

Implicit responses in the judgment of attractiveness in faces with differing levels of makeup

Article

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6

7 **Implicit Responses in the Judgement of Attractiveness in Faces with Differing**
8 **Levels of Makeup**

9

10 **Abstract**

11 Makeup is a form of body art which has been used for over 7000 years and is present in
12 the great majority of human cultures, often used to enhance facial attractiveness and to
13 accentuate features that represent femininity. This study examined how cumulative
14 levels of facial makeup influenced approach and avoidance tendencies and on facial
15 muscle responses associated with emotional response obtained through facial
16 electromyography (EMG) in a passive viewing task. Experiment 1 employed the
17 joystick variant of the approach-avoidance task, where 30 subjects categorised female
18 faces by visual orientation (portrait/landscape) in 7 cumulatively-added makeup levels.
19 In Experiment 2, facial EMG was recorded from 40 subjects in the passive viewing of
20 the same images. The present study shows that makeup application modulates implicit
21 responses and reveals two distinct implicit preferences, behavioural and affective, with
22 a male behavioural preference for heavy eye cosmetics, a female behavioural preference
23 for light makeup, and an overall affective preference in both men and women for
24 makeup accentuating visual contrast in the eye and mouth regions. These results are
25 consistent with the conception that perceptual cues underlying cosmetic enhancement
26 are key determinants in aesthetic facial preferences.

27

28 *Keywords:* cosmetics, facial attractiveness, facial electromyography, approach-
29 avoidance task.

30 *Abstract word count:* 190

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32 **Introduction**

33 Judgements of facial attractiveness have been shown to be remarkably consistent
34 between individuals and cultures (Langlois et al., 2000), in marked contradiction to the
35 commonly-held belief that “beauty is in the eye of the beholder”. Recent studies have
36 shed further light on the perceptual bases of facial attractiveness, by using techniques
37 traditionally employed in studies of the recognition of facial expressions to further
38 elucidate common perceptual cues for the evaluation of facial attractiveness, moving
39 beyond the concepts laid out in human ethology and evolutionary psychology of facial
40 symmetry, averageness and skin texture as the principal determinants of facial
41 attractiveness in humans (Fink & Neave, 2005; Rhodes, 2006; Little et al., 2011).

42 One key area of interest is the extent to which the application of cosmetics enhances
43 female facial attractiveness in the face of several conflicting claims from the health and
44 beauty industry. Female faces are judged to be significantly more attractive following
45 the application of differing layers of eye, lip and full-face makeup (Mulhern et al.,
46 2003), and this effect is enhanced for female observers compared to males. Mulhern et
47 al. (2003) investigated the effect of makeup on female facial attractiveness evaluated by
48 male and female participants using five cosmetic conditions: no makeup, foundation
49 only, eye makeup only, lip makeup only, and full facial makeup. Their results showed
50 that in explicit ratings of attractiveness, faces with full makeup were rated as more
51 attractive than those with no makeup or less makeup (e.g. lipstick only). While their

52 design allowed for the evaluation of cosmetic enhancement by region, in naturalistic
53 settings women more commonly combine cosmetic products applied to the face as a
54 whole. As such, both the number and combination of makeup products used should be
55 addressed when investigating the cosmetic enhancement of facial attractiveness.

56 In addition, women judged to be more attractive when wearing makeup are also
57 perceived as healthier, more confident and more professionally successful by male and
58 female participants (Nash et al., 2006), as part of a generalised “attractiveness halo”
59 effect for attractive faces (for a review, see Zebrowitz & Montepare, 2008). However,
60 differences in judgements of facial attractiveness due to makeup are statistically
61 negligible in comparison to differences due to identity (Jones & Kramer, 2016) and thus
62 the enhancement effect of makeup on overall attractiveness appears to be slight and may
63 potentially be due to an interaction with individual physiognomy.

64 Facial attractiveness is highly correlated with femininity or sexual dimorphism (Koehler
65 et al., 2004; Little et al., 2011). Perceptual analyses of female and male faces have
66 highlighted differences in luminance contrast in facial regions such as the eyes and
67 mouth as one of the prime determinants of sexual dimorphism (judging whether a face
68 is more feminine or masculine) regardless of face gender (Russell, 2003; 2009).

69 Accordingly, makeup appears to lead to an enhancement of this contrast effect with
70 products such as eyeshadow that accentuate the femininity of the face. At the same time,
71 products such as foundation are used to mask imperfections and smooth skin texture,
72 leading to an increase in overall facial symmetry and averageness which are seen as
73 common evolutionary-defined cues for assessing attractiveness (Rhodes, 2006; Russell,
74 2010). This is consistent with attractiveness research, which has highlighted specific
75 facial characteristics as determinants of female facial attractiveness beyond facial

76 symmetry, such as high cheekbones, large eyes and lips, thin eyebrows, and small noses
77 and chins (Cunningham et al., 1995; Baudouin & Tiberghien, 2004).

78 Previous studies have shown a remarkable consistency in male preferences for female
79 facial attractiveness across different races and cultures (Cunningham et al., 1995;
80 Thornhill & Grammer, 1999; Fink & Penton-Voak, 2002). One of the main divergences
81 in attractiveness preferences across race is related to the degree of sexual dimorphism
82 that female faces display (Penton-Voak et al., 2004). White British and Japanese men
83 show significant preference for more feminine female faces of the same race, while
84 Jamaican men show less preference for sexual dimorphism, evaluating female faces
85 with greater masculinity as significantly more attractive than feminised morphs (Penton-
86 Voak et al., 2004). Overall however, increased sexual dimorphism is preferred in female
87 but not male faces (Morrison et al., 2010), primarily as an indicator of health and
88 increased fertility (Law-Smith et al., 2006).

89 The majority of studies conducted to date on the effect of makeup on judgements of
90 facial attractiveness have employed an overt rating scale, with participants assigning
91 explicit scores to faces on the basis of their conscious perception of the individual's
92 attractiveness, similar to the design by Osborn (1996). There have been relatively few
93 studies conducted to date measuring implicit responses to faces with differing levels of
94 makeup. One of the few studies to do so (Richetin et al., 2004), used the Implicit
95 Association Test to test differences in reaction time in response to pairings of female
96 faces with and without makeup and positive and negative stimuli such as personality
97 traits, pleasant/unpleasant words and professions of high-/low-social status. They found
98 that faces with makeup were associated with positive personality traits and high-status
99 professions more than faces with no makeup, similarly to the results from Nash et al.
100 (2006). As makeup had no effect on reaction time in response to pleasant and

101 unpleasant words, the implicit processing of makeup may be dependent on social
102 context, and not merely affected by the emotional valence of the stimuli.

