The Effect of Gender Differences in Baby Faces on Gaze Cueing: The Moderating Role of Contrast Context

Authors: Hu Xiaoqian, Gao Yunfei, Zhang Tingkang, Yan Chi, Kong Feng, Wang Yonghui, Zhao Jingjing, Wang Yonghui, Zhao Jingjing

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Abstract

The baby-face effect plays an important role in human social cognitive responses toward others. However, as important information in social interaction, whether and how baby-facedness influences social attention in conjunction with other factors (gender, context, etc.) requires further investigation. Therefore, the present study employed a gaze cueing paradigm, using male and female adult baby-faced and mature-faced stimuli, to investigate the specific manifestation of the baby-face effect in social attention by manipulating different contextual factors. Experiment 1 adopted a contrastive context and found an interaction between face gender and face type (baby-faced, mature-faced). Compared to male baby faces, participants were more willing to follow the gaze direction of male mature faces; conversely, under the female face condition, participants were more willing to follow the gaze direction of female baby faces. To investigate whether a non-contrastive context could eliminate the aforementioned influence of the baby-face effect on social attention, Experiment 2 introduced a non-contrastive context using a between-block design. The results did not reveal any influence of the baby-face effect or gender information on the gaze cueing effect. Comprehensive analysis of the results from Experiments 1 and 2 indicated that contextual factors modulated the influence of face gender and face type on the gaze cueing effect. These results demonstrate that although baby-facedness can produce attentional bias in individuals during social interaction, this bias exists only in contrastive contexts with mature faces, and non-contrastive contexts can eliminate such bias. The findings of this study further support the theoretical viewpoint of the eyeTUNE framework, namely that the social modulation of the gaze cueing effect depends on contextual factors, which facilitates the prediction, intervention, and control of the baby-face effect according to practical needs.

Full Text

The Influence of Gender and Babyface on Gaze Cueing Effects: The Moderating Role of Comparative Context

HU Xiaqian[1], GAO Yunfei[1], ZHANG Tingkang[1], YAN Chi[1], KONG Feng[1], WANG Yonghui[1]*, ZHAO Jingjing[1]*

[1]School of Psychology, Shaanxi Normal University; Shaanxi Key Laboratory of Behavior and Cognitive Neuroscience; Shaanxi Provincial Key Research Center of Child Mental and Behavioral Health, Xi'an 710062, China

Abstract

The babyface effect plays an important role in human social cognitive responses to others. However, as an important source of information in social interactions, whether and how babyface influences social attention in conjunction with other factors (such as gender and context) requires further investigation. Therefore, this study employed a gaze cueing paradigm, using male and female adult faces with babyish and mature features as stimuli, to examine the specific manifestations of the babyface effect in social attention by manipulating contextual factors. Experiment 1, which used a comparative context, revealed an interaction between face gender and face type (babyface vs. mature face). Participants were more likely to follow the gaze direction of male mature faces compared to male babyfaces, whereas the opposite pattern emerged for female faces—participants showed greater tendency to follow the gaze of female babyfaces. To investigate whether a non-comparative context could eliminate these effects of babyface on social attention, Experiment 2 introduced a non-comparative context using a between-block design. The results showed no influence of babyface effect or gender information on gaze cueing effects. Combined analyses of Experiments 1 and 2 indicated that contextual factors moderate the influence of face gender and face type on gaze cueing effects. These findings demonstrate that although babyface can produce attentional biases in social interaction, such biases only emerge in comparative contexts with mature faces, and non-comparative contexts can eliminate this bias. The results further support the theoretical perspective of the eyeTUNE framework, which posits that social modulation of gaze cueing effects depends on contextual factors, thereby helping people predict, intervene in, and control the babyface effect as needed in practice.

