

RESEARCH ARTICLE

Seeing Others as a Disease: The Impact of Physical (but not Moral) Disgust on Biologization

Roberta Rosa Valtorta*, Cristina Baldissarri*, Luca Andrighetto† and Chiara Volpato*

Through three studies ($N = 306$), we analysed the association between physical disgust and implicit biologization – the perception of others as disease organisms. In doing so, we employed an adapted version of the Semantic Misattribution Procedure (SMP). Study 1 found that the higher was the level of physical (vs. moral) disgust that White participants felt towards Black people, the higher was their implicit tendency to biologize this ethnic group. Study 2 and Study 3 experimentally replicated the association between physical disgust and biologization by manipulating physical disgust through vignettes that portrayed a target behaving in a physically (vs. morally vs. non-disgusting) way. Results showed that participants assigned to the physical disgust condition biologized more the target – both implicitly and explicitly – than participants in the moral disgust and non-disgusting condition.

Overall, these findings shed light on the biological dehumanization of others and its emotional roots, by thus paving the way for its prevention.

Keywords: dehumanization; biologization; disease; physical disgust; Semantic Misattribution Procedure

Biologization is a form of dehumanization that involves the perception of individuals or groups as disease organisms and contagious entities (Savage 2007). This dehumanizing process employs metaphors linked to disease (Douglas 1966; Volpato & Andrighetto 2015) and has been especially examined within conflicting intergroup relations. For example, several theorists (e.g., Douglas 1966; Hirsch & Smith 1988; Sontag 2002) have revealed that biological rhetoric has been widely used in the political domain and in relation to genocidal episodes. More recently, some authors (e.g., McGuire & Canales 2010; O'Brien 2003) argued that linguistic metaphors related to disease are often used to describe the negative impact of immigrants on American society. In the Italian context, several research projects (e.g., ECRI 2016; Volpato et al. 2010) indicated a widespread perception among the Italian population that immigrants and Black people represent a threat to security, to well-being and to the preservation of cultural values. In addition, Valtorta, Signorato, and Volpato (2019), by analysing 179 posters employed by a famous Italian far-right political party during the period 2000–2018, found that some visual images depicted Black and foreign people as carriers of illness and disease organisms. Overall, infection- and disease-related

metaphors play a key role in keeping with the thinking of immigration restrictions and provide a rhetorical means of publicly sharing negative emotions, such as fear and disgust (O'Brien 2003; Utych 2018). Accordingly, Cottrell and Neuberg (2005) demonstrated that specific social groups that are perceived as posing contamination threats (e.g., gay men, African Americans) are directly associated with feelings of disgust. Furthermore, a fundamental role for disgust in other perceptions is supported by research (e.g., Buckels & Trapnell 2013; Harris & Fiske 2006; Hodson & Costello 2007) suggesting that this emotion may be uniquely involved in enabling dehumanized social cognition. For example, through an fMRI investigation, Harris and Fiske (2006) found that when people view members of certain disgust-eliciting outgroups (e.g., the homeless), their brain patterns resemble the brain patterns activated during viewing of non-social objects. This neural evidence supports the prediction that members of specific groups may be perceived as less than human, or dehumanized.

Drawing from these findings, the present research aimed to contribute to the literature on dehumanization by studying the potential link between feelings of disgust and biologization. In particular, as we will discuss below, we expected to find a relationship between feelings of physical (but not moral) disgust and biologization by analysing the implicit facet of this dehumanizing perception. Indeed, as far as we know, no previous research has experimentally investigated the role of physical (vs. moral) disgust in eliciting biologization by employing an indirect method for assessing implicit evaluations, namely an

* University of Milano-Bicocca, IT

† University of Genova, IT

Corresponding author: Roberta Rosa Valtorta
(r.valtorta1@campus.unimib.it)

adapted version of the Semantic Misattribution Procedure (SMP; Imhoff et al. 2011). This approach can be particularly helpful for verifying whether biological dehumanization actually involves unaware and automatic associations between specific human targets and metaphors concerning disease, by also providing evidence for this peculiar form of dehumanization over and beyond the people's social desirability.

Physical Disgust and Biologization

Rozin, Haidt, and McCauley (1999, 2008) analysed the basic emotion of disgust by distinguishing it between its physical and moral facet. More specifically, the authors suggested a cultural evolution of disgust: what originated as 'physical disgust', a rejection response to bad taste and dirt, has evolved into a much more abstract emotion, defined as 'moral disgust', which functions to protect the social order. In line with this conceptualization, a related framing of disgust conceives it as the emotion that protects both the bodily self and the social self against actual pathogens present in the environment (Curtis, Aunger & Rabie 2004; Curtis & Biran 2001; Fessler & Haley 2006; Fessler & Navarrete 2003; Miller 2004; Wronska 1990) and symbolic pollution presents in the social world (Haidt, McCauley & Rozin 1994; Haidt et al. 1997). In this respect, some researchers (e.g., Inbar, Pizarro & Bloom 2012; Schnall et al. 2008) have reasoned that moral disgust represents an extension of an adaptive reflex: just as feelings of disgust encourage withdrawal from substances and objects that are dangerous to the body, they similarly encourage withdrawal from humans whose behaviour signals danger to the group.

Numerous studies about feelings of disgust have demonstrated a key role for this emotion in dehumanizing representations of others (e.g., Harris & Fiske 2006; Hodson & Costello 2007). Buckels and Trapnell (2013), through a modified version of the Implicit Association Test (IAT; Greenwald, Nosek & Banaji 2003) and a minimal groups paradigm, found that all participants demonstrated a dehumanizing perception whereby outgroup members were more strongly associated with non-human entities than were ingroup members. Crucially, feelings of disgust significantly potentiated this dangerous cognitive bias. Furthermore, Dalsklev and Rønningsdalen Kunst (2015) experimentally tested the relationship between feelings of disgust, elicited through negative media portrayals, and dehumanizing perceptions of Roma, by showing that disgust led to higher degrees of dehumanization and support of deportation. Stevenson, Malik, Totton, and Reeves (2015) explored the relationship between feelings of disgust and attitudes towards juvenile sex offenders and found that as disgust sensitivity increased, participants were more likely to dehumanize the offenders and experience diminished empathy.

Although these results contributed significantly to research on dehumanization and correspond to other findings on disgust and dehumanization (see Schaller & Neuberg 2012), whether different perceptions in terms of physical and moral disgust play a relevant role in specific dehumanizing representations remains an open question.

To address this gap, the present research aimed to experimentally investigate the relationship between feelings of physical (but not moral) disgust and biological dehumanization. Literature on disgust and dehumanization (e.g., Case, Repacholi & Stevenson 2006; Cottrell & Neuberg 2005; Curtis, Aunger & Rabie 2004; Volpato & Andrighetto 2015), suggests indeed that both physical disgust and biologization are triggered by categories of people who are more likely to carry pathogens, which pose a more acute threat to well-being or who are stereotypically associated with specific types of infectious disease. Furthermore, as conceptualized by Curtis and colleagues (2004), unlike moral disgust, but similar to biologization, physical disgust communicates a potentially dangerous situation and makes health concerns salient. Therefore, it is plausible to think that eliciting the physical facet of this basic emotion may involve a dehumanizing process that links the source of disgust to the concept of disease. This assumption is also backed up by first preliminary evidence provided by Valtorta and Volpato (2018) about the specificity of the relationship between physical disgust and biologization. Through a minimal group procedure, the authors found that emphasizing feelings of physical disgust towards outgroup members, as opposed to feelings of moral disgust, promoted an increased explicit association between biological metaphors and outgroup (vs. ingroup) members. Crucially, this peculiar effect did not emerge for other forms of dehumanization, such as the animalistic one, which instead occurred when feelings of moral (vs. physical) disgust were made salient. Starting from these findings, here we systematically investigated the link between physical disgust and biologization among real intergroup (Study 1) and interpersonal (Study 2 and Study 3) settings and, more importantly, by also studying the implicit facet of this association. In particular, unlike previous empirical works that examined biologization by employing explicit measures (Valtorta et al. 2019a; Valtorta & Volpato 2018), here we explored this phenomenon through an adapted version of the SMP (Imhoff et al. 2011). As described below, this implicit method allowed us to verify whether the tendency to associate others with biological metaphors also persists in terms of automatic associations in memory.

