

**Reported maternal tendencies predict the reward value of infant facial  
cuteness, but not cuteness detection**

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**Manuscript word count: 2498**

1 **Abstract**

2 The factors that contribute to individual differences in the reward value of cute  
3 infant facial characteristics are poorly understood. Here we show that the  
4 effect of cuteness on a behavioral measure of the reward value of infant faces  
5 is greater among women reporting strong maternal tendencies. By contrast,  
6 maternal tendencies did not predict women's subjective ratings of the  
7 cuteness of these infant faces. These results show, for the first time, that the  
8 reward value of infant facial cuteness is greater among women who report  
9 being more interested in interacting with infants, implicating maternal  
10 tendencies in individual differences in the reward value of infant cuteness.  
11 Moreover, our results indicate that the relationship between maternal  
12 tendencies and the reward value of infant facial cuteness is not due to  
13 individual differences in women's ability to detect infant cuteness. This latter  
14 result suggests that individual differences in the reward value of infant  
15 cuteness are not simply a byproduct of low cost, functionless biases in the  
16 visual system.

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22 **Keywords:** incentive salience; motivational salience; baby; parental behavior;  
23 maternal desire

## 24 **Introduction**

25 Facial cuteness can have important effects on adult responses to infants.

26 Adults report being more likely to care for, protect, and form close bonds with  
27 infants displaying cute facial characteristics [1-4]. Similar patterns of results  
28 have been observed in studies of the actual care provided for infants [5].

29 Furthermore, neuroimaging [6] and behavioral [7,8] studies suggest that cute  
30 infant facial characteristics are rewarding. Similar results have also been  
31 reported for responses to infants with and without cleft lips [9-12] or displaying  
32 positive and negative emotional expressions [13].

33

34 Some studies report that the effects of infant facial cuteness on perceptual  
35 judgments and the reward value of infant faces (the latter assessed via  
36 behavioral key-press tasks similar to those used to study the motivational  
37 salience of stimuli in non-humans) are greater among women than men  
38 [7,8,14,15]. Although it has been suggested that this pattern of results occurs  
39 because women's interest in caring for infants is, on average, greater than  
40 men's [7,14,15], there have been no direct tests for links between individual  
41 differences in women's interest in caring for infants and their responses to  
42 infant facial cuteness. Indeed, some studies have not observed stronger  
43 responses to infants in women than men [16-19], further calling into question  
44 the presumed link between interest in caring for infants and women's  
45 responses to infant facial cuteness.

46

47 In light of the above, we investigated how nulliparous women's reported  
48 interest in caring for infants (i.e., what some researchers have called reported

49 *maternal tendencies* [20,21]) relates to their responses to experimentally  
50 manipulated infant facial cuteness in two tasks: a perceptual cuteness rating  
51 task and a behavioral key-press task. Because responses on perceptual  
52 rating and behavioral key-press tasks are thought to measure different  
53 constructs (subjective appraisal or 'liking' and 'wanting' or motivational  
54 salience, respectively [22]), maternal tendencies need not necessarily relate  
55 to responses on both tasks in the same way.

56

## 57 **Methods**

### 58 ***Participants***

59 Two hundred heterosexual nulliparous women (mean age=21.93 years,  
60 SD=4.58), recruited by following links from social bookmarking websites (e.g.,  
61 StumbleUpon.com), participated in this online study. Participants were not  
62 compensated for their participation. All procedures were approved by the  
63 University of Glasgow Psychology Ethics Review Board.

64

### 65 ***Stimuli***

66 We used computer-graphic techniques [23] to create high-cuteness and low-  
67 cuteness prototypes. These possessed the average shape information of the  
68 20 infant faces that received the highest and lowest cuteness ratings,  
69 respectively, in a previous study [15]. We then created high-cuteness versions  
70 of 10 different infant face images by adding 50% of the linear differences in  
71 2D shape between the high-cuteness and low-cuteness infant prototypes to  
72 each of the 10 infant face images (Figure 1). Low-cuteness versions of the 10  
73 infant face images were created by subtracting 50% of the linear differences

74 in 2D shape between the high-cuteness and low-cuteness infant prototypes  
75 from each of the 10 infant face images (Figure 1). Mouth shape was held  
76 constant [see 14].

