



Mapping the everyday concept of *disgust* in five cultures

Inge Schweiger Gallo¹ · Sofian El-Astal² · Michelle Yik³ · Iciar Pablo-Lerchundi⁴ · Reyes Herrero López⁵ ·
Mónica Terrazo-Felipe⁶ · Peter M. Gollwitzer^{7,8} · José Miguel Fernández-Dols⁶

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Abstract

Past research has shown that disgust is a heterogeneous category and lacks unity in its defining features. In the two studies reported in this paper, we examined the internal structure of *disgust* in English, and its translation equivalents of *asco* in Spanish, *Ekel* in German, *garaf* in Arabic, and *yanwu* in Chinese. In Study 1, 517 participants listed the most accessible constitutive features (definition, elicitors, and physical responses) of the concept of *disgust* in their culture. In Study 2, 653 participants were asked to judge the extent to which each of the 63 features extracted from Study 1 was typical of the concept of *disgust* in their respective culture. Results revealed differences in content, as well as internal structures across the five cultural groups: the *disgust* concepts differed in the degree of typicality of their constitutive features, the relevance of single features, the extent to which they shared features and the structural properties of the features. Taken together, our results question the assumed conceptual equivalence of the *disgust* concept across five cultures and raise questions about the suitability of deploying direct translations of *disgust* terms in cross-cultural research.

Keywords Disgust · Emotion concept · Cross-cultural comparison · Moral disgust

Despite its importance in everyday life, disgust had received little research attention at the beginning of the century (e.g., Marzillier & Davey, 2004), especially as compared to other emotions such as fear or anger. Though a considerable growth

of research on disgust has enabled a greater understanding of its physiological, expressive, and behavioral components, many unanswered questions remain (Rozin et al., 2008).

One of these questions refers to the nature of the emotion of disgust. Traditionally, the debate about the nature of emotions has centered on universalistic vs. (culturally) relativistic explanations. The former claim that there are universal emotion categories with distinct experiences and expressions, while constructionist theories of emotions sustain that emotions are non-entitative, cannot be reduced to neurobiologically developed products, and are acquired socially (Lindquist et al., 2022). This debate has addressed the question of whether or not emotion

Mónica Terrazo-Felipe is now at the Departamento de Medicina, Facultad de Ciencias Biomédicas, Universidad Europea de Madrid.

The Spanish and German data from Study 1 were previously published in Spanish in the conference proceedings of the XI Congreso Español de Sociología in Madrid (2013). The Spanish data from Study 1 were also used in another article on differentiating the Spanish *grima* from the Spanish disgust (*asco*) by Schweiger Gallo, Fernández-Dols, Gollwitzer & Keil (2017).

✉ Inge Schweiger Gallo
ischweig@ucm.es

- ¹ Departamento de Antropología Social y Psicología Social, Universidad Complutense de Madrid, Pozuelo de Alarcón, Spain
- ² Psychology Department, Al-Azhar University-Gaza, Gaza, Palestine
- ³ Division of Social Science, Hong Kong University of Science and Technology, Hong Kong SAR, China
- ⁴ Instituto de Ciencias de la Educación, Universidad Politécnica de Madrid, Madrid, Spain

⁵ Departamento de Ciencia Política y de la Administración, Universidad Complutense de Madrid, Pozuelo de Alarcón, Spain

⁶ Departamento de Psicología Social y Metodología, Universidad Autónoma de Madrid, Madrid, Spain

⁷ Department of Psychology, Universität Konstanz, Konstanz, Germany

⁸ Department of Psychology, New York University, New York, NY, USA

words are similar or vary between languages: Whereas some languages are reported to not have equivalent words in other languages (e.g., the German *Sehnsucht* or *Schadenfreude* are often cited as not having an equivalent word in English; Jackson et al., 2019, and Russell, 1991a, respectively), others are assumed to have translation equivalents across languages. However, it has been suggested that even if emotion words do have translational equivalents, the equivalence between translated emotion words across languages should not be presupposed; rather, it cannot be assumed that the same meaning is shared across languages (Fontaine & Breugelmans, 2021) as emotion words may be characterized by variability in meaning (Lindquist et al., 2022). Using colexification networks, Jackson and colleagues (2019) indeed showed that even though the psychophysiological dimensions of valence and activation allow for differentiation between emotions across language families, the meaning of emotion terms varies across languages – even in those cases in which there are translation equivalents. Thus, venturing beyond common translation procedures, it is of paramount importance to examine the equivalence of emotion terms by addressing the meaning of emotion terms and emotion features (Fontaine & Breugelmans, 2021).

Tackling the nature and features of disgust

This is also the case with respect to disgust, as research has pointed to the possibility that disgust may not be a clear basic emotion, but rather part of another emotion category. Indeed, Shaver, Schwartz, Kirson, and O'Connor's (1987) research suggested that the *disgust*¹ category is a subcategory of *anger* rather than a basic-level category. These findings are also in line with findings reported by Nabi (2002), who found that the lay meaning of *disgust* corresponds to the theoretical meaning of both *disgust* and *anger*.

Empirical work has also questioned the use of equivalent terms to *disgust* in other languages. In this regard, Han et al. (2016) challenged the assumption that disgust is a homogeneous emotion and found that the translations of the category of *disgust* into Korean and Malayalam were not equivalent to the English *disgust*. Rather, *disgust* and its equivalents were used differently depending on the language of the speakers: English speakers used *disgust* to refer to a larger number of events than did the Korean and Malayalam speakers.