Keywords: babyface effect, gaze cueing effect, social attention, comparative context

1. Introduction

Gaze direction plays a crucial role in interpersonal interaction and emotional expression, allowing individuals to infer others' attentional focus, mental states, and behavioral intentions from eye gaze (Kleinke, 1986). Friesen and Kingstone (1998) investigated social attention triggered by gaze direction using a modified central cueing paradigm. Even when explicitly informed that gaze direction did not predict target location, participants still responded faster to targets in valid cue conditions compared to invalid cue conditions—demonstrating the gaze cueing effect (GCE; Friesen & Kingstone, 1998; Friesen et al., 2004). In addition to gaze direction, other facial information (such as emotion and babyface) can also guide our attention to improve social interaction and behavioral prediction (Carlson, 2016; Lei et al., 2020; Zheng et al., 2018). Moreover, people often interpret gaze direction in conjunction with other facial information (Dalmaso et al., 2012; Ishikawa et al., 2021; Zhang et al., 2015). However, following others' gaze direction depends not only on certain intrinsic facial information (such as gender and babyface) but also on contextual factors in which social information is embedded (Zhang et al., 2022). Few studies have simultaneously examined the interactive effects of these factors on gaze cueing effects. Addressing this question will help us understand whether and how the attentional system processes various social cues from faces depending on situational factors, thereby facilitating more effective communication and contributing to achieving interaction goals.

Researchers have recently recognized the role of Kindchenschema (baby schema) in human survival and evolution. Proposed by ethologist Konrad Lorenz in 1942, baby schema refers to typical features of human or animal newborns (such as round faces and high foreheads) that evoke caregiving responses in adults, thereby facilitating offspring survival (Lorenz, 1942). Like threatening stimuli, infant faces occupy a privileged position in human cognitive processing systems. Research shows that infant faces elicit faster processing and prioritized attention compared to adult faces (Brosch et al., 2007; Cheng et al., 2019; Dou et al., 2014; Jia et al., 2022). Importantly, adults' preference for infant faces can generalize to adult faces or even non-living objects, producing the "babyface effect" (Berry & McArthur, 1985; Bressan et al., 2009; Dou et al., 2014; Zheng et al., 2018).

To date, research on the adult babyface effect has primarily focused on trait impression inference, with few studies examining its influence on attentional processing. Zheng et al. (2018) found that during selective attention to adult faces, female babyfaces and male mature faces captured attention more quickly, indicating that the babyface effect in adult face processing is moderated by face gender information due to different sociocultural stereotypes and expectations for male and female roles. Regarding social cognition, participants of different genders also show various differences. For instance, females are more sensitive to social stimuli than males (Geary, 2021; Kleinfeld, 2010). Bayliss et al. (2005) first investigated gender differences in gaze cueing effects, finding stronger effects in female than male participants. Gender differences have also been found in infant face research—due to evolutionary demands, females' roles and tasks make them more sensitive to infant information, with studies showing that females perceive infant face cuteness more sensitively than males (Luo et al., 2011). Therefore, gender information may play a role in how babyface influences social attention. Additionally, neuroimaging research provides evidence for interactions among various facial information types. fMRI studies show that the amygdala is involved in multiple face processing stages, including gaze direction (Sato et al., 2011), adult babyface (Zebrowitz et al., 2009), and gender information (Fischer et al., 2004), suggesting overlapping neural mechanisms for processing these three types of information. Since humans often exist in complex social scenes woven with various social information, investigating the interactive performance of babyface effect with various factors in social attention is of great significance.

Dalmaso et al. (2020) proposed a conceptual framework for social modulators of gaze cueing effects (abbreviated as "eyeTUNE"). A key hypothesis of this framework is that social modulation of gaze cueing effects depends on contextual factors. In trait inference research, the influence of contextual factors on the babyface effect has been confirmed. For example, Gorn et al. (2008) found that positive impressions of babyface features are not immutable—when a priming paradigm established an association between "babyface" and "intentional harm," participants rated babyface CEOs as less honest than mature-faced CEOs, a pattern opposite to that observed when "mature face" was associated with "intentional harm." This demonstrates that external manipulation of contextual factors can weaken or even reverse the babyface effect. Modern society increasingly emphasizes fairness and justice, yet the babyface effect sometimes contradicts these requirements. Therefore, understanding how to eliminate attentional biases caused by the babyface effect is crucial, and investigating the role of contextual factors can help predict, intervene in, and control the babyface effect as needed in practice. Previous studies show that contextual factors can be manipulated not only through top-down approaches such as emotion priming (Ishikawa et al., 2021) or social experience (Wilkowski et al., 2009) but also through bottom-up approaches such as the specific presentation mode of face conditions. For example, Zhang et al. (2021) used a within-block mixed presentation of various face conditions to provide a comparative context and found that face ethnicity could moderate gaze cueing effects. However, in a non-comparative context (different face conditions presented between blocks), the moderating effect of face ethnicity disappeared. The role of comparative versus non-comparative contexts has also been confirmed in other domains such as emotional expression. Kuhn et al. (2016) manipulated the relative frequency of fearful and happy faces (with fearful faces being either more or less frequent than happy faces) and found that fearful faces produced larger gaze cueing effects than happy faces only in contexts where happy faces were predominant (making fearful faces rare). These studies collectively demonstrate that comparative contexts highlight certain social information, thereby enabling gaze cueing effects to be modulated by this social information.

