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Social connection modulates perceptions of animacy

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Abstract

Human survival depends on identifying targets potentially capable of engaging in meaningful social connection. Using sets of morphed images created from animate (human) and inanimate (doll) faces, we provide converging evidence from across two studies showing that the motivation to connect with other people systematically alters the interpretation of the physical features that signal that a face is alive. Specifically, in their efforts to find and connect with other social agents, individuals who feel socially disconnected actually lower their thresholds for what it means to be alive, consistently observing animacy when fewer definitively human cues are present. From an evolutionary perspective, overattributing animacy may be an adaptive strategy, allowing people to cast a wide net when identifying possible sources of social connection and maximize their opportunities to renew social relationships.

Social relationships are a vital aspect of human life (Baumeister & Leary, 1995). Failure to satisfy the need for close social connections is associated with a host of mental and physical health problems, including increased stress hormones (Adam et al., 2006), increased blood pressure (Hawkley et al., 2006), as well as depression and suicidal tendencies (Cacioppo et al., 2006).

Feeling disconnected from others activates the desire to replenish social connections, and motivates social behaviors aimed at accomplishing this goal (DeWall, Baumeister & Vohs, 2008). Past research has demonstrated that socially disconnected individuals more readily and accurately identify social information (Gardner et al., 2000; 2005; Pickett, Gardner & Knowles, 2004), are more sensitive to emotional intonation (Pickett et al., 2004), and display a greater desire to make new friends and work cooperatively with others (Maner et al., 2007). This pattern highlights the overarching goal of re-establishing connections with other people.

Engaging in social encounters requires efficiently detecting targets in the environment that are potentially capable of meaningful mental connection (e.g., another living human).

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Author Contributions

K.E.P., J.B.F., T.W. and T.F.H. designed the research; K.E.P. and A.L.W. performed the research; K.E.P. analyzed the data; K.E.P. drafted the manuscript and A.L.W., J.B.F., T.W. and T.F.H. provided critical revisions. All authors approved the final version of the manuscript for submission.

Indeed, humans are preferentially tuned to detect other faces (Ro, Russell & Lavie, 2001; Langton et al., 2008), and discriminate carefully between faces that are alive and those that are not (Looser & Wheatley, 2010; Looser, Guntupalli, & Wheatley, 2013; Wheatley et al., 2011). However, when the connection with other humans is deemed impossible, the drive to fulfill this motivation may manifest itself in the attribution of mental states to nonhuman entities, such as gadgets and pets (Epley et al., 2008).

We suggest that when the motivation for social connection is unfulfilled, individuals may require less bottom-up evidence to detect the most basic of social cues: whether a face is alive. From this perspective, as other people become more motivationally relevant to perceivers, the threshold at which physical cues signal that a face is alive should be lowered and relaxed. To date, the putative relationship between motivation for social connection and biases in animacy detection has not been empirically tested. Here, we use both chronic and situational measures of social disconnection to test the hypothesis that feeling motivated to seek out social connections would prompt people to more readily perceive animacy in their environment.

STUDY 1

Method

Participants—Thirty undergraduates (22 female; age range 18-21) were recruited for Study 1. Responses from one participant indicated a clear misunderstanding of the responses labels, so this individual was excluded from all analyses. Participants were paid and gave consent in accordance with the guidelines set by the Committee for the Protection of Human Participants at Dartmouth College. Sample sizes for both studies were based on the studies reported in Looser and Wheatley (2010).

Stimuli—Stimuli consisted of animacy morphs from Looser and Wheatley (2010). Morphs were created by morphing inanimate faces (e.g., dolls, statues) with comparable human faces, resulting in sets of images ranging from 100% inanimate to 100% human. Study 1 employed images selected from 9 points spaced across these morph continua, including the spectrum end points (see Figure 1). Ten unique face identities (5 male, 5 female) were used, for a total of 90 morphs. All faces were resized to 416 × 500 pixels and placed onto a black background.

Experimental design—Each trial began with participants clicking a “START” button located in the bottom center of the screen. Once clicked, a face appeared, and participants were instructed to categorize that face as either ANIMATE or INANIMATE by clicking the corresponding label located at either the top-left or top-right corner of the screen. Faces were presented in a random order, and location of the labels on the screen was counterbalanced across participants. Before the experiment began, participants completed eight practice trials to ensure familiarity with the instructions and computer software. The practice trials were identical to the experimental trials, with the exception that unique face identities were used for the animacy morphs in the practice trials.

Immediately following the task, all participants filled out the Need to Belong Scale (NTB; Leary et al., 2013), a 10-item questionnaire designed to assess an individual's desire for social connections. Participants indicated the degree to which each statement (e.g., "I want other people to accept me") applied to them using a 1 (*strongly disagree*) to 5 (*strongly agree*) scale. The NTB Scale demonstrated adequate reliability in this sample ($\alpha = .78$).

