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The nonverbal environment of self-esteem: Interactive effects of facial-expression and eye-gaze on perceivers' self-evaluations

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HIGHLIGHTS

- We argued that a self-esteem sociometer is sensitive to others' facial behavior.
- Facial emotions with direct eye-gaze predictably influenced perceivers' self-esteem.
- Facial emotions with averted-gaze did not influence perceivers' self-esteem.
- Attention to faces moderated these effects.

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ABSTRACT

Self-esteem fluctuates in response to verbal feedback and social exclusion, but such unambiguous feedback may not occur frequently enough to account for moment-to-moment self-esteem fluctuations. We propose that others' facial behavior provides a frequently-encountered source of feedback to which self-esteem should respond. We expected repeated exposure to angry faces to reduce perceivers' self-esteem but only when those faces exhibited direct-gaze ("looked at" perceivers). Two studies supported this hypothesis. In Study 1, participants viewed a series of faces under the guise of a memory paradigm. Self-esteem was reduced among participants who viewed angry faces compared to participants who viewed neutral or happy faces. Crucially, this pattern only occurred in response to faces exhibiting direct-gaze. In Study 2, participants completed a word-identification task in which attention to faces was task-irrelevant. The results of this study replicated Study 1 but only to the extent faces captured participants' attention during the priming task.

It hurts to get rejected for a date or told of one's undesirable traits but fortunately for humans' self-esteem, most people do not receive this sort of overt feedback more than a few times daily (Blumberg, 1972; Felson, 1980; Leary, Cottrell, & Phillips, 2001; Waung & Highhouse, 1997; Zadro, Williams, & Richardson, 2004). Subtler feedback, such as feedback generated by facial expressions and other nonverbal cues, may occur with greater frequency (cf. Ambady & Weisbuch, 2010) and thus exert a persistent influence on self-esteem. Yet despite research demonstrating the influence of others' nonverbal behavior on perceivers' attention, emotion, and attitudes (e.g., Dimberg, Thunberg, & Elmehed, 2000; Phelps, Ling, & Carrasco, 2006; Weisbuch & Ambady, 2009), there is little evidence regarding how the self-concept is shaped by nonverbal cues. Drawing from theories that suggest the self-concept is built via social-feedback (Cooley, 1902; Leary, 1999; Mead, 1934), we here examine how self-esteem is shaped by others' nonverbal behavior.

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Self-esteem and social value

Classic theories across the social sciences suggest that the self-concept is shaped by others' opinions. In describing the *looking-glass self*, Cooley (1902) posited that beliefs about others' evaluations of oneself ("reflected appraisals") are the foundation of the self-concept. Mead (1934) built on this idea to emphasize the accumulation of reflected appraisals into a relatively stable *generalized other*. Consistent with the views of Cooley and Mead, self-esteem has recently been described as a gauge of one's perceived social value wherein state self-esteem fluctuates in response to moment-to-moment social feedback (e.g., Leary, 1999; Leary & Baumeister, 2000; Leary et al., 2001; Leary & Downs, 1995; Leary, Haupt, Strausser, & Chokel, 1998). Such fluctuations can also be described as oscillation around each individual's attractor (or resting) state of self-esteem (Vallacher Nowak, Froehlich, & Rockloff, 2002) with the key point here that self-esteem fluctuations reflect perceived social value.

Many studies have supported this *sociometer* model of self-esteem (Leary, 2012). For example, verbal feedback and ostracism both exert powerful influences on state self-esteem (Kamal, Blais, McCarrey, Laramee, & Ekstrand, 1992; Leary, Tambor, Terdal, & Downs, 1995; Leary et al., 2001; Zadro et al., 2004). Yet much of this evidence regards forms of feedback that occur relatively infrequently. Even the most talkative people speak only so-often (Ambady & Weisbuch, 2010) and when they do speak, are often hesitant to give negative or even positive feedback (Blumberg, 1972; Felson, 1980; Waung & Highhouse, 1997). Thus, while verbal feedback and ostracism can account for changes to self-esteem over longer time periods, they probably do not occur frequently enough to account for moment-to-moment fluctuations in self-esteem. These fluctuations may be explained, however, by feedback accruing via nonverbal behavior.

Nonverbal behavior and self-esteem

Whenever one person sees another, she or he typically sees body-posture, eye-gaze, facial-expressions (neutral *or* emotional), and other nonverbal cues. The high frequency of nonverbal behavior is consequential in that perceivers' emotions, attitudes, and behavior effortlessly respond to others' nonverbal cues (e.g., Dimberg et al., 2000; Murphy & Zajonc, 1993; Tiedens & Fragale, 2003; Weisbuch & Ambady, 2009). Yet little research has examined how the self-concept responds to others' nonverbal behavior.

In the one set of studies we located, participants watched a dynamic, 2-min video of a person exhibiting mostly-direct or mostly-averted gaze and visualized interacting with that person (Wirth, Sacco, Hugenberg, & Williams, 2010). Across three studies, participants in the mostly-averted gaze conditions exhibited an array of self-evaluative responses including reduced self-esteem, suggesting that self-esteem can be sensitive to a single nonverbal cue (eye-gaze). Importantly, this study established that self-esteem is sensitive to *dynamic* patterns of eye-gaze exhibited by a single individual. Thus, when participants envisaged interacting with a person who exhibited a particular dynamic pattern of eye-gaze, their self-esteem adjusted to whether that eye-gaze pattern was consistent with inclusion (mostly direct-gaze) or exclusion (mostly averted-gaze). These findings made an important contribution to scientific understanding of self-esteem but also opened up important new questions which we address herein.