Beyond research pointing to a lack of unity and equivalence of the construct of disgust, the last decade has also witnessed how assumptions regarding the disgust domains have been systematically questioned. One of these assumptions

holds that disgust serves as a pathogen-avoidance emotion and thus people or objects which have connotations of disease, such as body products (e.g., feces), foods (e.g., dirty food), animals, inappropriate sex, hygiene, body envelope violations (e.g., mutilations), death and signs of infection evoke strong feelings of disgust (Oaten et al., 2009). However, instead of relating to the presence of pathogens, injuries have been found to evoke empathy rather than disgust (Kupfer, 2018): Even though people refer to both with the term of disgust, stimuli involving infections (i.e., pathogen-relevant stimuli) were found to elicit disgust, as compared to stimuli representing injuries, which elicited empathic feelings of pain.

The question about disgust elicitors extends itself also to the cultural domain: Rozin and colleagues (2008) suppose that the cultural evolution of the inputs (i.e., elicitors) and outputs of the emotion of disgust followed a different evolutionary path: Whereas the expression, physiology, and behavior evoked by disgust have experienced little changes over the course of evolution (Rozin & Haidt, 2013), the inputs of disgust have evolved differently at a cultural level. However, cultural variation manifests differently depending on the domain of the disgust elicitors: whereas core disgust elicitors have been mostly regarded as being common across cultures, cross-cultural differences have been claimed to be greatest among some instances of interpersonal and socio-moral disgust (Rozin et al., 2008).

Moral disgust and moral content

Derived from the disagreement regarding the elements triggering moral disgust, an intriguing question refers to whether moral contents are specifically related to the concept of *disgust*. For example, some theories state that there is a correspondence between concrete kinds of moral content and emotions. In this regard, one prominent model, the CAD model (Rozin et al., 1999b), relates infractions of the three moral codes of community, autonomy, and divinity with specific emotions: community violations to contempt, autonomy violations to anger, and divinity violations to disgust. Though the CAD hypothesis has received mixed evidence (Kollareth & Russell, 2017), the findings seem to converge showing that violations in the three domains may not necessarily be associated in a one-on-one fashion to the predicted emotions. Moral violations, for example, have been found to often elicit several negative emotions, and mostly anger, in the domains of community and autonomy (Kollareth & Russell, 2017). Similarities across domains have also been reported in recent research on autonomy violations vs purity violations (Kollareth et al., 2022); autonomy violations elicited anger, disgust, and (to a lesser extent) being grossed out and were rated as more disgusting than nonhealth-related purity violations (e.g., wearing a sweater once owned by Adolf Hitler) as compared to health-related purity violations

¹ Italics will be used when we refer to a conceptual category or its features, whereas no special characters will be used when we refer to an emotion in general terms.

(e.g., licking between toes). Further evidence for a lack of association of moral-violation content and emotion as stated by the CAD model has been provided by Kollareth et al. (2019), who asked whether the link between community and contempt, on one side, and autonomy and anger, on the other, would hold true for three cultural groups, namely America, India, and Japan. They found that, overall, participants reported greater anger than contempt in both community target and person target violations.

But it is not only the links between community and autonomy violations to anger and contempt that have been explored in recent years. Kollareth and Russell (2019) also wondered whether sacred or nonsacred violations – in conjunction with or without pathogens – elicited disgust and found that for both American and Indian participants pathogens differently elicited emotional reactions as compared to sacred violations: Only pathogen exposure elicited a grossed out reaction, whereas violations of the sacred elicited disgust and anger.

Overview of the present studies

Given past research is suggesting that the everyday emotion concept of *disgust* may be a heterogeneous emotion category and that the words commonly translated as *disgust* may not refer to the same concept, we asked whether and to what extent the everyday concepts of *disgust* in different cultures share common content and internal structure. As we deemed it necessary to address the internal structure and content of *disgust* in both Western and non-Western cultures in order to provide a comprehensive map of the features of the *disgust* concept, we considered languages with different ranks in estimated numbers of speakers. The purpose of the present research was thus to explore the concept of *disgust* in four languages in addition to English and analyze whether the emotion concept of *disgust* and its translation equivalents refer to the same elicitors and encompass the same constructs. In order to unveil the structure of each of the emotion concepts and to gain new insights into the everyday concept of *disgust* and its translation equivalents, we used a novel methodological approach supplementing prototype analyses with network analyses.

The study of the everyday concepts of emotion, including their development and variation across cultures, has been inspired by Rosch's (1973) prototype approach and implemented by different researchers from the early 1990's on. One of the most representative theoretical contributions to this approach is Russell's review (1991a) on the historical and cross-cultural differences among emotion concepts. Russell argued that emotion concepts are scripts (i.e., cognitive representations) in which people categorize their emotional experiences in terms of features (e.g., behavioral responses,

phenomenological experiences, etc.) with different degrees of typicality. Using this approach, researchers mapped the features of emotion concepts such as *anger* (Russell & Fehr, 1994), *gratitude* (Lambert et al., 2009), *love* and *commitment* (Fehr, 1988), *shame* (Hurtado de Mendoza et al., 2010), and *vengeance* (Elshout et al., 2015). Based on the assumption stemming from a prototype perspective that there are no sharp boundaries separating members from nonmembers of a category (Russell, 1991b), we argue that the *disgust* concept has fuzzy boundaries. Thus, a prototype approach was deemed as best suited to analyze the content (i.e., unique or shared attributes) and boundaries between the *disgust* concepts in different cultures.