103 Another method for measuring implicit response, traditionally in the context of
104 emotional valence, is facial electromyography (EMG). Facial EMG is capable of
105 delivering great sensitivity and accuracy in the detection of the movement of facial
106 muscles associated with emotional expressions such as the *M. corrugator supercilii*
107 (associated with frowning and negative affect) and the *M. zygomaticus major*
108 (associated with smiling and positive affect). Facial EMG can detect face muscle
109 activations that are so subtle that they are not visible in the face due to the overlaying
110 fatty tissue and skin (Rinn, 1984). In addition, recordings from facial EMG can capture
111 responses to low-intensity emotional stimuli and even in situations where the participant
112 has no conscious awareness of producing an emotional response (Cacioppo et al., 1986;
113 Dimberg et al., 2000). An example of face muscle activity that can be measured using
114 EMG despite a lack of participants' awareness of the muscle activations is the
115 phenomenon termed 'facial mimicry' (see a review by Hess & Fischer, 2014). That is,
116 presenting participants with stimuli portraying facial emotional expressions on a
117 computer screen will produce only a subliminal perception of muscle activation in the
118 participant in accordance to the observed facial expression. Facial mimicry has been
119 demonstrated in the corrugator when participants observe emotional expressions of
120 negative valence and in the zygomaticus when observing positively valenced emotional
121 expressions (Achaibou et al., 2008; Dimberg, 1982; Dimberg & Thunberg, 1998;
122 Lundqvist, 1995; Lundqvist & Dimberg, 1995), and increased levator activity when
123 observing facial expressions of disgust and greater frontalis activation when observing
124 facial expression of fear and surprise (Lundqvist, 1995; Lundqvist & Dimberg, 1995).
125 That facial muscle activity associated with emotional facial expressions can be

126 measured without participants being aware of these activations makes facial EMG an
127 ideal implicit measure. Facial EMG holds great utility as an implicit measure of
128 individual affect, since face muscle activations (as measured via EMG) can reflect
129 underlying emotional states. For example, when watching pictures related to positive
130 and negative emotions, participants' EMG activity will increase in the zygomatic and
131 corrugator regions respectively, and subjective affective valence ratings are in line with
132 these increased muscle activations (e.g. Larsen et al., 2003). Facial EMG thus allows to
133 measure participants' affective responses independent of participants awareness of their
134 emotional states or accompanying facial muscle activations.

135 Employing facial EMG in response to faces of varying facial attractiveness results in a
136 modulation of activity mainly in the zygomatic and corrugator regions (Hazlett &
137 Hoehn-Saric, 2000; Gerger et al., 2011) and over the *levator labii superioris* muscle
138 (Principe & Langlois, 2011), associated with emotional reactions of disgust. Hazlett and
139 Hoehn-Saric (2000) found an interesting sex difference in facial EMG response to facial
140 attractiveness, with female subjects revealing increased corrugator response when
141 presented with highly-attractive female faces and greater zygomatic response when
142 viewing highly-attractive male faces. Overall however, there appears to be a linear
143 negative correlation between facial attractiveness and corrugator and levator response
144 (Principe & Langlois, 2011), and, to a lesser extent, a positive correlation between
145 attractiveness and zygomatic response (Gerger et al., 2011), regardless of the gender of
146 the subject. Facial EMG modulation has been shown to be consistent with explicit
147 ratings of facial attractiveness (Gerger et al., 2011) and sexual arousal (Hazlett &
148 Hoehn-Saric, 2000), but has not yet been compared to other measurements of implicit
149 response, such as approach/avoidance behaviour. Though, facial EMG might reveal
150 affective responses beyond what can be assessed with explicit measures. Another more

151 recent study (Tagai et al., 2017) investigated the effect of different levels of makeup on
152 amplitude differences of ERP components associated with face processing such as the
153 N170 and VPP. The authors observed that the processing of faces with light makeup
154 was accompanied by a decrease in N170 and VPP amplitude as compared to faces with
155 heavy makeup. This result was consistent with the explicit classification of facial
156 attractiveness, with slightly softer faces being evaluated as more attractive than faces
157 with heavy makeup, possibly due to the greater fluency and ease of visual processing of
158 faces with lighter makeup.

159 Several studies have investigated trustworthiness and facial emotion through an
160 approach/avoidance paradigm, whether through measurements of amygdalar activation
161 (Todorov et al., 2008) or manipulation of a virtual manikin or physical joystick (Heuer
162 et al., 2007; Krieglmeyer & Deutsch, 2010). As facial attractiveness and
163 approachability/trustworthiness are highly correlated (Todorov, 2008; Sofer et al.,
164 2015), additional feedback from an approach/avoidance measure such as joystick
165 position may provide useful data in response to emotional modulation by both
166 attractiveness and makeup levels. Concomitant effects of facial attractiveness on
167 emotional processing have long been established (Nakamura et al., 1998); several areas
168 associated with reward and positive-valenced emotions, such as the orbitofrontal cortex
169 and amygdala, are also activated when viewing and categorising faces by level of
170 attractiveness (Winston et al., 2007). In addition, this activation frequently occurs even
171 when the task is not specific to categorisation of facial attractiveness (Chatterjee et al.,
172 2009), indicating that the reward-inducing properties of attractive faces are at least
173 partly automatised. More recently, approach-related behaviour has been directly linked
174 with the reward value of faces explicitly categorised as more attractive in both male and
175 female participants (Kramer et al., 2020), with greater physical “lean” and approach

176 response towards attractive than unattractive female faces even in the absence of active
177 task demands. As emotionally-expressive facial cues have been shown to lead to the
178 modulation of task-selective motor response, the authors argue for a similar modulatory
179 effect from facial cues signalling attractiveness (Kramer et al., 2020).

180 This close correlation between beauty and emotional and behavioural response opens up
181 several possibilities for testing the perception of facial attractiveness using implicit
182 measures more commonly used for the analysis of affective valence or intensity
183 (Chatterjee & Vartanian, 2016). Interestingly, an interaction between positive emotional
184 feedback and visual fluency may lie behind one of the main determinants of facial
185 attractiveness, prototypicality or averageness. Winkielman et al. (2006) found that more
186 prototypical random-dot patterns were categorised more quickly and consistently rated
187 as more attractive than less prototypical displays, together with increased zygomatic
188 EMG response, revealing the close association between the increased perceptual fluency
189 of prototypical stimuli and higher measures of attractiveness and positive affect.