77

### 78 ***Procedure***

79 Half of our participants completed a *key-press* task used to assess the reward  
80 value of infant facial cuteness in previous studies [e.g., 7]. The other half  
81 completed a *rating* task used to assess the effect of morphological cues on  
82 infant facial cuteness [e.g., 14]. Participants were randomly allocated to either  
83 the key-press or rating task to ensure that possible differences in findings for  
84 these tasks could not be due to systematic differences in the characteristics of  
85 the two groups of women. See Supplemental Materials for instructions. All  
86 participants completed a maternal tendencies questionnaire. The order in  
87 which participants completed their face rating/key-press task and the  
88 questionnaire was randomized.

89

90 *Key-press task.* All 20 images were presented in a fully randomized order.  
91 Participants controlled the viewing duration of each face image by repeatedly  
92 pressing designated keys on their keyboard after initiating each trial by  
93 pressing the space bar. Participants could either increase the length of time a  
94 given face was displayed by alternately pressing the 7 and 8 keys or decrease  
95 the length of time a given face was displayed by alternately pressing the 1  
96 and 2 keys. Each key press increased or decreased the viewing duration by  
97 100ms. The default viewing duration for each image (i.e., the length of time a  
98 face remained onscreen if no keys were pressed) was 4 seconds. All

99 participants key pressed at least once during the task. Participants completed  
100 a block of practice trials at the start of the key-press task. Responses to faces  
101 assessed using key-press tasks are good predictors of neural measures of  
102 the reward value of faces [24].

103

104 Key-press scores for each face were calculated by subtracting the number of  
105 key presses made to decrease viewing time from those made to increase  
106 viewing time. These key-press scores were then used to calculate each  
107 participant's *cuteness reward score* by subtracting the mean key-press score  
108 for the low-cuteness versions of infant faces from that for the high-cuteness  
109 versions ( $M=5.91$ ,  $SD=10.41$ ). Higher scores indicate a greater effect of  
110 cuteness on reward value.

111

112 *Rating task.* All 20 infant face images were presented in a fully randomized  
113 order and were rated for cuteness on a 1 (not cute) to 7 (very cute) scale. We  
114 calculated each participant's *cuteness perception score* by subtracting the  
115 mean rating they gave to the low-cuteness versions of infant faces from that  
116 they gave to the high-cuteness versions ( $M=0.36$ ,  $SD=0.52$ ). Higher scores  
117 indicate that cuteness had a greater effect on ratings.

118

119 *Maternal tendencies questionnaire.* Participants completed a version of  
120 Ahrons' [25] Parental Involvement Scale, in which they were asked to rate on  
121 a 1 (not at all) to 5 (very much) scale how involved they would like to be in ten  
122 aspects of child raising (e.g., dressing and grooming your child, taking them  
123 for recreational activities). Maternal tendencies were also assessed by asking

124 participants to rate, using a 1 (much less than average) to 7 (much more than  
125 average) scale, and relative to others of their age and sex, how much they  
126 enjoy interacting with children, how maternal they consider themselves to be,  
127 and how strongly they want to have children. These additional questions have  
128 been used to assess maternal tendencies in prior work on individual  
129 differences in nulliparous women's maternal tendencies [20,21]. Factor  
130 analysis of women's average scores on the Parental Involvement Scale and  
131 scores on each of the additional questions produced a single *maternal*  
132 *tendencies factor* with which scores on the three additional questions were  
133 highly correlated (all  $r > .88$ ) and with which the Parental Involvement Scale  
134 score was moderately correlated ( $r = .47$ ). Scores on the *maternal tendencies*  
135 *factor* and participant age were not correlated ( $r = -.08$ ,  $p = .26$ ).

136

### 137 **Results**

138 In all analyses,  $N = 100$ . We used non-parametric tests for all analyses  
139 because some scores were more than three standard deviations from the  
140 mean (i.e., were potential outliers). Alternative analyses using t-tests and  
141 Pearson's correlations showed identical patterns of results, however.

142

143 A Wilcoxon signed ranks test comparing *cuteness reward scores* with chance  
144 (i.e., zero) showed that women looked longer at high-cuteness versions than  
145 low-cuteness versions ( $Z = 6.33$ ,  $p < .001$ ,  $M = 5.91$ ,  $SEM = 1.04$ ,  $d = 0.57$ ). There  
146 was also a significant positive correlation between *cuteness reward scores*  
147 and scores on the *maternal tendencies factor* ( $\rho = .35$ ,  $p < .001$ , Figure 2),  
148 indicating cuteness had a greater positive effect on the reward value of infant

149 faces among women reporting greater maternal tendencies. *Cuteness reward*  
150 scores were also positively and significantly correlated with each of the  
151 individual measures of maternal tendencies (all  $ps < .012$ ).