The aims of the present research were manifold: We first wanted to extend prototype theory and methodology to explore the concept of *disgust*. This research was expected to identify the features which compose the everyday concept of *disgust*. Second, most research on disgust has been undertaken in Western countries. As Rozin and colleagues (2008) pointed out, “almost the entire literature on disgust comes from the approximately 6% of the world in which English is the native language” (p. 766). Given the scarce cross-cultural research on disgust, and more specifically in non-American cultures, we aimed at shedding light on the conceptual and experiential differentiation of the internal structure of the emotion concept of *disgust* in five different cultures: three Western and two non-Western cultures. We were interested in assessing its definitions and physiological reactions, as well as physical and socio-moral disgust elicitors. Third, another concern in research on emotion has long been whether direct translations adequately assess emotion concepts. Therefore, we also questioned the direct translation of emotion terms and their assumed conceptual equivalence: We challenged the practice of one-on-one translation of emotion concepts in cross-cultural work by expanding related previous research to the emotion concept of *disgust*.

The present research provides a data-driven approach to the emotion concept of *disgust* and cross-cultural translation equivalents centered on the characteristics and features provided by the participants of different cultures instead of relying on an Anglo-centric analysis only. As compared to previous research on emotion based on prototype analyses only, we believed that an analytical approach based on both the combination of prototype analyses and network analyses is specially well suited to unravel the relevance of single features and the structure of interconnections (i.e., links) between the features of each of the emotion concepts of *disgust* and its translation equivalents. Thus, network method techniques were expected to allow us to study the structure of the *disgust* concepts and should aid in obtaining new insights into the emotion concept of *disgust* and four of its translation equivalents, respectively.

Study 1: Features of the concept of *disgust* in five cultures

In Study 1, we compared and contrasted the definition, prototypical antecedents, and physical responses associated with the concept of *disgust* in five cultures: Hong Kong, Germany, Palestine, Spain, and USA. The cultures in our studies were selected based on geographical (i.e., geographically distant) and cultural criteria.

Methods

Participants

One-hundred and two Hong Kong Chinese participants (females 48; mean age $M = 20.59$, $SD = 1.12$), 129 German participants (females 82; mean age $M = 23.41$, $SD = 3.91$), 88 Palestinian participants (females 60; mean age $M = 20.38$, $SD = 1.11$), 80 Spanish participants (females 49; mean age $M = 25.39$, $SD = 8.54$), and 118 American participants (females 86; mean age $M = 19.40$, $SD = 1.06$) all contributed voluntarily²; received course credit or financial compensation. Only those data stemming from participants fluent in Arabic, Chinese, English, German, and Spanish were considered. The Arabic speaking participants completed the paper-and-pencil questionnaire in the classroom, whereas Chinese speaking participants were recruited from a university in Hong Kong via mass invitation emails. The English speaking participants were invited through the usual recruitment system at their respective universities. The German and Spanish speaking participants were recruited through the university's usual recruitment system, as well as using a snowball sampling method. We aimed for similar sample sizes as used in previous research based on prototype approaches, such as studies compiling features and determining centrality ratings of *gratitude* (Lambert et al., 2009) or *vengeance* (Elshout et al., 2015).

Materials and procedure

We first asked participants to define *disgust* using their commonly used term in each of the five languages (*asco* in Spanish; *disgust* in English; *Ekel* in German; *garaf* in Arabic, and *yanwu* in Chinese), and then to freely list any situations or objects (i.e., elicitors) that were disgusting to them. With respect to this second question (“Are there any situations or objects in particular which are disgusting for

you?”), participants were asked to stop either after about a minute or 10 items. In response to a third question, participants described their bodily reactions to something disgusting (“How does your body react when it faces something disgusting?”). These questions were carefully chosen following previous prototype research so as to capture the definition of the concept (Hurtado de Mendoza et al., 2010), the items belonging to the category of *disgust*, as well as the behavioral aspects (Russell & Fehr, 1994).

As our interest was in the everyday concept of *disgust*, no definition of *disgust* or distinction between different emotion words was previously provided in order to prevent conveying a researcher-generated concept to the participants. Therefore, we did not include any guided questions in order to capture the everyday concept of *disgust* and its translation equivalents without interfering into the spontaneous generation of features. At the end, all participants were asked to fill out demographic variables, and then were thanked or thanked and compensated.

Preliminary data reduction

Following the procedure outlined by Fehr (1988), participants' responses were first of all organized into minimally inclusive linguistic units and grouped together into one category when coders considered that they were: 1) identical or almost identical with respect to their grammatical form (e.g., a verb inflected in different tenses; plural and singular forms of a noun; different but functionally similar prepositions and any other grammatical variation that didn't change the core meaning of the sentence), 2) modified by adjectives, or 3) identical in meaning. Examples included the linguistic units of “back away”, “distance myself from the source”, and “step back from disgusting thing”, which were subsumed into one category, or “sick to my stomach”, “stomach feels ill”, and “stomach unsettled”, which were subsumed into another category. Category analysis was performed for each of the questions asked: definition of *disgust*, elicitors, and physical reactions. On those cases where the two coders did not agree, consensus was reached by discussion. We focused on the features mentioned by at least 15% of the respondents of any of the five samples.³ Interrater reliability was calculated by randomly selecting 20 questionnaires, and then comparing and discussing the extraction of units. The agreement between coders was 87% for the Chinese sample,

² One participant in the German sample did not indicate the age and one participant in the Spanish sample did not indicate the age and gender.