190 Principe and Langlois (2012) investigated the effect of face prototypicality on emotional
191 response when categorising faces by attractiveness, and found that previous
192 familiarisation with human-chimpanzee morphed faces led to a shift in preferences;
193 with human-chimpanzee morphs categorised as more attractive and with a
194 correspondent increase in zygomatic activity in those participants than for participants
195 who received no previous familiarisation. This reveals that our internal prototypes for
196 facial attractiveness are both malleable and subject to previous cultural experience.

197 Taken together, these results reveal a diverse set of social and cognitive mechanisms
198 underlying the perception of makeup, ranging from a generalised “halo effect”, with
199 more heavily-applied cosmetics associated with greater professional success,
200 competence, and even physical health and wellbeing (Nash et al., 2006; Richetin et al.,

201 2004), to visual cues signalling femininity, youth and attractiveness, particularly a skin-
202 smoothing effect of foundation (Russell, 2010) and an increase in luminance contrast
203 provided by eye makeup (Russell, 2003, 2009) associated with sexual dimorphism.
204 Some researchers have argued for the integration of these components as part of an
205 ‘extended phenotype’ of cosmetic use, as a cultural tool to increase one’s social and
206 sexual success (Etkoff et al., 2011; Mileva et al., 2016).

207 Present study: The implicit techniques of facial EMG and AAT response were
208 employed as dependent measures in the present study to investigate the effect of
209 cumulative levels of applied makeup on participants’ implicit emotional and
210 behavioural responses to facial attractiveness and ethnicity while conducting a
211 perceptual categorisation task. We sought to investigate the implicit perception of
212 makeup by testing participants’ responses to varying conditions of makeup, from a basic
213 layer of foundation to the “heavier” application of eyeshadow. As makeup is commonly
214 applied in different stages in response to social context, with foundation and lipstick
215 used in more “everyday” contexts than other products, we designed a set of facial
216 stimuli containing the cumulative addition of cosmetic products from a base of
217 foundation and lipstick to the greater visual contrast of pencilling, mascara, eyeliner and
218 eyeshadow respectively. The inclusion of gradually-applied makeup levels in the stimuli
219 also sought to differentiate participants’ implicit response to the qualitative changes to
220 facial features and configuration caused by different makeup products, within a
221 naturalistic setting. Previous studies investigating implicit or physiological responses to
222 makeup differences have employed either a no-makeup/makeup design (Richetin et al.,
223 2004) or a no/light/heavy makeup design (Tagai et al., 2016; 2017), which may not have
224 shown sufficient sensitivity towards differences in intermediate levels of makeup
225 application.

226 As EMG markers associated with negative emotional response such as corrugator and
227 levator activation have previously shown to be negatively correlated with explicit face
228 attractiveness ratings (Principe & Langlois, 2011), and conversely zygomatic activation,
229 associated with positive affect, has been shown to be positively correlated with explicit
230 face attractiveness ratings (Gerger et al., 2011), we opted to include these specific
231 muscle sites in the design of the current study. Additionally, we included the frontalis
232 muscle (*M. Frontalis, pars lateralis*) as a site of EMG response, due to the previously
233 reported association of this muscle with the inducement of stress (Kukde & Neufeld,
234 1994), and negative affect (Cacioppo et al., 1986) similarly to the corrugator. We
235 hypothesised that the increased cosmetic enhancement of facial attractiveness would
236 lead to a decrease in activation at the three muscle sites associated with negative affect
237 and emotional response (corrugator, levator and frontalis), and a concurrent increase in
238 zygomatic activation, associated with positive affect. In addition, in line with studies
239 reporting a perceptual preference for increased visual fluency in faces with light
240 compared to heavy makeup (Tagai et al., 2016; 2017), we expected to observe a drop-
241 off in zygomatic activation following intermediate levels of makeup application, and an
242 increase in corrugator activation in response to heavy levels of makeup application,
243 consistent with previously-reported visual fluency effects in aesthetic preference
244 (Gerger & Leder, 2015).

245 The previously-reported effect of the cosmetic enhancement of facial attractiveness in
246 an implicit experimental design (IAT; Richetin et al., 2004) and a recent study
247 highlighting the utility of the approach-avoidance task (AAT) as an implicit measure of
248 facial attractiveness (Kramer et al., 2020), led us to include AAT response as a
249 dependent variable in our study. That is, beyond an affective preference for certain
250 makeup products or combinations of such products, we tested a behavioural preference

251 for cosmetic products in terms of participants' reaction time towards engaging more
252 closely or more distally with cosmetically-enhanced facial stimuli. Similarly to the
253 EMG response, we expected to observe a faster approach and slower avoidance time to
254 intermediate levels of makeup application, and a slower approach and faster avoidance
255 time to both no makeup and heavy levels of makeup application, driven primarily by
256 visual fluency effects.

257

258 **Experiment 1 - Methods**

259 **Subjects**

260 The sample of the approach/avoidance task in Experiment 1 was composed of 15
261 women and 15 men, heterosexual, between 19 and 27 years (M: 21.77, SD: 2.743) and
262 of Caucasian ethnicity. Sample size and composition were calculated based on the effect
263 sizes reported in previous related research studies (Tagai et al., 2016; 2017; $N = 38-45$,
264 $\eta^2 \approx 0.3$), using G*Power 3.1.9.2 (Faul et al., 2007). All participants were informed
265 about the procedure but not informed about the specific objective in the study
266 (approach-avoidance response to different cosmetics), and signed an informed consent
267 form indicating their willingness to participate in the experiment. Participant
268 recruitment took place through digital media such as social media and scientific
269 research recruitment sites. Participants enrolled as students received course credit for
270 their participation in the experiment. The study adhered to the Declaration of Helsinki
271 guidelines and was approved by the institutional ethics committee and national ethics
272 committee.

273

274 **Procedure**

275 *Stimuli*

276 The experimental stimuli were composed of 126 emotionally-neutral images of 18
277 female faces with 7 different levels of makeup (no makeup, added foundation, added
278 lipstick, added mascara, added pencilling, added eyeliner, added eyeshadow) from a
279 previously-constructed face database. The database used in the current study is
280 composed of facial photographs taken of 60 women aged 19 – 32, in a frontal pose, and
281 of three distinct ethnicities as identified by their self-classification on the electoral roll
282 as of Asian, Caucasian or African descent (20 faces for each ethnicity). All face models
283 were recruited through digital media such as social media and scientific research
284 recruitment sites, and models enrolled as students received course credit for their
285 participation in the study. The models were photographed in a frontal pose following the
286 application of makeup by a professional makeup artist. Makeup was applied in a
287 standardised manner for an “everyday” setting, with the first 5 levels (no makeup –
288 pencilling) corresponding to daytime use and the last 2 levels (eyeliner – eyeshadow)
289 corresponding to nighttime use, to closely mirror makeup use in naturalistic settings
290 (see Figure 1 for an example). All face images in the database were feature-aligned and
291 digitally standardised for luminance, visual contrast and visual spatial frequency. One
292 hundred and twenty-six images of 18 individuals were selected from the database
293 following image processing and standardisation. In addition, the images selected for the
294 study showed a linear increase in perceived lightness (as measured through HSV and
295 CIELAB) following each successive stage of application, with an additional increase in
296 Global Contrast Factor (GCF; Matkovic et al., 2005) on the last four levels, consistent
297 with the makeup “looks” employed in Etcoff et al. (2011).

