Effects of social context on facial trustworthiness judgments

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Abstract
People form the first impression of trustworthiness mainly based on face when interacting with strangers. Majority of facial trustworthiness judgment tasks used in the laboratory present one face only. In real life interaction, a face usually appears in certain contexts, such as different scenes or accompanied by others. Very few studies have investigated the effect of social contexts on trustworthiness judgments. The current work examined the influence of a simultaneously presented face as a context on trustworthiness judgment of a target face. The pre-rated neutral-looking faces served the target faces that was either paired by a neutral-looking face or presented alone in Experiment 1 ($N = 33$). No contextual effect was found except for one condition where a male face was paired by another male face. Experiment 2 ($N = 36$) manipulated the trustworthiness of the context face. The results showed that the neutral-looking faces were rated more trustworthy when paired by an untrustworthy-looking face than by a neutral- or trustworthy-looking face. Experiment 3 ($N = 36$) replicated the results of Experiment 2 via manipulating both the trustworthiness of target and context faces. Across three experiments, we found a contrast effect of an untrustworthy context. The current findings provided new evidence for the development of theories on the effects of social context on perceived trustworthiness. A different explanation was discussed.

Keywords Facial trustworthiness judgment · Contextual effect · The first impression formation · Negativity bias

Introduction

In interaction with strangers, the first impression of trustworthiness predicts subsequent social outcomes in business, law, and politics (Olivola et al., 2014; Wilson & Rule, 2015). People are capable of judging trustworthiness based merely on faces presented within 100 ms (Engell et al., 2007; Willis & Todorov, 2006). A large body of research indicates that facial trustworthiness judgment is biased by some facial cues. For example, happy faces look more trustworthy and angry faces appear more untrustworthy relative to neutral ones (Dong et al., 2015; Franklin & Zebrowitz, 2013; Said et al., 2009; Zebrowitz et al., 2010). Female faces are rated more trustworthy than male faces (Dzhelyova et al., 2012; Mattavelli et al., 2012; Sutherland et al., 2015b; Wincenciak et al., 2013). Individuals make trustworthiness of faces not only basing on a single facial cue, but also on multiple

facial cues (Li et al., 2021). Even cues from the background where a face is presented plays a significant role. The current work focused on the effects of social context on facial trustworthiness.

A major task used in the previous studies is to rate the trustworthiness of a single face. However, in real life, a face is often encountered within a context. Researchers have found that certain contexts can strongly bias our social judgments. The information of visual context, such as body gesture (Aviezer et al., 2011), the scene in which the face appears (Ngo & Isaacowitz, 2015), or the expression on surrounding faces (Hess et al., 2019) has been suggested to impact how facial expressions are interpreted. The contextual cues also influence the perceived facial trustworthiness. Slepian and colleagues found that body gesture impacted impression formation. Arm flexion increases perception of facial trustworthiness relative to arm extension, which may due to that embodied cues of arm flexion indicate approach. It looks like that individuals could combine both facial and contextual cues when making judgments of facial trustworthiness (Slepian et al., 2012).

Although there is evidence for that contextual cues were involved in facial trustworthiness judgments, it is still not

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very clear how the contextual cues work. Keres and Chartier (2016) investigated the potential influence of wealthy vs. impoverished environment on impression formation by placing a trustworthy or untrustworthy face image in a wealthy, impoverished, and control environment background. They observed that the wealthy background enhanced trustworthiness and the impoverished background increased untrustworthiness judgments. The compatibility effect of the visual context was partially replicated in two studies using a mouse-tracking paradigm. Both the threatening and positive contexts biased the responses. However, the negative but unthreatening context had no effect (Brambilla et al., 2018; Wang et al., 2020).

The abovementioned research focuses on visual/physical context and finds an assimilation effect of the visual scenes. That is, a face is perceived to be more trustworthy when appearing in a positive context (e.g., a wealthy neighborhood or a happy scene) as compared to in a neutral context, and a face is perceived to be more untrustworthy when appearing in a negative context than in a neutral one. The positive visual contexts make a face look more trustworthy and the negative visual contexts make a face look more untrustworthy.