³ The percentage of mentions of the features was calculated after the extraction of the linguistic units and grouping of the features into a category taking into account the total number of participants even though each participant might have generated more than a single feature for each of the questions.

89% for the Palestinian sample, and 90% for the Spanish, German, and US American samples.

This coding procedure yielded a total of 258 features for the definition of *yanwu*, which were grouped into 55 categories. With respect to the elicitors of *yanwu*, 843 linguistic units were assorted into 161 categories, while 214 physical responses were grouped into 58 categories. With respect to *Ekel*, 350 features of its definition were extracted from the German questionnaires, which were grouped into 86 categories; 466 elicitors were extracted and grouped into 66 categories, and the 156 physical responses were grouped into 48 categories. The question of the definition of the Arabic *garaf* yielded 150 attributes, which were grouped into 47 categories; 352 elicitors were grouped into 72 categories, and 197 physical responses into 52 categories. The extraction of attributes for the Spanish *asco* yielded 237 features for the question of its definition, which were grouped into 118 categories; 344 elicitors were extracted and grouped into 57 categories, and 51 categories were created out of 106 features of the physical responses. Finally, in the US sample, we extracted a total of 351 linguistic units regarding the definition of *disgust*, which were subsumed into 88 categories; 548 elicitors were grouped into 80 categories, while 225 physical responses were assorted into 50 categories.

Finally, we followed previous research on disgust and classified the elicitors as pertaining to one out of nine domains of disgust, which have been classified into four broad categories (Rozin et al., 2008): core disgust (i.e., animals, body products and food); animal-reminder disgust (death, inappropriate sex, poor hygiene, and violations of the exterior envelope of the body such as deformity or gaping wounds); interpersonal contamination (involving rejecting social contacts) and moral offenses (e.g., hypocrites and racists). The analysis of the features also revealed the need to incorporate interpersonal disgusting features (e.g., arrogant people) as a further domain.

Results

The analysis of the first domain (i.e., defining features of *disgust*) revealed that the participants from Germany, Palestine, and the USA (see Table 1) conceived of *disgust* as a feeling, whereas Chinese and Spanish participants agreed in describing it as causing unpleasant feelings. The behavioral components of *disgust* were mentioned in terms of “causing someone to escape” by Chinese and German participants and as “rejection” by Spanish and Chinese participants. In addition, *disgust* was associated to “feeling anger” by American and Chinese participants. The remaining features (e.g., “something with which people avoid being in contact”), however, were generated by participants of one country only.

Among the most mentioned elicitors of *disgust* were bugs, including spiders and cockroaches, which were mentioned by a large number of participants of all five countries. Body products were also mentioned by all Western participants (e.g., “feces” by American, Spanish, and German participants; “vomit” by American, Spanish, and German participants). Finally, food (i.e., “rotten food”) was mentioned by American and Spanish participants. Poor hygiene also made up a kind of elicitor, including “dirty bathrooms” (mentioned by German and American participants), “something dirty” (mentioned by Chinese and Spanish participants), or “bad smell” (mentioned by American, Spanish, and Chinese participants). Sexual behaviors, such as “rape”, “child abuse”, and “incest” were mentioned by American participants only, as also happened to be the case for the violations of the exterior envelope of the body, which were mentioned by participants of one country only (e.g., “open wound” by German participants only). With the exception of “racism”, which was mentioned by Spanish and American participants, the moral offenses yielded a large number of mentions, though by participants of one country only (e.g., “intolerance” and “politicians” were mentioned by Spanish participants only, and “people who cheat on their significant others” by American participants only).

Finally, the analysis of the physical reactions revealed that “nausea” was mentioned by Spanish, American, and German participants. Interestingly, this was not the case for the Chinese or the Palestinian samples, though Chinese participants mentioned that *disgust* “causes someone to vomit”. Further, *disgust* was physiologically described as “causing shivering” by German and Palestinian participants, and “causes the stomach to feel ill” was mentioned by American, as well as Spanish participants. With regards to the facial expression, American, Chinese, and Spanish participants mentioned respective changes.

Discussion

When it came to describing *disgust*, participants described *disgust* as an unpleasant feeling people dislike and avoid being in contact with, both behaviorally (including escaping, as mentioned by Chinese and German participants, or backing away, as mentioned by American participants) and visually (as mentioned by American and Chinese participants). However, participants of all five countries did not generally agree on the features describing *disgust*. Indeed, on the physiological level, American, German, and Spanish participants associated *disgust* with nausea, while Chinese participants related it to vomiting. *Disgust* also produces responses such as sickness, goose bumps, shivering, and trembling, whereby these latter reactions were listed by German and Palestinian participants only.