Although people often interact with single individuals, those single individuals display multiple nonverbal cues at any one moment (not just eye-gaze). Moreover, the social environment includes many individuals some of whom are only encountered briefly. We thus sought to examine the extent to which self-esteem tracks meaningful *combinations* of nonverbal cues and whether it can track such combinations across multiple target persons. Even if eye-gaze and other nonverbal cues can evoke meaningful responses when isolated, these cues typically do not exist in isolation. For example, eye-gaze and facial expression can be artificially isolated with photo-editing software, but such isolation is atypical in everyday experience. Facial expressions (including neutrality) and eye-gaze regularly occur together in space. The comingling of these cues is not lost on perceivers, who interpret eye-gaze with respect to facial-expression and vice-versa (Adams & Kleck, 2003, 2005; Lobmaier, Tiddeman, & Perrett, 2008; Slepian, Weisbuch, Adams, & Ambady, 2011). Similarly, a photograph or video can isolate the face of a single individual but over time, most people encounter many faces and each of these faces contain nonverbal cues (e.g., eye-contact). Consistent with this "nonverbal environment," perceivers update their attitudes and appetites to reflect the temporally-distributed pattern of nonverbal cues they encounter (Weisbuch & Ambady, 2009; Weisbuch, Pauker, & Ambady, 2009; Winkielman, Berridge, & Wilbarger, 2005).

A sociometer sensitive to complex nonverbal patterns in the environment could find state self-esteem readings in *any* face-to-face interaction, would be sensitive to evaluations that people are unwilling or unable to communicate overtly, and would be sensitive to the accrual of such tacit evidence. In short, people can process spatially- and temporally-distributed patterns of nonverbal cues and we expect self-esteem to be sensitive to those patterns.

The current research

We examined whether self-esteem was reliably influenced by multiple nonverbal cues encountered across different faces over time. We focused here on the well-studied combination of eye-gaze and facial-emotion (cf. Adams, Franklin, Nelson, & Stevenson, 2010). In each of two studies, participants completed self-esteem measures after viewing a series of faces that varied—on a between-subjects basis—with respect to emotion expression and eye gaze.

We expected exposure to negative (versus positive) facial emotion to reduce perceivers' self-esteem but only when those faces exhibited *direct-gaze* (i.e., were "looking at" perceivers). In other words, self-esteem should only be influenced by facial emotions directed at the self. Just as hearing negative statements directed at oneself may reduce one's self-esteem (Kamal et al., 1992; Kernis & Johnson, 1990), seeing negative facial expressions directed at oneself might reduce one's self-esteem. Negative facial expressions directed away from oneself are not self-oriented and thus might not reduce self-esteem. Our hypotheses were strongest for negative facial expressions. Positive facial expressions directed at oneself may increase self-esteem but this hypothesis was a bit more exploratory in that positive facial expressions are normative (Cole, 1986; Hayes & Metts, 2008; Matsumoto, 1993) so may not be received as signals about the self. Consequently, we expected self-esteem to be lower after exposure to a temporally-distributed pattern of facial anger versus facial joy or facial neutrality, but *only when those faces exhibited direct-gaze*.

We have argued that self-esteem is most likely to respond to complex patterns of nonverbal cues. Yet it is also possible that exposure to negative facial expressions decreases perceivers' self-esteem, regardless of eye-gaze cues. This pattern might be observed for several reasons. For example, compared to eye-gaze direction, facial expressions may be more salient, may be interpreted as more reliable indices of others' responses to oneself, or may generate subjective emotion in perceivers (via emotion contagion; e.g., Dimberg et al., 2000; Neumann & Strack, 2000; Wild, Erb, & Bartels, 2001) that bleeds over into self-esteem. We examined this alternative hypothesis but based on evidence reviewed in preceding sections, we expected the influence of facial expressions to be moderated by eye-gaze.

Study 1

Participants saw 24 faces in an ostensible face-memory study. There were three facial emotion conditions (neutral, angry, happy) such that all faces within a given between-subject condition exhibited the same emotion. Thus, each participant viewed 24 different faces that exhibited the same emotion (e.g., anger). Orthogonal to this independent variable, there were three eye-gaze conditions corresponding to the ratio of direct to averted-gaze faces (mostly-direct, equal, or mostly-averted). Each participant was thus randomly assigned to view a series of faces within a 3 (facial emotion) × 3 (eye-gaze) independent-groups design. We predicted that that exposure to facial anger (vs. joy or neutrality) would reduce participants' self-esteem but only when faces displayed direct-gaze.

Method

Participants and setting

Participants were recruited and paid via Mechanical Turk (for guidelines, see Buhrmester, Kwang, & Gosling, 2011) and the experiment was conducted online. The sample was limited to people living in the United States under age 41 (to parallel facial ages presented in this study). Participants were excluded if they completed the experiment twice ($n = 9$), failed to finish ($n = 6$), or used the answer-choice "1" to

Table 1
Study 1: Exclusions by condition.

	Mostly direct			Equal			Mostly averted		
	Neutral	Angry	Happy	Neutral	Angry	Happy	Neutral	Angry	Happy
Completed experiment twice	2	1	3	1	2				
Failed to finish		2				2		1	2
Used answer–choice "1"									1
Total	**2**	**3**	**3**	**1**	**2**	**2**		**1**	**3**

respond to all survey items ($n = 1$). The distribution of exclusions by condition is listed in Table 1. The final sample included 241 participants (145 women), including 172 White non-Hispanic, 20 Asian, 17 Black, 14 mixed-race, and 13 Hispanic participants ranging in age from 18 to 40 with quartiles at 21, 25, and 30 years of age. Refer to the Appendix A for an explanation of sample size determination.

Materials

Study images. Twenty-four models (12 male) were selected from the NimStim collection of empirically standardized facial images (Tottenham et al., 2009). We selected 19 White, 4 Asian, and 1 Latina models with unambiguous neutral, angry, and happy expressions. For each image, we generated an averted-gaze version and a direct-gaze version via photo-editing software (Fig. 1).

Using these images, we generated nine face-sets. Each face-set included 24 faces (one of each model) and all faces within the set exhibited the same emotion. Yet because our hypotheses regarded the interactive influence of facial-emotion and eye-gaze, we generated three face-sets per emotion. In mostly-direct conditions, the ratio of direct-gaze faces to averted-gaze faces was 2:1 (16 direct-gaze faces and 8 averted-gaze faces). In mostly-averted conditions, the ratio of direct-gaze faces to averted-gaze faces was 1:2. And in equal conditions, the ratio of direct-gaze faces to averted-gaze faces was 1:1. For example, we created three sets of angry faces. One set included 24 angry faces with most exhibiting direct-gaze, a second set included 24 angry faces with most exhibiting averted-gaze, and a third set included 24 faces with exactly half exhibiting direct-gaze. In total, we generated nine sets of images (3 emotion: neutral, angry, happy × 3 gaze-ratio: mostly-direct, equal, mostly-averted). Each set contained 24 images and each participant viewed only one of these nine sets.

