of data: ASC
Contributed to analysis and interpretation of data: ASC, EAH
Drafted and/or revised the article: ASC, EAH
Approved the submitted version for publication: ASC, EAH

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**Competing interests**

The authors have no competing interests to report.

**Supplemental materials**

**Figure S1.** Demographic differences between participants who were included in the analysis and excluded for deception failure on a) age, b) gender, c) personality characteristics. Error bars show the 95% CI.

**Figure S2.** Average emoji feedback chosen by participants for each avatar a) when responses to the similarity manipulation matched and b) when responses to the similarity manipulation did not match.

**Data accessibility statement**

The full datasets used in this paper are openly available on the Open Science Framework (OSF; osf.io/ehpuf/)

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Appendix 1: Trust Items used in Experiment 3

1. Lend your car keys to
2. Believe lied to you about something
3. Ask for a character reference for a job from
4. Give your computer password to
5. Do a group project with
6. Believe intentionally gave you bad advice for an assignment
7. Let watch your pet while you are away
8. Give a spare house key to
9. Choose for a housemate
10. Lend $20 to
11. Let hand in an assignment on your behalf
12. Get class selection advice from
13. Ask to be your designated driver
14. Ask to take notes for you if you cannot make it to class.
SUPPLEMENTARY MATERIALS

Supplementary material
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