Table 1 Percentage of Constitutive Features of *Yanwu*, *Ekel*, *Garaf*, *Asco*, and *Disgust* Mentioned by at least 15% of the Participants in Alphabetical Order (Study 1)

Features	Frequency of mentions				
	<i>yanwu</i>	<i>Ekel</i>	<i>garaf</i>	<i>asco</i>	<i>disgust</i>
It causes closing the eyes					21%
It causes feeling tense					19%
It causes goose bumps		33%			
It causes nausea		28%		53%	31%
It causes rejection	19%			19%	
It causes shivering		26%	16%		
It causes sickness		27%			
It causes someone to escape	45%	20%			
It causes someone to refuse looking at or listening to	18%				
It causes someone to vomit	19%				
It causes strong nervousness			17%		
It causes the face to screw up		16%			
It causes the facial expression to change	17%			15%	41%
It causes the stomach to feel ill				15%	15%
It causes to back away					41%
It causes to feel anger	18%				19%
It causes trembling			16%		
It causes unpleasant feelings	27%			19%	
It is a feeling		19%	40%		25%
It is a misconduct without taking others into consideration	24%				
It is a repugnant feeling			28%		
It is a sensation of boredom			35%		
It is an emotion					17%
It is an open wound		24%			
It is bad breath		43%			
It is bad smell	21%			21%	36%
It is based on vision		17%			
It is being grossed out					15%
It is bugs, such as spiders and cockroaches	19%	81%	16%	43%	32%
It is child abuse					17%
It is dirty bathrooms		40%			33%
It is feces		20%		23%	25%
It is gore					23%
It is hair in the food		16%			
It is having problems at home			17%		
It is incest					16%
It is intolerance				55%	
It is irritating	30%				
It is mold		62%			
It is noisy	33%				
It is not agreeing with some customs			16%		
It is people smelling bad				20%	
It is people spitting in the street				18%	31%
It is people who cheat on their significant others					15%
It is people who don't shower					20%
It is politicians				26%	
It is poverty			18%		
It is racism				38%	28%

Table 1 (continued)

Features	Frequency of mentions				
	<i>yanwu</i>	<i>Ekel</i>	<i>garaf</i>	<i>asco</i>	<i>disgust</i>
It is rape					48%
It is rats				33%	
It is raw meat		26%			
It is repetitive work with low value	31%				
It is repulsion					21%
It is rotten food				58%	23%
It is rude people					19%
It is some types of food					53%
It is someone who behaves hypocritically	19%				
It is someone who gets frustrated by own failures	17%				
It is someone who is arrogant	22%				
It is someone who is selfish	17%				
It is something					19%
It is something dirty	36%			31%	
It is something people dislike	33%				
It is something repugnant	35%				
It is something unpleasant					19%
It is something with which people avoid being in contact	22%				
It is studying	22%		36%		
It is the division among the Palestinian people			48%		
It is the lack of understanding between people			35%		
It is the smell of milk gone off				34%	
It is the smell of septic tanks			26%		
It is to see rubbish			25%		
It is undesirable pressure resulting from examinations	16%				
It is vomit		29%		30%	42%
It is when being disturbed	20%				
It is when I see gory torture movies					16%

Interestingly, features related to the stomach were generated by American and Spanish participants only, with facial changes mentioned by all but the Palestinian sample.

Only one kind of *disgust* elicitors among those that have been conceptualized as the origin of disgust in the literature (foods, body products, and animals; Rozin et al., 1999a) took up a central role in all of our samples. Consistent with the research highlighting the animal-origin of disgust, animals were mentioned by a large number of participants. In line with recent research on disgust elicited by animals (e.g., Polak et al., 2020), bugs such as spiders elicited *disgust* in all five samples, with as much as 81% mentions in German respondents. However, feces, which together with vomit and spitting constitute body products, were mentioned by Western participants only. The same applies to foods, which, despite its importance in previous research, were described as especially *disgusting* by American, German, and Spanish participants (see for example Rozin et al., 1999a).

With regard to animal-reminder disgust, different features belonging to poor hygiene were mentioned by all five samples (e.g., “dirty bathrooms” by American and German participants; “something dirty” by Chinese and Spanish participants; or “bad smell” by American, Chinese, and Spanish participants), though none of the features was generated by the participants of all five countries; sexual behaviors were mentioned by American participants only, whereby only American and German participants referred to violations of the exterior envelope of the body, such as open wounds or gory torture movies. The largest number of mentions of moral offenses was yielded by Spanish (i.e., “intolerance” and “racism”) and Palestinian participants (i.e., “the division among the Palestinian people” and “lack of understanding between people”); even though American and Chinese participants generated other examples of moral offenses, this was not the case for the examples of moral offenses mentioned by German participants.

In sum, the participants of the five countries agreed with respect to only one feature of *disgust* (i.e., bugs), with many of the remaining characteristics being mentioned by participants from one country only. Thus, there was only low agreement with regard to what defines *disgust*, its elicitors, and the bodily reactions to something *disgusting*.

Study 2: Internal structure of the *disgust* concept

In Study 2, we aimed at analyzing the internal structure of the concept of *disgust* within and between the five countries. Therefore, we relied on the features generated in Study 1 in order to assess the constitutive features and the degree to which each of the features is typical of *disgust* in the respective country. Further, to address the overall structure of each emotion concept, but also how the different features relate to each another and the relevance of singles features, we conducted network analyses.

A network is comprised by nodes, with pairs of nodes being connected by edges. Networks have been traditionally applied in the social domain. However, in the last decade, the application of network analyses to psychological variables has gained importance. Instead of representing social actors as nodes as is done in social networks, in psychological networks the nodes are representing psychological variables and the edges statistical relations (Epskamp et al., 2018).