Semantic Misattribution Procedure

The SMP (Imhoff et al. 2011) is a variant of the Affect Misattribution Procedure (AMP; Payne et al. 2005), an indirect method for assessing implicit evaluations. In the AMP, participants are instructed to rate the pleasantness of Chinese ideographs that are briefly displayed and then masked. The evaluation of the ideographs is influenced by the valence of the preceding primes: positive primes elicit more positive and negative primes more negative evaluations. In contrast to the standard AMP, in the SMP, participants do not rate the pleasantness of the ideograph but guess the meaning of the ideograph. This technique uses the theoretically more straightforward structure of sequential priming; thus, the effects of the SMP are the result of a general misattribution mechanism that operates on semantic concepts (Loersch & Payne 2011). According to this account, the prime stimuli alter the

mental state of the perceiver (i.e., accessibility of semantic concepts), which may be mistakenly attributed to internal thought processes rather than the primes. As a consequence, the information implied by the mental state may be unconsciously used as a basis for judgments about the ambiguous target stimuli (Oikawa, Aarts & Oikawa 2011; Vezzoli & Zogmaister 2016). Therefore, the evaluations of the primes are expressed in a not explicit way, because the primes are irrelevant for task performance, and subjects evaluate the primes without any task-related need to do so. In other words, similarly to the AMP, the SMP is regarded as an implicit measure by virtue of the automatic and unintended effects of primes on responses (Payne & Lundberg 2014).

As reported by Imhoff and colleagues (2011), the SMP was found to be a reliable and valid measure for assessing a wider range of semantically defined concepts beyond the domain of attitudes. The only implicit measure combining good psychometric properties and applicability to a large variety of constructs was the Implicit Association Test (IAT; Greenwald et al. 2003), a double discrimination task in which participants are asked to assign single stimuli to a given pair of target categories. However, contrary to the IAT, the SMP is not restricted to two target categories and their association with one attribute dimension. For example, in Imhoff et al. (2011, Study 1), by adopting the SMP as an indirect measure of sexual interest, participants were instructed to guess the meaning of the Chinese ideographs (sexual meaning vs. non-sexual meaning) by using as prime stimuli images of male and female individuals belonging to five categories of sexual maturation either in bathing suits or nude. Therefore, different prime categories (i.e., target sexual maturation, target sex, and nudity) produced a meaningful pattern of distinct priming effects.

In the context of studies on dehumanization, the SMP has been used by Imhoff (2010) to assess animalistic dehumanization of Germans and Roma. In particular, participants were instructed to guess whether Chinese ideographs had a meaning related to the human sphere (e.g., house) or related to the animal kingdom (e.g., nest). The ideographs were preceded by pictures of Germans or Roma. Results showed evidence that ideographs were rated as having a meaning related to animals after pictures of Roma compared to Germans. In other words, the expected dehumanization of a disadvantaged group was reflected in a higher frequency of guessing that the ideograph stood for a concept from the animal kingdom.

In the present studies, we adapted the SMP to get a measure of implicit biologization. More specifically, participants were asked whether Chinese ideographs had a meaning related to the concept of disease (i.e., the core dimension defining biologization) or related to other contrasting categories. Furthermore, as we previously reported, we expected to find a relationship between feelings of physical (but not moral) disgust and our SMP measure.

Overview of the Studies

Our main assumption was tested in three studies, in which biological dehumanization was measured by using an adapted version of the SMP (Imhoff et al. 2011). In Study 1,

we examined the relationship between feelings of physical disgust and implicit biologization in an intergroup context, by considering 'well-being' as the contrasting category in the SMP and Black people as the outgroup target. Through this study, we wanted to test whether the SMP could produce the effect of greater frequency of guessing 'disease' after pictures of Black people than pictures of White people. Most importantly, we expected to find an association between feelings of physical (but not moral) disgust towards Black people targets and implicit biologization.

Study 2 was designed to experimentally verify the association between physical (vs. moral) disgust and biologization and to confirm the pervasiveness of this link in an interpersonal context. To do so, we manipulated disgust experiences through vignettes that portrayed a target behaving in a physically (vs. morally vs. non-disgusting) way. Then, participants were asked to complete the SMP. In Study 3 we improved our biologization SMP measure by using 'earthquake' as the contrasting category instead of 'well-being'. Through this study, we aimed to demonstrate that the indirect procedure adopted in the previous studies indeed measured biological dehumanization and not just the implicit negative attitude towards the targets.

Study 1

In this study, we assessed the relationship between feelings of physical disgust and implicit biologization by considering Black people as the outgroup target. We elected to focus on this ethnic group because, as mentioned before, in our research context (i.e., Italy), biological dehumanization is often implicitly or explicitly used to portray this minority group (e.g., Valtorta et al. 2019a; Volpato et al. 2010). For this reason, we wanted to test whether the SMP could produce the effect of greater frequency of guessing 'disease' after pictures of Black people than pictures of White people. Furthermore, in order to establish the validity of our biologization SMP measure, we included words related to the concept of disease as additional primes (for a similar procedure, see Imhoff 2010; Payne et al. 2005). Thus, we supposed that participants would guess a disease-related meaning more often following primes characterized by words related to disease than either of the two human categories. Crucially, we expected to find a relationship between feelings of physical (but not moral) disgust and implicit biologization – operationalized as the mean frequency of guessing a disease-related meaning after pictures of Black people.

Method

Participants and experimental design

Ninety (50 females) Italian undergraduates participated in the study in exchange for partial course credits. Participants' ages ranged from 18 to 44 years ($M = 23.37$, $SD = 3.26$). A within-subjects design was used in which all participants completed the SMP. A sensitivity analysis conducted with G*Power (Faul et al. 2007) showed that our sample was sufficient to detect small-to-medium effects of $f = 0.21$, assuming an α of 0.05, and power of 0.95 for a within-participants ANOVA (observed correlation among repeated measures, $r = 0.38$).

Procedure and measures

Participants were seated in front of a computer and were initially informed that the study was about impression formation. All of the participants completed the SMP and a self-report measure to evaluate feelings of physical disgust and moral disgust. As a final task, participants were asked to provide demographic information, thanked, and fully debriefed.

Semantic Misattribution Procedure

Participants were instructed to intuitively guess whether a Chinese ideograph had a meaning related to disease or one related to well-being without allowing the primes to bias their decisions. In particular, participants were informed that we were interested in how well they could tell by intuition what the ideograph stood for. Following the procedure reported in Payne et al. (2005), participants were further warned that the ideographs were preceded by images and words and that they should try their absolute best not to let the stimuli bias their intuition about the meaning of the ideographs (see **Figure 1**).

The primes were randomly presented for 75 ms, followed by a blank screen for 125 ms, and the Chinese ideographs for 750 ms (Vezzoli & Zogmaister 2016). Then a monochromatic noise mask was presented on the screen until participants completed their ratings by pressing either the left response key ('disease') or the right response key ('well-being'). The SMP consisted of 144 trials out of which 48 trials for each category (words related to the concepts of disease, Black people, White people), followed by 144 randomly chosen Chinese ideographs taken from the original set used in Payne et al. (2005). The Black and White people stimuli were 24 pictures (12 pictures of Black people and 12 pictures of White people, half males and half females for each group) selected from *Face Place*, a face database that includes multiple

images for over 200 individuals of many different nationalities (Righi, Peissig & Tarr 2012).¹ The 12 words related to the concept of disease (i.e., *disease, contagion, virus, contamination, filth, germ, plague, illness, microbe, bacterium, bacillus, pestilence*) were instead selected from the literature concerning dirtiness and biologization (e.g., Douglas 1966; Savage 2007; Speltini & Passini 2014; Steuter & Wills 2010; Tipler & Ruscher 2014; Valtorta & Volpato 2018).

We tested the SMP's reliability by estimating its internal consistency. Specifically, we calculated a single score of biological dehumanization by subtracting the SMP score of the trials with White people primes from the SMP score of the trials with Black people primes. Thus, higher scores on this index reflect higher levels of biologization towards Black individuals. The internal consistency of this score was estimated by splitting the procedure into thirds and calculating three scores of biological dehumanization that were treated as individual 'items' (for a similar procedure, see Payne et al. 2005; Ye & Gawronski 2018). Each of these scores was calculated using 48 different trials. The SMP score of biological dehumanization showed excellent internal consistency with Cronbach's $\alpha = 0.93$.