In summary, this study employed a gaze cueing paradigm to investigate the specific manifestations of the babyface effect in social attention by manipulating different contextual factors, further verifying the critical role of contextual variables in social modulation of gaze cueing effects as proposed by the eyeTUNE framework. The research comprised two experiments. Experiment 1 used a within-block design to create a comparative context. Experiment 2 presented the four conditions (female babyface, female mature face, male babyface, and male mature face) in separate blocks to create a non-comparative context. Based on existing research, we hypothesized that in the comparative context (Experiment 1), consistent with the babyface effect pattern reported by Zheng et al. (2018), male mature faces and female babyfaces would elicit larger gaze cueing effects, with female participants showing larger babyface and gaze cueing effects than male participants. In the non-comparative context (Experiment 2), consistent with the eyeTUNE framework, separate block presentation cannot provide a direct comparative environment and is unlikely to activate category-based information (such as stereotypes; Masip et al., 2004). Therefore, we hypothesized that the babyface effect (differences in gaze cueing effects between babyface and mature face categories) would diminish or disappear, leaving only the gaze cueing effect, with female participants showing larger effects than males.

2. Experiment 1: Comparative Context

2.1.1 Participants

We first conducted an a priori power analysis using G*Power (Version 3.1.9.7) to determine the sample size. Setting a medium effect size f of 0.25 for a 2 (face gender: male, female) × 2 (face type: babyface, mature face) × 2 (gaze cue validity: valid, invalid) interaction, with $\alpha = 0.05$ and power = 0.80, the calculated sample size was 24. Referring to sample sizes in previous GCE research (Ishikawa et al., 2021; Zhang et al., 2022), we determined a planned sample size of 25–35 to ensure adequate statistical power. Experiment 1 recruited 28 university students (14 female, 14 male) aged 17–23 years (M = 19, SD = 1.47). All participants were healthy, with normal or corrected-to-normal vision, right-handed, and had not participated in similar experiments. Informed consent was obtained from all participants, who received compensation after the experiment.

2.1.2 Materials

The experiment used two male faces (one babyface and one mature face) and two female faces (one babyface and one mature face), each with neutral emotional expressions. Each face had two gaze direction images (looking left, looking right). Face images were selected from the adult subset of the "Same Face Multi-Expression Image Database for Infants and Adults" created by Jia et al. (2019). The selection process was as follows:

First, we identified a face database that met experimental requirements. Previous research has identified forehead height and cheek smoothness as characteristic vectors of babyface features (Zebrowitz-McArthur & Montepare, 1989; Zheng et al., 2016), so face materials needed complete forehead and cheek contours. Additionally, most previous studies used face stimuli derived from parametric transformations of the same face (Bressan et al., 2009; Doi et al., 2017; Masip et al., 2004), which inevitably creates differences in attractiveness, dominance, and other variables between babyface and mature face conditions. To control for extraneous variables, all face materials in this study were evaluated through questionnaires on multiple dimensions including attractiveness, dominance, and babyface degree, selecting faces that differed significantly only in babyface degree. The "Same Face Multi-Expression Image Database for Infants and Adults" (SFME-IDIA) created by Jia et al. (2019) could meet these requirements. Second, to make face selection more scientific, this study combined objective measurement and subjective evaluation methods to screen face materials.