Other than visual context, there are different types of contexts, one of which is social context. The general idea of social context effects on the first impression formation has been discussed early in social psychology. Kenrick and Gutierres (1980) conducted a field study and two laboratory experiments to examine the context effect of precedingly exposing highly attractive faces on the attractiveness judgment of target faces with average attractiveness. Their results showed that the target faces were rated less attractive when presented after a highly attractive face than when presented singly (i.e., a contrast effect). If a target face was rated to be less attractive/trustworthy in a positive context and was rated to be more attractive/trustworthy in a negative context relative to a neutral or no context condition, there would be a contrast effect. However, Geiselman et al. (1984) found that context faces of high and average attractiveness enhanced the attractiveness of the target face with average attractiveness (i.e., an assimilation effect). Furthermore, the assimilation effect was robust when the target and context faces were presented simultaneously and the effect was not influenced by the number of context faces (i.e., one vs. two faces). Those two studies yield different contextual effects on facial attractiveness. At the same time, both studies use different presentation modes of stimuli. It could be possible that different effects of social context on facial attractiveness were determined by the presentation mode. The context faces produce either a contrast effect or an assimilation effect, depending on whether the context and the target faces were presented successively or simultaneously (Wedell et al., 1987). Other researchers argued that presentation modes

per se did not account for the different contextual effects. At least, the contrast effect was not due to the sequential presentation. Instead, it was caused by differential judgment strategies. Individuals perceive the target and context faces to be the same category when those faces are similar in one dimension. Attractiveness judgments are made based on the comparison between the target and context faces, resulting in a contrast effect. However, if the target and context faces were too different and could not be perceived as the same category, no comparison between those faces would occur. Thus, there is no effect. (Cogan et al., 2013).

A great deal of research has indicated that social contexts yield either a contrast effect or an assimilation effect on facial attractiveness. It leaves open how social contexts influence facial trustworthiness. Trustworthiness as a critical dimension of facial first impression forms a judgment of threat of strangers. It is relevant to the motivation of self-protection. Attractiveness as another dimension of first impression represents cues of sexual selection, which links to the motivation of reproduction (Sutherland et al., 2013, 2015a, 2016; Vernon et al., 2014). Visual/Physical contexts showed differential effects on facial trustworthiness and attractiveness judgments. That is, there was an assimilation effect of context on trustworthiness judgment and no significant contextual effect on attractiveness judgment (Keres & Chartier, 2016). As for the social contexts, the same influential pattern was also observed. Barker et al. (2020) reported heterogeneous effects of social contexts in a series of 4 experiments in which a target face and a context face were presented simultaneously. They found both assimilation and contrast effects on facial extraversion, only contrast effect on dominance and competence, only assimilation effect on trustworthiness, and no effects on attractiveness. Very recently, Carragher et al. (2021) also reported the differential effects of social context on judgments of facial trustworthiness and attractiveness. They replicated the cheerleader effect for the target faces with high- and low-attractiveness in an attractiveness judgment task, but they failed to find the cheerleader effect for the trustworthy target faces in a trustworthiness judgment task. The cheerleader effect in facial attractiveness judgment refers to the phenomenon that a face looks more attractive when seen in a group than when seen alone (Walker & Vul, 2014). The cheerleader effect is one type of the assimilation effect.

As far as we know, very few studies have investigated the effect of social context on facial trustworthiness judgment. The critical questions asked in the present work was whether the context face was powerful enough to bias facial trustworthiness judgment, and whether the context face resulted in a contrast effect or an assimilation effect. We conducted three experiments with simultaneous presentation of the target and context faces. Experiment 1 was to explore the contextual effect by comparing the trustworthiness ratings of a target

face between conditions with and without a context face. All face stimuli were previously rated to be average trustworthy. The design was similar to what was used in studies on the cheerleader effect, except that our experiment had less faces in the context. Carragher et al. (2021) found no cheerleader effect on trustworthiness. If we assumed that the number of context faces did not affect the contextual effect, we would predict no effect in Experiment 1. Experiment 2 manipulated trustworthiness of the context face only. Faces with high, low, and average trustworthiness serving as the context face. Experiment 3 manipulated trustworthiness of both the target and the context face. The target faces were with either high or low trustworthiness, and the context faces were the same as in Experiment 2. Since there is evidence for the differential effects of social contexts on trustworthiness and attractiveness (Barker et al., 2020; Carragher et al., 2021), the predictions of the current research were based on the findings of previous studies involving facial trustworthiness judgment tasks. Despite of differences in the type of context and in the trustworthiness of the target face, the previous research revealed assimilation effects of context on facial trustworthiness. Therefore, we predicted that we would observe assimilation effects of social context in the present Experiment 2 and 3.

Experiment 1

The purpose of the first experiment was to determine whether a context face could bias trustworthiness ratings of the target faces. A target face was rated on trustworthiness either singly or paired by a context face. All face stimuli were wearing neutral facial expression and with average pre-rated trustworthiness. The face stimuli were selected from a Chinese face database in order to obtain better control over some confounding variables.

Methods

Participants Sample size was determined before the data collection. Specifically, an a priori power analysis was conducted for sample size estimation using G*power 3.1 (Faul et al., 2007). The projected sample size needed to detect a small-to-medium effect size with 80% power is 28 for a within-subject ANOVA. Thirty-three (19 females) undergraduate and graduate students, (mean age = 20.61 years, $SD = 1.6$, age range = 18–24 years), participated in Experiment 1. All students reported to have normal or corrected-to-normal vision. Participants received 15 Yuan RMB (about 2.4 US dollars) for their participation. All experimental procedures of the current study were approved by Ethics Committee of Department of Psychology, Renmin University.

