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FlashReport

Brighten up: Smiles facilitate perceptual judgment of facial lightness[☆]Hyunjin Song^{a,*}, Andrew J. Vonasch^b, Brian P. Meier^c, John A. Bargh^a^a Yale University, USA^b Florida State University, USA^c Gettysburg College, USA

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ABSTRACT

The metaphoric expression 'bright smile' may reflect the actual judgment of facial lightness under varying emotional expressions. The present research examined whether people in fact judge smiling faces as perceptually brighter than frowning faces. Four studies demonstrated that participants believed smiling faces were brighter compared to frowning faces in a binary choice task and in an absolute judgment task. The results suggest that emotional expressions (i.e., smiles and frowns) can bias judgments of facial brightness in ways consistent with the metaphor. Among other implications, such results suggest that stereotypes about darker-skinned individuals may be attenuated by smiles.

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Perceptual judgments of facial lightness have substantial influence on social interactions as darker-skinned individuals often experience disadvantages due to their skin tone (e.g., Dasgupta, McGhee, Greenwald, & Banaji, 2000; Wittenbrink, Judd, & Park, 2001). Perceptual judgments of facial lightness can be biased by non-perceptual factors. For instance, the same face is perceived to be darker if it is identified as 'black' rather than 'hispanic' by labeling (Levin & Banaji, 2006) or other ethnic facial features (MacLin & Malpass, 2003). Furthermore, people perceive the face of a political candidate to be lighter if the candidate has the same political ideology as their own (Caruso, Mead, & Balcetis, 2009).

We contend that facial expressions may bias perceptual judgments of facial lightness. Our prediction is based upon the metaphoric mapping of 'brightness' and 'smiling.' Common expressions reveal that a smile 'brightens' one's face, and that faces 'light up' when people smile. These metaphoric mappings seem to be a universal phenomenon, as the expression 'bright smile' is manifested in many languages, including English, German, Italian, Korean, Chinese, and Russian. Previous research has revealed that metaphors are not only linguistic devices but can reflect and reinforce actual physical experiences (Lakoff & Johnson, 1999; Landau, Meier, & Keefer, 2010). For example, interpersonal trust is expressed in terms of warmth (e.g., a warm hug) likely because in early childhood, psychological closeness with caregivers is experienced with physical warmth through bodily

contact (Williams, Huang, & Bargh, 2009). In adulthood, such experiences and resulting metaphors bias the perception of other people. Indeed, physical warmth causes people to rate a stranger as more psychologically warm (Williams & Bargh, 2008). We examined the connection between judgments of facial brightness and emotional expression (smiling versus frowning).

Research on metaphor-related associations between affect and brightness supports a possible link between emotional expression and judged facial brightness. Studies using Stroop-like tasks and priming manipulations have revealed that people tend to associate positivity with light and negativity with dark. For instance, people recognize words with a positive or moral meaning faster when presented in white versus black font, whereas people recognize words with a negative or immoral meaning faster when presented in black versus white font (Meier, Robinson, & Clore, 2004; Sherman & Clore, 2009). Furthermore, being primed with words that have a positive meaning caused people to judge gray patches as brighter (Meier, Robinson, Crawford, & Ahlvers, 2007) and being primed with an immoral behavior speeded the identification of words in black compared to white font (Sherman & Clore, 2009). Facial expressions such as smiling and frowning represent inner affective states, of course, but facial expressions have evaluative and moral connotations in their own right: smiles are viewed as moral and positive whereas frowns are viewed as immoral and negative (Markus & Kitayama, 1994; Song & Ybarra, 2008). Therefore, we hypothesized an association between facial affect and facial brightness such that smiling faces would be judged as brighter than frowning faces.

In the present research, we conducted four experiments to test the hypothesis that smiling faces are judged as lighter than frowning faces. Participants were presented with smiling and frowning facial stimuli and were asked to report on their brightness. The first two

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studies used a binary choice paradigm with schematic faces and examined whether people chose smiling faces as brighter than frowning faces. The final two studies used schematic and realistic faces and examined this phenomenon using an absolute judgment task.