2.1.2.1 Objective Measurement of Candidate Faces [Figure 1: see original paper] Schematic diagram of objective measurement of babyface degree

Previous research has shown that babyface degree is related to facial characteristic vectors. Following Zheng et al.'s (2016) measurement of Chinese adult babyface facial features, we quantified initially selected neutral faces (Figure 1). Specific characteristic vector descriptions are shown in Table 1 . After measurement, each vector was standardized by dividing by pupil distance as shown in Table 2 . Babyface degree = V1×r1 + V2×r2 + V3×r3 + V4×r4 + V5×r5. Finally, faces were ranked by score, with the top one-third selected as the babyface group and the bottom one-third as the mature face group for both male and female faces.

2.1.2.2 Subjective Evaluation of Candidate Faces We recruited 20 university students to rate 56 neutral face images on six dimensions: babyface degree (1 = extremely not babyfaced, 9 = extremely babyfaced), emotional valence (1 = extremely unpleasant, 9 = extremely pleasant), arousal (1 = extremely calm, 9 = extremely excited), dominance (1 = extremely uncontrollable, 9 = extremely controllable), attractiveness (1 = not at all attractive, 9 = extremely attractive), and trustworthiness (1 = extremely untrustworthy, 9 = extremely trustworthy), all using a 9-point Likert scale. Paired samples t-tests were then used to select faces that showed no differences on other dimensions but differed significantly in babyface degree rating within the same gender.

Finally, combining objective measurement results, we further screened faces that met the subjective evaluation criteria. We ultimately selected one female babyface (ID: a32fn01), one female mature face (ID: a04fn01), one male babyface (ID: a51mn01), and one male mature face (ID: a63mn01) as stimulus materials (see Supplementary Table 1 for dimensional difference analysis results).

For the selected face images, following previous research (Li et al., 2013; Zhang et al., 2015), we used Photoshop software to adjust the eye gaze direction in the faces, shifting the iris approximately 0.21° from the center of the eye to generate left- or right-gazing face images.

2.1.3 Apparatus

Experimental stimuli were presented on a 19-inch Lenovo LCD monitor with a resolution of 1280$×$1024 and a refresh rate of 60 Hz. E-Prime software was used to program the experiment and collect response data.

2.1.4 Experimental Design and Procedure

2.1.4.1 Formal Experiment The experiment employed a 2 (participant gender: male, female) × 2 (face gender: male, female) × 2 (face type: babyface, mature face) × 2 (gaze cue validity: valid, invalid) mixed design, with participant gender as a between-subjects variable. The dependent variable was participants' correct response time.

The formal experiment lasted approximately 20 minutes, consisting of 528 trials, including 480 target-present trials and 48 blank trials. It comprised three blocks, with trials randomly presented within each block. In target-present trials, the probability of valid gaze cues was 50%.

Participants were tested individually in a quiet, well-lit experimental booth, seated 57 cm from the screen and instructed to fixate on the center of the display. The stimulus sequence is shown in Figure 2 [Figure 2: see original paper]A, with all condition trials mixed and randomly presented within the same block. Each trial began with a central fixation cross (500 ms, 0.6°$×0.6°visualangle),followedbya1000mspresentationofafacewithdirectgaze(7.85°×9.06°).Next,a200msp located 5° horizontally from central fixation). Except in blank trials, the target appeared randomly at either the valid or invalid location and remained until participants responded by pressing the "M" key or until 2000 ms elapsed. Before the formal experiment, participants completed a practice block of 24 trials using male and female neutral faces not included in the formal experiment, with identical stimulus size and presentation methods.

2.1.4.2 Rating Task After the experiment, participants rated the face images on trait impressions. Following previous research (Dou et al., 2014), we set up two contexts—daily life and workplace—and included key variables from prior studies. In addition to rating babyface degree, participants rated the extent to which the faces matched adjectives in each context: for daily life—"warm" and "trustworthy"; for workplace—"easy to cooperate with" and "competent." Ratings were made on a 1–9 scale (1 = extremely uncharacteristic, 9 = extremely characteristic).

2.2 Data Analysis and Results

Data were analyzed using SPSS 23.0. All participants achieved accuracy rates above 90%, with an average false alarm rate of 9.1% in blank trials. Before formal analysis, error trials and extreme response times (beyond $±$3 SD from the mean) were excluded, resulting in a 1.1% exclusion rate.