Feelings of disgust

Perceptions of physical and moral disgust towards the target (i.e., Black people) were identified using two physical disgust-related words (*nausea, revulsion*, $r = 0.73$, $p < 0.001$) and two moral disgust-related words (*contempt, scorn*, $r = 0.49$, $p < 0.001$). In particular, participants were asked to rate the extent to which they felt physical and moral disgust towards the target by answering, on a 7-point Likert scale (1 = *not at all*; 7 = *extremely*), the following question: "How much do you feel [nausea] towards Black people?"

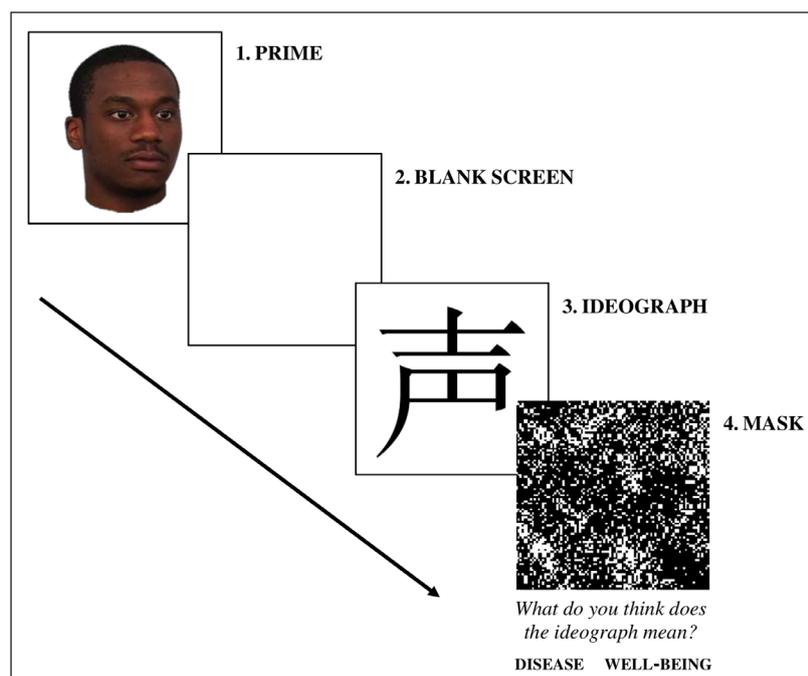


Figure 1: Study 1: Schematic representation of the SMP.

Results and discussion

Semantic Misattribution Procedure

We performed a repeated measures ANOVA (type of prime: disease-related words, Black people pictures, White people pictures) on the frequency of guessing a disease-related meaning. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 9.71, p = 0.008$; therefore, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\epsilon = 0.92$). The results showed a main effect of prime, $F(1.85, 164.32) = 67.30, p < 0.001, \eta_p^2 = 0.43$, indicating that participants guessed a disease-related meaning significantly more often following primes characterized by words related to disease ($M = 34.91, SD = 11.10$) than either of the two human categories ($M = 22.29, SD = 13.22, p < 0.001, d = 1.03$ for Black people pictures; $M = 16.51, SD = 9.37, p < 0.001, d = 1.79$ for White people pictures). More central to the question of biologization, Black people pictures evoked more disease responses than White people pictures, $p < 0.001, d = 0.50$ (see **Figure 2**).

Feelings of disgust and implicit biologization

A preliminary inspection of the correlation matrix revealed that the implicit biologization score – considered as the mean frequency of guessing a disease-related meaning after Black people pictures – positively correlated with physical disgust ($r = 0.29, p = 0.006$) and did not result as directly associated with feelings of moral disgust ($r = 0.18, p = 0.090$).

Then a multiple regression analysis was conducted to examine whether physical (but not moral) disgust was a statistically significant predictor of implicit biologization. Thus, we regressed standardized scores of biologization onto standardized scores of feelings of physical and moral disgust. As seen in **Table 1**, R (for regression) was significantly different from zero, $F(2,87) = 3.96, p = 0.023$. Importantly, physical disgust contributed significantly to the prediction of biologization ($p = 0.030$), as indicated by the unique variance and relative weight displayed in **Table 1**. In contrast, as supposed, moral disgust did not predict biological dehumanization ($p = 0.755$).

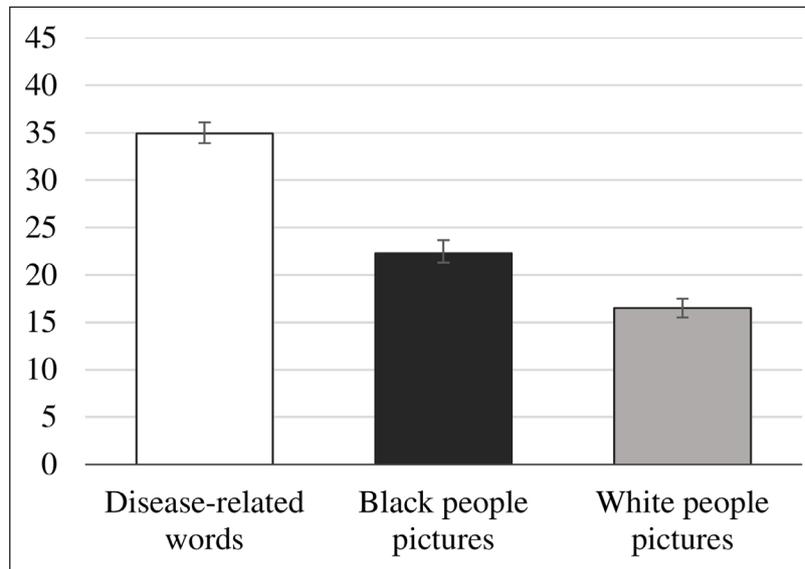


Figure 2: Study 1: Frequency of guessing a disease-related meaning of the Chinese ideograph as a function of the preceding prime category (disease-related words, Black people pictures, White people pictures).

Table 1: Study 1: Standard multiple regression statistics for the dependent variable implicit biologization, with independent variables physical and moral disgust.

	B	t	95% Confidence Interval		sr ² (%)	RW (%)
			Lower	Upper		
Physical disgust	0.27	2.21	0.03	0.51	5.11	6.7
Moral disgust	0.04	0.31	-0.20	0.28	0.10	1.7
R	0.29*					
R ²	0.08					
Adjusted R ²	0.06					
F	3.96*					

Note: Unique variability = 5%; shared variability = 3%. RW = relative weights. sr² = unique variance in implicit biologization accounted for uniquely by each independent variable.

* $p \leq .05$.

Study 1 provided the first evidence of implicit biologization: our findings showed that Black people – usually biologized in explicit manners through metaphors related to disease – were implicitly perceived as contagious entities. In particular, by using the SMP, biological dehumanization of the Black target (compared to the White target) was reflected in a higher frequency of guessing that Chinese ideographs stood for a concept related to disease. Importantly, in line with our assumptions and previous literature (e.g., Valtorta & Volpato 2018), the results of Study 1 also showed that physical (but not moral) disgust was significantly associated to implicit biologization. Furthermore, by showing that our measure was sensitive to evaluations of items that are universally considered as associated with the disease domain, we provided evidence for the validity of the SMP as an implicit procedure to assess biologization.

Study 2

Study 2 was designed to extend the findings obtained in Study 1. In particular, our first goal was to experimentally verify the crucial role of physical (vs. moral) disgust in eliciting biologization in an interpersonal context. To do so, we manipulated disgust experiences by randomly assigning participants to see a picture of a White man, named Marco (from here on called ‘target’), while they were reading one of three vignettes describing a situation eliciting physical disgust (i.e., physical disgust condition), moral disgust (i.e., moral disgust condition) or no emotion (i.e., non-disgusting condition). As in Study 1, implicit biologization was assessed by using the SMP with ‘disease’ and ‘well-being’ as contrasting categories; however, here, only White people primes were employed. Similar to the previous study, we predicted that feelings of physical disgust would produce implicit biological dehumanization: participants in the physical disgust condition would guess a disease-related meaning after target-related primes (vs. non-target related primes) more often compared to those assigned to the moral disgust and non-disgusting conditions. In contrast, the moral disgust and the non-disgusting scenarios were not expected to produce these dehumanizing perceptions.

