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**THE SMELL OF PREJUDICE.
DISGUST, SENSE OF SMELL AND SOCIAL ATTITUDES.
AN EVOLUTIONARY PERSPECTIVE**

Evolutionary psychology represents a meta-theoretical approach that posits that some behaviors evolved under selective pressure and encompasses several psychology branches (Buss, 2005). The current pandemic situation reminds us that throughout history, we have evolved through an often-invisible threat that can pose a serious pressure to our evolution (Seitz et al., 2020): pathogen threat. The so-called Behavioral Immune System framework (BIS; Schaller & Park, 2011) offers an evolutionary account (Ketelaar, 2015) of a set of psychological functions to detect, emotionally react, and avoid pathogen threats. Interestingly, these behavioral responses to pathogen threats can also be observed in animals other than humans (Townsend et al., 2020). However, the responses seem to span from decreased sociality (e.g., lobsters, bats) to increased sociality characterized by affiliative interactions that promote recovery. Evolutionary psychology can help shed light on the cognitive, affective, and behavioral repertoire we evolved to defend ourselves from pathogens (Seitz et al., 2020). However, it is unclear whether this repertoire is well suited to face the current pandemic situation (Ackerman, Tybur, and Blackwell, 2020).

Within the BIS, the core emotion of disgust plays a pivotal role in triggering the appropriate avoidance behavior. Ekman and colleagues' Seminal research describes disgust as a universal emotion, characterized by a specific facial muscle activation pattern (Ekman, 1992, but see Barrett, 2017 for a constructionist view that challenges the universalistic stance). The facial expression of disgust seems to serve the function of expelling distasteful food (Darwin, 1872) and minimize air inflow (Susskind et al., 2008). This observation prompted many scholars to contend that disgust is probably an emotion that

evolved to avoid poisonous substances (Rozin and Fallon, 1987) and/or contaminants (Oaten, Stevenson and Case, 2009). In an elegant study, Valerie Curtis, Robert Anger, and Tamer Rabie (2004) showed that physically similar stimuli differed in self-reported evoked disgust. For instance, participants rated a towel with the stain depicted in reddish yellow to represent blood and bodily secretions, twice as disgusting as the same white towel with a blue color. The BIS activation varies across individuals (Tybur et al., 2011) and cultures (Gelfand et al., 2011; Tybur et al., 2016). However, even though BIS related norms and personality differences across countries seem to be related to parasite stress (Tybur et al., 2016), cross-national variability in parasite stress does not seem to covary to country-wise levels of disgust sensitivity (Thornhill, Fincher, Murray and Schaller, 2010; Tybur et al., 2016), disgust sensitivity does not seem to vary across countries as a function of parasite stress (Tybur et al., 2016). Moreover, it is not clear what motivates interindividual variability in disgust sensitivity (Tybur et al., 2018). However, recent studies suggest a negative relationship between disgust sensitivity and pathogen exposure (Cepon-Robins et al., 2021), thus corroborating the idea that disgust evolved as a disease avoidance mechanism.

Curtis and Biran (2001) identified some disgust elicitors that seem universal, including body odors. Body odors are relevant in regulating human interactions (Low 2006) and, at the same time, are particularly salient disgust cues. Olsson and colleagues (2014) found that several humans may even use body odor cues to detect disease signs and regulate social behaviors accordingly (Olsson et al., 2014). Related to this, some scholars are investigating in the possible clinical use of electronic noses to diagnose infectious diseases and through analysis of volatile organic compounds the body and its products (Shirasu and Touhara, 2011).

Olfaction might provide a key signaling system for avoiding pathogens, as it is widely acknowledged that a principal function of olfaction is to detect pathogen threats (Bulsing et al., 2009). Indeed, olfactory sensations might uniquely detect potential microbial threats before they reach our body (Stevenson 2010), in addition to many kinds of potential harms (Santos, Reiter, DiNardo & Costanzo, 2004). Patients with olfactory disorders are very likely to eat spoiled food at least once in their life (Temmel et al., 2002). Moreover, these patients

often show personal hygiene issues due to their inability to perceive their own smell (Temmel et al., 2002). Alaoui-Ismaïli and colleagues have shown that disgust is the primary emotional response to unpleasant odors (Alaoui-Ismaïli, Robin, Rada, Dittmar, & Vernet-Maury, 1997; Alaoui-Ismaïli, Vernet-Maury, Dittmar, Delhomme, & Chanel, 1997), and unpleasant odors are the easiest to memorize. Furthermore, odor-evoked disgust is less permeable to top-down influences (Ferdenzi et al., 2013) and harder to suppress than disgust evoked by visual stimuli (Adolph & Pause, 2012), testifying to the power of olfaction.