2.2.1 Response Times A four-way repeated measures ANOVA on correct response times was conducted with 2 (participant gender: male, female) × 2 (face gender: male, female) × 2 (face type: babyface, mature face) × 2 (gaze cue validity: valid, invalid), with participant gender as a between-subjects factor. Response time data for each condition are shown in Table 3 . Results revealed a significant main effect of participant gender, $F(1, 26) = 6.96$, $p = 0.014$, $p^2 = 0.21$, with male participants responding significantly faster (M = 291 ms, SD = 28) than females (M = 315 ms, SD = 23). The main effect of face gender was significant, $F(1, 26) = 10.34$, $p = 0.003$, $p^2 = 0.28$, with faster responses to female faces (M = 302 ms, SD = 29) than male faces (M = 304 ms, SD = 28). The main effect of face type was significant, $F(1, 26) = 9.50$, $p = 0.005$, $p^2 = 0.27$, with faster responses to mature faces (M = 302 ms, SD = 28) than babyfaces (M = 304 ms, SD = 29). The main effect of gaze cue validity was significant, $F(1, 26) = 93.72$, $p < 0.001$, $p^2 = 0.78$, with faster responses on valid trials (M = 296 ms, SD = 27) than invalid trials (M = 310 ms, SD = 29), indicating a significant gaze cueing effect. Critically, the three-way interaction between face gender, face type, and gaze cue validity was significant, $F(1, 26) = 14.53$, $p = 0.001$, $p^2 = 0.36$. All other main effects and interactions were non-significant, $Fs < 4.14$, $ps > 0.052$.

2.2.2 Gaze Cueing Effect Magnitude To further examine the effects of face gender and face type on gaze cueing magnitude, we conducted a three-way repeated measures ANOVA on gaze cueing effect magnitude (RT_{invalid} − RT_{valid}) with 2 (participant gender: male, female) × 2 (face gender: male, female) × 2 (face type: babyface, mature face), with participant gender as a between-subjects factor. As shown in Figure 3 [Figure 3: see original paper], the interaction between face gender and face type was significant, $F(1, 26) = 14.53$, $p = 0.001$, $p^2 = 0.36$. Simple effects analysis revealed that for male faces, mature faces produced significantly larger gaze cueing effects (M = 15 ms, SD = 10) than babyfaces (M = 10 ms, SD = 10), $F(1, 26) = 7.86$, $p = 0.009$, $p^2 = 0.23$. For female faces, babyfaces produced significantly larger gaze cueing effects (M = 19 ms, SD = 12) than mature faces (M = 13 ms, SD = 11), $F(1, 26) = 8.94$, $p = 0.006$, $p^2 = 0.25$. All other main effects and interactions were non-significant, $Fs < 3.65$, $ps > 0.067$.

2.2.3 Rating Results Paired samples t-tests on post-experiment babyface ratings for different genders showed that male babyface ratings (M = 4.54, SD = 2.41) were significantly higher than male mature face ratings (M = 3.04, SD = 1.91), $t(27) = 2.28$, $p = 0.031$. Similarly, female babyface ratings (M = 5.82, SD = 2.31) were significantly higher than female mature face ratings (M = 3.00, SD = 1.92), $t(27) = 5.88$, $p < 0.001$, confirming the effectiveness of our babyface stimulus selection.

Paired samples t-tests on post-experiment ratings for other dimensions revealed (see Supplementary Table 2) that in daily life contexts, ratings for "warm" and "trustworthy" dimensions showed a significant babyface effect for female faces but a reversed babyface effect for male faces. Specifically, for male faces, babyface ratings (M = 4.25, SD = 1.94; M = 4.39, SD = 1.77) were significantly lower than mature face ratings (M = 5.25, SD = 1.90; M = 5.71, SD = 1.80), $t(27) = -2.32$, $p = 0.028$; $t(27) = -2.89$, $p = 0.008$. For female faces, babyface ratings (M = 4.36, SD = 1.75; M = 5.61, SD = 1.83) were significantly higher than mature face ratings (M = 3.43, SD = 1.60; M = 4.32, SD = 1.68), $t(27) = 2.46$, $p = 0.021$; $t(27) = 3.44$, $p = 0.002$. In workplace contexts, ratings for "easy to cooperate with" showed a significant babyface effect only for female faces, with female babyface ratings (M = 5.71, SD = 2.00) significantly higher than mature face ratings (M = 4.39, SD = 1.69), $t(27) = 3.05$, $p = 0.005$. Ratings for "competent" showed a reversed babyface effect for both genders: male babyface ratings (M = 5.21, SD = 1.77) were significantly lower than mature face ratings (M = 6.32, SD = 1.85), $t(27) = -2.89$, $p = 0.007$, and female babyface ratings (M = 4.75, SD = 1.53) were significantly lower than mature face ratings (M = 5.61, SD = 1.71), $t(27) = -2.83$, $p = 0.009$.