Our second goal was to confirm the specificity of the link between physical disgust and biologization in the interpersonal context also at an explicit level. Towards this end, an explicit measure of dehumanization was included in this study. Specifically, we considered three self-report scales, assessing respectively objectification, animalization, and biologization (i.e., the perception of others as objects, animals, and disease organisms). Assuming that our findings reflect genuine effects of feelings of physical (vs. moral) disgust on biologization, we expected that only this kind of dehumanizing perception (vs. objectification and animalization) would show the predicted relationship with physical (but not moral) disgust.

Method

Participants and experimental design

One hundred (75 females) Italian undergraduates participated in the study in exchange for partial course credits. Participants’ ages ranged from 19 to 52 years ($M = 24.77$,

$SD = 5.73$). A 3 (disgust: physical disgust vs. moral disgust vs. non-disgusting condition) \times 2 (type of prime: target related, non-target related) design was used, with disgust as a between-subjects variable and the type of prime as a within-subjects variable. Participants were randomly allocated across experimental conditions.

Procedure and measures

As in the previous study, participants were seated in front of a computer and were informed that the study examined impression formation. The participants were first randomly assigned to see a picture of a White man – that was used, along with other images, as a target-related prime stimulus in our SMP measure – while they were reading one of three vignettes describing a situation in which the portrayed man behaved eliciting physical disgust (i.e., physical disgust condition), moral disgust (i.e., moral disgust condition), or no emotion (i.e., non-disgusting condition). Then, all of the participants completed the SMP and a questionnaire to evaluate dehumanizing perceptions towards the target, feelings of physical disgust, and feelings of moral disgust. Finally, the participants were asked for their demographic information and were thanked and fully debriefed.

Disgust manipulation

To manipulate disgust, participants were assigned to read one of three vignettes describing a situation eliciting physical disgust, moral disgust, or no emotion. Participants first read the following: ‘Marco is 27 years old and lives in Milano. One evening, he decided to invite his friend Paolo to his house to spend time together’. The subsequent sentence varied depending on the experimental condition.

For the physical disgust condition, participants read: ‘Marco wanted to offer him something to eat, but he had not cleaned the fridge for months, and he realized he had not thrown out expired food. Because of the bad smell, Marco vomited on Paolo’.

For the moral disgust condition, participants read the following: ‘Marco received a phone call and moved to the other room to answer. During the call, Marco bragged to his interlocutor for having succeeded in seducing Paolo’s girlfriend’.

Finally, for the non-disgusting condition, participants read the following: ‘Marco proposed to watch a movie and eat pizza. The two friends had a great time, Paolo returned the invitation, and they decided to meet each other the following week’.

Semantic Misattribution Procedure

The implementation of the SMP followed the procedure described in Study 1, according to which participants were instructed to intuitively guess whether a Chinese ideograph had a connotation related to disease or one related to well-being without allowing the primes to bias their decisions. In this study, the SMP consisted of 96 trials out of which three trials for each of the two categories of prime stimuli (target-related primes, non-target related primes) repeated 16 times, followed by 96 randomly cho-

sen Chinese ideographs from Study 1. The target-related prime stimuli were three pictures depicting the target (i.e., Marco) from different angles, whereas the non-target related prime stimuli were three images of different White men selected from the same database adopted in Study 1.²

As in the previous study, the SMP's reliability was tested by estimating its internal consistency. The priming score of biologization was calculated in line with the procedure in Study 1. More specifically, we calculated a single score of biological dehumanization by subtracting the SMP score of the trials with non-target related primes from the SMP score of the trials with target-related primes. Similar to Study 1, the internal consistency of this score was estimated by splitting the procedure into thirds and calculating three scores of biologization using 32 different trials for each of them. The SMP score of biological dehumanization showed good internal consistency with Cronbach's $\alpha = 0.81$.

Explicit dehumanizing perceptions

Dehumanizing perceptions of the target were measured by employing words that recalled the considered forms of dehumanization (i.e., objectification, animalization, and biologization). More specifically, respondents were asked to rate the extent to which the target could be considered similar to these words (1 = *not at all*; 7 = *extremely*). Objectification was measured employing six object-related words (*object, tool, device, thing, instrument, and number*; $\alpha = 0.73$) borrowed from previous research (e.g., Andrighetto, Baldissarri & Volpato 2017; Valtorta et al. 2019a). Instead, animalization and biologization were measured using, respectively, four animal-related nouns (*animal, savage, primitive, and beast*; $\alpha = 0.70$) and four disease-related nouns (*virus, contamination, filth, and contagion*; $\alpha = 0.87$) borrowed from previous research (e.g., Valtorta & Volpato 2018) and Study 1.

Feelings of disgust

Perceptions of physical and moral disgust towards the target were identified using the same measure that was used in Study 1 (*nausea, revulsion*, $r = 0.71$, $p < 0.001$ for physical disgust; *contempt, scorn*, $r = 0.80$, $p < 0.001$ for moral disgust).

Manipulation check items

After completing the scales, participants were asked to indicate which scenario they had previously read. Participants selected one of three responses: (a) 'Marco vomited on Paolo', (b) 'Marco received a phone call' or (c) 'Marco proposed to watch a movie and eat pizza'. Furthermore, participants were shown the pictures used in the SMP as prime stimuli and were asked to indicate which one depicted the target presented along with the vignette at the beginning of the study.

Results and discussion

Thirteen participants were excluded from the study because they failed the manipulation check items. Specifically, three participants failed to report which scenario they had read, and 10 participants failed to match the

picture of the target with that used for the SMP. Thus, the final sample was composed by 87 participants (65 females; $M_{\text{age}} = 24.86$; $SD = 6.01$; age range: 19–52). A sensitivity analysis conducted with G*Power (Faul et al. 2007) showed that our sample was sufficient to detect small-to-medium effects of $f = 0.23$, assuming an α of 0.05, and power of 0.95 for a mixed within and between participants repeated measures ANOVA (observed partial correlation among repeated measures, $r = 0.46$).

Disgust manipulation

A one-way between-subjects (disgust: physical disgust vs. moral disgust vs. non-disgusting condition) MANOVA was conducted to analyse the effect of disgust manipulation through the vignettes on participants' feelings of physical and moral disgust. The multivariate test revealed a main effect of disgust, $\lambda = 0.25$, $F(4,166) = 41.20$, $p < 0.001$, $\eta_p^2 = 0.50$. As reported below, univariate tests showed a significant effect of disgust on feelings of physical and moral disgust.

Physical disgust

The analysis showed a main effect of disgust manipulation, $F(2,84) = 34.94$, $p < 0.001$, $\eta_p^2 = 0.45$, indicating that the participants in the physical disgust condition showed more physical disgust ($M = 4.02$, $SD = 1.84$) than participants in the moral ($M = 3.06$, $SD = 1.64$), $p = 0.037$, $d = 0.55$, and non-disgusting ($M = 1.05$, $SD = 0.20$), $p < 0.001$, $d = 2.27$, conditions. Furthermore, the participants' mean score in the moral and non-disgusting conditions significantly differed ($p < 0.001$, $d = 1.72$).

Moral disgust

The analysis showed a main effect of disgust manipulation, $F(2,84) = 51.08$, $p < 0.001$, $\eta_p^2 = 0.55$, indicating that the participants in the moral disgust condition showed more moral disgust ($M = 4.26$, $SD = 1.68$) than participants in the physical ($M = 2.28$, $SD = 1.38$), $p < 0.001$, $d = 1.29$, and non-disgusting ($M = 1.00$, $SD = 0.00$), $p < 0.001$, $d = 2.74$, conditions. Furthermore, the participants' mean score in the physical and non-disgusting conditions significantly differed ($p < 0.001$, $d = 1.31$).