Self-esteem measures. Self-esteem was measured with two scales. The Heatherton and Polivy (1991) state self-esteem scale (HPSE; here: $\alpha = .90$) includes 20 items that participants respond to by indicating how they felt in *that moment* (from 1, *Not at all,* to 5, *Extremely*; $M = 3.68$, $SD = .61$). The Rosenberg (1965) self-esteem scale (RSE; here: $\alpha = .91$) includes 10 statements to which participants indicate their agreement (from 0, *Strongly Disagree,* to 3, *Strongly Agree*; $M = 1.94$, $SD = .59$). The RSE boasts high test–retest reliability (Bosson, Swann, & Pennebaker, 2000) but is also sensitive to state fluctuations (e.g., Leonardelli, Lakin, & Arkin, 2007; Morse & Gergen, 1970; Wilcox & Laird, 2000). We used the RSE here for purposes of convergent validity.

Positive and Negative Affect Schedule (PANAS). We measured subjectively-experienced emotion with items from the PANAS (Watson, Clark, & Tellegen, 1988). Participants used a 1 (*Very slightly or Not at All*) to 5 (*Extremely*) scale to rate their current happiness, anxiety, irritation, hostility, pride, sadness, and enthusiasm as well as the extent to which they felt "good" and "bad." After reverse-scoring, composite scores were created for emotion ($\alpha = .67$; $M = 3.53$, $SD = .57$) and mood ($\alpha = .67$; $M = 3.79$, $SD = .90$).

Procedure

After informed consent, participants read instructions for a "memory study" and were then shown (in random order) each of 24 faces for 3 s. The particular faces viewed by a participant depended on random assignment in a 3 (anger, happy, neutral) × 3 (mostly-direct, equal, mostly-averted) independent-groups design. After viewing facial images, participants completed the PANAS and the HPSE scale. These scales were described as "distractors" prior to a memory test.[1] Refer to the Appendix A for information on additional measures. Participants then completed the RSE scale and demographic questions before being thanked, debriefed, and paid.

Results and discussion

A 3 (neutral, angry, happy) × 3 (mostly-direct, equal, mostly-averted) independent-groups ANOVA revealed the predicted emotion-by-gaze interaction on HPSE scores, $F(4, 232) = 2.43$, $p = .049$ (see Fig. 2). We conducted simple-effects tests based on our *a priori* hypotheses. On the HPSE scale (1991), participants exhibited lower state self-esteem after exposure to direct-gaze anger than after exposure to direct-gaze joy $t(51) = 2.66$, $p = .01$, $r_{pb} = .35$, or direct-gaze neutrality, $t(53) = 2.58$, $p = .01$, $r_{pb} = .33$ (all simple-effects tests in this article are two-tailed). Exposure to direct-gaze joy—as compared to exposure to direct-gaze neutrality—did not significantly influence HPSE scores, $p = .76$. There were no significant influences of facial emotion on self-esteem within the averted-gaze condition ($ps > .35$) or the equal-gaze condition ($ps > .88$).

We conducted identical analyses on the RSE. A 3 × 3 independent-groups ANOVA revealed a main effect of emotion [$F(2, 232) = 3.05$, $p = .049$], indicating the exposure to angry faces reduced self-esteem relative to exposure to neutral faces, $t(166) = 2.36$, $p = .02$, $r_{pb} = .18$. Crucially, however, this effect was qualified by an emotion by gaze interaction, $F(4, 232) = 2.97$, $p = .02$. As with the HPSE scale, participants exhibited lower self-esteem after exposure to direct-gaze anger than after exposure to direct-gaze joy, $t(51) = 2.43$, $p = .02$, $r_{pb} = .32$, or direct-gaze neutrality, $t(53) = 3.47$, $p = .001$, $r_{pb} = .43$. Exposure to direct-gaze joy—as compared to exposure to direct-gaze neutrality—did not significantly influence RSE scores, $p = .34$. There were no significant influences of facial emotion on self-esteem within the averted-gaze condition ($ps > .11$) or the equal-gaze condition ($ps > .58$). Thus, the interactive influence of facial expression and eye gaze was quite similar for the HPSE and the RSE.

The RSE is intended as a measure of trait self-esteem but often captures state fluctuations around this trait level and is responsive to contextual manipulations (Leonardelli et al., 2007; Morse & Gergen, 1970; Wilcox & Laird, 2000). We suspect that the influence of nonverbal cues in this study was specific to state fluctuations and indeed, the RSE scale and the HPSE scale were highly correlated, $r(241) = .66$, $p < .001$. Additionally, we conducted a 3 (emotion) × 3 (gaze) ANCOVA on RSE scores controlling for HPSE scores. The critical emotion by gaze interaction was no longer significant, $F(4, 231) = .98$, $p = .41$. Although this

[1] This memory test was part of a separate study—neither memory accuracy (d') nor bias (*Criterion C*) were associated with either self-esteem measure ($rs < |.07|$, $ps > .35$) and controlling for these variables in analyses did not alter the pattern of results reported below. Consequently, this memory test is not discussed further.

Fig. 1. Study images: direct- and averted-gaze study images for each facial emotion (from left to right: angry, happy, and neutral).

result is consistent with the view that the influence of nonverbal cues is limited to state self-esteem fluctuations, it is not conclusive. The more conservative interpretation of this analysis is that nonverbal cues influenced variance shared by state and trait self-esteem measures. Therefore, in Study 2 we examined whether a state-worded version of the RSE would obtain the same results.

