



# Facing Competing Motives: Testing for Motivational Tradeoffs in Affiliative and Pathogen-Avoidant Motives via Extraverted Face Preferences

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## Abstract

Affiliative and pathogen-avoidant motives adaptively influence interpersonal preferences. For facial structures connoting extraversion, affiliative motives heighten preferences for extraverted faces, whereas pathogen-avoidant motives downregulate preferences. Despite what appears to be competing tension between motives for preferences in extraverted faces, previous research had yet to identify this possibility within a single experiment. The current study temporally activated an affiliative, pathogen-avoidant, or control state before tasking participants with indicating preferences for extraverted faces, relative to introverted, and support for campus-wide social networking activities to demonstrate convergence with previous findings demonstrating temporal shifts in affiliative interest. Although activated motivational states did not influence interpersonal preferences directly in this study, mediation analyses revealed participants' upregulated extraverted face preferences and support for a campus social network following an exclusionary experience because of a heightened affiliative desire. We frame results as motivational tradeoffs, offering suggestions to identify competing motive effects more effectively for future research.

**Keywords** Disease · Exclusion · Motivational tradeoff · Extraversion · Face perception

In pursuing survival and reproductive goals, fundamental motives adaptively shape interpersonal behaviors. Two pervasive motives include seeking affiliation and avoiding infection (Baumeister and Leary 1995; Murray and Schaller 2016). Proximate environmental threats (e.g., social exclusion, disease prevalence) lead individuals to prioritize specific motives at the expense of others, thus adaptively influencing interpersonal preferences to optimize benefits and minimize costs (Kenrick et al. 2010). Affiliative and pathogen-avoidant motives appear to work in opposition to each other, with the salience of one motive muting that of the other, necessitating a tradeoff in interpersonal preferences in a manner that favors those capable of mitigating disease threat or enhancing affiliative opportunities (Sacco et al. 2014).

Recent work has shown how tradeoffs between affiliative and pathogen-avoidant motives shift individuals' preferences for facial cues. Specifically, these motives are especially instrumental in shaping preferences for extraversion (Brown and Sacco 2016, 2017; Brown et al. 2019), a trait implicated in offering affiliative benefits while posing infection risk (Ashton and Lee 2007; Nettle 2005). Specifically, whereas affiliative motives upregulate preferences for extraverted facial structures, pathogen-avoidant motives downregulate this preference. However, previous studies only considered these motives separately, rather than simultaneously. This experiment sought to address this limitation by determining whether preferences for extraversion differ as a function of these somatic motives.

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## Tradeoffs in Affiliative and Pathogen-Avoidant Motives

Despite group living being essential for human survival, interpersonal contact poses risk (e.g., disease exposure), necessitating some caution when choosing interaction partners

(Neuberg et al. 2011). However, thwarted belonging needs activate affiliative motives in the service of optimizing affiliative opportunities, particularly toward new affiliative opportunities that were previously not a source of rejection (Maner et al. 2007). Previous findings indicate this upregulation subsequently downregulates disease-avoidant concerns, including reduced sensitivity to facial symmetry, a perceived immunological health cue (Sacco et al. 2014). A reduced sensitivity to putative health cues implicates exclusion as eliciting a tradeoff with individuals emphasizing the benefits of affiliating with suboptimal conspecifics rather than the costs of potential infection risks.

Conversely, satisfaction of affiliative motives may ultimately become saturated when affiliative opportunities become excessive, leading to concerns over the pathogenic costs of affiliation. Heightened population density is associated with heightened infection risk across various species, including humans, which could result in affiliative cues implicating conspecifics as pathogenically threatening (Jones et al. 2008; Møller et al. 1993). Indeed, salient disease threats downregulate affiliative motives by heightening perceptions of increased physical contact as threatening (Wang & Ackerman, 2019), fostering interpersonal reticence (Miller and Maner 2011; Mortensen et al. 2010), and muting affiliative interest (Sacco et al. 2014; Sawada et al. 2018). Furthermore, environmental pathogen loads are associated with reductions in extraversion, a personality trait associated with sociability, which appears to be in the service of eliminating the physical proximity with others necessary for disease transmission that extraverted behavioral repertoires guarantee (Schaller and Murray 2008). It would thus seem sensible to predict these motives differentially influence affiliative decisions to interact with those implicated in optimizing affiliative opportunities or reducing infection risk.