Participants signed the informed consent form before the experiment.

Stimulus materials Facial stimuli consisted of 102 images of faces, with a half female faces. One hundred images served as the target face, and the other two images were context faces. These face images were selected from the Chinese Facial Affective Picture System (Gong et al., 2011). All faces in the database are with direct gaze. The direction of eye gaze can modulate the individual's social attention (see Dalmaso et al., 2020 for a review), it also affects the social judgments based on the facial characteristics. Previous studies have found that faces with direct gaze are perceived to be more trustworthy than faces with averted gaze (Li & Ang, 2019). Thus, it is crucial to control the direction of eye gaze. Both the target and context faces used in the current experiments were with direct gaze. In addition, the target faces were the same in all conditions in our experiments. Even if the gaze direction affected judgment of trustworthiness, there would be no effect of gaze direction on the context effect.

In a pilot study, 40 participants (20 females, mean age = 21.61 years, $SD = 1.91$, age range = 18–27 years) who did not participate in the current study rated the facial trustworthiness and attractiveness of 222 face with neutral expression. The faces were rated on a 7-point Likert scale (1 = extremely untrustworthy/unattractive, 7 = extremely trustworthy/attractive). The mean score of the target faces was 3.52, $SD = 0.25$. The mean rating for the context faces was 3.35, $SD = 0.35$. All selected faces were low on attractiveness ($M = 2.80$, $SD = 1.60$ for target faces and $M = 2.45$, $SD = 1.30$ for context faces). The Each face was cropped with a rectangle-shaped mask, subtending 4.67° in height and 3.89° in width. A plus sign ('+'), subtending 1.2°, served as the fixation point. E-prime 2.0 controlled the stimulus presentation and data collection. All face stimuli were presented at the center of computer screen on a black background.

Procedure Participants performed a facial trustworthiness judgment task. On each trial, a fixation ('+') was presented and stayed on the screen for 1000 ms, followed by a target display that remained on the screen for 1000 ms. Then, a 7-point scale (1 = extremely untrustworthy, 7 = extremely trustworthy) was presented until a response was detected. Figure 1 shows examples of the trial procedure in conditions with and without a context face. The target display included either a single target face on the right or a context face on the left paired with a target face. The location of the target face was always presented on the right. There were 3 blocks that each consisted of 100 trials. All trials of each block were in the same context condition. The order of blocks was counterbalanced across participants in all three experiments. It

Fig. 1 Examples of event sequence on a trial in a condition with (right) and without a context face (left)
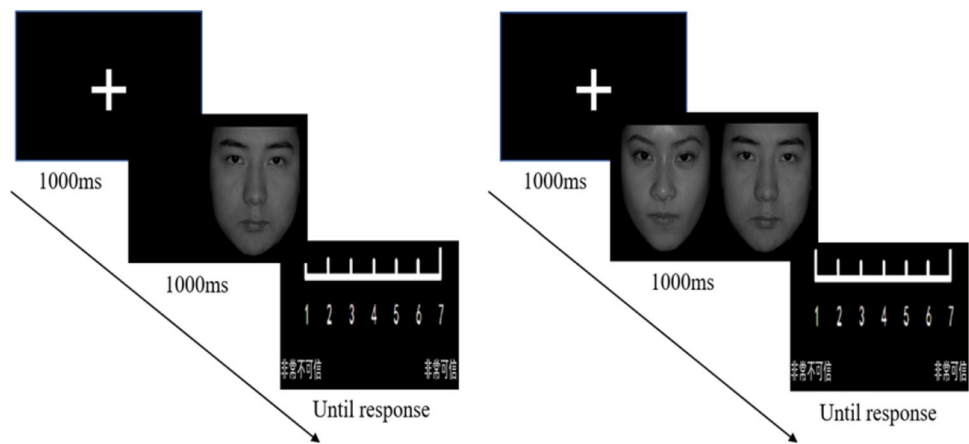

Table 1 Means and standard deviations for trustworthiness ratings of the target face by context and gender of the target face

Context	Gender of the Target Face	
	Female	Male
No context	3.89 ± 0.12	3.46 ± 0.14
Female context face	3.89 ± 0.10	3.45 ± 0.13
Male context face	3.86 ± 0.11	3.66 ± 0.13

took approximately 15 minutes to finish the experiment. Participants in all experiments could take a one-minute break after every 100 trials.