298

299 FIGURE 1 GOES HERE

300

301 The images selected for the current study were tested in an online validation task
302 whereby each face was rated according to emotional valence (1: negative valence – 7:
303 positive valence) and facial attractiveness (1: very unattractive – 7: very attractive). In
304 addition, participants were required to indicate whether they had previously met or
305 knew the person shown in the task. Twelve participants (6 male/female, mean age:
306 23.14, SD: 2.47) completed the validation task on an online research platform (Google
307 Forms), with no participants indicating they were familiar with the identities presented.
308 A repeated-measures ANOVA revealed no significant differences in median facial
309 attractiveness or emotional valence scores between the three ethnicity groups (Asian,
310 Caucasian, African descent), with mean emotional valence scores ranging between 3
311 and 5 on the rating scale.

312 *Approach / Avoidance Task (AAT)*

313 The approach-avoidance task used in the present study was based on the Approach-
314 Avoidance Task (AAT) used in the study by Wiers et al. (2009). The task version was
315 designed and executed using the Inquisit psychological research software (Millisecond,
316 Inc.).

317 Images of 18 facial identities and 7 cumulative makeup levels were presented in both
318 vertical (portrait) and horizontal (landscape) orientations, totalling 252 images. Initial
319 portrait resolution was 1500 x 2000 pixels while initial landscape resolution was 2000 x
320 1500 pixels, measuring approx. 168° of visual angle. All facial stimuli were unframed
321 and presented against a grey background. Participants were instructed to maintain their
322 attention in the centre of the screen and to move the joystick forwards or backwards
323 according to the image orientation, with the movement assigned to either orientation

324 counterbalanced between participants. The image size increased or decreased according
325 to the extension of the joystick (Thrustmaster® PC USB) in a backwards and forwards
326 direction respectively, up to a maximum increase or decrease of 70% percent of the
327 original image size (see Rinck & Becker, 2007, for a more detailed technical
328 description). That is, pulling the joystick towards the participant resulted in a continuous
329 increase in image size, with a maximum increase of 70% of the original image size,
330 while pushing the joystick away from the participant resulted in a continuous decrease
331 in image size, with a maximum decrease of 70% of the original image size. Each image
332 was presented four times over the course of four blocks, with a total of 1008 trials (144
333 trials per makeup condition), and an equal number of portrait/landscape presentations.
334 Each image stayed on screen until the joystick was fully extended in either direction,
335 and the next trial was initiated. The reaction time on each trial was calculated as the
336 difference between onset of stimulus presentation and the terminus of joystick
337 extension, to ensure a standardised response for all participants, as image
338 contraction/inflation is also an exteroceptive cue of approach/avoidance (Wiers et al.,
339 2009). The order of image presentation was randomised with no replacement.

340

341 ***Explicit Rating Task***

342 Immediately following the completion of the AAT, all participants were instructed to
343 rate the images shown in the AAT rated according to emotional valence (1: negative
344 valence – 7: positive valence) and facial attractiveness (1: very unattractive – 7: very
345 attractive). In addition, participants were required to indicate whether they had
346 previously met or knew the person shown in the task, with no participants indicating
347 they were familiar with the identities presented.

348

349 ***AAT Pre-Processing***

350 The initial phase of data analysis consisted in excluding trials containing incorrect
351 responses. Only 3.12% of trials contained an incorrect response and means comparisons
352 revealed no significant differences in error rate between the experimental conditions of
353 makeup level and participant gender. Next, AAT difference scores were calculated from
354 the subtraction of the median approach value (pulling the joystick) from the median
355 avoidance value (pushing the joystick) for each image (see Table 1 in the Supplement).
356 Thus, positive values correspond to a faster approach time and slower avoidance time,
357 values close to zero correspond to equal speeds of approach and avoidance, and a
358 negative index corresponds to faster avoidance times and slower approach times. The
359 mean AAT score for each face ethnicity was then computed for every participant. Two
360 experimental factors were examined: makeup level and gender of the participant.

361 To compare the indices between the different levels of makeup, a mixed ANOVA
362 analysis was performed, with participant gender as a between-subjects factor, and
363 makeup level as a within-subjects factor.

364

365 **Results – Experiment 1**

366 **Explicit Rating Task**

367 A repeated-measures ANOVA revealed a significant main effect of makeup on median
368 attractiveness scores ($F(6, 23) = 6.476, p < .001, \text{partial } \eta^2 = .188$), with Bonferroni
369 post-hoc testing revealing significantly lower scores in response to M1 than all other
370 makeup levels ($p < .05$), with no other significant differences between makeup levels (p

371 = n.s.). No significant main effect of gender on median attractiveness ($F(1, 28) = 1.679$,
372 $p = n.s.$) or emotional valence ($F(1, 28) = 1.082$, $p = n.s.$) was observed, and no
373 significant main effect of makeup level on emotional valence ($F(6, 23) = 1.585$, $p =$
374 $n.s.$) was observed (see Figure 2 for details).

375

376 INSERT FIGURE 2 HERE

377

378 **AAT Difference Scores**

379 A repeated-measures ANOVA was conducted to test the effect of two factors (makeup
380 level and participant gender) on the AAT difference scores computed from the
381 subtraction of the avoidance response by the approach response. The analysis revealed a
382 significant main effect of gender ($F(1, 41) = 8.233$, $p = .005$, partial $\eta^2 = .086$), with a
383 significantly higher AAT value for the female group ($M = 15.82$, $SD = 4.649$) as
384 compared to the male group ($M = -3.046$, $SD = 4.649$), indicating a faster approach time
385 and a slower avoidance time in response to all images, and a significant interaction
386 between gender and makeup level ($F(6, 41) = 2.299$, $p = .034$, partial $\eta^2 = .025$). Simple
387 effects testing Bonferroni-corrected for multiple comparisons revealed a significantly
388 higher female response at level M2 ($M = 32.98$) compared to M5 ($M = -0.667$; $p = .017$)
389 and M7 ($M = 8.4$; $p = .027$), and significantly higher male responses at level M1 ($M =$
390 5.389) compared to M2 ($M = -14.62$; $p = .038$) and M4 ($M = -18.26$; $p = .032$), at level
391 M6 ($M = 8.744$) compared to M2 ($p = .027$) and M4 ($p = .009$), and at level M7 ($M =$
392 13.23) compared to M2 ($p = .008$), M3 ($M = -8.033$; $p = .029$), M4 ($p = .003$) and M5
393 ($M = -7.778$; $p = .030$), indicating a female preference for light compared to heavy
394 makeup and a male behavioural preference for no or heavy makeup as opposed to

395 medium makeup. In addition, there was a near-significant main effect of makeup ($F(6,$
396 $41) = 2.108, p = .051$). See Figure 3 below for more details.