## Motivated Preferences for Facially Communicated Extraversion

In selecting motivationally optimal conspecifics, individuals infer others' personalities in the service of identifying their social affordances (Zebrowitz and Collins 1997). Such affordance judgments facilitate identification of the potential costs and benefits of individuals, thereby shaping affiliative decisions. Personality inferences occur multimodally, with humans having considerable perceptual acuity toward another's personality through espoused behavioral repertoires or choice in attire (Borkenau et al. 2004; Funder 2012; Naumann et al. 2009).

A growing body of research further indicates information connoted through facial structures is similarly robust in veridically connoting personality, with various motivational states shaping subsequent affiliative decisions (Sacco and Brown

2018a). Extraversion, a trait quickly and reliably inferred through facial structures, is heavily considered in affiliative decisions, given its social benefits and potential interpersonal costs (Little and Perrett 2007). Extraverted individuals are gregarious and possess extensive social networks (Pollet et al. 2011), with affiliative motives upregulating preferences for extraverted faces to acquire affiliative opportunities (Brown and Sacco 2017; Brown et al. 2019). Conversely, given the reduction in affiliative interest following disease salience, pathogen-avoidant motives should downregulate interest in extraverted conspecifics (Mortensen et al. 2010). In fact, extraversion is associated with greater likelihood of hospitalization for illness (Nettle 2005). Despite sociability being capable of bolstering immunological functioning (Cohen et al. 2003), the heightened physical contact of extraverted individuals' social networks would increase their likelihood of coming into contact with diseases that could be transmitted to others without them recognizing their own infection risk. Pathogen-avoidant motives subsequently downregulate preferences for extraverted others, as these proximal costs of infection would ultimately outweigh distal social benefits (Brown and Sacco 2016).

## Current Research

This experiment sought to replicate and extend previous findings by directly comparing interpersonal preferences and affiliative decisions of those experiencing exclusion or disease threat within the same experiment. This direct comparison would thus afford us the opportunity to determine the extent to which these competing motives adaptively shift preferences for extraverted faces similarly to other interpersonal preferences (e.g., Sacco et al. 2014). We predicted social exclusion would heighten affiliative motives, as indexed by greater preferences for extraverted facial structures and interest in social networking. Conversely, we predicted disease threats would downregulate these preferences.

## Method

### Participants

We recruited 239 undergraduates ( $M_{\text{Age}} = 19.39$ ,  $SD = 2.63$ ; 192 women, 47 men; 47.7% White) from a public university in Southeastern USA for course credit in a laboratory study. Sensitivity analyses indicated 237 participants would have sufficiently detected effects (Cohen's  $f = 0.20$ ;  $\beta = 0.80$ ). Most importantly, this sample is noticeably larger than sample sizes in similar studies (e.g., Maner et al. 2007; Sacco et al. 2014; Sawada et al. 2018).

## Materials

**Motivational Priming** Participants were initially primed with one of three vignettes designed to activate motivational states. Two primes described protagonists in a geriatric hospital (disease condition;  $n = 79$ ) or searching for a lost wallet (control;  $n = 80$ ; White et al. 2013). We developed a third prime to activate exclusionary concerns with a protagonist being ignored at a party ( $n = 80$ ). Whereas previous studies investigating tradeoffs pertaining to affiliative and pathogen-avoidant motives were constrained by having only one motivational prime compared with a control, we designed our third prime to provide an equivocal experience to the other two primes, albeit with the intent of activating another motivational state. Participants responded to three items assessing pathogen concern and three items assessing exclusion concerns as manipulation check, as well as four items assessing affiliative interest as internal replication of previous findings ( $\alpha s > 0.77$ ). Items operated along 7-point scales (1 = Strongly Disagree; 7 = Strongly Agree) (Table 1).