Results

Mean rating scores and standard deviations in each condition were shown in Table 1. We conducted a 2 (Gender of the target face: male vs. female) × 3 (Context: no context, a female context face, and a male context face) repeated measure, within-subject design ANOVA for the mean trustworthiness ratings of the target face. There was a significant main effect of gender of the target face, $F(1, 32) = 13.67$, $p < .001$, $\eta_p^2 = .30$, indicating that female faces were rated to be more trustworthy than male faces. The interaction between gender of the target face and the context was also significant, $F(2, 64) = 3.78$, $p = .028$, $\eta_p^2 = .11$. The simple effect analysis showed that, when the target was a male face, a male context face increased the trustworthiness of the target face, $F(2, 31) = 4.12$, $p = .026$, $\eta_p^2 = .21$, and a female context face had no effect. When the target was a female face, no context effect was significant, $F(2, 31) = 0.09$, $p = .907$, $\eta_p^2 = .006$. The main effect of context was not significant, $F(2, 64) = 2.40$, $p = .099$, $\eta_p^2 = .07$.

Discussion

With both target and context faces of average trustworthiness, we found no overall effect of social context on trustworthiness in Experiment 1. Our results were consistent with Carragher et al. (2021), though the number of faces in the context was different. In addition, there was a significant context effect only for the male target faces paired by a male face. That is, a male face increased the trustworthiness of another male face presented simultaneously. Gender of face was not considered much in the previous research, which might because that either only male faces or computer-generalized male-looking faces were used. Since the male faces are usually perceived less trustworthy than female faces (e.g., Sutherland et al., 2015b), including face gender as a factor is necessary for helping us to rule out the possibility that the contextual effect on trustworthiness is limited to male faces.

According to Cogan et al. (2013), when the target and context faces were similar in the judged dimension, they were compared with one another and produced a contrast effect. Then, Experiment 1 should have shown a significant contrast effect, which was not the case. Although both target and context faces were with average trustworthiness, they might be too similar and there was no need to compare. Still, this could not explain the significant contextual effect for male faces paired by another male face.

Experiment 2

No overall contextual effect was found in Experiment 1. At least two reasons might cause the insignificant effect. One was that the stimuli of Experiment 1 were only faces with average trustworthiness. The other was that the contextual effect was defined as the difference in trustworthiness ratings between conditions with and without a context face. Majority of previous researchers usually manipulated

trustworthiness of the context face (e.g., Barker et al., 2020) and defined the contextual effect as the difference in trustworthiness ratings between a neutral context and a positive/negative context. Experiment 2 was to further explore whether the context effect was limited to male face pairs by adding context faces with high and low trustworthiness. The target face was the same as Experiment 1. Based on the findings of Barker et al. (2020), there would be assimilation effects. Face gender might moderate the assimilation effects. The no-context condition was deleted in Experiment 2 in order to remain the same procedure used in the previous research.

Methods

Participants A power analysis estimated the sample size was 19. Thirty-six (21 females) undergraduate and graduate students, (mean age = 20.75 years, $SD = 2.15$, age range = 18–30 years), participated in Experiment 2. All students reported to have normal or corrected-to-normal vision. Participants received 30 Yuan RMB (about 4.5 US dollars) for their participation.

Stimulus materials The target faces were the same as in Experiment 1. The context faces were six pre-rated face images with three male faces and three female faces. The mean trustworthiness score was 4.96, $SD = 0.27$ for the two faces with high trustworthiness, 3.60, $SD = 0.34$ for the faces with average trustworthiness, and 2.23, $SD = 0.09$ for the faces with low trustworthiness. The high trustworthiness faces were rated to be more trustworthy than average trustworthiness faces, $t(39) = 4.80$, $p < .001$, 95% $CI = [0.69, 1.70]$, and low trustworthiness faces, $t(39) = 11.47$, $p < .001$, 95% $CI = [1.99, 2.85]$. Similarly, average trustworthiness faces were more trustworthy than low trustworthiness faces, $t(39) = 4.74$, $p < .001$, 95% $CI = [0.70, 1.74]$.

Procedure The procedure was the same as Experiment 1, except that the target face was presented within a red rectangle to avoid confusing the context face with the target face. There were 6 blocks that each consisted of 100 trials. All trials of each block were in the same context condition. The presentation order of the block was counterbalanced across participants. It took approximately 25 minutes to finish the experiment.