397

398 INSERT FIGURE 3 HERE

399

400 **Experiment 2 - Methods**

401 **Subjects**

402 In Experiment 2 facial EMG recordings were collected for 40 participants, 20 men and
403 20 women, heterosexual, aged 20 to 26 ($M: 22.72, SD: 3.879$) and of Caucasian
404 ethnicity. Sample size and composition were calculated based on the effect sizes
405 reported in previous related research studies (Tagai et al., 2016; 2017; $N = 38-45, \eta^2 \approx$
406 0.3), using G*Power 3.1.9.2 (Faul et al., 2007). All participants were informed about the
407 procedure but not informed about the specific objective in the study. Furthermore,
408 deception was employed, by instructing participants the EMG recording device
409 measured skin conductance response (SCR), not muscle activity, to prevent participants
410 from modulating their facial expressions. Participants signed an informed consent form
411 indicating their willingness to participate in the experiment. Participant recruitment took
412 place through digital media such as social media and scientific research recruitment
413 sites. Participants enrolled as students received course credit for their participation in
414 the experiment. The study adhered to the Declaration of Helsinki guidelines and was
415 approved by the institutional ethics committee and national ethics committee.

416 **Procedure**

417 *Stimuli*

418 The experimental stimuli were composed of 108 emotionally-neutral images of 18
419 female faces with 6 different levels of makeup (no makeup, added foundation, added
420 lipstick, added eyebrow pencil and mascara, added eyeliner, and added eyeshadow)
421 from a previously-constructed face database. In this experiment only 6 separate levels
422 were used: 1: no makeup; 2: added foundation; 3: added lipstick; 4: added eyebrow
423 pencil and mascara; 5: added eyeliner; 6: added eyeshadow, to reduce the total number
424 of trials, as no significant differences were reported between the M4 (eyebrow pencil)
425 and M5 (mascara) levels used in Experiment 1, and both products serve as similar
426 perceptual cues (cues signaling higher visual contrast in eye region).

427 *Facial Electromyography (EMG) Recording*

428 Psychophysiological data was collected through surface EMG recording with four
429 shielded electrode pairs to measure voltage changes linked to muscle activity while
430 participants passively viewed images of female faces with different cumulative levels of
431 makeup, composed of the same images used in the first experiment. The passive
432 viewing task was designed and executed using the E-Prime 2.0 psychological
433 presentation software (Psychology Software Tools, Inc., Pittsburgh, PA). After placing
434 all electrodes on the left side of the face, participants were instructed to maintain their
435 attention in the centre of the screen and passively view images of female faces while
436 recording the EMG signal, with each stimulus level corresponding to a specific marker
437 in the EMG signal. In addition, instructions were given to maintain a relaxed and still
438 posture so as to minimise interference with the recording device, which participants
439 were deceptively informed was for monitoring their skin conductance response. The
440 experiment consisted of 3 blocks, with a total of 324 trials (54 trials per makeup
441 condition). Participants were instructed to take a 5-minute break in between each block,
442 with a total experiment time of approximately 50 minutes. Each image was presented

443 for 2000ms, with an inter-stimulus interval (ISI) of 2000ms, and a 500ms pre-stimulus
444 baseline containing a fixation cross. Prior to the participant debriefing, participants were
445 asked what they perceived to be the objectives of the experiment, with no participant
446 correctly identifying the objective.

447 Data was recorded using the BIOPAC MP150 system with Acqknowledge software
448 (Version 4, Biopac Systems, Inc., Goleta, CA) and a separate EMG110C unit for each
449 of the four facial muscles sires recorded with the current study. The electrodes were
450 positioned over the following muscle sites, according to the guidelines of Fridlund and
451 Cacioppo (1986): corrugator (Corrugator supercilii); zygomatic (Zygomaticus major);
452 levator (Levator labii superiors); and frontalis (Frontalis, pars lateralis). Silver-silver
453 chloride (Ag-AgCl) shielded surface electrode pairs (EL254S) filled with conductive gel
454 (Signa Gel with saline solution) with a contact area of 4mm diameter were used. EMG
455 amplifiers were set to a gain of 2000 and real-time data filtering was conducted through
456 a bandwidth with lower and upper thresholds of 10 Hz and 500 Hz, respectively.

457 Grounding was performed through an additional electrode placed in the middle of the
458 forehead. The sampling rate was held constant at 1000 Hz throughout the experiment.
459 Prior to electrode placement, the surface area of participant's face was wiped with cotton
460 wool and an ethanol solution to remove excess oils and dead skin and thus secure
461 electrode attachment with double-stick adhesive rings. During the task, the experimenter
462 observed the participant through a webcam (recording offline) placed above the
463 monitor, and documented any instances of movement such as coughing or sneezing, for
464 later removal of experimental artefacts in the EMG data.

465 ***Facial EMG Pre-Processing***

466 EMG data preparation was conducted with a custom-made MATLAB script
467 (Mathworks, Natick, MA). First, artifacts were removed according to the documentation

468 during data collection by excluding artefactitious data segments per participant in the
469 respective channel. The EMG data was then filtered with a 28 Hz high-pass filter,
470 rectified and smoothed with a moving average of 50 ms. A total of 2.179 %, 4.362 %,
471 4.341 % and 2.685 % of trials were excluded from the data recorded at the corrugator,
472 zygomatic, levator and frontalis respectively. Each trial was segmented in 100 ms bins
473 resulting in a 500 ms initial baseline period, a 2000 ms period corresponding to stimulus
474 presentation, and a 2000 ms interstimulus interval (ISI). Further data preparation was
475 conducted in Excel (Microsoft Office, Microsoft, Inc.). A spike filter was applied to the
476 EMG data defined by a deviation of +/- 3 SD of the total mean from one bin to the next.
477 All trials that exceeded this definition were winsorized, such that extreme values were
478 set to the next-highest value, as described by Field (2013). To compare the mixed
479 factors of makeup condition (within-subjects) and participant gender (between-
480 subjects), the bins from each trial were z-standardised according to the participant mean,
481 as a secondary dataset. The bins from the two datasets (EMG values and z-scores) were
482 then baseline-corrected, subtracting the mean value from the baseline period. Statistical
483 analysis of the within-subjects factor of makeup condition was conducted using the
484 means across participants for each makeup condition (M1 – M7). An R script (R-
485 Project) was used to conduct functional ANOVA (FANOVA) analyses on the EMG
486 response observed during stimulus presentation, separately for each muscle site
487 (corrugator, zygomatic, levator and frontalis).