**Extraverted/Introverted Faces** Participants indicated preferences among face pairs manipulated to communicate extraversion and introversion (Brown and Sacco 2016). We specifically tasked participants with considering these faces in a general affiliative context, with these faces not having any connection to the content of the priming scenario. Faces were 40 morphed individuals comprised of unique Caucasian identities (20 male, 20 female) with neutral expressions who appeared between 18 and 40 years old from various face databases. The unique identities were morphed with extraverted and introverted composite face prototypes comprised of 10 individuals reporting high or low levels of extraversion of either sex (Holtzman 2011). Unique identities were morphed with matched-sex prototypes for extraversion and introversion for 50%/50% blends of faces, which resulted in a high- and low-extraversion variations of each unique identity (see Fig. 1 for example faces).

Targets were presented in random, counterbalanced orders in pairs, with participants selecting preferred faces in each pair in a self-paced task. We coded extraversion preferences as “1” and introversion “0,” with higher values reflecting greater extraversion preferences. We calculated relative extraversion preferences by summing the frequency of extraverted target selection and dividing it by the total number of trials, separately for male and female targets. No interactive effects emerged for Target Sex, so preferences were collapsed across both sexes.

**Connect** We assessed interest in a fictitious student service called Connect that afforded the opportunity to make new friends at the university and organize student events (Maner et al. 2007). Participants indicated their interest in using Connect using 10 items (1 = Strongly Disagree; 12 = Strongly Agree;  $\alpha = 0.96$ ).

Consenting participants were placed in individual lab cubicles and randomly assigned to one of three conditions before indicating their extraversion preferences and then interest in Connect. Finally, and consistent with previous research investigating face preferences following motivational primes (Bernstein et al. 2010; Brown and Sacco 2016; Brown et al. 2019; Sacco et al. 2014; Young et al. 2011), participants provided demographics information and were debriefed.

## Results

### Preliminary Analyses

**Manipulation Check** We submitted data to one-way ANOVAs; we utilized LSD tests for post hoc analyses unless we violated in assumptions of homogeneity, for which we used Games-Howell tests. A significant main effect emerged for disease concerns ( $F(2, 236) = 102.31, p < 0.001, \eta_p^2 = 0.46$ ). Games-Howell tests indicated disease-primed participants were most

**Table 1** Example excerpts from the three primes

Condition	Excerpt
Disease	You are asked to change the bandages on an elderly patient with a distended swelling on the upper thigh. As you remove the bandage, you are shocked to see a large open sore. You involuntarily pull your head back from the putrid stench and sight of puss.
Exclusion	You are starting to get the sense that no one at the party is interested in including you in any activities. You walk into another room and see some people watching a movie. You see that there is a chair open and you ask if you can have a seat and watch the movie with them. They hesitate but eventually one of them says it's okay.
Control	As you go to get your keys and wallet from the counter, you only find your keys. The wallet is nowhere in sight. Thinking that it's a little awkward, you feel your pockets. No wallet in there either. You try to think back to where you last saw the wallet, but you cannot exactly remember.

**Fig. 1** Example target male and female faces connoting high (left) and low (right) levels of extraversion



concern ( $M = 4.72$ ,  $SD = 1.45$ ), followed by exclusion-primed participants ( $M = 2.62$ ,  $SD = 1.17$ ), and then control participants ( $M = 2.06$ ,  $SD = 1.04$ ); all were significantly different from each other ( $ps < 0.01$ ,  $ds > 0.50$ ). Another significant main effect emerged for exclusion concerns ( $F(2, 236) = 618.43$ ,  $p < 0.01$ ,  $\eta_p^2 = 0.84$ ). Games-Howell tests indicated that exclusion-primed participants were most concerned ( $M = 6.65$ ,  $SD = 0.63$ ), followed by disease-primed ( $M = 2.45$ ,  $SD = 1.21$ ), and then control-primed ( $M = 1.65$ ,  $SD = 0.96$ ); all were significantly different from each other ( $ps < 0.01$ ,  $ds > 0.73$ ).