Results

Mean rating scores and standard deviations in each condition were shown in Table 2. We conducted a 2 (Gender of the target face: male vs. female) × 3 (Context Trustworthiness:

Table 2 Means and standard deviations for trustworthiness ratings of the target face by trustworthiness, gender of the context and gender of the target face

Context (Gender/Trustworthiness)	Gender of the Target Face	
	Female	Male
Female/high	3.84 ± 0.12	3.53 ± 0.12
Female/average	3.90 ± 0.11	3.57 ± 0.11
Female/low	4.08 ± 0.11	3.81 ± 0.11
Male/high	3.94 ± 0.12	3.53 ± 0.12
Male/average	3.84 ± 0.11	3.67 ± 0.12
Male/low	4.10 ± 0.12	3.77 ± 0.12

high, average, and low) × 2 (Gender of the context face: male vs. female) repeated measure, within-subject design ANOVA for the mean trustworthiness ratings of the target face. The main effect of gender of the target face was significant, $F(1, 35) = 14.66$, $p < .001$, $\eta_p^2 = .30$, which indicated that female faces were perceived to be more trustworthy than male faces. There was a significant main effect of context trustworthiness, $F(2, 70) = 8.02$, $p < .001$, $\eta_p^2 = .19$. The rating score for the target face was higher when paired with a low trustworthy face than when paired with a face of high trustworthiness [$t(39) = 2.95$, $p = .006$, 95% $CI = [0.07, 0.38]$] or average trustworthiness [$t(39) = 3.35$, $p = .002$, 95% $CI = [0.07, 0.31]$]. There was no significant between when paired with average and high trustworthiness, $t(39) = 0.77$, $p > .05$, 95% $CI = [−0.06, 1.26]$. The interaction of the context trustworthiness and the gender of the target face was also significant, $F(2, 70) = 4.53$, $p = .014$, $\eta_p^2 = .12$. The simple effect analysis showed that the context trustworthiness was significant for both female target faces, $F(2, 34) = 7.44$, $p = .002$, $\eta_p^2 = .30$, and male target faces, $F(2, 34) = 4.86$, $p = .014$, $\eta_p^2 = .22$. That is, both the male and female target faces were rated to be more trustworthy when paired by an untrustworthy face as compared to when paired by a neutral and trustworthy face (see Fig. 2). The main effect of gender of the context face was not significant, $F(1, 35) = 0.004$, $p = .953$, $\eta_p^2 < .001$. The interactions of Gender of the target face × Gender of the context face ($F(1, 35) = 0.52$, $p = .474$, $\eta_p^2 = .02$), Context Trustworthiness × Gender of the context face ($F(2, 70) = 1.07$, $p = .348$, $\eta_p^2 = .03$) were not significant. The three-way interaction was also not significant ($F(2, 70) = 0.80$, $p = .453$, $\eta_p^2 = .02$).

Discussion

When manipulating trustworthiness of the context faces, we found a significant contextual effect for the context faces with low trustworthiness. In another words, an

Fig. 2 Mean trustworthiness ratings for female and male target face in three types of context (Experiment 2). ** indicates $p < .01$; * indicates $p < .05$. Error bars are standard errors
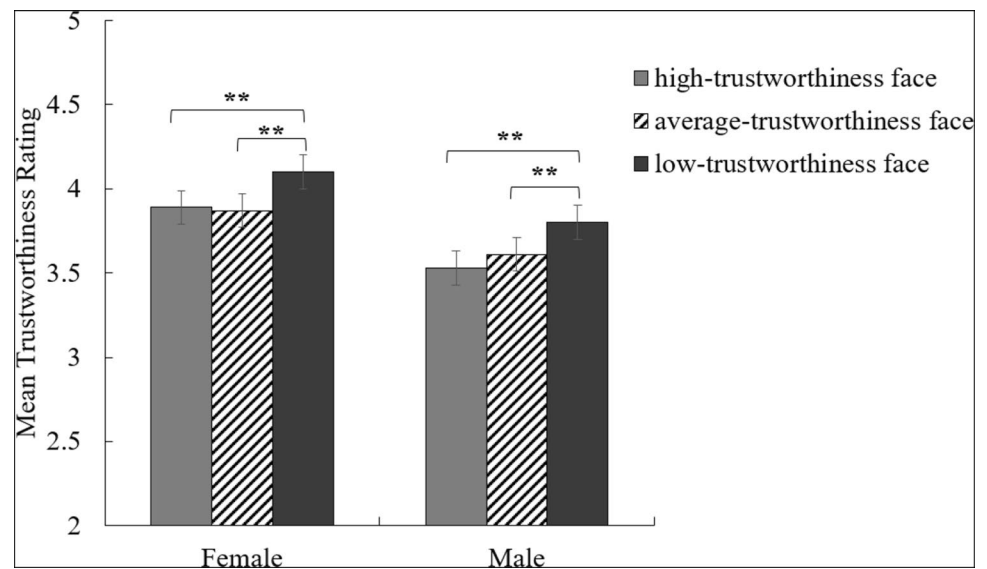
untrustworthy-looking face increased the perceived trustworthiness of a target face with average trustworthiness (i.e., the negative contrast effect). In addition, the contextual effect was robust for both male and female target faces. There was no context effect for highly trustworthy faces.