Studies 1 and 2

Studies 1 and 2 used a binary-choice paradigm in which participants chose which face was brighter in sets of smiling and frowning faces. We hypothesized that people would tend to judge a smiling face as brighter than a frowning face even when the actual luminance did not differ. In order to determine that any effects were not merely based on the semantic association between the words 'bright' and 'smile', Study 2's instructions used the word 'light' instead of 'bright.'

Method

In Study 1, 171 people (120 females, 50 males, 1 unknown; M age = 35.3) participated in an on-line study through the Yale E-lab System to win a \$15 Amazon.com gift certificate. Participants were instructed that they would participate in a study on brightness perception. Participants were told that there were subtle differences in facial color and that their task was to detect which one was brighter. In fact, there was no difference in brightness of the stimuli. Participants were presented with a set of two schematic faces side by side, one smiling and one frowning, both in one of three colors (gray, yellow or red). The positions of the two faces (left–right) were randomized. The faces were created with Microsoft Paint. Each face consisted of a circle with two eyes and a mouth, and the only difference between the smiling and the frowning face was the angle of the mouth. Gray faces were set at hue = 160, saturation = 0, luminance = 120; yellow faces were set at hue 40, saturation = 240, luminance = 120; red faces were set at hue = 0, saturation = 240, luminance = 60. The gray face stimuli are presented in Fig. 1. Participants answered the question 'Which one is brighter than the other in its color?'

In Study 2, 113 people (73 female, 39 male, 1 unknown; M age = 33.7) followed the same procedure as in Study 1 except that the question was phrased in terms of 'light' instead of 'bright' and participants were assigned to one of two colors, yellow or red.

Results and discussion

The results from Study 1 and 2 are presented in Table 1. Regardless of the particular colors and wording of the questions, the majority of people chose the smiling face as brighter (lighter) than the frowning face.

While Study 2 demonstrated that the effect is not likely to be driven by a simple semantic association between the words 'bright' and 'smile,' a more direct measure of perceptual judgment may be required in order to demonstrate this conclusively. In addition, more realistic face stimuli would increase the ecological validity of the results. Consequently, Studies 3 and 4 measured the perceptual

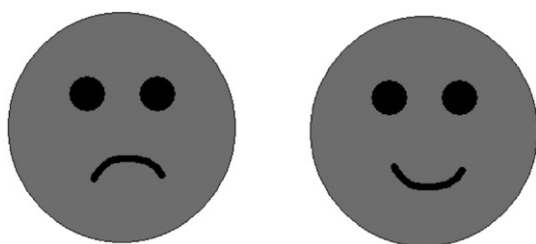


Fig. 1. Gray smiling and frowning face stimuli (Study 1 & 3).

Table 1
Frequency of choices of a brighter (lighter) face in Studies 1 and 2.

	Choice of a brighter (lighter) face		
	% Smile	% Frown	χ^2
Study 1 Gray	69% (42/61)	31% (19/61)	8.67**
Study 1 Yellow	70% (38/54)	30% (16/54)	8.96**
Study 1 Red	66% (37/56)	34% (19/56)	5.79*
Study 2 Yellow	65% (37/57)	35% (20/57)	5.07*
Study 2 Red	66% (37/56)	34% (19/56)	5.79*

* $p < .05$, ** $p < .01$

judgment of facial lightness more directly with luminance scales as well as both schematic (Study 3) and realistic faces (Study 4).

Studies 3 and 4

Studies 3 and 4 adopted a more objective measure of brightness. In Study 3, participants were shown one of the gray faces used in Study 1 and judged the absolute level of brightness of the stimulus on a 9-point gray shade scale. We hypothesized that the smiling face would be judged as lighter than the frowning face. Study 4 replicated Study 3 using more realistic stimuli. Participants observed a real person's facial expressions painted in pink and judged the perceived lightness of the skin tone on 9-point pink shade scales. We again hypothesized that the smiling face would be perceived as lighter than the frowning face.