Responses to both concerns were significantly greater in the motivational conditions than the control condition. Although unexpected, perhaps the motive-primers were more highly arousing in general than the control-primers, leading to somewhat broad effects. Most importantly, we found that affiliation and disease primes preferentially activated the targeted states, with the differences between the primed and non-primed motive being larger than differences between the non-primed motive and control condition.

We conducted subsequent one-sample  $t$  tests weighted against a mean of 4 to determine participants' categorical disease and exclusion concerns. Disease-primed participants were categorically concerned about disease ( $t(78) = 4.40$ ,  $p < 0.01$ ,  $d = 0.76$ ); exclusion-primed and control participants were not ( $|ts| > 10.46$ ,  $ps < 0.01$ ). Conversely, exclusion-primed participants were categorically concerned about exclusion ( $t(79) = 37.65$ ,  $p < 0.01$ ,  $d = 0.76$ ); disease-primed and control participants were not ( $|ts| > 11.30$ ,  $ps < 0.01$ ). Thus, primes categorically activated condition-relevant concerns but not condition-irrelevant concerns.

**Extraversion Preferences** Like previous research (e.g., Brown and Sacco 2016, 2017; Sacco and Brown 2018b), one-sample  $t$  test weighted against 0.50 (i.e., no preference) for overall preferences for extraverted faces found participants preferred extraverted faces to introverted ( $M = 0.55$ ,  $SD = 0.11$ ;  $t(238) = 7.07$ ,  $p < 0.01$ ,  $d = 0.43$ ).<sup>1</sup>

### Primary Analyses

A significant main effect emerged for affiliative desire ( $F(2, 236) = 37.55$ ,  $p < 0.01$ ,  $\eta_p^2 = 0.24$ ). LSD tests revealed exclusion-primed participants were more interested in affiliation ( $M = 5.70$ ,  $SD = 1.19$ ) than disease-primed ( $M = 4.00$ ,  $SD = 1.47$ ) and control participants ( $M = 4.27$ ,  $SD = 1.31$ ) ( $ps < 0.01$ ,  $ds > 1.14$ ); disease and control conditions did not differ ( $p = 0.20$ ,  $d = 0.19$ ).

Main effects did not emerge for interest in Connect or preference for facial extraversion ( $Fs < 1.24$ ,  $ps > 0.29$ ). However, given the association between affiliative interest and preferences for extraverted faces (Brown and Sacco 2017), we found it prudent to correlate affiliative interest with both preferences for extraverted faces and interest in Connect. Consistent with previous research, affiliative interest positively correlated with both interest in Connect ( $r = 0.15$ ,  $p = 0.02$ ), and preferences for facially communicated extraversion ( $r = 0.16$ ,  $p = 0.01$ ).

<sup>1</sup> Individually analyzing preferences for male and female faces indicated participants preferred extraverted female faces ( $M = 0.60$ ,  $SD = 0.14$ ;  $t(238) = 11.75$ ,  $p < 0.001$ ,  $d = 0.43$ ), but not extraverted male faces ( $M = 0.49$ ,  $SD = 0.14$ ;  $t(238) = -0.49$ ,  $p = 0.626$ ,  $d = 0.09$ ).

Exclusionary experiences heightened affiliative desires. This heightened affiliative desire further heightened interest in both engaging in affiliative behavior and conspecifics compared with those in the pathogen-avoidant and control conditions. Given, the sequential nature of these associations, affiliative desire may serve as a mechanism in selecting similarly affiliative others (Bernstein et al. 2010). This could suggest an indirect effect of social exclusion on both extraversion preferences and Connect interest.