In the present research, we conceived the network in terms of shared meaning (Doerfel & Barnett, 1999). Each node represents a feature and the edges the relationship between them. All five networks were undirected as there are no origin or destination nodes (e.g., Benítez-Andrades et al., 2020) but associations between features.

First of all, we focused on the cohesion of the network by addressing its density (i.e., the number of connections in relation to all possible connections; Hanneman & Riddle, 2005) and thus the extent to which the network is connected (Zhang, 2010). Next, we approached the meso- structure of the network to complement observations at the level of the entire network and the individual node-level, and thus analyzed how the nodes were grouped into smaller groups of nodes within each network forming communities. Each community is formed by nodes (i.e., features) which are more densely connected with each other than the remaining nodes in the network (e.g., (Murata, 2010). Therefore, nodes within communities are more similar than nodes of different communities (İlhan et al., 2014).

Finally, we also tackled at the node level of analysis the importance and relative position of the features of the respective emotion concept of *disgust* within each network and how the nodes relate to each other by computing two

types of centrality measures: betweenness centrality and degree centrality. The centrality serves to address the relevance of a node in a network and its influence within a network (İlhan et al., 2014). A specific measure of centrality, betweenness centrality, refers to “the shortest paths in a network that passes through a node” (İlhan et al., 2014), p. 4). This measure serves to connect pairs of nodes which are not directly communicated with each another (Zhang, 2010). In our research it reflects the likelihood of getting activated by other features or activating other features (Greibitus & Bruhn, 2008). Degree centrality, on the other hand, is related to the activity or involvement of a node (O’Malley & Marsden, 2008), as it captures the sum of all the direct connections to a particular node (Zhang, 2010) and thus can be conceived of as an indicator of a central feature with a greater influence within a network (Benítez-Andrades et al., 2020) in contrast to peripheral features (Greibitus & Bruhn, 2008).

Method

Participants

Six hundred and fifty-three participants from Hong Kong ($N=164$, females 76; mean age $M=20.72$, $SD=1.35$), Germany ($N=110$, females 72; mean age $M=22.17$, $SD=3.39$), Palestine ($N=128$, females 84; mean age $M=22.57$, $SD=4.32$), Spain ($N=134$, females 81; mean age $M=22.75$, $SD=5.06$), and USA ($N=117$, females 86; mean age $M=19.41$, $SD=1.13$) participated either voluntarily, in exchange for course credit, or for financial compensation.⁴ The Arabic speaking participants were recruited in their respective classes and completed the paper-and-pencil questionnaire in the classroom. The Chinese speaking participants were recruited from a university in Hong Kong via mass invitation emails, whereas English speaking participants were recruited at their university. For the German and Spanish speaking participants a snowball sampling method was also used.

Materials

Participants were given a forced-choice questionnaire containing 63 items culled from Study 1. This questionnaire included the constitutive features mentioned by at least 15% of the respondents from Study 1 in each country, and it comprised the three main categories of statements describing each emotion concept of *disgust* or its translation equivalent: the definition of *disgust*, elicitors, and physical symptoms.

⁴ The German and the Palestinian data set included one missing value related to the age of a participant, and the Spanish data set one missing value related to the age and gender of a participant.

Each category identified in Study 1 was summarized by the most frequent sentence within the category (e.g., “back away” was mentioned more frequently than “distance myself from the source” and was therefore selected to represent this category). Final items of the definition and elicitors of *disgust* were phrased as “It is x” (e.g., “It is a sensation of boredom”), and physical symptoms were phrased as “It causes z” (e.g., “It causes to back away”). Next, the items of the five countries were compared, and two or more items were aggregated into one single item if they were semantically identical (e.g., if they referred to the same feature such as “It causes to escape” and “It causes to back away”). In addition, generally framed statements such as “It is a feeling” or “It causes an unpleasant feeling” or synonyms of disgust such as “grossed out” were not included in the questionnaire; they did not contribute much to the core meaning or to a better understanding of the internal structure of *disgust* because they were too vague or tautological. Indeed, the English term *grossed-out* has been found to correspond to the theoretical meaning of *disgust* (Nabi, 2002) and specifically to physical disgust rather than moral disgust (Herz & Hinds, 2013).

Procedure

Participants were asked to indicate the extent to which they considered each of the statements as typical of the *disgust* concept. They were told that whereas the number 0 indicated that the sentence was not typical of *disgust*, the number 5 indicated an intermediate prototypicality, and 10 meant that it was very typical. The items were listed in random order.

Results

Prototypicality of central and peripheral features.