Overall, these results showed that the three experimental conditions significantly differed each other, for both physical and moral disgust. Thus, the two conditions recalling disgust elicited more physical and moral disgust perceptions than the non-disgusting condition. More importantly, our findings confirmed that the disgust manipulation through the vignettes was successful: participants in the physical disgust condition reported more physical disgust than all the other participants and that those in the moral disgust condition reported more moral disgust than all the other participants.

Semantic Misattribution Procedure

We performed a 3 (disgust: physical disgust vs. moral disgust vs. non-disgusting condition) \times 2 (type of prime: target related, non-target related) ANOVA with repeated measurements on the frequency of guessing a disease-related meaning. The analysis did not yield a main effect of dis-

gust, $F(2,84) = 1.75$, $p = 0.179$, $\eta_p^2 = 0.04$. Instead, the main effect of the type of prime was significant, $F(1,84) = 6.22$, $p = 0.015$, $\eta_p^2 = 0.07$, indicating that participants guessed a disease-related meaning significantly more often following target-related primes ($M = 24.38$, $SD = 6.76$) than non-target related primes ($M = 22.63$, $SD = 6.52$).

Importantly, as expected, we observed that Disgust \times Type of prime interaction was significant, $F(2,84) = 3.25$, $p = 0.044$, $\eta_p^2 = 0.07$. Simple effects showed that when participants were shown the vignette eliciting physical disgust, the effect of the type of prime was significant, $F(1,84) = 10.93$, $p = 0.001$, $\eta_p^2 = 0.12$. As reported in **Table 2**, in the physical disgust condition, when the primes depicted the target, participants guessed a disease-related meaning more often than when primes depicted other people. In line with our assumptions, for both moral disgust and non-disgusting conditions, the effect of the type of prime was not significant: $F(1,84) = 1.46$, $p = 0.230$, $\eta_p^2 = 0.02$ for the moral disgust condition; $F(1,84) = 0.06$, $p = 0.810$, $\eta_p^2 = 0.00$ for the non-disgusting condition. According to our hypotheses, simple effects showed that, when the primes depicted the target, the effect of disgust was significant, $F(2,84) = 3.66$, $p = 0.030$, $\eta_p^2 = 0.08$. As reported in **Table 2**, when the primes depicted the target, in the physical disgust condition, participants guessed a disease-related meaning more often than participants in the moral disgust ($p = 0.024$, $d = 0.57$) and in the non-disgusting ($p = 0.019$, $d = 0.65$) conditions. Participants' scores in the moral and non-disgusting conditions did not differ ($p = 0.998$). As supposed, when the primes depicted other people than the target, the effect of disgust was not significant, $F(2,84) = 0.63$, $p = 0.537$, $\eta_p^2 = 0.02$.

Explicit dehumanizing perceptions

A MANOVA was conducted to analyse the effect of disgust (physical disgust vs. moral disgust vs. non-disgusting condition) on participants' explicit dehumanizing perceptions (i.e., objectification, animalization, and biologization) of the target. The multivariate test revealed a main effect of disgust, $\lambda = 0.78$, $F(6,164) = 3.66$, $p = 0.002$, $\eta_p^2 = 0.12$.

For both objectification and animalization, the effect of disgust was not significant: $F(2,84) = 0.20$, $p = 0.816$, $\eta_p^2 = 0.01$ for objectification; $F(2,84) = 2.24$, $p = 0.113$, $\eta_p^2 = 0.05$ for animalization. Regarding objectification, the participants' mean scores in the physical ($M = 1.22$, $SD =$

0.51), moral ($M = 1.27$, $SD = 0.55$), and non-disgusting conditions ($M = 1.30$, $SD = 0.46$) did not significantly differ (all $ps > 0.05$). In the same vein, the participants' mean scores of animalization did not significantly differ (all $ps > 0.05$) among the experimental conditions ($M = 1.82$, $SD = 0.93$ for the physical disgust condition; $M = 1.94$, $SD = 1.00$ for the moral disgust condition; $M = 1.48$, $SD = 0.66$ for the non-disgusting condition).

Crucially, in line with our assumptions, for biologization, the analysis showed a significant effect of disgust, $F(2,84) = 5.97$, $p = 0.004$, $\eta_p^2 = 0.12$: pairwise comparisons with Bonferroni adjusted alpha levels confirmed that in the physical disgust condition, the target was more biologized ($M = 1.95$, $SD = 1.36$) than in the moral ($M = 1.35$, $SD = 0.71$), $p = 0.050$, $d = 0.55$, and in the non-disgusting ($M = 1.16$, $SD = 0.42$), $p = 0.004$, $d = 0.78$, conditions. Furthermore, the participants' mean scores in the moral and non-disgusting conditions did not significantly differ ($p = 1.00$).

In order to examine the relationship between implicit and explicit biological dehumanization, we conducted a partial correlation analysis considering the standardized scores of biologization resulted from the SMP and the self-report scale. Results showed that the mean frequency of guessing a disease-related meaning after target-related primes in the SMP was not related to the explicit association of the target with disease-related words ($r = 0.05$, $p = 0.665$).

In line with the preceding study, by using the SMP, Study 2 showed that biological dehumanization of a specific target eliciting physical disgust (vs. moral disgust vs. non-disgusting condition) was reflected in a higher frequency of guessing that Chinese ideographs stood for a concept related to disease. In addition, the SMP score of biologization proved to be internally consistent and provided evidence of validity: biological representations from both the SMP and the explicit measure, albeit they were not associated in the correlational analysis, showed the predicted relationship with physical disgust. It is noteworthy that this link did not emerge for the other dehumanizing self-report scales.

Study 3

The purpose of this study was to replicate the findings obtained in Study 2 while incorporating a methodological improvement related to our SMP measure. In particu-

Table 2: Study 2: Means and standard deviations for the frequency of guessing a disease-related meaning of the Chinese ideograph as a function of disgust (physical disgust vs. moral disgust vs. non-disgusting condition) and the preceding prime category (target related, non-target related).

	Mean frequency of guessing a disease-related meaning			
	Target related		Non-target related	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Physical disgust	27.07 _b	6.92	22.97 _a	6.29
Moral disgust	23.04 _a	7.27	21.48 _a	7.12
Non-disgusting	23.03 _a	5.49	23.32 _a	6.26

Note: The different letters, in the same row or column, indicate that the difference between the two means is significant, $p \leq .05$.

lar, using the same materials that were used in Study 2, we aimed to demonstrate that the indirect procedure adopted in the previous studies indeed measured biological dehumanization and not just the implicit negative attitude towards the targets. To do so, after manipulating disgust experiences through vignettes that portrayed a target behaving in a physically, morally, or non-disgusting way, implicit biologization was assessed by using the SMP paradigm with two equally negative response options, one disease-related (i.e., 'disease') and the other not (i.e., 'earthquake'). Consistent with Study 2, we predicted participants in the physical disgust condition to guess a disease-related meaning after target-related primes (vs. non-target related primes) more often compared to those assigned to the moral disgust and non-disgusting conditions. In contrast, the moral disgust and the non-disgusting scenarios were not expected to produce these dehumanizing perceptions.

Method

Participants and experimental design

One hundred sixteen (94 females) Italian undergraduates participated in the study in exchange for partial course credits. Participants' ages ranged from 18 to 49 years ($M = 22.06$, $SD = 4.08$). A 3 (disgust: physical disgust vs. moral disgust vs. non-disgusting condition) \times 2 (type of prime: target related, non-target related) design was used, with disgust as a between-subjects variable and the type of prime as a within-subjects variable. Participants were randomly allocated across experimental conditions.

Procedure and measures

The procedure and the measures were the same that were used in Study 2, except for the contrasting category to 'disease' employed in the SMP. Through a pretest, we selected the word 'earthquake' as the contrasting category, as it was perceived with a similar negative valence to the term 'disease', but at the same time not associated with the concept of disease (see the Supplementary material for further details about this pretest). Therefore, after seeing the picture of the target and reading the vignette, participants were asked to complete the implicit procedure, in which they were instructed to intuitively guess whether Chinese ideographs, presented after prime stimuli (target and non-target related), had a meaning connected to the concept of disease or connected to the concept of earthquake ($\alpha = 0.69$ for the SMP). Then, participants were asked to fill in a questionnaire to evaluate dehumanizing perceptions ($\alpha = 0.63$ for objectification; $\alpha = 0.82$ for animalization; $\alpha = 0.90$ for biologization), feelings of physical disgust ($r = 0.82$, $p < 0.001$), and feelings of moral disgust ($r = 0.87$, $p < 0.001$). Finally, manipulation check items and demographic questions were administered.