Method

In Study 3, 74 people (45 females, 28 males, 1 unknown; M age = 32.87) participated in an on-line study to win a \$15 Amazon.com gift certificate. The task was introduced as a brightness perception task and participants were asked to observe the brightness in color of the presented face. Half of the participants were presented with the smiling gray face and the other half the frowning gray face. Participants observed the stimuli at their own pace and were told to turn to the next page when ready. On the next page, participants indicated the brightness of the stimulus on a 9-point gray shades scale. To counter the general association between 'right side' and 'goodness' (Casasanto, 2009), the darkest shade was presented on the farthest right with the lightest shade on the farthest left. Each shade of the scale differed 5 points in luminance, where 9 was the darkest (luminance = 110), 1 was the brightest (luminance = 150), and 7 was the correct shade (luminance = 120). Finally, participants reported their current mood on a 9-point scale (-4 = very negative to $+4$ = very positive).

In Study 4, 123 people (60 males, 63 females; M age = 31.5) followed the same procedure as Study 3 except that the stimuli were realistic faces colored in pink. We adopted the smiling and frowning gray scale images of a male model called J. J. in Ekman and Friesen's (1976) classic facial expression pictures, as modified by Horstmann and Bauland (2006). The stimuli differed from each other only in terms of elements to depict facial expressions. To equate facial luminance, we painted the two faces with the same pink color (hue = 9, saturation = 210, luminance = 203). The stimuli used for the Study 4 are presented in Fig. 2. The pink scale had 9 shades with a 5-point luminance difference in each shade, 9 was the darkest (luminance = 188), 1 was the brightest (luminance = 228), and 6 was the correct answer (luminance = 203).

Results and discussion

Participants judged the smiling faces as brighter (Study 3: $M = 4.68$, $SD = 1.69$; Study 4: $M = 4.76$, $SD = 1.76$) than the frowning faces (Study 3: $M = 5.51$, $SD = 1.69$; Study 4: $M = 5.36$, $SD = 1.62$), t

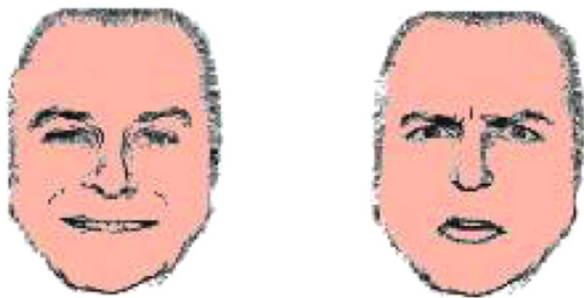


Fig. 2. Pink smiling and frowning face stimuli (Study 4).

(72) = -2.07 , $p = .043$, $d = .49$ (Study 3); $t(121) = -1.97$, $p = .05$, $d = .35$ (Study 4), for both the schematic and realistic faces. In both studies, participants in the two conditions did not differ in self-reported mood, all t s < 1 . Therefore, facial expression affected the perceptual judgment of facial brightness, but not participants' mood.

These findings revealed that facial expressions influenced the more objective absolute judgment of brightness and this effect held for more realistic facial stimuli. In addition, the manipulation did not influence participants' mood, which suggests that the effects are not driven by stimulus influences on perceiver's mood.

General discussion

Four studies demonstrated that people judged smiling faces as brighter in luminance than frowning faces. Studies 1 and 2 showed that people select smiling schematic faces as brighter than frowning schematic faces in a binary-choice paradigm. Studies 3 and 4 used an absolute judgment task and revealed that people judged smiling schematic and realistic faces as brighter than frowning schematic and realistic faces.

The present results reveal the potential impact that metaphor and embodiment may have for social interactions. Stereotype research shows that darker- (vs. lighter-) skinned individuals are at a disadvantage in a number of evaluative situations simply due to the darkness of their skin tone (Dasgupta et al., 2000; Wittenbrink et al., 2001). The current research, however, suggests that darker-skinned individuals who smile would be perceived as having a lighter skin color, which might decrease the automatic negative evaluations such individuals typically receive. Future work could examine such a prediction as well as address whether the influence is bi-directional (i.e., are people with lighter skin judged to be happier or friendlier than people with darker skin?).