Based on the assumption that the respective features of each of the concepts would vary in their representativeness, in a first step we addressed the prototype structure of each of the emotion concepts of *disgust* by analyzing the centrality vs. periphery of the features. We therefore used the standard procedure by Fehr (1988), as well as other prototype research (Elshout et al., 2015; Lambert et al., 2009). This procedure revealed that the features with ratings higher than 5.83, 4.88, 6.94, 5.97, and 5.68 were conceived of as central by Chinese, German, Palestinian, Spanish, and US participants respectively, and yielded 34, 34, 19, 31 and 32 features (see Table 2). The central features shared by all five countries were then subjected to one way ANOVAs, which revealed significant differences for the features belonging to the domains of poor hygiene (“bad breath”, $F(4, 648) = 8.04, p < 0.01$; “people who don’t shower”, $F(4, 646) = 7.98, p < 0.01$; “bad smell”, $F(4, 645) = 3.93,$

$p < 0.01$; “something dirty”, $F(4, 648) = 9.84, p < 0.01$; “smell of septic tanks”, $F(4, 647) = 8.75, p < 0.01$), food (“smell of milk gone off”, $F(4, 648) = 4.88, p < 0.01$; “hair in the food”, $F(4, 647) = 10.19, p < 0.01$), body products (“vomit”, $F(4, 647) = 3.99, p < 0.01$), sexual behavior (“child abuse”, $F(4, 647) = 10.83, p < 0.01$; “rape”, $F(4, 646) = 7.10, p < 0.01$; “incest”, $F(4, 645) = 8.78, p < 0.01$), as well as the behavior of causing someone to vomit, $F(4, 646) = 7.69, p < 0.01$. On the contrary, marginal differences were found for “feces”, $F(4, 647) = 1.97, p < 0.1$, and no differences were found for “mold”, $F(4, 647) = 1.67, ns$, nor for “dirty bathroom”, $F(4, 646) = 1.43, ns$. *Post-hoc* comparisons (see Table 3) revealed that the most frequent differences were found between three countries for the feature of “rape”, with German participants differing from the participants of all other countries by rating it as less prototypical (even though the mean centrality rating of the German participants was as high as 6.98), whereas Spanish participants rated “causes vomit” as more prototypical than German, Palestinian, and US participants. The same was true for “bad breath” in the case of the Chinese participants, who rated it as less prototypical than German, Palestinian, and Spanish participants, and with “child abuse” in the case of Spanish and US participants, both of which rated this feature significantly higher than Chinese, German, and Palestinian participants. The feature of “no shower” was rated higher by Palestinian participants than by Chinese, German, and US participants, whereas Spanish participants also differed in the ratings given to this feature from Chinese, German and US participants. All other differences were found between two or one country only.

Network analyses

In a next step, we explored the relevance of single features, as well as the structure and communities of features within the respective network. Therefore, we generated one matrix for each country (i.e., five in total). Each matrix is an undirected, valued network based on zero-order correlations, in which nodes represent the features of each emotion concept of *disgust* and a set of ties connect the respective pairs of nodes.⁵ We analyzed each network by tackling the overall structure and advancing towards smaller structures (i.e., from the overall network, through partitions of the network, to the single features). Thus, we followed an analytic strategy focusing first on the overall structure of each of the networks by addressing its density. Next, we analyzed the underlying communities. The communities were generated using the Louvain optimization method and represented (see Figs. 1, 2, 3, 4 and 5) using the algorithm of Kamada

⁵ All analyses were run with Pajek.

Table 2 Mean Centrality Ratings of the Features of Disgust, Ekel, Garaf, Asco and Yanwu in Alphabetical Order (Study 2)