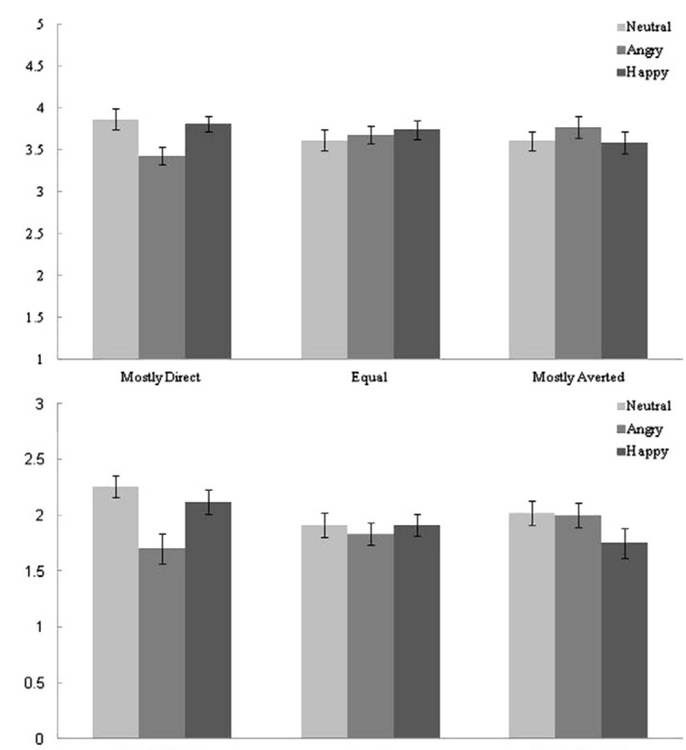

Fig. 2. Self esteem (y-axis) in Study 1 as a function of eye-gaze exposure (x-axis) and facial-expression exposure (see legend). The top panel depicts HPSE scores and the bottom panel depicts RSE scores. Please see text for inferential statistics.

Exploratory analyses

Our hypotheses focused on the influence of facial emotion and therefore motivated the comparisons reported above. However, we conducted within-emotion comparisons on an exploratory basis. Among participants exposed to angry faces, HPSE was significantly lower in the mostly-direct-gaze condition than in the mostly-averted-gaze condition, $t(55) = 1.99$, $p = .05$, $r_{pb} = .26$, or (marginally) than in the equal-gaze condition, $t(54) = 1.76$, $p = .08$, $r_{pb} = .23$. No other within-emotion comparisons on HPSE were significant, $ps > .15$.

We also conducted exploratory within-emotion comparisons for the RSE. For participants exposed to angry faces, self-esteem was marginally lower in the mostly-direct-gaze condition than in the mostly-averted-gaze condition, $t(55) = 1.80$, $p = .08$ $r_{pb} = .24$. For participants exposed to happy faces, self-esteem was higher in the mostly-direct gaze condition than in the mostly-averted gaze condition, $t(47) = 2.12$, $p = .04$ $r_{pb} = .30$. For participants exposed to neutral faces, self-esteem was higher in the mostly-direct gaze condition than in the equal condition, $t(52) = 2.37$, $p = .02$, $r_{pb} = .31$, or (marginally) the mostly-averted gaze condition, $t(54) = 1.62$, $p = .11$, $r_{pb} = .21$. This latter effect conceptually replicates Wirth et al. (2010). No other within-emotion comparisons on the RSE were significant, $ps > .17$.

Influence of nonverbal cues: Affect, mood, or self-esteem?

The influence of nonverbal cues on self-esteem conformed to predictions. Yet these effects might simply be explained by subjective emotion and/or mood. Indeed, HPSE and RSE scores were correlated with positive emotion, $rs(241) > .35$, $ps < .001$, and mood, $rs(241) > .32$, $p < .001$. However, the critical two-way interactions remained significant whether controlling for affect (HPSE $p = .02$; RSE $p = .01$), mood (HPSE $p = .03$; RSE $p = .03$), or both (HPSE $p = .03$; RSE $p = .03$) in an ANCOVA. Finally, we conducted ANOVAs with emotion and mood as dependent variables. These analyses revealed *no* interactive effects of facial-emotion and eye-gaze, $ps > .8$. Thus, subjective emotional responses to nonverbal cues did not account for self-evaluative responses to those cues.

Study 2

Study 1 provided initial evidence that state self-esteem is shaped by a complex environment of nonverbal cues. An accumulated pattern of exposure to angry facial expressions reduced perceivers' state self-esteem but only when most faces were exhibiting direct-gaze. Although exposure to several faces was sufficient to influence state self-esteem, participants were not simply *exposed* to 24 faces—performance of the memory task ostensibly required participants to pay close attention to those faces. Thus, elaborated processing of others' facial emotion may be necessary for such faces to influence self-esteem.

In Study 2, we sought to examine whether attention was indeed necessary for the observed effects or if simple exposure to nonverbal cues was sufficient to influence self-esteem. We set up Study 2 such that prolonged attention to faces would reduce task performance. Specifically, participants completed a lexical decision task (LDT; Neely, 1977) in which a neutral word (or non-word) was preceded by an image of either a house or a face. Reaction-times were used to index the extent to which participants attended to faces versus houses, such that increased reaction-times following faces indexed increased attention to (or cognitive elaboration of) faces. After the LDT, participants completed self-esteem measures. If focused attention is necessary for facial expressions to influence self-esteem, the results of this study should replicate Study 1 but *only* to the extent participants attended to faces during the LDT. Conversely, if focused attention is unnecessary for facial expressions to influence self-esteem, the results of this study should replicate those of Study 1 irrespective of the extent to which participants attended to faces during the LDT.

Method

Participants and setting

Participants were recruited from undergraduate psychology classes and received extra credit for their participation. The experiment was conducted on computers using Direct RT© software. Five participants' data could not be recovered, three participants completed self-esteem scales prior to the LDT (experimenter error), and one participant was a minor.[2] The distribution of exclusions by condition is listed in Table 2. After excluding these participants, the final sample was 182 participants (136 women), including 119 White, 28 Asian, 23 Latina(o), 7 mixed-race, 4 Black, and 1 Native American. Ages ranged from 18 to 33, with quartiles at 18, 19, and 20.

Materials

Study images. Facial images were identical to those in Study 1. Each of six face-sets included all 24 models expressing one emotion-gaze pairing. We thus employed a 3 (neutral, angry, happy) × 2 (direct, averted) independent-groups design. Unlike Study 1, every face encountered by a participant in Study 2 exhibited the same gaze-direction (either direct or averted).