2.3 Discussion of Experiment 1

Experiment 1 found that participants responded faster under valid than invalid gaze cue conditions, indicating a significant gaze cueing effect. More importantly, analysis of gaze cueing effect magnitude revealed an interaction between face gender and face type. For male faces, a reversed babyface effect emerged—participants were more likely to follow the gaze direction of male mature faces compared to male babyfaces. For female faces, a babyface effect was observed—participants were more likely to follow the gaze of female babyfaces. This pattern resembles Zheng et al.'s (2018) finding that female babyfaces and male mature faces capture attention more effectively. The results only showed participant gender differences in response times, without an interaction between face type and participant gender. One possible reason is that when a babyfaced face belongs to an adult, it may not evoke caregiving responses as infants do. Additionally, post-experiment ratings showed babyface effects for female faces on "warm" and "trustworthy" dimensions in daily life contexts, but reversed babyface effects for male faces on these dimensions. In workplace contexts, a babyface effect emerged for female faces on "easy to cooperate with," while reversed babyface effects appeared for both genders on "competent." Experiment 1 confirmed our hypothesis that babyface and face gender information interactively influence gaze cueing effects in comparative contexts, demonstrating that babyface produces attentional biases in social interaction that further affect subsequent evaluations of others—a phenomenon inconsistent with modern society's emphasis on fairness and justice. To investigate whether non-comparative contexts could eliminate these effects of babyface on social attention and trait inference, Experiment 2 presented the four conditions (female babyface, female mature face, male babyface, male mature face) in separate blocks.

3. Experiment 2: Non-Comparative Context

3.1.1 Participants

Twenty-eight university students (14 female, 14 male) aged 18–23 years (M = 20, SD = 1.55) voluntarily participated in the experiment. All participants were healthy, with normal or corrected-to-normal vision, right-handed, and had not participated in similar experiments. Informed consent was obtained from all participants, who received compensation after the experiment.

3.1.2 Experimental Design and Procedure

The experimental design and procedure were identical to Experiment 1, except that Experiment 2 presented the four conditions (female babyface, female mature face, male babyface, male mature face) in separate blocks (see Figure 2B [Figure 2: see original paper]). All other aspects remained the same as in Experiment 1.

3.2 Data Analysis and Results

Data analysis methods were identical to Experiment 1. All participants achieved accuracy rates above 90%, with an average false alarm rate of 11.6% in blank trials. Before formal analysis, error trials and response times beyond 3 SD from the mean were excluded, resulting in a 1.2% exclusion rate.

3.2.1 Response Times A four-way repeated measures ANOVA on correct response times was conducted with 2 (participant gender: male, female) × 2 (face gender: male, female) × 2 (face type: babyface, mature face) × 2 (gaze cue validity: valid, invalid), with participant gender as a between-subjects factor. Response time data for each condition are shown in Table 4 . Results revealed a significant main effect of gaze cue validity, $F(1, 26) = 66.64$, $p < 0.001$, $p^2 = 0.72$, with faster responses on valid trials (M = 299 ms, SD = 28) than invalid trials (M = 311 ms, SD = 30), indicating a significant gaze cueing effect. The interaction between participant gender and gaze cue validity was significant, $F(1, 26) = 7.35$, $p = 0.012$, $p^2 = 0.22$. All other main effects and interactions were non-significant, Fs < 2.79, ps > 0.107.