488 Functional ANOVA applies the assumptions of analysis of variance to functional
489 observations that, while discrete to specific timepoints in the data, are sampled
490 frequently over a defined period (Ramsay & Silverman, 2005). FANOVA was
491 employed in this case for its utility in analysing the time course of facial EMG response
492 to a complex visual stimulus such as a cosmetically-enhanced face, with a Type-II sum

493 of squares for testing main effects and interactions (Langsrud, 2003). In addition, a
494 functional generalized F-test designed for electrophysiological data analysis was
495 employed whereby exact F statistics and p-values are estimated using Monte Carlo
496 simulation (Causeur et al., 2019b). Data from all time periods (baseline, stimulus
497 presentation, ISI) was included in the analysis but only data from the period of stimulus
498 presentation was included for the purpose of significance testing.

499 Following bandpass filtering and baseline correction, the mean facial EMG response at
500 the four muscle sites: corrugator, zygomatic, levator and frontalis, was calculated for
501 each 100 ms bin including the baseline, stimulus presentation time and ISI. The within-
502 subjects analysis of makeup level was plotted against mean EMG response (μV) and
503 time (ms), while the mixed between- and within-subjects analysis of participant gender
504 and makeup level was plotted against mean z-score and time (ms). Detection of extreme
505 curves was conducted for all participants defined as curves showing large variation with
506 respect to the mean curve under the same conditions of muscle site and gender. A
507 FANOVA using Type-II sum of squares was then conducted to test the effect of makeup
508 condition on EMG response, and makeup condition and gender on participant z-scores
509 (Causeur et al., 2019a; 2019b).

510

511 **Experiment 2 - Results**

512 **Facial EMG Response**

513 The Type-II functional ANOVA of the corrugator EMG response revealed a significant
514 main effect of makeup condition ($F = 41.25, p = .003$), with Bonferroni-corrected
515 pairwise comparisons revealing significant differences between M1 and M2 ($p < .001$),
516 M1 and M3 ($p < .001$), M2 and M3 ($p < .001$), M3 and M5 ($p = .042$), and significant

517 differences between M6 and all other makeup levels (M1: $p < .001$; M2: $p < .001$; M3: p
518 $< .001$; M4: $p = .011$; M5: $p < .001$) (see Figure 4 for details). No other significant
519 effects were observed at other muscle sites for EMG response (Zygomatic: $F = 28.75$, p
520 $= 0.325$; Levator: $F = 22.87$, $p = 0.796$; Frontalis: $F = 20.19$, $p = 0.859$).

521

522 FIGURE 4 GOES HERE

523

524 The Type-II functional ANOVA conducted on the z-scores again revealed a significant
525 main effect of makeup condition for the corrugator muscle ($F = 45.61$, $p < .001$), with
526 Bonferroni-corrected pairwise comparisons revealing a significant difference between
527 M1 and M3 ($p = .048$) and between M2 and M3 ($p = .006$), with no significant main
528 effects of makeup condition observed for the other muscle sites (Zygomatic: $F = 23.61$,
529 $p = 0.785$; Levator: $F = 23.71$, $p = 0.768$; Frontalis: $F = 19.86$, $p = 0.918$) (see Figure 5
530 for details). In addition, significant main effects of participant gender were observed for
531 the corrugator ($F = 6.873$, $p < .001$) and levator ($F = 2.845$, $p < .001$), revealing
532 significantly higher z-scores in both instances for female participants compared to males
533 (see Figure 6 for details). No significant main effects of gender were observed for the
534 zygomatic ($F = 1.509$, $p = 0.197$) or frontalis ($F = 0.974$, $p = 0.529$) sites. No significant
535 interactions were observed between gender and makeup condition during the time
536 period of stimulus presentation (Corrugator: $F = 24.37$, $p = 0.586$; Zygomatic: $F =$
537 40.43 , $p = 0.138$; Levator: $F = 27.22$, $p = 0.488$; Frontalis: $F = 25.42$, $p = 0.503$).

538

539 FIGURE 5 GOES HERE

540 FIGURE 6 GOES HERE

541

542

General Discussion

543 Overall, the results from this study indicate a greater behavioural tendency for greater
544 approach and lower avoidance to no and light makeup in female participants, and a
545 specifically male behavioural tendency for greater approach and lower avoidance for
546 heavy over light makeup, and reveal differences in corrugator response (indicating
547 negative affect) towards varying levels of makeup in both men and women, as well as a
548 higher corrugator and levator response in women than men towards all makeup levels.
549 Given the linear increase in reported attractiveness observed over all makeup levels in
550 the explicit rating task (although insignificant from M2 – M7), the results from our
551 EMG analysis are in line with past research showing a negative linear relationship
552 between facial attractiveness and corrugator response (Hazlett & Hoehn-Saric, 2000;
553 Principe & Langlois, 2011). Furthermore, the present study extends past research in
554 both social psychology (Mulhern et al., 2003; Nash et al., 2006), visual perception
555 (Koehler et al., 2004; Russell, 2009), and aesthetic neuroscience (Chatterjee et al., 2009;
556 Tagai et al., 2017), by revealing the interplay between gender, aesthetic preference and
557 visual fluency through the use of implicit responses, as well as the contribution of visual
558 cues linked to female facial attractiveness to implicit emotional response. For the first
559 time, the present study shows changes in electromyographical activity linked to facial
560 affect in response to different levels of makeup in face stimuli.