House images were selected from Google image searches of "normal house"; these 10 images were selected for their affectively neutral appearance, dissimilarity from facial features (e.g., two windows centered above a door), and location within the USA.

Attention to faces. To measure attention to faces we used a modified LDT with 72 randomly-ordered trials. In each trial, participants first saw an image and then a string of letters. Participants were instructed to ignore the image but to indicate as quickly as possible whether or not the string of letters was a word (words were affectively-neutral according to established norms; e.g., content, elbow, glass; Bradley & Lang, 1999). Of the 72 trials, 48 were *face-trials* corresponding to experimental condition. For example, participants in the direct-gaze anger condition always saw direct-gaze anger on face-trials.[3] The remaining 24 trials included images of houses rather than faces and these 24 trials provided a baseline from which to measure face-specific attention. Image presentation time was systematically-varied (500, 1000, or 2000 ms) to increase task difficulty.

Prior to calculating *face-attention scores,* we excluded incorrect responses and response times that were 2.5 standard deviations above a given participant's face or house mean. Face-attention scores were calculated by subtracting response times to house-trials from response times to face-trials and standardizing the difference.

Table 2
Study 2: Exclusions by condition.

	Direct			Averted		
	Neutral	Angry	Happy	Neutral	Angry	Happy
Data not recoverable	2			1	1	1
Experimenter error			1		1	1
Minor						1
Face attention 2.5 SDs below mean			1	2	1	
Face attention 2.5 SDs above mean	1	1	1		1	
RSE 2.5 SDs below mean	1		1			
Total	**3**	**1**	**4**	**3**	**4**	**3**

Self-esteem measures. We again used the HPSE ($M = 3.78$, $SD = .53$, here, $\alpha = .88$). However, to reduce ambiguity in the (state vs. trait) meaning of the RSE, we followed prior research (e.g., Seery, Blascovich, Weisbuch, & Vick, 2004) by modifying the wording so that participants indicated how they thought of themselves *at the present moment* (not just in general) ($M = 2.13$, $SD = .46$, here, $\alpha = .87$). These two measures were highly correlated, $r(169) = .80$, $p < .001$, but analyzed separately to examine convergent validity.

Procedure

Participants were randomly assigned to one of the six conditions described above. After informed consent, participants read instructions for an "attention task" (the LDT). After completing the LDT, participants were told they had completed their first study and would now participate in a second (questionnaire) study. Participants then completed the self-esteem measures and demographics questions before being thanked, debriefed, and paid.

Results and discussion

We hypothesized that participants' self-esteem would be lower after exposure to angry faces than after exposure to happy faces (or neutral faces) but *only* when faces exhibited direct-gaze. To the extent that attention moderates the influence of nonverbal cues on self-esteem, these effects should only obtain to the degree that participants had high face-attention scores.

We regressed self-esteem scores onto a dummy-coded gaze variable (1 = Averted), two dummy-coded variables for the three-level facial emotion factor (reference group = Anger), centered Face-Attention Scores, and all interactions among these variables.[4] Following standard

[2] Internal Review Board (IRB) approval did not include reporting of data for minors.

[3] Response time to faces did not vary by gaze, $F(1, 163) = .18$, $p = .67$, by emotion, $F(2, 163) = 1.06$, $p = .35$, or by the interaction of the two, $F(2, 163) = .05$, $p = .95$.

[4] Participants with Face Attention scores at least 2.5 SDs above or below the mean ($n = 8$) and participants with RSE scores at least 2.5 SDs away from (below) the mean ($n = 2$) were excluded from analyses. Inclusion of these participants does not alter the pattern of results but several of these participants were also multivariate outliers.

guidelines (e.g., Aiken & West, 1991), one-way, two-way, and three-way effects were entered hierarchically and interpreted at Step 1, Step 2, and Step 3 in the equation, respectively. To simplify interactions, we conducted simple effects tests between groups by recentering Face-Attentiveness to one standard deviation above (*attenders*) or below (*non-attenders*) the mean, recalculating interactions where appropriate. We thus examined simple effects separately for attenders and non-attenders.

HPSE

For the Heatherton and Polivy (1991) scale, the Step 1 model was not significant, $R^2 = .05$, $F(4, 164) = 2.09$, $p = .09$. The addition of the two-way interactions at Step 2 did not account for a significant proportion of variance, $\Delta R^2 = .05$, $\Delta F(5, 159) = 1.93$, $p = .09$.[5] More importantly, the addition of the three-way interactions at Step 3 accounted for substantial variance, $\Delta R^2 = .03$, $\Delta F(2, 157) = 3.12$, $p = .047$. The Anger-vs.-Neutral × Gaze × Attention interaction was significant, $\beta = -.36$, $t(157) = -2.24$, $p = .03$, and the Anger-vs.-Joy × Gaze × Attention interaction was marginally-significant, $\beta = -.22$, $t(157) = -1.87$, $p = .06$ (see Fig. 3). Among attenders exposed to direct-gaze faces, self-esteem was marginally lower after exposure to facial-anger than after exposure to facial-neutrality, $\beta = .33$, $t(157) = 1.98$, $p = .049$, and significantly lower after exposure to facial-anger than after exposure to facial-joy, $\beta = .34$, $t(157) = 2.10$, $p = .037$. The comparison of direct-gaze neutrality to direct-gaze joy was not significant, $\beta = .01$, $t(157) = .07$, $p = .95$. As in Study 1, this pattern of effects only emerged in response to faces exhibiting direct-gaze. Among attenders exposed to averted-gaze faces, self-esteem was not different after exposure to facial-anger versus facial-joy, $\beta = -.31$, $t(157) = -1.51$, $p = .13$, or versus neutrality, $\beta = -.06$, $t(157) = -.36$, $p = .72$. The comparison of averted-gaze neutrality to averted-gaze joy was not significant, $\beta = .26$, $t(157) = 1.24$, $p = .21$.

Among *non-attenders*' there were no significant simple effects.