3.2.2 Gaze Cueing Effect Magnitude A three-way repeated measures ANOVA on gaze cueing effect magnitude (RT_{invalid} – RT_{valid}) was conducted with 2 (participant gender: male, female) × 2 (face gender: male, female) × 2 (face type: babyface, mature face), with participant gender as a between-subjects factor. Results showed a significant main effect of participant gender, $F(1, 26) = 7.35$, $p = 0.012$, $p^2 = 0.22$, with male participants showing significantly smaller gaze cueing effects (M = 8 ms, SD = 12) than female participants (M = 15 ms, SD = 10). All other main effects and interactions were non-significant, Fs < 2.79, ps > 0.107.

3.2.3 Rating Results Paired samples t-tests on post-experiment babyface ratings showed that male babyface ratings (M = 5.39, SD = 2.22) were significantly higher than male mature face ratings (M = 3.11, SD = 1.66), $t(27) = 4.71$, $p < 0.001$. Female babyface ratings (M = 5.29, SD = 1.94) were also significantly higher than female mature face ratings (M = 3.96, SD = 2.41), $t(27) = 2.57$, $p = 0.016$, confirming the effectiveness of our babyface stimulus selection.

Paired samples t-tests on post-experiment ratings for other dimensions (see Supplementary Table 3) revealed that in workplace contexts, ratings for "competent" showed a significant babyface effect only for male faces, with male babyface ratings (M = 4.89, SD = 1.45) significantly lower than male mature face ratings (M = 6.00, SD = 1.36), $t(27) = -3.35$, $p = 0.002$. No other significant differences emerged between face types for male or female faces.

3.3 Discussion of Experiment 2

Experiment 2 found that participants responded faster under valid than invalid conditions, indicating a significant gaze cueing effect. More importantly, in the non-comparative context, gaze cueing effects were only influenced by participant gender, with female participants showing stronger effects than males—consistent with previous research (Bayliss et al., 2005). This suggests that without a comparative context, babyface information was no longer salient, eliminating the babyface modulation effect observed in Experiment 1. Additionally, post-experiment ratings showed that participants only differentiated between male babyfaces and mature faces on the "competent" dimension in workplace contexts. Experiment 2 not only confirmed our hypothesis that non-comparative contexts can eliminate attentional biases toward babyfaces in social interaction but also demonstrated that this influence partially extends to subsequent evaluations of others.

3.4 Combined Analysis of Experiments 1 and 2

To further verify the joint effects of babyface, gender information, and contextual factors on gaze cueing magnitude, we combined data from Experiments 1 and 2 and conducted a three-way repeated measures ANOVA on gaze cueing effect magnitude with 2 (participant gender: male, female) × 2 (face gender: male, female) × 2 (face type: babyface, mature face) × 2 (context: comparative, non-comparative), where participant gender and context were between-subjects factors. Results showed a significant face gender × face type interaction, $F(1, 52) = 5.21$, $p = 0.027$, $p^2 = 0.091$. More importantly, the three-way interaction between face gender, face type, and context was significant, $F(1, 52) = 6.64$, $p = 0.013$, $p^2 = 0.113$, indicating statistically significant differences between the patterns under the two contextual conditions.

4. General Discussion

This study used a gaze cueing paradigm to investigate whether face type, face gender, and participant gender interactively influence gaze cueing effects and how the babyface effect manifests in social attention under different contextual factors. Experiment 1, using a comparative context with male and female faces varying in babyface degree, found that face type and face gender interactively influenced gaze cueing effects—female babyfaces elicited larger gaze cueing effects than mature faces, while male babyfaces elicited smaller effects than mature faces. Experiment 2, using a non-comparative context with each condition presented in separate blocks, yielded a different pattern: gaze cueing effects were no longer modulated by babyface or gender information, showing only participant gender differences (female > male). Collectively, these results highlight that although babyface can interact with face gender to influence gaze cueing effects, this social modulation depends critically on contextual factors.