561 Overall, the AAT task revealed a main effect of gender on behavioural response.

562 However, this effect appears to be in part due to the faster reaction times of the male
563 group as compared to the female group across all images, as confirmed by separate

564 analyses of the median approach and avoidance RTs (see Tables 2 and 3 in
565 Supplement), revealing that male participants were faster in their response to both
566 approach and avoidance of the images. Thus, differences in the behavioural response to
567 the distinct makeup levels should be considered with respect to a separate baseline for
568 each gender. Interestingly, simple effect analyses conducted on the significant
569 interaction between gender and makeup level showed that female participants responded
570 more positively to faces with light makeup (foundation) than heavy makeup applied to
571 the eye regions, with AAT scores for M2 higher than M5 (pencil) and M7 (eyeshadow),
572 consistent with a previously-reported “visual fluency” effect of light makeup in female
573 participants (Tagai et al., 2016; 2017). In contrast, males showed an “all-or-nothing”
574 effect of behavioural preference towards makeup, with simple effects analysis showing
575 significantly higher AAT scores in response to no makeup (M1) and heavy eye makeup
576 (M6 and M7) as opposed to light and intermediate (M2 – M5) levels of makeup. These
577 two distinct patterns of results appear to correspond to separate mechanisms of visual
578 expertise and sexual preference, as described below.

579 With regards to a previously-reported light makeup advantage for visual fluency, the
580 behavioural AAT response indicated a partial preference of female participants for faces
581 with little makeup as compared to medium and high makeup faces, primarily due to a
582 slower avoidance response to these faces (see Table 1 in the Supplement). As a previous
583 study by Tagai et al. (2016) found a recognition bias for light makeup faces in female
584 participants, this effect is in line with past research, and indicates an additional bias in
585 terms of approach-avoidance behaviour for light makeup. However, given the present
586 study does not systematically vary the information content within each makeup level
587 (i.e. visual spatial frequency, skin tone), these results do not offer widespread support
588 for or against a visual fluency account of the cosmetic enhancement of facial

589 attractiveness. Instead, the higher response to foundation (M2) in female participants
590 may simply be due to increased sensitivity to the visual cues provided by foundation, as
591 all female participants reported regularly using facial cosmetics. By contrast, the
592 specifically-male preference for heavy makeup over medium makeup appears to
593 indicate the presence of a secondary effect of sexual propensity towards heavy makeup
594 primarily accentuating greater visual contrast in the eye regions, consistent with the
595 corrugator response recorded in Experiment 2, discussed later.

596 The surprising result of higher AAT response for no makeup compared to light makeup
597 in male participants, appears to have no previous correspondence in the literature, as
598 “no makeup” conditions have been consistently rated as the least attractive faces
599 according to past studies utilising explicit ratings of attractiveness in response to
600 cosmetic enhancement (Mileva et al., 2016; Mulhern et al., 2003; Osborn, 1996), a
601 result confirmed by the explicit rating of the attractiveness of the faces in the present
602 study, revealing that “no makeup” was judged as significantly less attractive than all
603 other makeup levels. However, at an implicit behavioural level, positive male responses
604 to faces with no makeup may be due to the evaluation of such faces as neutral, non-
605 sexualised stimuli, as opposed to cosmetically-enhanced female faces viewed as
606 potential mates and rejected at the initial phase of makeup application. Similarly, female
607 participants may show more positive approach-avoidance behaviour towards faces with
608 no makeup due to being viewed as neutral non-threatening competitors (Stockley &
609 Campbell, 2013).

610 With regards to the facial EMG response in Experiment 2, activity at the corrugator
611 muscle site over the course of stimulus presentation was significantly higher in response
612 to no makeup (M1) than light makeup (M2 and M3) and eyeshadow (M6), revealing a
613 more relaxed corrugator pose in response to addition of these levels of cosmetic

614 application, indicative of decreased negative affect (Principe & Langlois, 2011). In
615 addition, lipstick (M3) was found to play a key role in the attenuation of corrugator
616 response, with the lowest corrugator response recorded and significantly lower than all
617 levels with the exception of mascara and pencilling (M4). Finally, eyeshadow (M6)
618 displayed the next lowest corrugator response, with significantly lower values to all
619 other makeup levels with the exception of lipstick. Overall, these results indicate a
620 significant effect of makeup application on the attenuation of corrugator response.

621 While corrugator response has been associated with increased cognitive load (Lishner et
622 al., 2008) which may have contributed to the smoothing effect of foundation (M2) on
623 corrugator activity, these results primarily indicate lower negative affect in response to
624 an increase in the stages of makeup application. Interestingly, this effect was observed
625 in both genders, indicating a similar affective response to the visual cues of makeup.

626 Notably however, the addition of eye makeup such as mascara, pencilling and eyeliner
627 (associated with higher visual contrast) did not produce a significant decrease in
628 corrugator response as compared to the no makeup condition. Thus, we found no
629 evidence for the effect of these products on facial attractiveness as gauged by corrugator
630 response. Instead, significant attenuation of corrugator response was observed only in
631 response to the addition of eyeshadow. Visual contrast accentuating the eye and lip
632 regions has been proposed as one of the major determinants of facial attractiveness and
633 femininity in female faces (Russell, 2009; 2010). Our results suggest that the visual
634 contrast in the eye regions must be sufficiently intense to produce a change in affective
635 response contributing to perceived attractiveness. This is consistent with the observation
636 of a linear increase in global contrast factor (Matkovic et al., 2005) on levels M4 – M7
637 of the images employed in the AAT task as well as a gradual, but non-significant,
638 increase in explicitly-rated attractiveness of these makeup levels. The significant

639 decrease in corrugator activity observed for the addition of lipstick highlights the
640 importance of this region in providing a visual cue likely associated with luminance
641 contrast (Russell, 2003; 2009), to determine an appropriate affective response for
642 guiding the evaluation of facial attractiveness. The marked reduction in corrugator
643 response towards the presence of lipstick and eyeshadow does not support the role of
644 visual fluency in reducing cognitive load as the sole determinant of perceived
645 attractiveness, at least on an affective level, instead indicating that the evaluation of
646 facial attractiveness as enhanced by makeup relies on a wide set of visual cues eliciting
647 distinct behavioural and affective reactions.

648 An analysis of the participants' z-scores over the course of stimulus presentation
649 revealed higher corrugator and levator activity for female subjects than male subjects.
650 Interestingly, this gender difference occurred at an early peak of EMG response, likely
651 corresponding to an orienting response towards novel facial stimuli (Achaibou et al.,
652 2008; Dimberg, 1982). While corrugator activity has specifically been correlated with
653 early visual processing (approximately 200 ms after stimulus onset; Achaibou et al.,
654 2008), we cannot discount the possibility that this difference may be due to enhanced
655 attention towards facial stimuli containing makeup in female participants. Alternatively,
656 this result may reflect an initially adverse negative emotional response in women
657 towards female faces prior to subsequent modulation, indicating increased female
658 intrasexual competition (Stockley & Campbell, 2013).