RSE

For the Rosenberg (1965) scale, the model was not significant at Step 1, $R^2 = .04$, $F(4, 164) = 1.70$, $p = .15$. The addition of the two-way interactions at Step 2, however, accounted for significant variance, $\Delta R^2 = .07$, $\Delta F(5, 159) = 2.73$, $p = .02$. The interaction of gaze and joy was significant, $\beta = .38$, $t(159) = 2.72$, $p = .007$, but we hesitate to interpret this effect because it was qualified by three-way interactions. Specifically, the addition of the three-way interactions at Step 3 accounted for a significant proportion of variance, $\Delta R^2 = .06$, $\Delta F(2, 157) = 5.60$, $p = .004$. Both of the three-way interactions were significant (Joy-vs.-Anger × Gaze × Attention, $\beta = .44$, $t(157) = 2.70$, $p = .008$; Neutral-vs.-Anger × Gaze × Attention, $\beta = .33$, $t(157) = 2.86$, $p = .005$; see Fig. 3).

Among attenders exposed to direct-gaze faces, self-esteem was lower after exposure to facial-anger than after exposure to facial-neutrality, $\beta = .37$, $t(157) = 2.28$, $p = .02$, or facial-joy, $\beta = .467$ $t(157) = 2.95$, $p = .004$. The comparison of direct-gaze neutrality to direct-gaze joy was not significant, $\beta = .10$, $t(157) = .56$ $p = .57$. As for HPSE, this pattern only emerged in response to faces exhibiting direct-gaze. In fact, among attenders exposed to averted-gaze faces, self-esteem was *higher* after exposure to facial-anger than after exposure to facial-joy, $\beta = .50$, $t(157) = -2.50$, $p = .01$ (see General Discussion). The comparison of averted-gaze anger to averted-gaze neutrality was not significant, $\beta = -.20$, $t(157) = -1.18$, $p = .24$, nor was the comparison of averted-gaze neutrality to averted-gaze joy, $\beta = .33$, $t(157) = 1.58$, $p = .12$.

Non-attenders' self-esteem did not conform to the pattern observed for attenders. There was one unexpected significant simple effect: self-esteem was higher among non-attenders exposed to averted-gaze neutrality than averted-gaze joy, $\beta = .37$, $t(157) = 2.14$, $p = .03$. Although several explanations are possible, we are reluctant to speculate about this unexpected effect.

Exploratory analyses

We again conducted within-emotion comparisons on an exploratory basis. Among attenders exposed to happy faces, self-esteem was higher after exposure to direct-gaze faces than after exposure to averted-gaze faces, whether measured with the HPSE $\beta = .47$, $t(157) = 2.10$, $p = .04$, or with the RSE, $\beta = .54$, $t(157) = 2.47$, $p = .01$. No significant effects emerged for angry faces on the HPSE but ($p = .18$) for the RSE, attenders exposed to angry faces exhibited lower self-esteem after exposure to direct-gaze faces than after exposure to averted-gaze faces, $\beta = .51$, $t(157) = 3.00$, $p = .003$. No significant effects emerged on either scale for neutral faces ($p > .30$).

Study 2 extended the findings of Study 1 by providing evidence in support of the idea that the joint influence of facial emotion and eye-gaze on self-esteem depends upon perceivers' attention. In replication of Study 1, participants exhibited lower state self-esteem after exposure to facial anger than after than after exposure to facial joy or facial neutrality but only when those faces exhibited direct-gaze. This pattern only emerged to the extent that participants attended to faces, suggesting that attention is necessary for facial cues to reliably influence perceivers' self-esteem.

Meta-analysis

We conducted a mini meta-analysis of the two studies to examine the size and reliability of the observed simple effects. Following standard guidelines (Rosenthal, 1991), we transformed t statistics to r and Fisher's Z_r. Mean effect sizes (Z_r) were transformed back to unweighted rs for reporting. Significance level was computed by summing the standard normal deviates of p and dividing by the square root of k.[6] Following standard guidelines (Rosenthal, 1995), we also calculated standard error to estimate confidence intervals for each effect size r. Consistent with our hypotheses, we focused on within-gaze comparisons. The observed effects were specific to people attending to faces and we therefore limited this meta-analysis to those individuals (Study 1 participants and Study 2 attenders).

HPSE

We first examined the hypothesized influence of direct-gaze anger on perceivers' HPSE scores. The effect of direct-gaze anger relative to direct-gaze joy, $r = .31$ [.23, .39], $Z = 3.26$, $p = .001$, and the effect of direct-gaze anger relative to direct-gaze neutrality, $r = .29$ [.22, .37], $Z = 3.13$, $p = .001$, were indeed medium in size and reliable. Consistent with individual-study analyses, the effect of direct-gaze joy (relative to direct-gaze neutrality) was negligible and unreliable, $r = .02$ [0, .07], $Z = .17$, $p = .86$.

We next turned our attention to if and how HPSE scores were influenced by averted-gaze faces. One effect emerged that was not present in either study analyzed individually: exposure to averted-gaze anger (relative to averted-gaze joy) caused a small and marginally-significant increase in self-esteem, $r = .17$ [.09, .25], $Z = 1.73$, $p = .09$. Other influences of averted gaze faces on HPSE were small and not reliable. Hence, the effect of averted-gaze anger relative to averted-gaze neutrality was small and unreliable, $r = .08$ [.02, .15], $Z = .87$, $p = .38$, as was

[5] The marginally significant p value owes to an effect of attention by gaze, $\beta = .27$, $t(159) = 2.36$, $p = .02$. Among those exposed to averted-gaze faces, self-esteem did not significantly vary as attention increased $\beta = -.09$, $t(159) = -.63$, $p = .53$. Among those exposed to direct-gaze faces, however, self-esteem significantly increased as attention increased, $\beta = .28$, $t(159) = 2.06$, $p = .04$. This interaction is qualified by the three-way interaction below.

[6] We did not observe heterogeneity in the significance levels (HPSE: $.44 < p < .86$; RSE: $.45 < p < .98$) or effect sizes (HPSE: $.44 < r < .78$; RSE: ($.28 < r < .98$) from Studies 1 and 2.