Despite this evidence on the primary role of the sense of smell in pathogen avoidance, olfactory disgust has played a minor role in previous assessments of disgust sensitivity, such as the Disgust Scale-Revisited (DS-R, Olatunji, et al. 2007), the Three Domains of Disgust (Tybur et al. 2009) and Questionnaire for the Assessment of Disgust Proneness (QADP, Schienle, et al. 2002), with the number of olfactory-related items ranging between 5% and 16%. To fill this gap, our team has developed a body odor disgust sensitivity scale (BODS, Liuzza et al., 2017a), in which participants were presented with olfactory disgust inducing scenarios (e.g., “You are standing next to a stranger and notice that the t-shirt they are wearing smells strongly from their sweat.”). Participants had to rate how much disgusting they would find each scenario on a Likert-type response format ranging from 1 (“Not disgusting at all”) to 5 (“Extremely disgusting”). We administered the BODS to 528 participants in three studies, and we reduced the scale to 12 items that describe scenarios involving six different body odors (sweat, breath, feet, gas, urine, feces). The BODS subscales showed convergent validity with other general disgust scales, as well as with other olfactory function measures and with aspects of personality that are related to pathogen avoidance. Also, we found (Liuzza et al. 2017a) that, as compared to those other assessments, BODS is more strongly correlated with perceived vulnerability to disease (Duncan et al. 2009). This result supports the notion that body odor perception might play a key role in perceiving disease cues. In another study (Liuzza et al., 2017b), we ascertained that our scale also displayed criterion validity. In fact, we found that, among a pool of ninety-four participants, the ones who reported higher BODS

levels were more disgusted by the real sweat samples that they had to sniff and rate.

Social conformity, namely our natural tendency to change our behavior to match others' responses, seems to be boosted by pathogen threats. In fact, in the face of the high level of uncertainty posed by an invisible threat (such as a pathogen), we are more likely to rely on others' behavior (Murray & Schaller, 2012; Jacquet et al., 2018; Wu & Chang, 2012). Social conformity is a powerful social glue that allows people to coordinate. However, research from developmental psychology suggests that although beneficial in the short term, learning from others may undermine other skills that should be harnessed, such as autonomy and creativity (Bonawitz et al., 2011, Zenasni et al., 2008). Furthermore, people tend to be selective in the way they conform to others. In fact, meta-analytical evidence on the classic paradigms used to study social conformity (e.g., Asch, 1956) has shown that people tend to conform more to people who belong to their in-group (Bond and Smith, 1996), to peers (Proestakis et al., 2018) and to majority groups (Liuzza et al., 2019). Such a selective conformity bias has been at play since childhood. In fact, Yuejiao Li and colleagues (2021) have shown that children from 3 to 11 years old are more likely to try a new food if they watch someone from their in-group (i.e., an adult who fluently speaks their own language), as compared to an outgroup (i.e., an adult speaking with a foreign accent) eagerly eating it. Social conformity seems to be one of the strongest motivators of authoritarianism (Feldman, 2003), a general tendency to submit to established authority and social convention (Adorno, 1956; Altemeyer, 1998). Michal Reifen Tagar and colleagues (2014) conducted a study on forty-three (43) preschoolers and their parents. They found that the children whose parents scored high in authoritarianism and social conformity trusted adults who adhered to a convention (vs. adults who did not) more than did children of parents who scored low in authoritarianism, thus finding a link between conformism, conventionalism, and authoritarianism.