659 Similarly, the increase in corrugator and levator response in women than men in
660 response to all images is unlikely to be due to increased cognitive load due to the greater
661 familiarisation the women had with the makeup products applied (all female
662 participants reported regularly using makeup at least once per week). While a recent
663 large-scale study examining facial muscles according to the Facial Action Coding

664 System (FACS; Ekman et al, 2002) has shown greater expressiveness in female facial
665 actions associated with positive valence, a corresponding difference in negative facial
666 affect between male and female faces was not reported (McDuff et al., 2017). Given
667 these factors and the well-established link between corrugator response and negative
668 affect (Larsen et al., 2003; Neta et al., 2009), the corrugator response observed in the
669 present study can reasonably be attributed to an affective index of aesthetic preference
670 for facial cosmetics, revealing a more negative affective response to female faces with
671 and without makeup in women than men.

672 An important caveat must be made with respect to the limitations of utilising facial
673 EMG in the measurement of differences in aesthetic judgement. We were unable to
674 compile a complete affective ‘profile’ of the valence and intensity of participants’
675 emotional response due to the variability and lack of significant voltage changes to the
676 different stimulus types used in Experiment 2, at all muscle sites with the exception of
677 the corrugator supercilii and levator (Figure 3.). While EMG measurement was more
678 sensitive than AAT response to intermediate differences in makeup application, for
679 example in the distinct perceptual cues associated with lipstick and eye makeup, as a
680 whole facial EMG may be insufficiently sensitive towards the effect of relatively subtle
681 physiological cues on facial attractiveness, and future studies investigating the affective
682 responses underlying aesthetic experience should consider pairing the technique with an
683 explicit attractiveness rating task, for example. The inclusion of eye-tracking measures
684 to monitor which precise face regions the participant attends to while rating
685 attractiveness, may also provide a useful ‘attentional’ index of aesthetic preference.
686 Previous studies have tested the role of eye gaze in evaluating female facial
687 attractiveness, indicating both that attractive faces receive longer gaze durations and a
688 greater number of directed saccades than unattractive faces (Leder et al., 2016) and that

689 participants attend longer to the nose than other facial regions during the evaluation of
690 facial attractiveness (Zhang et al., 2017). Future research may be directed at the role of
691 cosmetic enhancement in guiding attention during attractiveness judgments.

692 A further caveat is the limited support this study found for the smoothing, texturing and
693 colour distribution effects of foundation on the evaluation of facial attractiveness,
694 commonly associated with signals of youth and individual health (Fink & Matts, 2008;
695 Jones et al., 2015; Porcheron et al., 2013). While there was a slight (but non-significant)
696 increase in mean AAT score from M1 (no makeup) to M2 (foundation) for female
697 participants, this effect was inverted in male subjects, showing significantly greater
698 behavioural preference for no makeup than foundation. However, EMG recording of the
699 corrugator site revealed a significantly lower response to faces with foundation than
700 faces with no makeup in both genders, suggesting that this cue of facial attractiveness is
701 more dependent on one's affective response than the enhancement of visual contrast in
702 the eye regions for example, which was reflected in both EMG and AAT response.

703 Overall, the present study found two clear indices of the implicit evaluation of facial
704 attractiveness as modulated by changes in facial cosmetics; a behavioural index,
705 characterised in female participants by a preference for faces with light makeup, and in
706 males by an all-or-nothing preference for faces with no makeup or heavy eye cosmetics.
707 The second index corresponds to the individual's negative affective response, reflected
708 primarily in terms of reduced electromyographical response at the corrugator muscle
709 site to facial cosmetics accentuating visual contrast in the mouth and eye regions. Given
710 the counterintuitive results reported, particularly with regards to a male implicit
711 behavioural preference for no makeup over light makeup, the evaluation of female
712 facial attractiveness appears to rely on a complex set of perceptual and behavioural
713 cues, highlighting the importance of implicit measures in further investigations.

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933

Figure Legends

934 Figure 1. Examples of the different makeup levels used in Experiment 1 (a) and
935 Experiment 2 (b). For illustrative purposes, this figure shows the same individual at
936 different stages of makeup application. A total of 18 individuals were shown in all
937 makeup levels. The individual shown gave explicit written consent for the publication
938 of her face images.

939 Figure 2. Graphs of median response scores of a) attractiveness (“How attractive is this
940 face from 1 to 7?”) and b) emotion (“How emotional is this face from 1 to 7?”), as
941 measured on the explicit rating task in Experiment 1. Scores from 1 to 7 reflect faces
942 judged as a) 1: not at all attractive to 7: very attractive; and b) 1: very emotionally
943 negative, to 4: emotionally neutral, to 7: very emotionally positive. Error bars show ± 1
944 standard error of the mean.

945 Figure 3. Graph of AAT difference scores for each makeup level (no makeup,
946 foundation, lipstick, mascara, pencil, eyeliner, eyeshadow), with separate lines for
947 gender. AAT scores refer to median avoidance RT – median approach RT, with higher
948 scores reflecting faster approach and slower avoidance of the image. Error bars show \pm
949 1 standard error of the mean.

950 Figure 4. Graphs of EMG values (μV) recorded at the corrugator, zygomatic, levator,
951 and frontalis sites in response to viewing of 6 makeup levels (M1: no makeup; M2:
952 foundation; M3: lipstick; M4: mascara + pencil; M5: eyeliner; M6: eyeshadow). Curves
953 show average EMG voltage change across participants for each 100 ms bin over the
954 periods of pre-stimulus baseline (-500 to 0 ms), stimulus presentation (0 to 2000 ms)
955 and interstimulus interval (ISI; 2000 to 4000 ms).

956 Figure 5. Graphs of Z-transformed EMG values at the corrugator, zygomatic, frontalis
957 and levator sites in response to viewing of 6 makeup levels (M1: no makeup; M2:
958 foundation; M3: lipstick; M4: mascara + pencil; M5: eyeliner; M6: eyeshadow). Solid
959 curves show average Z-scores of all participants and shaded areas show confidence
960 intervals for each 100 ms bin over the periods of pre-stimulus baseline (-500 to 0 ms),
961 stimulus presentation (0 to 2000 ms) and interstimulus interval (ISI; 2000 to 4000 ms).

962 Figure 6. Graphs of Z-transformed EMG values at the corrugator and levator sites in
963 male and female participants. Solid curves show average Z-scores of male and female
964 participants and shaded areas show confidence intervals for each 100 ms bin over the
965 periods of pre-stimulus baseline (-500 to 0 ms), stimulus presentation (0 to 2000 ms)
966 and interstimulus interval (ISI; 2000 to 4000 ms).