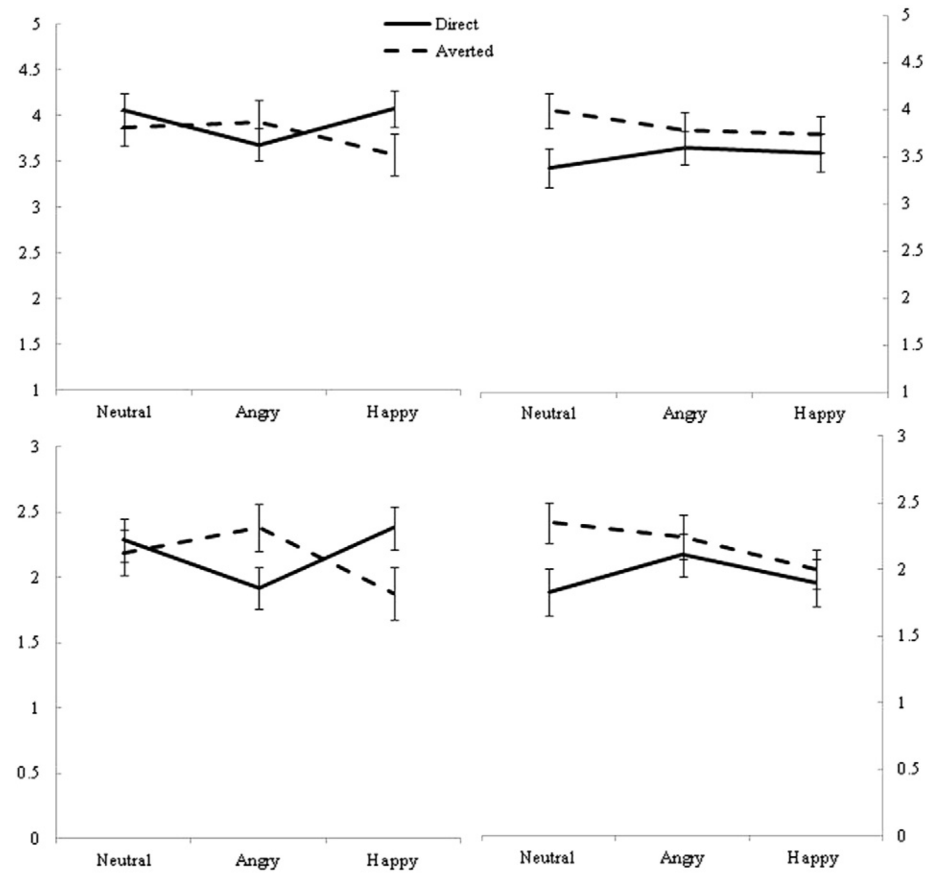

Fig. 3. Self esteem (y-axis) in Study 2 as a function of facial-expression exposure (x-axis) and eye-gaze exposure (see legend). Left panels depict attenders and right panels depict non-attenders. The top panel depicts HPSE scores and the bottom panel depicts RSE scores. Means were calculated using a weighted effects-coded model. Please see text for inferential statistics.

the effect of averted-gaze joy relative to averted-gaze neutrality, $r = .09$ [−.06, .24], $Z = .96$, $p = .34$.

RSE

We first examined the hypothesized influence of direct-gaze anger on perceivers' RSE scores. The effect of direct-gaze anger relative to direct-gaze joy, $r = .34$ [.30, .39], $Z = 3.70$, $p < .001$, and the effect of direct-gaze anger relative to direct-gaze neutrality, $r = .36$ [.22, .50], $Z = 3.90$, $p < .001$, were medium-to-large in size and reliable. Consistent with individual studies, the effect of direct-gaze joy (relative to direct-gaze neutrality) was negligible and unreliable, $r = .03$ [−.18, .24], $Z = 1.08$, $p = .28$.

We next turned our attention to if and how RSE scores were influenced by averted-gaze faces. In our meta-analysis of HPSE scores, the effect of averted-gaze anger relative to averted-gaze joy was small but marginally significant (see above). For RSE scores, this effect was medium and reliable, $r = .27$ [.14, .40], $Z = 2.75$, $p = .006$ (see General Discussion). Additionally, the effect of averted-gaze joy relative to averted-gaze neutrality was small but reliable, $r = .21$ [.20, .22], $Z = 2.22$, $p = .03$ (see General Discussion for interpretation). Finally, and as for the HPSE, the effect of averted-gaze anger (relative to averted-gaze neutrality) was negligible and unreliable, $r = .07$ [−.11, .24], $Z = .94$, $p = .35$.

General discussion

Few people are (un)fortunate enough to be told, from moment-to-moment, how others feel about them. Yet the social environment is saturated with nonverbal cues that can potentially provide such feedback (cf. Ambady & Weisbuch, 2010) and it appears that self-esteem is responsive to these cues. Specifically, participants' self-esteem was reduced after exposure to angry facial-expressions but only when those expressions were paired with direct-gaze. Moreover, it appears that this effect depends on perceivers' attention, as exposure to direct-gaze anger only reduced self-esteem to the extent participants attended to faces.

These findings illustrate sophistication in the response of self-esteem to nonverbal cues. This response requires perceivers to integrate the self-relevant meaning of spatially-distributed nonverbal cues and to update memory about nonverbal cues distributed over time and target persons. Although attention to faces does appear to be necessary for facial cues to reliably influence self-esteem, faces in the studies reported here could not be attended to for more than a few seconds and participants were never instructed to imagine anything meaningful about the faces. They were simply asked to remember the faces (Study 1) or ignore them (Study 2). Consequently, attention may be both necessary *and* sufficient for spatially- and temporally-distributed patterns of nonverbal cues to influence perceivers' self-esteem.

One component of our predictions was that direct-gaze emotion expressions may be more diagnostic than are averted-gaze emotion expressions. This same explanation might be applied to another pattern of findings: the influence of direct-gaze facial expressions on self-esteem was driven more by negative than positive facial expressions. Compared to exposure to direct-gaze neutrality, exposure to direct-gaze anger reduced self-esteem but exposure to direct-gaze joy did *not* increase self-esteem. Among Americans, positive facial expressions paired with direct-gaze are normative and expected (Cole, 1986; Hayes & Metts, 2008; Matsumoto, 1993). Direct-gaze joy may seem normative or unspectacular and thus non-diagnostic. Although negative facial expressions may not be unheard of responses to eye-contact, they are perhaps less normative and thus more diagnostic of others' evaluations of the self.