The results of Experiment 2 differed from findings in Barker et al. (2020). Instead of a contrast effect, Barker et al. (2020) revealed an assimilation effect. Notice that there were several differences in experimental design between the current experiment and Barker et al.'s: (1) the face stimuli were different. Barker et al. used computer-generated faces, whereas we used real face photos in Experiment 2. The computer-generated faces were not equivalent to real photographs due to the technological limitations (Crookes et al., 2015). Also, Barker et al. included extremely trustworthy and untrustworthy faces as context; (2) The response mode and response display in each trial were also different. Barker et al. used an open-ended measure by asking participants a question like "How often does the target deceive somebody every month?" This was a reversed measure of trustworthiness. In addition, participants in Barker et al. saw the target and context faces when making a response. The current experiment used a 7-point Likert scale and presented the scale on a different screen following the face display. Those differences in design might introduce extra moderating variables that lead to opposite effects.

The results of Experiment 2 provided further evidence for that social and visual/physical contexts worked differentially in facial trustworthiness judgment. Visual/physical contexts involved cues that were related to certain stereotypes. When those cues were processed and the stereotypes were activated, it resulted in stereotypes-consistent response (i.e., an assimilation effect) in trustworthiness judgment (Keres & Chartier, 2016; Wang et al., 2020). Whereas, social context

induced social comparisons between a target and the comparison standard, which then led to either an assimilation or a contrast effect (Mussweiler, 2003). We obtained a contrast effect only for targets paired by a low trustworthy face in our experiment. The contextual effect occurs in certain condition but not in all conditions. It calls for a new explanation.

Experiment 3

The contrast effect for low but not high trustworthy context face in Experiment 2 was a new result. We attempted to replicate those results in Experiment 3. Since similarity and dissimilarity between the target and the standard determine an assimilation or a contrast effect, we manipulated trustworthiness of the target and context faces. The context faces were the same as Experiment 2, while the target faces were faces with either high or low trustworthiness.

Methods

Participants The power analysis was the same as Experiment 2. Thirty-six (21 females) undergraduate and graduate students, (mean age = 21.11 years, $SD = 2.41$, age range = 18–26 years), participated in Experiment 3. All students reported to have normal or corrected-to-normal vision. Participants received 30 Yuan RMB (about 4.5 US dollars) for their participation.

Stimulus materials The context faces used in Experiment 3 were the same as in Experiment 2. The target faces were 70 pre-rated face images with a half male and a half female faces. The mean trustworthiness score for

the highly trustworthy faces was 4.60, $SD = 0.25$ and was 2.71, $SD = 0.23$ for the faces with low trustworthiness. All selected highly trustworthy faces were female faces, and all low trustworthy faces were male faces.

Procedure The procedure was the same as Experiment 2. Participants were still instructed to rate the trustworthiness of the target face. There were 420 trials in total. It took approximately 20 minutes to finish the experiment.

Results

Mean rating scores and standard deviations in each condition were shown in Table 3. We conducted a 2 (Target trustworthiness: high vs. low) × 3 (Context Trustworthiness: high, average, and low) × 2 (Gender of the context face: male vs. female) repeated measure, within-subject design ANOVA for the mean trustworthiness ratings of the target face. There was a significant main effect of target

Table 3 Means and standard deviations for trustworthiness ratings of the target face by trustworthiness, gender of the context face and trustworthiness of the target face

Context (Gender/Trustworthiness)	Trustworthiness of the target face	
	High	Low
Female/high	4.54 ± 0.10	3.03 ± 0.11
Female/average	4.59 ± 0.09	2.97 ± 0.12
Female/low	4.75 ± 0.11	3.24 ± 0.12
Male/high	4.63 ± 0.10	3.03 ± 0.13
Male/average	4.57 ± 0.11	3.03 ± 0.12
Male/low	4.78 ± 0.12	3.15 ± 0.12