A possible common denominator for both social conformity and authoritarianism is that pathogens pose an invisible threat, which implies a higher level of uncertainty, in the face of which we are more likely to rely on the behavior of others (Murray & Schaller, 2011; Jacquet et al., 2018; Wu & Chang, 2012), especially if they share our cul-

tural norms in terms of pathogen avoidance relevant behaviors (Kärinen et al., 2019). In a situation of pathogen threat, it may make more sense to conform to in-group members, who have been exposed to similar pathogen threats and therefore are either less likely to carry new pathogen threats or to adhere to food preparation norms that are less suited to minimize the pathogen threat in our environment (Wu & Chang, 2012). Moreover, individual differences in the BIS activation have been consistently related to social conservatism measures (see Terizzi Jr. et al., 2013, for robust meta-analytical evidence in this direction), including right-wing-authoritarianism (RWA, Altemeyer, 1998). Our team found that BODS is reliably correlated with RWA (Liuzza et al., 2018, studies 1 and 2), but not with social dominance orientation (SDO, Sidanius and Pratto, 1999), which is another measure of social conservatism that pertains more to the willingness to dominate other groups for competition motives rather than a willingness to avoid or even aggress other groups because they are perceived as a threat (Duckitt, 2001). In a study conducted during the US presidential race of 2016, we also found that the intentions to vote for Donald Trump were correlated with BODS, and this relationship was mediated by RWA, but not SDO (Liuzza et al., 2018, study 3).

People with higher BIS activations tend to react to cues that are only loosely related to pathogen cues. For instance, people who report being more prone to get diseases also report higher stigmatization levels towards obese people (Park, Schaller Crandall, 2007), even though obesity is not related to infection. This over-generalization can lead to many forms of prejudice and discrimination, including xenophobia, defined as a dislike or fear of strangers or foreign people (Faulkner et al., 2004; O'Shea et al., 2020). Within this framework, a possible common denominator for discriminatory attitudes and social conformity is that it may make more sense to conform to in-group members in a pathogen threat situation. This may happen either because ethnic in-group members have been exposed to similar pathogen threats or because they adhere to shared pathogen avoidance habits and behaviors (e.g., food preparation and hygiene norms) suited to minimize the pathogen threat in the environment (Wu & Chang, 2012).

Our team found that BODS is related to both explicit (Zakrzewska et al., 2019) xenophobia. In the first study, we collected data from

a large online sample from the US, which was administered the BODS, and presented with the following scenario (readapted from Faulkner et al., 2004): "Imagine the following scenario: There is a country in Central Africa, which for this study we will refer to as Dhrashnee, that has been experiencing a great deal of civil unrest in recent years. As a result of these conditions, many people from this country are trying to leave. A large number of these refugees are seeking to immigrate to the United States of America." Then, they were asked to rate six items related to the following: (1) their overall attitudes towards Drashneans, (2) how much they agree that Drashneans could bring health-related problems, and (3) criminality into the country if they were allowed to immigrate, and to what degree they perceive Drashneans as similar (or dissimilar) to themselves in terms of (4) food, (5) hygiene, and (6) sanitary practices. We also used a measure of general attitudes towards immigration (Faulkner et al., 2004). We found that xenophobia (responses to items 1 – 3 and to a feeling thermometer to assess their overall attitudes towards the Dhrashneans) was related to BODS. This relationship was partially mediated by general attitudes towards immigration and perceived similarity in hygiene and food preparation. Although correlative and limited in its scope, this finding seems to be in line with the hypothesis that cultural norms, rather than avoidance of "unknown pathogens" that explains the link between individual differences in BIS and xenophobia (Karinen et al., 2019, but see Bressan 2020 for conflicting evidence). A possible limitation of this study is that, despite the large sample size (N = 805), it focuses exclusively on a Western Educated Industrialized Rich Democracy (Heinrich, 2010). We are currently replicating these results on large, demographically representative, and culturally diverse samples globally, including African countries, where the Drashneans should be perceived as similar.

Another limitation of the previous study is that it explicitly assesses xenophobia. In other words, participants were overtly asked to report their feelings towards a fictive immigrant group. However, in many Western societies, overt prejudice is morally sanctioned, and people are often unwilling to report negative attitudes toward ethnic or racial minorities. To circumvent this possible bias caused by social desirability, we (Zakzweska & Liuzza et al., 2020) assessed the relationship between individual differences in BODS and an implicit as-

sociation test (IAT; Greenwald et al., 1998), one of the most widely used implicit measures of stereotypes and prejudice (Greenwald et al., 2009). The IAT is a categorization task in which reaction-time differences between prejudice congruent and prejudice-incongruent trials (divided by participants' variability) provide a standardized measure of bias (D scores). The IAT appears to be a fairly reliable measure of implicit bias toward social outgroups, whether based on race, sexual orientation, gender, or political preference (Nosek et al., 2007). In our study, the IAT was designed to assess implicit preference towards in-group (Swedes) vs. outgroup (Roma people) in a convenience (psychology college students) in Stockholm, Sweden. Moreover, the IAT was administered under three different odor conditions: unpleasant and sweat-like odor (valeric acid), pleasant and soap-like odor (lilac), and a no odor condition (clean cotton pad). Although the experimental manipulation of the odor did not seem to affect the participants' responses, we found solid evidence for a relationship between BODS and xenophobic attitudes. However, this time, the attitudes were measured implicitly.