Other trends in the data await further examination. The meta-analytic results indicate that participants' self-esteem was lower after exposure to averted-gaze joy than after exposure to averted-gaze anger. According to the meta-analysis, this pattern was significant for the RSE and marginal for the HPSE. Additionally, participants' RSE (but not HPSE) scores were also lower after exposure to averted-gaze joy than after exposure to averted-gaze neutral cues. The influence of averted-gaze joy on perceivers' self-esteem was somewhat inconsistent across measures, so we are reluctant to interpret this effect. Nonetheless, several explanations are possible. For example, to the extent averted-gaze joy reliably reduces self-esteem, it may be because averted-gaze facial emotion is interpreted as an evaluation of another person thereby influencing participants' comparison standards. Social comparison processes might thus reduce perceivers' self-esteem in response to averted-gaze joy. Alternatively, averted-gaze can signal social disengagement (e.g., Kleinke, 1986) so averted-gaze joy may signal that gazers are pleased that interaction with the perceiver has been discontinued.

Regardless of whether exposure to averted-gaze anger or neutrality enhances perceivers' self-esteem or does not change it, the influence of facial emotion on perceivers' self-esteem is clearly moderated by emoter eye-gaze. Direct-gaze anger expressions clearly and reliably reduced the self-esteem of people attended to those expressions. Averted-gaze anger expressions did not. In conclusion, we have presented the first evidence (to our knowledge) that self-esteem tracks complex patterns of nonverbal cues across multiple target persons. Combined with the high-frequency of nonverbal cues in daily life, the current results are suggestive of the possibility that the nonverbal environment shapes self-esteem on a moment-to-moment basis.

Appendix A. Elaboration of methods

Sample size

To determine sample size in Study 1, we recorded the sample sizes and effect sizes of past studies that were methodologically and conceptually similar (Leary et al., 1998; Strahan, Spencer, & Zanna, 2002; Weisbuch et al., 2009; Winkielman et al., 2005; Wirth et al., 2010). Specifically, we identified studies from the last decade in which (a) participants were exposed to prolonged nonverbal behavior or repeated instances of nonverbal behavior, (b) a between-subject design was used, and (c) the outcome measure was something other than emotion. We identified three such studies (Strahan et al., 2002; Weisbuch et al., 2009; Winkielman et al., 2005). We additionally reviewed the sample sizes in work examining sociometer hypotheses (Leary et al., 1998; Wirth et al., 2010).

First, we examined the set of three studies with similar methodology. Strahan et al. (2002) examined persuasiveness in response to subliminally presented sad and neutral faces. The effect size (d) was .57 and the average sample size per condition was 23. Weisbuch et al. (2009) examined race bias in response to directed emotion. In two studies, the average effect size (d) was .65 and the average sample size per condition was 25. Winkielman et al. (2005) examined thirst in response to masked happy and angry faces. In two studies, the average effect size (d) was .96 and the average sample size per condition was 17.

Next, we examined studies regarding the sociometer hypothesis. Leary et al. (1998) examined feelings of acceptance in response to explicit feedback. In three studies, the average effect size (d) was 2.38 and the average sample size per condition was 11. Wirth et al. (2010) examined implicit self-esteem and feelings of exclusion in response to averted gaze. In three studies, the average effect size (d) was .68 and the average sample size per condition was 32. The median effect size among these five sets of studies was .68, a medium to large effect size. Recommended sample size to achieve .8 power with an effect size of .7 is 33 (Cohen, 1988). The median sample size per condition among these five sets of studies was 23. Based on these two sources of information, we sought 30 participants per condition. However, after exclusions and eliminating data from several participants who were inadvertently paid but did not want to participate after reading informed consent, the final sample size was 27 per condition. Post-hoc power analyses indicate that observed power with this sample size was .71 for HPSE and .81 for RSE. Data were not analyzed until collection was complete.

In Study 2, we eliminated one-third of the experimental conditions ("equal" conditions). To estimate power for Study 2, we calculated f^2 from those six conditions in Study 1. The effect size estimates for HPSE and RSE yielded an average f-squared of .055. With this effect-size estimate, we used an *a priori* power calculator for hierarchical multiple regression in order to calculate a sample size that achieved 80% power. This led to a sample size estimate of 185, which we sought to obtain in Study 2. After exclusions, we had a final sample size of 182.

Due to limitations in funding and the University of Denver subject-pool, we elected to initially analyze the data after two academic quarters of data collection. Results were marginal but not counter-hypothetical so we identified new funding and completed data collection. The procedure of analyzing data once prior to final analysis results in an increase in Type I error. Using the O'Brien-Fleming function appropriate for confirmatory analysis, we arrive at an effective alpha-level significant threshold of $p = .043$ (Lakens, 2014; O'Brien & Fleming, 1979). Consequently, there are several results in Study 2 that have a p-value of less than .05 but greater than .043 that we describe as marginal rather than significant. Finally, we wish to note that observed power in Study 2 was .79 for HPSE and .94 for RSE.

Additional variables

Study 1 was part of a broader investigation regarding personality and memory. Thus Study 1 also included the following measures: the Ten-Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003), the Narcissistic Personality Inventory (Raskin & Terry, 1988), the Self-Consciousness Scale-Revised (Scheier & Carver, 1985), and the Fear of Negative Evaluation Scale (Watson & Friend, 1969). Similarly Study 2 included the following measures: the Behavior Inhibition and Activation Scales (Carver & White, 1994), the International Personality Item Pool Assertiveness and Dominance Scales (Goldberg, 1999), the Trait Transportability Scale (Dal Cin, Zanna, & Fong, 2004), and a single question that simply asked participants what their self-esteem was (Robins, Hendin, & Trzesniewski, 2001). Although we did not have predictions for this last single-item because of its theoretical ambiguity and trait-wording, it could be regarded as relevant to our hypotheses and so we examined it as an outcome variable. The three-way interaction terms most relevant in Study 2 were not significant for this item, $ps > .23$.

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