Results and discussion

Four participants were excluded from the analyses because they failed the manipulation check items. Specifically, one participant failed to report which scenario he had read, and three participants failed to match the picture of the target with that used for the SMP. Two other participants

were eliminated from the study because the software failed to record their responses. Thus, the final sample was composed by 110 participants (91 females; $M_{\text{age}} = 22.14$; $SD = 4.16$; age range: 18–49). A sensitivity analysis conducted with G*Power (Faul et al. 2007) showed that our sample was sufficient to detect small-to-medium effects of $f = 0.18$, assuming an α of 0.05, and power of 0.95 for a mixed within and between participants repeated measures ANOVA (observed partial correlation among repeated measures, $r = 0.53$).

Disgust manipulation

To analyse the effect of disgust manipulation through the vignettes on participants' feelings of physical and moral disgust, a one-way between-subjects (disgust: physical disgust vs. moral disgust vs. non-disgusting condition) MANOVA was conducted. The multivariate test revealed a main effect of disgust, $\lambda = 0.13$, $F(4,212) = 91.80$, $p < 0.001$, $\eta_p^2 = 0.63$. As reported below, univariate tests showed a significant effect of disgust on feelings of physical and moral disgust.

Physical disgust

The analysis showed a main effect of disgust manipulation, $F(2,107) = 57.23$, $p < 0.001$, $\eta_p^2 = 0.52$, indicating that the participants in the physical disgust condition showed more physical disgust ($M = 4.64$, $SD = 1.69$) than participants in the moral ($M = 3.41$, $SD = 1.72$), $p = 0.001$, $d = 0.72$, and non-disgusting ($M = 1.13$, $SD = 0.45$), $p < 0.001$, $d = 2.84$, conditions. Furthermore, the participants' mean score in the moral and non-disgusting conditions significantly differed ($p < 0.001$, $d = 1.81$).

Moral disgust

The analysis showed a main effect of disgust manipulation, $F(2,107) = 143.41$, $p < 0.001$, $\eta_p^2 = 0.73$, indicating that the participants in the moral disgust condition showed more moral disgust ($M = 5.42$, $SD = 1.24$) than participants in the physical ($M = 2.51$, $SD = 1.46$), $p < 0.001$, $d = 2.15$, and non-disgusting ($M = 1.07$, $SD = 0.24$), $p < 0.001$, $d = 4.87$, conditions. Furthermore, the participants' mean score in the physical and non-disgusting conditions significantly differed ($p < 0.001$, $d = 1.38$).

Thus, as in the previous study, disgust manipulation through the vignettes was successful.

Semantic Misattribution Procedure

We performed a 3 (disgust: physical disgust vs. moral disgust vs. non-disgusting condition) \times 2 (type of prime: target related, non-target related) ANOVA with repeated measurements on the frequency of guessing a disease-related meaning. Neither the main effect of disgust, $F(2,107) = 0.34$, $p = 0.714$, $\eta_p^2 = 0.01$, nor the main effect of the type of prime were found to be significant, $F(1,107) = 0.23$, $p = 0.633$, $\eta_p^2 = 0.00$.

Importantly, as expected, we observed that Disgust \times Type of prime interaction was significant, $F(2,107) = 6.01$, $p = 0.003$, $\eta_p^2 = 0.10$. When participants were shown the vignette eliciting physical disgust, the effect of the type of prime was significant, $F(1,107) = 9.65$, $p = 0.002$, $\eta_p^2 =$

0.08. As reported in **Table 3**, in the physical disgust condition, when the primes depicted the target, participants guessed a disease-related meaning more often than when primes depicted other people. In line with our assumptions, for both moral disgust and non-disgusting conditions, the effect of the type of prime was not significant: $F(1,107) = 0.87, p = 0.353, \eta_p^2 = 0.01$ for the moral disgust condition; $F(1,107) = 1.75, p = 0.189, \eta_p^2 = 0.02$ for the non-disgusting condition. According to our hypotheses, simple effects showed that, when the primes depicted the target, the effect of disgust was significant, $F(2,107) = 3.24, p = 0.043, \eta_p^2 = 0.06$. As reported in **Table 3**, when the primes depicted the target, in the physical disgust condition, participants guessed a disease-related meaning more often than participants in the moral disgust ($p = 0.029, d = 0.49$) and in the non-disgusting ($p = 0.030, d = 0.49$) conditions. Participants' scores in the moral and non-disgusting conditions did not differ ($p = 0.998$). As supposed, when the primes depicted other people than the target, the effect of disgust was not significant, $F(2,107) = 0.58, p = 0.561, \eta_p^2 = 0.01$.

Explicit dehumanizing perceptions

To analyse the effect of disgust (physical disgust vs. moral disgust vs. non-disgusting condition) on participants' explicit dehumanizing perceptions (i.e., objectification, animalization, and biologization), a MANOVA was conducted. The multivariate test revealed a main effect of disgust, $\lambda = 0.57, F(6,210) = 11.44, p < 0.001, \eta_p^2 = 0.25$.

For objectification, the effect of disgust was not significant: $F(2,107) = 2.51, p = 0.086, \eta_p^2 = 0.05$: the participants' mean scores in the physical ($M = 1.20, SD = 0.29$), moral ($M = 1.41, SD = 0.59$), and non-disgusting conditions ($M = 1.23, SD = 0.39$) did not significantly differ (all $ps > 0.05$).

Regarding the animalization score, analyses revealed a main effect of disgust: $F(2,107) = 15.72, p < 0.001, \eta_p^2 = 0.23$. Bonferroni-adjusted comparisons revealed that participants in the moral disgust condition ($M = 2.63,$

$SD = 1.53$) perceived the target as more similar to an animal than participants in the physical ($M = 1.61, SD = 0.88$), $p < 0.001, d = 0.82$, and in the non-disgusting ($M = 1.31, SD = 0.44$), $p < 0.001, d = 1.17$, conditions. Instead, animalistic dehumanization for participants' in the physical and non-disgusting conditions was not different, $p = 0.702$.

Most importantly, in line with our assumptions, for biologization, the analysis showed a significant effect of disgust, $F(2,107) = 12.92, p < 0.001, \eta_p^2 = 0.20$: pairwise comparisons with Bonferroni adjusted alpha levels confirmed that in the physical disgust condition, the target was more biologized ($M = 2.28, SD = 1.26$) than in the moral ($M = 1.68, SD = 0.90$), $p = 0.019, d = 0.55$, and in the non-disgusting ($M = 1.17, SD = 0.48$), $p < 0.001, d = 1.16$, conditions. Furthermore, the participants' mean scores in the moral and non-disgusting conditions did not significantly differ ($p = 0.068$).

In order to examine the relationship between implicit and explicit biological dehumanization, we conducted a partial correlation analysis. As in the previous study, results showed that the mean frequency of guessing a disease-related meaning after target-related primes in the SMP was not related to the explicit association of the target with disease-related words ($r = 0.17, p = 0.073$).

Overall, the findings of Study 3 confirmed the relationship between physical disgust and biological dehumanization. By using the SMP, results showed that biologization of a specific target behaving in a physically (vs. morally vs. non-disgusting) way was reflected in a higher frequency of guessing that Chinese ideographs stood for a concept related to disease. It is noteworthy that this association emerged by controlling for the valence of the response options adopted in our implicit measure. Furthermore, in line with Study 2, biological representations from both the SMP and the explicit scale, despite their non-significant correlation, showed the predicted relationship with physical disgust. Crucially, this link did not emerge for the other dehumanizing self-report measures.