Some authors argue that moral judgment is also underpinned by the emotion of disgust (Tybur et al., 2009). Even though a violation of social norms (e.g., cheating) does not necessarily pose a pathogen threat, we might have utilized this emotion to avoid social interactions with individuals that pose the cohesion of our society at risk. Therefore, another possible link between disgust sensitivity, and therefore of the BIS, and authoritarianism could be explained by authoritarians' tendency to be more punitive towards the violators of social norms (Altemeyer, 1998). Core – pathogen – disgust and moral disgust seem closely intertwined (Chapman et al., 2009; Vicario et al., 2018) and may share a common neurocognitive system (Vicario et al., 2017). Some support for a causal link between feelings of disgust and moral judgments comes from recent research demonstrating that chemical inhibition of nausea reduces the perceived severity of judgments toward moral violations (Tracy et al., 2019). However, it is not clear whether the involvement of disgust in moral judgment of specific types of moral transgressions or to moral condemnation more generally.

Jesse Graham, Jonathan Haidt, and Brian Nosek (2009) suggested that people's morality rests on five moral foundations: harm-

/care, fairness/reciprocity, in-group/loyalty, authority/respect, and purity/sanctity. Purity violations (violations of norms of decency) evoke disgust (Graham et al., 2011), and high levels of trait disgust are related to an emphasis on this the Purity foundation (van Leeuwen et al., 2017). Moreover, it was recently found that disgust sensitivity relates more strongly to moral condemnation of purity-based transgressions than to moral condemnation of transgressions in any other domains (Wagemans et al., 2018). However, in their literature review on emotions and morality, Cameron et al. (2015) suggest that people experience as much disgust in response to purity transgressions than to harm transgressions. Hence, while some findings indicate that BIS-related emotions play a specific role in transgressions with some ancestral relation with disease-related behaviors (e.g., sexually promiscuous behavior, Tybur et al., 2009), further evidence is needed to clarify this issue. In 2019, our team conducted a pre-registered online study on a large sample (N = 632). We hypothesized that individual differences in BIS-related traits would be associated with greater disgust (vs. anger) reactivity and greater condemnation of Purity (vs. Harm) violations. Participants were asked to rate scenarios concerning moral wrongness or Inappropriateness and regarding disgust and anger. In line with our predictions, we found that scores on the BODS relate more strongly to affective reactions to Purity, as compared to Harm violations. Besides, BODS relates more strongly to Moral condemnation than to perceived Inappropriateness and condemnation of Purity violations compared to Harm violations. These results suggest that the BIS is involved in moral judgment. To some extent, this role seems to be specific for violations of "moral purity," a response that might be rooted in disease avoidance. Therefore, our results support the idea that the link between moral judgment and disgust seems specific for moral violations that are more closely related, at least conceptually, with pathogen threats.

Conclusions

Through the present article, I have briefly reviewed the evidence on the role of the core emotion of disgust and a set of psychological mechanisms that evolved to avoid diseases, the so-called behavioral immune system (BIS). I also emphasized how olfactory-induced disgust, especially in response to body odors, seems to be deeply in-

volved in the BIS. Therefore, the BIS seems to hold a surprising relationship with social and ideological attitudes such as authoritarianism. I reviewed my team's contribution in shedding light on the sensory and social psychological processes that underpin this surprising relationship. It is important to stress that I am not advocating that our social and ideological attitudes are uniquely explained by individual differences in disgust sensitivity and, more in general, in pathogen avoidance. Obviously, the lion's share in the variance of our social and ideological attitudes is played by other factors, for instance, socialization processes, to name the most relevant ones. Nevertheless, although small, the relationship between BIS and authoritarianism can provide valuable insights into the possible evolution of emotion and more complex social behaviors. However, the literature presented in this article is mostly, but not solely, cross-sectional, and future experimental studies are warranted to draw more firm causal inferences on the relationship between disgust and authoritarianism.

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