152

153 A Wilcoxon signed rank test comparing *cuteness perception scores* with  
154 chance (i.e., zero) showed high-cuteness versions were rated significantly  
155 higher than low-cuteness versions ( $Z=5.96$ ,  $p < .001$ ,  $M=0.36$ ,  $SEM=0.05$ ,  
156  $d=.69$ ). However, there was no significant correlation between *cuteness*  
157 *perception scores* and scores on the *maternal tendencies factor* ( $\rho = -.15$ ,  
158  $p = .14$ ). The correlation between *cuteness reward scores* and scores on the  
159 *maternal tendencies factor* was significantly stronger than that between  
160 *cuteness perception scores* and scores on the *maternal tendencies factor*  
161 ( $Z=3.60$ ,  $p < .001$ ).

162

### 163 **Discussion**

164 In common with previous work [14,15], women perceived high-cuteness  
165 versions of infant faces to be cuter than low-cuteness versions. Also in  
166 common with previous work [7,8], responses on the key-press task indicated  
167 that high-cuteness versions of infant faces were more rewarding than low-  
168 cuteness versions. Importantly, however, reported maternal tendencies were  
169 positively correlated with the reward value of infant facial cuteness, but not  
170 with perceptions of infant cuteness. These results suggest that (i) maternal  
171 tendencies are more closely linked to the reward value of infant facial  
172 cuteness than it is to perceptual judgments of infant cuteness and (ii) the  
173 relationship between maternal tendencies and the reward value of infant facial



174 cuteness are not simply due to individual differences in women's ability to  
175 *detect* infant cuteness. This latter result is noteworthy, since it suggests that  
176 the relationship between maternal tendencies and the reward value of infant  
177 facial cuteness is not simply a byproduct of low cost, functionless biases in  
178 the visual system. Because we investigated this issue in nulliparous women  
179 only, further work is needed to investigate whether motherhood has additional  
180 effects on the relationship between reported maternal tendencies and  
181 responses to infant cuteness.

182

183 That the relationship between maternal tendencies and responses to infant  
184 facial cuteness appears to be task-specific (i.e., was evident in responses on  
185 the key-press task, but not perceptual ratings) is consistent with prior research  
186 suggesting that key-pressing and perceptual judgments measure different  
187 components of approach responses: 'wanting' or motivational salience and  
188 subjective appraisal or 'liking', respectively [22]. For example, heterosexual  
189 men's subjective ratings distinguish physically attractive from unattractive  
190 faces regardless of their sex, but responses on the key-press task distinguish  
191 physically attractive from unattractive faces for female stimuli only [24]. Our  
192 data extend this distinction between reward value and subjective ratings by  
193 demonstrating that only individual differences in the reward value of infant  
194 cuteness are related to nulliparous women's reported maternal tendencies.

195

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283

284 **Figure Captions**

285

286 **Figure 1.** High-cuteness (left) and low-cuteness (right) versions of faces used  
287 in our study.

288

289 **Figure 2.** Correlation between *cuteness reward* scores and scores on the  
290 *maternal tendencies factor*.

291

**Author contributions**

ACH/BCJ/LMD designed the study; ACH/BCJ carried out statistical analyses; ACH/BCJ/LMD wrote the manuscript; all authors gave final approval for publication.

**Funding statement**

Funded by ERC Starting Grant 282655 and ESRC grant ES/1031022/1.

**Competing interests statement**

The authors state that they have no competing interests

**Data accessibility**

The data have been made available as electronic supplementary material.

**Ethics & Consent**

All procedures were approved by the local Ethics Review Board at the University of Glasgow and all participants provided informed consent prior to beginning the study.

## **Supplemental Materials**

All study interfaces were custom-written in php and Javascript.

### **Instructions for key-press task**

In this study, you will look at baby faces for 1.5 minutes. How long you look at each face is up to you. You can change the time each image is on the screen by pressing buttons like you did in the button-pressing training task you just completed.

As in the training task, press 7 and 8 to keep the image on the screen. Press 1 and 2 to remove the image from the screen.

### **Instructions for cuteness rating task**

In this study, you will be shown a series of baby faces and asked to rate how cute you think they are. Please look closely as some images will be very similar in appearance. For each face, please type your rating on the 1 (not cute) to 7 (very cute) scale in the box below and press enter to submit.

### **Reported participant ethnicities**

70% White, 8% Latina, 6.5% mixed-race, 3.5% East Asian, 2.5% African, 1.5% Native American, 1.5% Arabic, 6.5% other/undisclosed.

### **Reported participant geographic location**

60% North America, 31% Europe, 7% Oceania, 2% South America.