General Discussion

The main aim of this research was to provide deeper insights into the link between feelings of physical disgust and biologization by analysing, for the first time in the literature, the implicit facet of this dehumanizing process. In three studies, we used the SMP (Imhoff et al. 2011), a modified variant of the AMP (Payne et al. 2005) designed to assess spontaneous behaviours resulting from the activation of semantic concepts rather than affective states (Gawronski & Ye 2014; Imhoff et al. 2011; Sava et al. 2012; Ye & Gawronski 2018). According to our assumptions and previous literature (e.g., Case, Repacholi & Stevenson 2006; Cottrell & Neuberg 2005; Valtorta & Volpato 2018), in Study 1, physical (but not moral) disgust emerged as a statistically significant predictor of the SMP score of biologization (i.e., the mean frequency of guessing a disease-related meaning after Black people pictures). Crucially, similar results emerged in Study 2 and Study 3, in which feelings of disgust were made salient through vignettes. In particular, Study 2 showed that in the physical disgust condition (vs. moral disgust vs. non-disgusting condition),

Table 3: Study 3: Means and standard deviations for the frequency of guessing a disease-related meaning of the Chinese ideograph as a function of disgust (physical disgust vs. moral disgust vs. non-disgusting condition) and the preceding prime category (target related, non-target related).

	Mean frequency of guessing a disease-related meaning			
	Target related		Non-target related	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Physical disgust	25.68 _b	5.90	22.97 _a	6.13
Moral disgust	23.11 _a	4.40	23.92 _a	5.07
Non-disgusting	23.11 _a	4.54	24.28 _a	4.74

Note: The different letters, in the same row or column, indicate that the difference between the two means is significant, $p \leq .05$.

participants guessed a disease-related meaning more often when primes depicted the target person eliciting disgust than when primes depicted other individuals. Relevant to our main aim, we found that, in contrast to the other dehumanizing perceptions (i.e., objectification and animalization), the scores of biologization from the SMP and from the explicit scale showed the same pattern of results. In other words, we found that only biological representations showed the predicted relationship with physical disgust, confirming that the present findings actually reflect genuine effects of feelings of physical (but not moral) disgust on this form of dehumanization. All these results were replicated in Study 3, in which the biologization SMP measure was modified to disambiguate biological dehumanization from the implicit negative attitude towards the targets. More specifically, we replaced the response option 'well-being' with 'earthquake' so that the two contrasting categories (i.e., 'disease' vs. 'earthquake') differed in the disease-related content but not in valence. By showing the same pattern of results as the preceding studies, this experiment seems to confirm that our SMP procedure validly measured biologization, providing us with further support for the role of physical disgust as a potential antecedent of this specific kind of dehumanizing perception.

Through the present research, by integrating the theoretical insights regarding feelings of disgust (e.g., Rozin et al. 1999, 2008) with previous empirical findings on biological dehumanization (e.g., Valtorta & Volpato 2018), we experimentally demonstrated that physical and moral disgust are two distinct mechanisms and that only physical disgust appears to have the unique capacity to foster social-cognitive biologization of others. Several research projects (e.g., Buckels & Trapnell 2013; Dalsklev & Rønningsdalen Kunst 2015; Schaller & Neuberg 2012) have demonstrated the relevant role of disgust in eliciting dehumanization; however, few efforts have been made to deeply investigate the impact of the physical and moral facet of this emotion on dehumanizing representations. As observed by Rozin and colleagues (2008), although moral disgust may be related to contamination-based disgust, it is different from the most primitive form of this emotion that is connected to bad taste, dirt, and contagion. In particular, they stated that, unlike moral disgust, physical disgust can be linked to potential sources of disease that pose the threat of mortality and genetic extinction. In the same vein, we demonstrated that eliciting this kind of emotion triggers the association of the source of disgust with concepts concerning the disease domain in both intergroup (Study 1) and interpersonal (Study 2 and Study 3) settings. We think that the *somatic marker hypothesis* (Damasio 1996), into which the emotion of disgust fits well, helps us to better understand this association. Considering that bodily reactions to real positive and negative events come to be so well learned that whenever people merely think about a similar situation, they get an 'as-if' reaction in the parts of their brains that control or sense those reactions, simply reading a vignette in which someone behaves eliciting physical disgust, may contribute to guide judgments and perceptions by making salient different concepts related

to this basic emotion (e.g., disease). From a social-psychological perspective, our results can also be explained in the light of the behavioural immune system theory, according to which human social interactions are likely to be shaped by pathogen stress (Murray & Schaller 2016; Neuberg, Kenrick & Schaller 2011; O'Shea et al. 2020; Schaller & Park 2011; Schnall 2016; Taylor 2019). Some of the most striking findings in the behavioural immune system literature suggest that pathogens and disgust sensitivity might influence intergroup perceptions and behaviours. For example, at the individual and intergroup level, studies suggest a strong relationship among pathogen cues, feelings of physical disgust, and prejudice towards outgroup members (Faulkner et al. 2004; Huang et al. 2011; Ji, Tybur & van Vugt 2019).

Of particular relevance to the dehumanization literature, we provided the first empirical evidence of the implicit facet of biological dehumanization. So far, empirical studies analysing biologization (e.g., Valtorta et al. 2019a; Valtorta & Volpato 2018) have employed explicit measures to assess the association between the considered targets and biological terms. For example, by investigating the phenomenon of workplace biologization, Valtorta and colleagues (2019a) found that certain types of occupational groups are more likely to be considered as contagious entities. In addition, the authors showed that disgust can be considered as a relevant antecedent of this kind of dehumanizing perception. Through our studies, not only did we confirm the key role of disgust in eliciting biologization, but we also demonstrated that biological dehumanization actually involves automatic and unaware associations between specific human targets and metaphors concerning disease.

Furthermore, we provided evidence for this peculiar form of dehumanization over and beyond the people's social desirability. Valtorta and Volpato (2018) found that physical (vs. moral) disgust increased biological dehumanization towards others; however, similarly to our results on self-report dehumanizing scales, the mean ratings of the measures used by the authors, despite varying according to the manipulations, were low in all conditions, indicating a weak association of the target with the non-human-related words adopted in the study. These results confirm the possible relevant role of social desirability in guiding responses to explicit measures of dehumanization and, thus, stress the importance of the need for indirect procedures, less susceptible to motivated responding (Gawronski & Bodenhausen 2006), to assess this phenomenon. These considerations seem to be supported by our correlation analyses between implicit and explicit measures of biologization, where the two dehumanizing scores resulted completely unrelated in both Study 2 and Study 3. Indeed, according to Hofmann, Gawronski, Gschwendner, Le, and Schmitt (2005), implicit measures are generally unbiased by motivational influences, whereas explicit self-reports are often influenced by social desirability concerns. This assumption is reflected in Fazio's MODE model (Fazio & Olson 2003), according to which implicit and explicit measures should be highly correlated unless people are motivated and able to control their responses

on the explicit measure (e.g., Fazio et al. 1995; Gawronski, Geschke & Banse 2003; Hofmann, Gschwendner & Schmitt 2005). Thus, correlations between implicit and explicit measures may be high for relatively mundane topics (e.g., consumer preferences), but they may be low or non-significant for socially sensitive perceptions (e.g., prejudice against outgroups). In this regard, we performed a mini meta-analysis with the data of Study 2 and Study 3 (for a similar procedure, see Goh, Hall & Rosenthal 2016) and found that, across the studies, the implicit score was not associated with the explicit measure ($M_r = 0.12$, $p = 0.11$, two-tailed). This result seems to confirm some previous findings on the controversial association between implicit and explicit measurements. For example, through three studies conducted using the IAT, Karpinski and Hilton (2001) demonstrated a lack of association between implicit and explicit attitudes. Similar results were found by Greenwald, McGhee, and Schwartz (1998). This pattern, along with previous theorizing about the independence between implicit and explicit attitudes (see Wilson, Lindsey & Schooler 2000), supports the idea that implicit and explicit attitude measures mostly detect independent constructs.

Importantly, through the present research, we provided a meaningful new alternative indirect method to reveal the 'hidden side' of biological dehumanization. Indeed, across these studies, our SMP implicit procedure showed, on average, good internal consistency (average Cronbach's $\alpha = 0.81$) and evidence of validity in two ways. First, the SMP measure used to assess biological dehumanization was sensitive to evaluations of items that are universally considered as associated with the concept of disease, namely, the core dimension defining biologization. In particular, in Study 1, participants guessed a disease-related meaning more often following primes characterized by words related to disease than either of the two human categories (i.e., Black and White people pictures). Second, in Study 2 and Study 3, the pattern of relationships between disgust experiences in terms of physical and moral disgust and the SMP score emerged as consistent with the link between feelings of disgust and the self-report explicit scale used to measure the same dehumanizing process. Crucially, this pattern of relations was not found for the self-report objectification and animalization scales. Therefore, in addition to providing insights for the link between physical (vs. moral) disgust and biological dehumanization, the current findings provide evidence for the reliability and validity of the SMP as an implicit measure of biologization.