Results & Discussion

Scores on the NTB Scale ranged from 21-43 (possible range: 10-50; $M = 32.2$, 95% CI [29.7, 34.7]), with higher scores signaling greater desire for social connection.

As an initial step to examine whether motivation for social connection systematically biased perceptions of animacy, we analyzed each participant's categorization performance using a standard psychometric approach (see Yssaad-Fesselier & Knoblauch, 2006). Individual psychometric functions, representing number of animate categorizations across the 9-point morph continuum, were constructed for each participant using the following equation:

$$P(c) = \gamma + (1 - \gamma - \lambda) (1 - e^{-(c/\alpha)^\beta})$$

(see Figure 2). The psychometric functions were modeled using the Weibull function, and certain starting parameters (e.g., steepness of curve ascent) were adjusted on a participant-by-participant basis to achieve the best fit between the model and the data (using maximum likelihood estimates). From these functions, we calculated threshold parameters (α) for each participant. This parameter provides a quantitative measure of the point at which participants began consistently observing animacy, with lower thresholds indicating detection of animacy when fewer distinctly human features were present.

On average, participants achieved threshold when faces were 68.9% human ($M = 0.689$, 95% CI [0.646, 0.732], range = 0.530 – 0.998). These values are consistent with prior work revealing that faces must contain significantly more than 50% human features to be considered alive (Looser & Wheatley, 2010; Hackel, Looser & Van Bavel, 2013). As predicted, threshold parameters varied as a function of individual differences in desire for social connections. Specifically, increasing desire for social connections (i.e., higher NTB scores) was associated with decreasing threshold parameters, $r(29) = -.37$, 95% CIs [–0.65, –0.01] (see Figure 3A). That is, individuals more motivated to seek out social connections were more likely to perceive animacy with fewer human cues. NTB scores accounted for 14% of the variance in threshold parameters.

From these functions we also calculated the point of subjective equality (PSE), representing the point at which a face was equally likely to be deemed animate or inanimate, for each participant. PSEs were strongly correlated with threshold parameters, $r(29) = .999$, and maintained the same inverse relationship with NTB scores, $r(29) = -.36$, 95% CI [–0.64, .01].

STUDY 2

In Study 1, we demonstrated that individual differences in the desire for social connections predict sensitivity to animacy cues in a face. In Study 2, we used an experimental manipulation to demonstrate a causal link between motivation for social connection and biases in animacy detection.

Method

Participants—Forty-nine undergraduates were recruited for Study 2. Seven participants were dropped from final analyses, due either to experimenter error during the practice trials ($n = 2$) or the inability to calculate usable threshold parameters because the threshold for animacy detection was never reached ($n = 5$). This resulted in a final sample of 42 participants (33 female; age range 18-21). Participants received course credit in exchange for their participation, and gave consent in accordance with the guidelines set by the Committee for the Protection of Human Participants at Dartmouth College.

Experimental design—To manipulate motivation for social connection, we employed a modified version of the future alone versus future belonging paradigm, which has been used extensively to induce feelings of social loss and disconnection (e.g., Baumeister, Twenge & Nuss, 2002; Twenge et al., 2001; DeWall et al., 2008, 2009; Epley et al., 2008; Powers et al., 2013).

We told participants this study was investigating the relationship between personality and categorical perception. Participants first completed a computerized version of the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975), and were subsequently provided with feedback ostensibly derived from their answers. In reality, feedback was randomly assigned prior to the experimental session. Half of the participants ($n = 22$) were told their future lives would be isolated and lonely (socially disconnected), while the other half ($n = 20$) were told that their lives would be filled with long-lasting, stable relationships (socially connected). To increase believability, the feedback also included personality descriptions typically believed by the average person (i.e. the 'Barnum Effect'; Snyder, Shenkel & Lowery, 1977), as well as two statements regarding self-esteem and social skills tailored to each participant (based on self-report information obtained in a mass survey). Immediately following feedback, participants completed a 24-item mood questionnaire (Vohs & Heatherton, 2001) to assess effectiveness of the manipulation.

Participants then completed the face categorization task described in Study 1. To reduce potential confusion regarding the meaning of the response labels, this time participants were instructed to categorize each face as simply ALIVE or NOT ALIVE. The rest of the experimental protocol was identical to that of Study 1. At the end of the experiment, all participants were thoroughly debriefed regarding the fictitious nature of the feedback they had received.

Results & Discussion

Analysis of the 24-item mood questionnaire revealed that socially disconnected participants reported being in a more negative mood ($M = 54.8$, 95% CI [48.9, 60.6]) than socially

connected participants ($M = 47.0$, 95% CI [41.4, 52.6]). The estimated difference between the means is 7.8, 95% CI [-0.15, 15.7], which is not a large effect. However, we note that prior work using this paradigm has consistently failed to find any effects of generalized negative mood (e.g., Twenge et al., 2001; Baumeister et al., 2002; Maner et al., 2007) and even when differences in mood are observed they do not mediate any of the reported effects (e.g., DeWall et al., 2009, Powers et al., 2013).