trustworthiness, $F(1, 35) = 318.52$, $p < .001$, $\eta_p^2 = .90$, which indicated that high-trustworthiness faces were perceived to be more trustworthy than low-trustworthiness faces. Most importantly, the main effect of context trustworthiness was also significant, $F(2, 70) = 5.45$, $p = .006$, $\eta_p^2 = .14$, which indicated that the target faces were rated to be more trustworthy when paired by a low-trustworthiness face than by an average [$t(35) = 3.81$, $p = .001$, 95% $CI = [0.09, 0.30]$] and a high trustworthiness face, $t(35) = 2.10$, $p = .04$, 95% $CI = [0.003, 0.35]$. There was no significant difference between average and high trustworthiness contexts, $t(35) = -0.31$, $p > .05$, 95% $CI = [-0.12, 0.09]$ (see Fig. 3). The main effect of gender of the context face was not significant, $F(1, 35) = 0.33$, $p = .567$, $\eta_p^2 = .009$. The interactions of Target trustworthiness × Context Trustworthiness ($F(2, 70) = 0.08$, $p = .922$, $\eta_p^2 = .002$), Target trustworthiness × Gender of the context face ($F(1, 35) = 0.14$, $p = .708$, $\eta_p^2 = .004$), Context Trustworthiness × Gender of the context face ($F(2, 70) = 0.83$, $p = .439$, $\eta_p^2 = .02$) were not significant. The three-way interaction was also not significant ($F(2, 70) = 0.74$, $p = .481$, $\eta_p^2 = .02$).
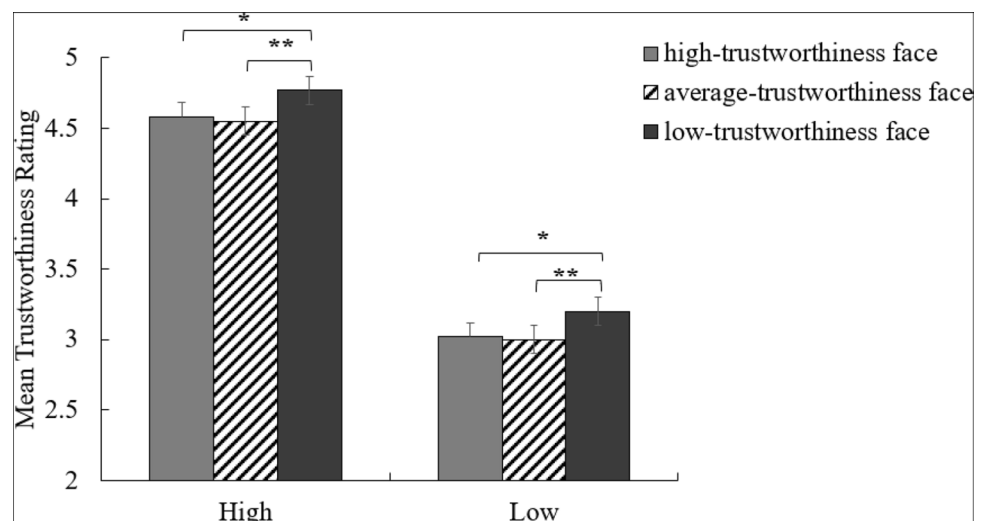
Discussion

By using different set of target faces, we replicated the contrast effect of social context on trustworthiness judgments. There was a contrast effect of low- but not high-trustworthiness context in Experiment 3. This contextual effect was not moderated by trustworthiness of target faces. Low-trustworthiness context increased perceived trustworthiness for both low- and high- trustworthiness target faces.

Fig. 3 Mean trustworthiness ratings for high and low trustworthiness target face in three contexts (Experiment 3). ** indicates $p < .01$; * indicates $p < .05$. Error bars are standard errors

General discussion

The current work included three experiments to explore the influence of social context on facial trustworthiness judgments. Table 4 shows a summary of the three experiments. The consistent findings were the contrast effects for low- but not high-trustworthiness context. There was no contextual effect when both the target and context faces were pre-rated to be average trustworthiness, except that a male face was rated more trustworthy when appeared in a face pair than when appeared alone. When the context was a face with high, average, or low trustworthiness, it yielded a contrast effect for a context face with low trustworthiness only. This contrast effect was replicated in Experiments 2 and 3 with two different sets of target faces. Our results were inconsistent with previous research (Barker et al., 2020).

One general theory for contextual effects of social context on social judgments is the selective accessibility model (SAM; Mussweiler, 2003). This model focuses on social comparison processes involved in social judgments. Once the social context induces comparison processes, individuals take several steps before making the final response. The first step is to assess similarity of the target and the comparison standard, which determines the type of hypothesis formed in the second step. The third step is to search for confirmatory evidence for the hypothesis. Thus, if the target and the standard look similar, a similarity hypothesis is formed, and there is evidence for the hypothesis, then an assimilation effect will be observed. Otherwise, if the evidence supports for dissimilarity hypothesis, then a contrast effect will be found. The SAM framework fails to explain our results. According to the SAM, the current Experiments 2 and 3 should have produced an assimilation effect, because extremely high or low trustworthiness faces were not used as contexts. And, Participants were more likely to form and test a similarity hypothesis for those moderately trustworthiness faces. Even if we assumed that our target and context faces were different enough to for a dissimilarity hypothesis, we would have found a contrast effect for both high- and low- trustworthiness contexts. However, no effect was found for high- trustworthiness context in Experiments 2 and 3.