A growing body of research indicates that metaphorical expressions are often grounded in physical experiences, and that concepts in abstract domains influence related physical experiences and vice versa (for reviews, see Landau et al., 2010 & Williams et al., 2009).

The present research extends this work to the realm of facial expressions and judgments of perceptual brightness. Existing research on embodied metaphor and emotion has tended to focus on one's own emotional experiences. For instance, immoral or guilty feelings increase the perception that one is physically dirty (Zhong & Liljenquist, 2006), a sad mood biases people's visual attention in the vertical plane (Meier & Robinson, 2006), and feelings of loneliness are experienced as physical coldness (Bargh & Shalev, in press). The present research adds to this intriguing story by showing that other's emotional expressions can also bias important physical judgments that likely have significant influence on social interactions.

References

- Bargh, J. A. & Shalev, I. (in press). The substitutability of physical and social warmth in everyday life. *Emotion*.
- Caruso, E. M., Mead, N. L., & Balcetis, E. (2009). Political partisanship influences perception of biracial candidates' skin tone. *Proceedings of the National Academy of Sciences*, 106(48), 20168–20173.
- Casasanto, D. (2009). Embodiment of abstract concepts: Good and bad in right- and left-handers. *Journal of Experimental Psychology: General*, 138(3), 351–367.
- Dasgupta, N., McGhee, D. E., Greenwald, A. G., & Banaji, M. R. (2000). Automatic preference for White Americans: Eliminating the familiarity explanation. *Journal of Experimental Social Psychology*, 36, 316–328.
- Horstmann, G., & Bauland, A. (2006). Search asymmetries with real faces: Testing the anger-superiority effect. *Emotion*, 6, 193–207.
- Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenges to western thought*. New York: Basic Books.
- Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin*, 136, 1045–1067.
- Levin, D. T., & Banaji, M. R. (2006). Distortions in the perceived lightness of faces: The role of face categories. *Journal of Experimental Psychology: General*, 135, 501–512.
- MacLin, O. H., & Malpass, R. S. (2003). Last but not least. *Perception*, 32, 249–252.
- Markus, H. R., & Kitayama, S. (1994). The cultural construction of self and emotion: Implications for social behavior. In S. Kitayama, & H. R. Markus (Eds.), *Emotion and culture* (pp. 89–130). Washington, DC: American Psychological Association.
- Meier, B. P., & Robinson, M. D. (2006). Does "feeling down" mean seeing down?: Depressive symptoms and vertical selective attention. *Journal of Research in Personality*, 40, 451–461.
- Meier, B. P., Robinson, M. D., & Clore, G. L. (2004). Why good guys wear white: Automatic inferences about stimulus valence based on color. *Psychological Science*, 15, 82–87.
- Meier, B. P., Robinson, M. D., Crawford, L. E., & Ahlvers, W. J. (2007). When 'light' and 'dark' thoughts become light and dark responses: Affect biases brightness judgments. *Emotion*, 7, 366–376.
- Sherman, G. D., & Clore, G. L. (2009). The color of sin: White and black are perceptual symbols of moral purity and pollution. *Psychological Science*, 20, 1019–1025.
- Song, H., & Ybarra, O. (2008). But are you really happy?: The negativity effect in the inference of happiness and unhappiness. *Basic and Applied Social Psychology*, 30, 56–65.
- Williams, L. E., & Bargh, J. A. (2008). Experiencing physical warmth promotes interpersonal warmth. *Science*, 322, 606–607.
- Williams, L. E., Huang, J. Y., & Bargh, J. A. (2009). The scaffolded mind: Higher mental processes are grounded on early experiences of the physical world. *European Journal of Social Psychology*, 39, 1257–1267.
- Wittenbrink, B., Judd, C. M., & Park, B. (2001). Spontaneous prejudice in context: Variability in automatically activated attitudes. *Journal of Personality and Social Psychology*, 81, 815–827.
- Zhong, C., & Liljenquist, K. (2006). Washing away your sins: Threatened morality and physical cleansing. *Science*, 313, 1451–1452.