Given recent findings indicating that motive-relevant approach/avoidance tendencies indirectly affect interpersonal decisions following the activation of a fundamental social motive (Brown et al. 2017; Keefer et al. *in press*), we found it necessary to consider potential mediational pathways. The lack of difference between the disease and control condition for affiliative desire prompts us to collapse across both conditions, which we subsequently compared with responses with the exclusion condition. We made this analytic decision for two reasons. First, it appeared that affiliative motives were the mechanism eliciting extraversion preferences and Connect interest. With only exclusion-primed participants having their exclusion concerns categorically activated (i.e., significantly above the midpoint), it was necessary to compare those whose motives were activated versus those whose motives were not. Second, we sought to minimize the number of omnibus tests conducted for both outcomes, which would inflate the Type I Error rate.<sup>2</sup> We conducted two separate mediation models using Model 4 of PROCESS with 5000 bootstraps and 95% confidence intervals (Hayes 2013) with affiliative desire as the proposed mediator and extraversion preference and Connect interest as outcomes for their respective models.

Unsurprisingly, given the null findings in the previous analyses, no direct effects emerged for exclusion predicting heightened extraversion preferences ( $b < 0.01$ ,  $SE = 0.01$ ,  $p = 0.72$ ), or Connect interest ( $b = 0.17$ ,  $SE = 0.42$ ,  $p = 0.68$ ). However, consistent with recent arguments favoring testing for indirect effects in the absence of direct effects, particularly in a specific temporal sequence (Kline 2015; Rucker et al. 2011), we additionally considered the indirect path of affiliative desire toward both outcomes. Specifically, affiliative desire was higher for exclusion-primed participants more than the other two conditions ( $b = 1.56$ ,  $SE = 0.18$ ,  $p < 0.01$ ). Affiliative desire significantly predicted both Connect interest ( $b = 0.30$ ,  $SE = 0.13$ ,  $p = 0.02$ ), and extraversion preferences ( $b = 0.011$ ,  $SE = 0.01$ ,  $p = 0.04$ ). A test of the indirect effects indicated that affiliative desire mediated the association between exclusion with both extraversion

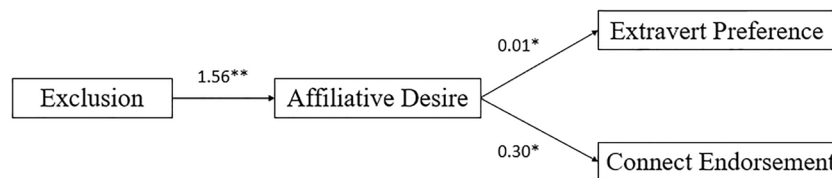
preferences, 95% CI [0.002, 0.034] and interest in Connect, 95% CI [0.016, 0.906]. Figure 2 provides a simplified model of both analyses. Taken together, effects suggest the basis of social exclusion's heightening of interpersonal preferences for sociable others is affiliative desire.

## Discussion

Do preferences for extraverted facial features invoke a tradeoff based on the salience of affiliative and pathogen-avoidant motives? Although hypotheses derived from previous research were not fully supported, mediation analyses indirectly found partial support. This partial support appeared as a tradeoff in emphasizing affiliative benefits over potential pathogenic costs. Specifically, affiliative desire mediated associations between exclusionary experiences and both interest in Connect and upregulated preferences for extraversion. This aligned with previous work investigating how exclusion upregulates interest in affiliative opportunities and identifying motivational mechanisms that facilitate identification of affiliative others (Bernstein et al. 2010; Brown et al. 2019). Findings contribute to extant literature demonstrating the importance of identifying affiliative opportunities following exclusion. Preferences may reflect pervasiveness of affiliative motives in shaping interpersonal preferences; participants could be more sensitive to extraversion's benefits than costs (Pollet et al. 2011).

Conversely, no downregulation in affiliative motives or face preferences emerged among disease-primed participants. A lack of effect could suggest extraversion preferences as not fully hydraulic, or completely subject to the push and pull of competing motives, when only exclusion-primed participants appeared to engage in the tradeoff. This finding nonetheless remains consistent with previous research demonstrating only chronic pathogen-avoidant motives downregulate preferences for extraversion, implying states of pathogen avoidance may not be as impactful in influencing extraversion preferences (Brown and Sacco 2016). Alternatively, the lack of affiliative downregulation in the disease-avoidance condition may encourage consideration of other primes, which could be apparent by the categorical activation of disease concern among disease-primed participants being magnitudinally stronger than for exclusion concern among exclusion-primed participants. Future research could implement especially effective disease manipulations, namely immersive discussions about illness (Murray et al. 2019). To equate manipulations designed to activate disease-avoidance and affiliation motives, a primary concern of the current research, a similarly immersive discussion about an exclusionary experience could also be used. Doing so could provide opportunities to elicit tradeoffs with corresponding up- and downregulations in affiliative interests.