A possible explanation for our results was the automatic threat coping assumption. Individuals automatically pay attention to threatening information in the environment and they are able to take timely and flexible strategies to avoid potential harm. Participants saw a target face and a context face at the same time and they had to pay attention to the target face to perform the judgment task in the current experiments. Since the context face was identical across all trials in one experimental condition, participants might learn to ignore the trustworthy and neutral context face but fail to ignore the untrustworthy context face. The fail-to-be-ignored untrustworthy context face is easily to be identified as a threat and is powerful enough to induce and enhance the self-protection motivation (Kenrick et al., 2010; Miller et al., 2010). When participants realize that there is no way to escape from the threat, they adopt active strategies such as gathering available resources to cope with it (Blanchard et al., 2001; Eilam et al., 2011). Individuals are likely to look for people who at least appear to be trustworthy, because they believe that those people may be a potentially reliable source of protection (Young et al., 2015). In the case of facial trustworthiness judgment of a target face paired by an untrustworthy face, participants automatically pay attention to the untrustworthy face and feel to be threatened. They also have to perform the task of rating trustworthiness of the target face. In order to reduce the threat and finish the task successfully, they transform the target face into the easily accessible resource by rating the face to be more trustworthy.

The automatic threat coping assumption is not a replacement of the SAM, instead, it just provides a boundary condition in which the SAM can work efficiently. The contextual effects, including an assimilation effect a contrast effect, are not robust in all social judgments. Depending on different dimension that is being judged, social contexts produce either no effect or different types of effects (Barker et al., 2020). Even within a same dimension, there are still mixed results. In facial attractiveness, some researchers found a

Table 4 A summary of the three experiments in this study

Experiment	Conditions		Results
	The context face	The target face	
Exp.1	No context vs. average-trustworthiness	average-trustworthiness	No overall contextual effect. The male target faces were rated to be more trustworthy when paired by a male context face than when presented singly.
Exp.2	high-, average-, and low-trustworthiness	average-trustworthiness	A contrast effect for the context faces with low trustworthiness, but not with high trustworthiness.
Exp.3	high-, average-, and low-trustworthiness	high- and low-trustworthiness	Replication of the results of Experiment 2.

contrast effect for both high- and low-attractiveness contexts (Cogan et al., 2013; Kenrick & Gutierres, 1980). Others found an assimilation effect for high- and average- attractiveness contexts (Geiselman et al., 1984). Similarly, in facial trustworthiness, Barker et al. (2020) reported an assimilation effect for extremely high- and low-trustworthiness contexts, whereas, we revealed a contrast effect only for low- trustworthiness contexts. The SAM is powerful to explain steps of comparison processes. Further research is needed to explore more factors that affect similarity assessment.

Another concern in the literature is the loose operational definition of contextual effects. One line of research focuses on the cheerleader effect (e.g., Peng et al., 2020; Walker & Vul, 2014). Researchers found that a face was rated to be more attractive when appeared in a group than when appeared alone. The contextual effect was the difference in attractiveness ratings of happy female faces between conditions with and without context faces. Carragher et al. (2021) used female faces with positive expression and three context faces in an attractiveness judgment and a trustworthiness judgment tasks. They replicated the cheerleader effect for attractiveness judgments but failed to find the effect for trustworthiness judgments. The current Experiment 1 also found no overall contextual effect on trustworthiness by using the same paradigm. The other line of research operationally defined contextual effects as the differences between positive, negative, and neutral contexts. A contrast and assimilation effect were evident in different boundary conditions. Difference in operational definitions of contextual effects are not the reason for various outcome, but it may indirectly determine the result pattern by allowing researcher to use certain types of stimuli and procedure.

One limitation of the present study was that the location of the target face was not randomized. The target face was always presented on the right of the fixation in all experiments. It might introduce some confounding variable because of the hemispheric differences in face processing (Gazzaniga & Smylie, 1983). However, facial trustworthiness judgment based on faces is much more complicated than face processing. Bzdok et al. (2012) indicated that social judgments on human faces (e.g., facial trustworthiness judgments) were related to the neural correlates of social, face-specific, emotional, and cognitive components. So far as we know, there is no direct evidence for hemispheric differences in facial trustworthiness judgments. It should be pointed out that Carragher et al. (2018) found that the location of the target face did not modulate the context effect of social judgments. In addition, we replicated the similar context effect when we place the target face in the center of the visual field in the follow-up new experiments.

In conclusion, the first impression formation of trustworthiness often occurs in certain social context. However, social context may not bias the judgment of facial trustworthiness in every condition. Our findings indicate that individuals will rate a person to be more trustworthy when he/she is accompanied by untrustworthy people, which may due to the seeking of protection in the condition of threat. We proposed an automatic threat coping assumption to explain the contrast effect in trustworthiness. Further research should continue to explore more boundary conditions in which social context will bias trustworthiness judgments and to examine the moderating effect of different types of threatening cues.

Authors' contribution Both authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Xuemei Yu. The first draft of the manuscript was written by Yongna Li and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Department of Psychology, Renmin University of China (Date: September 7th, 2020/No. 20–027).

Consent to participate Informed consent was obtained from all individual participants included in the study.

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

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