With regard to the explicit dehumanizing perceptions, it is important to note that, in Study 3, participants in the moral disgust condition perceived the target as more similar to an animal than participants in the physical and non-disgusting conditions. In other words, a target behaving in a morally disgusting way elicited animalistic dehumanization. This unexpected result is in line with other studies about morality and dehumanization (e.g., Haslam 2006; Haslam et al. 2008; Haslam & Loughnan 2014; Haslam & Stratemeyer 2016; Kteily & Bruneau 2017). For example, Haslam (2006) stated that when individuals are denied

uniquely human characteristics, they should be seen as lacking refinement, self-control, and morality and likened to animals. In addition, Valtorta and Volpato (2018) found that emphasizing moral disgust promotes an increased explicit association between animalistic metaphors and outgroup members. Pacilli, Rocco, Pagliaro, and Russo (2016) revealed that within the political domain, the perception of moral distance from political outgroups positively predicts their animalization. Similarly, Valtorta, Baldassarri, Andrighetto, and Volpato (2019b) observed that occupations perceived as morally tainted (i.e., carried out through methods that are deceptive or immoral) are associated with an increase in animalized perceptions of people who perform these activities. Along with these findings, our results contribute to the idea that morality is one of the core dimensions defining human beings and that perceiving others as lacking morality has a crucial role in animalistic dehumanization.

Despite the relevance of our research, future investigations are needed to deepen understanding of the phenomenon and to go beyond the limits of the present studies. The main methodological limitation regards the vignettes we used in Study 2 and Study 3 to manipulate feelings of disgust. Specifically, in the physical disgust condition participants read a scenario in which the target person vomited on his friend. Even if in the vignette it is explained that the vomit was caused by a bad smell and not by illness, it is possible that it evokes in participants' minds a hygiene problem that potentially could be a vector of a disease. Therefore, the effect emerged in the SMP of greater frequency of guessing 'disease' could depend on the salience of the hygienic component rather than physical disgust per se. Further investigations could employ other types of emotion manipulations. This would be particularly helpful for ruling out the possibility that physical disgust facilitated biologization more strongly than moral disgust simply because the vignette adopted in the physical disgust condition contained a potential disease component.

With regard the SMP measure employed in Study 1, it is noteworthy that the considered stimuli had a different nature, as they were pictures compared with verbal stimuli. This was mainly due to the difficulties in creating appropriate visual stimuli representing the concept of disease. However, it will be important that future research would confirm the validity of our proposed measure by using a more homogenous selection of prime stimuli.³

Finally, it is important to note that although the SMP has some advantages over other implicit measures such as the IAT (Imhoff et al. 2011), it also has some limitations. For example, as reported by Bar-Anan and Nosek (2014), findings obtained with the SMP might be more sensitive to extreme scores compared to those obtained with other implicit measures. In this respect, we believe that more research is needed to deeper investigate the potential shortcomings of the SMP and to better understand the processes underlying this task. Indeed, no conclusive evidence exists about the mechanisms behind the SMP. Consistent with several authors (e.g., Deutsch & Gawronski 2009; Imhoff et al. 2011), it is plausible to imagine that

the SMP primes differentially activate a semantic concept (e.g., disease) that in turn influences the guessing of the meaning of Chinese ideographs. However, it cannot be excluded that some participants do not respond to the Chinese ideographs, but directly to the primes themselves, thus producing a not completely implicit evaluation.

Conclusions

The present research contributes to comprehending the nature and the mechanism underlying biologization, revealing that physical (but not moral) disgust leads to the implicit perception of specific target persons as contagious entities. Furthermore, our findings suggest that the SMP is a promising tool for the assessment of the implicit facet of this phenomenon. Given that biologization and the mechanisms behind this process have been relatively unexplored, we hope that our findings will encourage further investigations of this important topic. Indeed, according to several authors (e.g., Buckels & Trapnell 2013; Hodson & Costello 2007), a deeper understanding of how feelings of disgust promote dehumanizing perceptions might lead to novel interventions for understanding conflicting relationships and defusing intergroup violence.

Data Accessibility Statement

The data and analysis codes for all the three studies are available at https://osf.io/rfyms/?view_only=0385574f8e4c46a59002a4096afbb088.

Supplementary Material

Details of the pretest (Study 3)

Aims and procedure

To identify a contrasting category to 'disease' for the SMP employed in Study 3, we conducted a pretest whose aim was to identify a response option that differed from 'disease' in the disease-related content but not in the valence one. To do so, a separate sample ($N = 32$, 14 females) rated the term *disease* and a list of nine negative words (i.e., *earthquake*, *calamity*, *adversity*, *misfortune*, *disaster*, *tragedy*, *misery*, *negativity*, *unpleasantness*) for valence from -3 (*extremely negative*) to 3 (*extremely positive*). Then, participants were asked to indicate the extent to which each of the nine negative terms had a connotation related to disease ($1 = \text{not at all}$; $7 = \text{extremely}$).

Results

Regarding the valence ratings, results showed that the word *disease* ($M = -1.69$, $SD = 1.31$) did not significantly differ from *earthquake* ($M = -2.06$, $SD = 1.05$; $t(31) = 1.83$), *adversity* ($M = -2.03$, $SD = 1.18$; $t(31) = 1.65$), *misfortune* ($M = -1.66$, $SD = 0.94$; $t(31) = -0.17$), *misery* ($M = -1.88$, $SD = 1.10$; $t(31) = 0.95$), and *negativity* ($M = -1.47$, $SD = 1.16$; $t(31) = -1.00$), all $ps > 0.05$. As for the meaning, the analysis showed that *earthquake* was the word less associated with the concept of disease, as its score was the only one that did not significantly differ from the point 1 of the scale ($M = 1.16$, $SD = 0.45$; $t(31) = 1.97$, $p = 0.057$). Given that *earthquake* was perceived as negative as the term *disease*, but not associated with the concept of disease, we decided to consider this word as contrasting category to 'disease' in our biologization SMP measure.

Notes

- ¹ Stimulus images courtesy of Michael J. Tarr, Center for the Neural Basis of Cognition and Department of Psychology, Carnegie Mellon University, <http://www.tarr-lab.org/>.
- ² A separate sample ($N = 60$, 35 females) rated the images used in Study 2 as prime stimuli on two scales ranging from 1 (*not at all*) to 7 (*extremely*) in response to the following questions: 'How much would you associate these men with the concept of "disease"?' and 'How much would you associate these men with the concept of "well-being"?' Two repeated measures ANOVAs were conducted, one on the associations with the concept of disease and one on the associations with the concept of well-being. Regarding disease, Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(14) = 26.72$, $p = 0.021$; therefore, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\epsilon = 0.94$). The results showed a non-significant effect of image, $F(4.71, 278.08) = 1.22$, $p = 0.302$. Regarding the well-being associations, the analysis revealed a non-significant effect of image, $F(5, 295) = 0.72$, $p = 0.610$. Overall, our findings indicated that all the selected pictures were equally perceived in terms of both disease and well-being associations.
- ³ In order to demonstrate that the main expected result for the biologization SMP measure was not affected by the different type of stimuli, we reran the analyses by excluding the trials with words related to disease as primes. The results still showed a main effect of prime, $F(1,89) = 17.78$, $p < 0.001$, $\eta_p^2 = 0.17$, indicating that participants guessed a disease-related meaning significantly more often following primes characterized by Black people pictures ($M = 22.29$, $SD = 13.22$) than White people pictures ($M = 16.51$, $SD = 9.37$).

Ethics and Consent

The present studies were carried out in accordance with the APA ethical guidelines with written informed consent from all participants. All participants gave written informed consent in accordance with the Declaration of Helsinki.

Competing Interests

The authors have no competing interests to declare.

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