As in Study 1, we fit individual psychometric functions and calculated threshold parameters for each participant. Similarly to Study 1, threshold parameters ranged from 0.522 to 0.910 ($M = 0.694$, 95% CI [0.666, 0.724]). Examination of the extent to which social disconnection impacted threshold parameters revealed that socially disconnected individuals displayed lower threshold parameters ($M = 0.661$, 95% CI [0.627, 0.695]) than socially connected individuals ($M = 0.732$, 95% CI [0.686, 0.777]). The estimated difference between the means is 0.07, 95% CI [0.02, 0.13], Cohen's $d = .83$ (see Figure 3B). That is, social disconnection lowers the threshold for animacy detection by approximately 7%. Though the numerical value of this shift is relatively small, Cohen's d indicates this is a large effect. This shift in perceptions of animacy suggests that social disconnection prompts individuals to be less stringent when attributing animacy to potential social contacts.

Again, PSEs were strongly correlated with threshold parameters, $r(42) = .999$, and were similarly modulated by social disconnection, estimated mean difference = 0.07, 95% CI [.02, .12].

General Discussion

As a social species, our ability to sustain meaningful relationships with other people is critical for survival. Engaging in social encounters necessitates efficiently detecting targets in the environment capable of making meaningful mental connections (Heatherton, 2011; Wheatley et al., 2012). Across two studies, we showed that the motivation to connect with other people systematically biases this perceptual ability. Individuals characterized by a chronic desire for social connections (Study 1), or those who have these needs momentarily heightened through an experimental manipulation (Study 2), were consistently more likely to say a morphed face was alive.

People seem to be exceptionally conservative in their judgments of animacy. Prior work revealed that the physical features of a face must be predominately human (i.e., significantly towards the human end of the morph continuum) in order for people to attribute the qualities of life and mind (Looser & Wheatley, 2010). Here, we show that increasing the motivational relevance of other people reliably reduces the amount of humanness a face must contain to be considered alive. From an evolutionary perspective, more readily detecting animacy serves to cast a wide net when identifying possible sources of social connection, thereby allowing these individuals to maximize opportunities for renewing social relationships. Though refinement of these judgments may follow as realistic sources of affiliation are parsed (Maner et al., 2007), the initial perceptual bias we have demonstrated suggests that overattributing animacy may be a fundamentally adaptive strategy.

Interestingly, the ability to perceive that people have minds capable of conscious thought (e.g., mind perception) has been identified as a close proxy of animacy (Looser & Wheatley, 2010). Effective and harmonious interactions between social group members require the capacity to recognize and infer the contents of the thoughts of others (Frith & Frith, 2001; Heatherton, 2011). Considered in this light, our findings suggest that social disconnection may similarly influence the extent to which people engage in mental state attribution. Indeed, increased attempts to accurately decode what other people are thinking and feeling could facilitate attempts at social reconnection (Heatherton, 2011).

More broadly, these implications contribute to the conceptualization of mind perception as a dynamic process in which contextual information and motivational states interact with bottom-up visual cues to affect an individual's ability to understand the thoughts and feelings of others. Consistent with this reasoning, prior work has documented modulation of mind perception in the presence of other social motivations, including dehumanization (Waytz & Epley, 2012), social identity (Hackel et al., 2013) and outgroup threat (Hackel et al., 2013). Moreover, the consistency between the precise threshold shift we report here (approximately 7%) and those documented in prior studies investigating mind perception (between 4 and 8%; Hackel et al., 2013) underscores the reliability of the influence of basic social motives on perceptions of life and mind.

The need for social interaction is a pervasive and powerful human drive. Across two studies, we have presented converging evidence demonstrating that the motivation for social connection reliably alters the interpretation of the physical features in a face that signal animacy and the presence of another mind. Given the physical and psychological consequences associated with the lack of social relationships (Baumeister & Leary, 1995), overattributions of animacy when social contacts are lacking may be a fundamentally adaptive strategy.

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Figure 1.
Example morph stimuli used in both studies, ranging from 0% human to 100% human.

Figure 2.

Individual psychometric functions depicting perceptions of animacy as a function of the inanimate-animate morph continuum. Example functions from *Study 1* participants approximately 1 standard deviation above (blue line) and below (red line) the mean on NTB are shown.

Figure 3.

A) *Study 1* results: Individuals with a greater chronic desire for connections (i.e., higher NTB scores) displayed lower threshold parameters, indicating they were more likely to perceive animacy when fewer definitively human cues were present. B) *Study 2* results: Socially disconnected participants ($n = 22$) displayed lower thresholds for animacy detection than did socially connected participants ($n = 20$). Figure depicts means and 95% confidence intervals (CIs) of threshold parameters; the difference between the group means, along with its 95% CI, is depicted on a floating difference axis on the right.