<sup>2</sup> We conducted 4 additional mediation analyses in which we compared the exclusion condition with the other two conditions directly. Results from those analyses indicated the effects were most apparent when comparing disease-primed and exclusion-primed participants directly, although the comparison of exclusion and control conditions was descriptively in the same direction. Results from these analyses are available via the OSF link.



**Fig. 2** Mediation pathways for extraverted face preferences and endorsement of Connect with unstandardized coefficients. Note:  $*p < 0.05$ ,  $**p < 0.01$ . Note: This is a simplified representation of the indirect effects for both outcome variables, which were analyzed separately

## Limitations and Future Directions

One reason for disease-primed participants' lack of downregulation of extraversion preferences could have been overall valuation of benefits of extraversion over costs, with social exclusion being an especially aversive experience. Although facial asymmetry is especially aversive during disease salience (Ainsworth and Maner *in press*; Young et al. 2011), asymmetry may not provide similar social benefits as would extraversion, potentially explaining disparate findings. Extraverted faces have structural features resembling happiness and youth, which are positively valenced and appetitive qualities (Kramer and Ward 2010; Naumann et al. 2009). Thus, these targets likely seem like relatively preferable even when disease threats loom large. Consequently, they provide a very stringent test of our motivational tradeoff hypothesis and future research could consider other facially communicated traits. Along with extraversion, disease salience downregulates agreeableness, a socially desirable trait itself (Mortensen et al. 2010). Studies could utilize similar competing motives paradigms to identify adaptive up- and downregulations for agreeable faces (Sacco and Brown 2018b).

Another limitation of the current study is its lack of consideration for individual differences in affiliative and pathogen-avoidant motives. Although perceived vulnerability to disease was previously found only to predict extraversion preferences independent of disease salience (Brown and Sacco 2016), it could be possible that pathogen-avoidant motives mute the up-regulated affiliative motives following an exclusionary experience (see Sacco et al. 2014). Indeed, chronic pathogen-avoidant motives negatively correlate with affiliative motives (Neel et al. 2016). This suggests that pathogen-avoidant individuals would be less concerned about seeking affiliation following an exclusionary experience. Conversely, individual differences in affiliative motives could similarly influence reaffiliation measures from participants, given the association between need to belong and extraversion preferences (Brown and Sacco 2017). Indeed, highly affiliative individuals are especially distressed following an exclusionary experience, both psychologically and physiologically (Beekman et al. 2016), which could provide a catalyst to seek affiliation with sociable conspecifics.

One potential explanation for the lack of effects for disease-primed participants could pertain to sex differences in baseline levels of pathogen-avoidant motives. Specifically, women report greater levels of disgust than do men across myriad

domains, which could be an adaptive response to their greater vulnerability to sexually transmitted infections (e.g., Al-Shawaf et al. 2015; Centers for Disease Control and Prevention 2008; Tybur et al. 2009). As the majority of our sample was female, we may not have had the variability necessary to consider how disease salience influences interpersonal preferences for men. It could be possible that women are less affected by disease primes because of an already heightened aversion (Al-Shawaf et al. 2018). Future research would benefit from having an optimally powered sample of men to ensure the ability to consider sex differences.

## Conclusion

Despite providing mixed evidence for shifts based on competing motives, the current study provided sensible evidence for the activation of affiliative motives in shaping interpersonal preferences and behaviors. Results identified a possible mechanistic basis for extraversion preferences following social exclusion. Considerations of mechanisms ultimately provide a litany of directions for future research in motivational tradeoffs and adaptive face perception.

**Data Availability** Data and materials are available at <https://doi.org/10.17605/OSF.IO/35YNH>.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that there are no conflicts of interest.

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