The current study demonstrates that male and female babyfaces produce attentional biases in social interaction, with male mature faces and female babyfaces eliciting larger gaze cueing effects. While gaze cueing effects are considered reflexive, the finding that babyface can co-modulate this effect with gender suggests that babyface processing may be automatic, supporting McCall's (1980) proposal that infant schema faces are processed rapidly and extending this to adult faces. On one hand, previous research shows that processing adult faces with babyish features (Luevano & Zebrowitz, 2007; Phelps et al., 2000; Zebrowitz et al., 2009) and processing infant faces (Bartels & Zeki, 2004; Nitschke et al., 2004; Strathearn et al., 2008; Glocker et al., 2009) both activate the fusiform gyrus and amygdala associated with positive emotion, suggesting that the babyface effect observed for adult female faces in this study originates from preferences for infant schema. On the other hand, differences between male and female faces may reflect the operation of gender role stereotypes. Qian et al.'s (1999) preliminary survey of gender stereotypes among Chinese university students found that males were generally perceived as stronger and more competent than females, while females were seen as more passive and compliant—traits opposite to those inferred from babyfaces (e.g., warmth, innocence, compliance). Our findings support this view and align with Zheng et al.'s (2018) pattern of babyface effects in visual selective attention, revealing differences in gaze cueing effects elicited by babyfaces and mature faces across genders, with a reversed babyface effect for male faces (male mature faces eliciting larger effects). This suggests that gender stereotypes may co-influence behavioral responses with the babyface effect.

More importantly, this study further demonstrates that contextual factors are crucial in moderating how male and female babyfaces influence gaze cueing effects. When faces are mixed within the same block, the comparative context makes babyface features more salient, allowing observation of babyface effects in social attention. Zhang et al. (2022) similarly showed that face ethnicity can moderate gaze cueing effects depending on whether the social information conveyed by faces is salient—when contextual factors were manipulated by changing comparative contexts, this moderating effect disappeared in non-comparative contexts. Additionally, we found a moderating effect of participant gender on gaze cueing effects in the non-comparative context, consistent with previous research (Bayliss et al., 2005), with female participants showing stronger effects than males. However, contrary to our hypothesis, this gender difference did not appear in the comparative context. One possible explanation is that the salience of babyfaces in the comparative context activated face type-based stereotypes (Masip et al., 2004), and because face stimuli were presented for a short duration in this study, processing of babyface faces was rapid (McCall, 1980), limiting attentional resources and making face type modulation stronger than participant gender modulation, thus preventing significant participant gender differences in the comparative context. As the eyeTUNE framework (Dalmaso et al., 2020) posits, social modulation of gaze cueing is not immutable—contextual factors play a key role. Notably, we also observed that babyface effects on certain dimensions of trait inference in the comparative context disappeared in the non-comparative context, consistent with previous trait inference research showing that external manipulation of contextual factors can weaken or even reverse babyface effects (Gorn et al., 2008).

This study is the first to explore the babyface effect in social attention and demonstrates interactive effects of multiple variables on gaze cueing effects. However, several limitations should be noted, suggesting directions for future research. First, previous research has found that facial emotion moderates the babyface effect. For example, Sparko and Zebrowitz (2011) found that negative expressions can reduce perceived differences in babyface between neutral faces. Future research could investigate how different facial expressions influence the effect of babyface on social attention. Second, our findings demonstrate that contextual factors play a key role not only in the babyface effect on social attention but also to some extent in trait inference. However, this study only included trait inference as a post-experiment measure, and faces had already been exposed during the formal experiment. Future research could further examine whether comparative contexts moderate the babyface effect in trait inference. Finally, contextual manipulation can be achieved not only through bottom-up, stimulus-driven approaches but also through top-down methods such as emotion or social experience priming paradigms and manipulating social backgrounds (Ishikawa et al., 2021; Rule et al., 2010; Wilkowski et al., 2009). Future studies could introduce more types of contexts to further supplement and explore the role of contextual factors in babyface and gaze cueing effects.

5. Conclusion

Gender and babyface interactively influence gaze cueing effects, and this influence is moderated by contextual factors. In comparative contexts, male mature faces and female babyfaces elicit larger gaze cueing effects, whereas non-comparative contexts can eliminate this social attention bias caused by gendered babyfaces. These findings support the eyeTUNE framework's theoretical perspective that social modulation of gaze cueing effects depends critically on contextual factors.

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Supplementary Table 1: Dimensional ratings for the four selected neutral face models (M, SE)

Supplementary Table 2: Post-experiment trait ratings for each face in daily life contexts under comparative context (M, SD, SE)

Supplementary Table 3: Post-experiment trait ratings for each face in daily life and workplace contexts under non-comparative context (M, SD, SE)

Note: Figure translations are in progress. See original paper for figures.