Features	Concept									
	<i>yanwu M</i>	<i>SD</i>	<i>Ekel M</i>	<i>SD</i>	<i>garaf M</i>	<i>SD</i>	<i>asco M</i>	<i>SD</i>	<i>disgust M</i>	<i>SD</i>
closing eyes	2.96	2.81	6.15	2.77	6.57	2.79	5.69	3.13	5.79	2.63
feeling tense	3.21	2.48	4.63	2.59	6.20	2.61	4.14	2.87	4.82	2.54
goose bumps	5.20	2.82	4.04	2.69	6.06	2.41	3.33	2.78	3.79	2.52
nausea	7.86	2.08	7.31	2.21	6.55	2.74	7.78	2.22	6.98	1.84
rejection	6.28	2.33	8.07	2.20	6.09	2.44	7.20	2.42	5.38	2.88
shivering	3.52	2.74	6.06	2.54	5.26	2.37	3.82	2.77	3.29	2.31
sickness	6.26	2.53	7.24	2.18	6.45	2.49	6.65	2.46	6.44	2.35
refuse looking or listening	6.72	2.38	7.59	2.15	6.29	2.68	7.29	2.52	7.23	2.11
causes vomit	7.79	1.97	6.92	2.33	7.24	2.91	8.22	2.14	6.87	2.58
nervousness	5.04	2.77	3.85	2.35	6.16	2.48	4.03	2.56	4.17	2.26
face screw up	5.59	2.80	7.84	2.00	6.22	2.85	5.44	3.05	6.22	2.90
facial expression change	3.35	2.95	8.00	2.46	6.31	2.59	7.19	2.38	7.40	2.62
stomach ill	5.63	2.34	6.74	2.11	6.39	2.90	7.24	2.24	6.77	2.19
back away	4.64	2.76	7.26	2.58	7.04	2.72	7.35	2.53	6.79	2.31
anger	5.28	2.96	2.39	2.46	6.42	2.76	3.34	2.92	4.52	2.75
trembling	4.10	2.90	5.36	2.75	5.66	2.43	3.82	2.78	3.81	2.42
misconduct	7.29	2.22	2.51	2.30	5.98	3.00	4.38	2.92	4.62	2.65
boredom	4.80	2.70	0.82	1.36	6.21	2.86	2.62	2.59	1.74	2.25
open wound	3.34	2.47	5.07	2.68	6.86	2.85	4.99	2.89	5.62	2.57
bad breath	6.77	2.17	7.64	1.87	7.74	3.28	8.16	1.83	7.08	2.18
bad smell	7.41	2.01	7.74	1.69	7.02	3.20	8.06	1.93	7.40	2.06
based vision	2.73	2.64	5.75	2.81	6.15	2.64	6.21	2.67	5.07	2.76
bugs	6.30	3.30	6.70	2.58	6.67	2.68	6.91	3.04	6.68	2.86
child abuse	7.77	2.48	7.36	3.35	7.65	3.12	9.13	2.08	8.80	2.01
dirty bathrooms	8.28	1.81	7.96	1.91	8.15	3.10	8.06	1.86	7.67	2.21
feces	8.24	2.06	8.18	2.05	7.82	3.30	8.50	2.09	7.79	2.34
hair in food	6.63	2.72	6.18	2.48	7.48	3.33	8.06	2.16	7.44	2.26
problems at home	4.59	2.93	1.66	1.96	6.69	3.12	4.30	3.08	3.26	2.34
incest	7.85	2.42	6.33	3.37	8.30	3.12	7.37	3.16	8.26	2.61
intolerance	6.55	2.66	3.10	2.57	6.33	3.12	5.43	3.06	5.98	2.64
irritating	6.28	2.61	4.64	3.04	6.66	2.53	5.40	2.73	5.79	2.75
mold	6.36	2.47	6.90	2.21	7.12	3.29	6.64	2.69	6.91	2.78
noisy	6.10	2.41	2.38	2.24	6.71	2.92	2.43	2.48	2.22	2.24
not agreeing with customs	3.38	2.53	2.00	2.62	5.13	2.25	2.91	2.39	3.62	2.45
spitting in street	7.92	1.77	5.78	2.51	7.95	2.75	6.76	2.54	5.44	3.08
people cheating	7.53	2.64	3.49	2.86	7.80	3.18	6.37	3.03	7.32	2.60
people don't shower	7.03	2.27	7.15	1.96	8.06	2.97	8.21	1.76	7.13	2.44
politicians	3.64	2.59	2.34	2.75	4.85	3.50	5.96	2.88	4.87	2.57
poverty	3.51	3.00	1.93	2.43	5.55	3.33	5.40	3.41	4.94	3.09
racism	5.46	2.82	4.39	3.30	6.76	3.13	7.22	2.99	7.77	2.74
rape	8.01	2.66	6.98	2.94	8.13	3.23	8.45	2.61	8.79	2.07
rats	5.60	3.00	4.44	2.97	6.67	3.33	5.99	2.84	5.98	2.91
raw meat	2.74	2.34	3.33	3.00	5.84	3.46	3.81	2.91	4.01	3.17
repetitive work with low value	6.54	2.83	1.55	2.04	6.43	2.95	3.98	2.84	3.02	2.60
rotten food	7.38	2.29	7.54	1.89	6.91	3.39	8.09	2.02	7.15	2.14
rude people	4.41	2.33	2.12	2.10	6.90	3.07	4.89	2.80	5.12	2.76
types of food	1.95	2.33	5.68	2.50	4.76	2.71	5.62	2.80	5.02	2.67
behaves hypocritically	7.22	2.08	3.17	2.46	6.95	2.96	5.51	2.80	5.51	2.49

Table 2 (continued)

Features	Concept									
	<i>yanwu M</i>	<i>SD</i>	<i>Ekel M</i>	<i>SD</i>	<i>garaf M</i>	<i>SD</i>	<i>asco M</i>	<i>SD</i>	<i>disgust M</i>	<i>SD</i>
frustrated by own failures	5.38	3.10	1.28	1.83	6.11	2.98	3.21	2.95	2.82	2.52
arrogant	6.43	2.22	2.15	2.02	6.58	2.88	4.35	2.73	4.50	2.79
selfish	7.09	2.24	2.85	2.54	6.46	2.84	4.66	2.85	5.20	2.34
something dirty	7.38	2.09	5.74	2.31	7.41	3.13	6.88	2.24	6.74	2.03
avoid contact	6.66	2.44	8.05	2.19	6.43	2.80	7.66	2.29	7.34	2.44
studying	3.90	2.95	0.91	1.76	4.91	3.71	2.05	2.31	2.32	2.85
division among people	5.39	2.63	1.78	2.39	6.23	3.82	4.11	3.14	4.28	2.58
lack of understanding people	4.52	2.90	2.10	2.20	6.51	2.95	3.37	2.83	3.98	2.49
smell of milk gone off	6.45	2.72	6.93	2.27	7.14	3.31	7.57	2.28	7.62	2.20
smell of septic tanks	8.54	1.77	7.17	2.05	7.53	3.16	8.49	2.09	7.82	2.36
rubbish	5.12	2.44	3.82	2.26	6.28	2.93	5.16	2.65	4.32	2.57
undesirable pressure from examinations	6.32	2.56	1.69	2.40	6.83	3.11	3.28	2.81	3.22	3.03
vomit	7.88	2.29	8.05	1.75	7.33	3.10	8.41	1.97	7.67	2.08
disturbed	6.41	2.40	4.06	2.68	6.19	2.89	3.37	2.79	4.82	3.07
gory torture movies	4.83	2.78	5.94	3.29	4.71	3.30	5.98	3.10	5.71	2.98

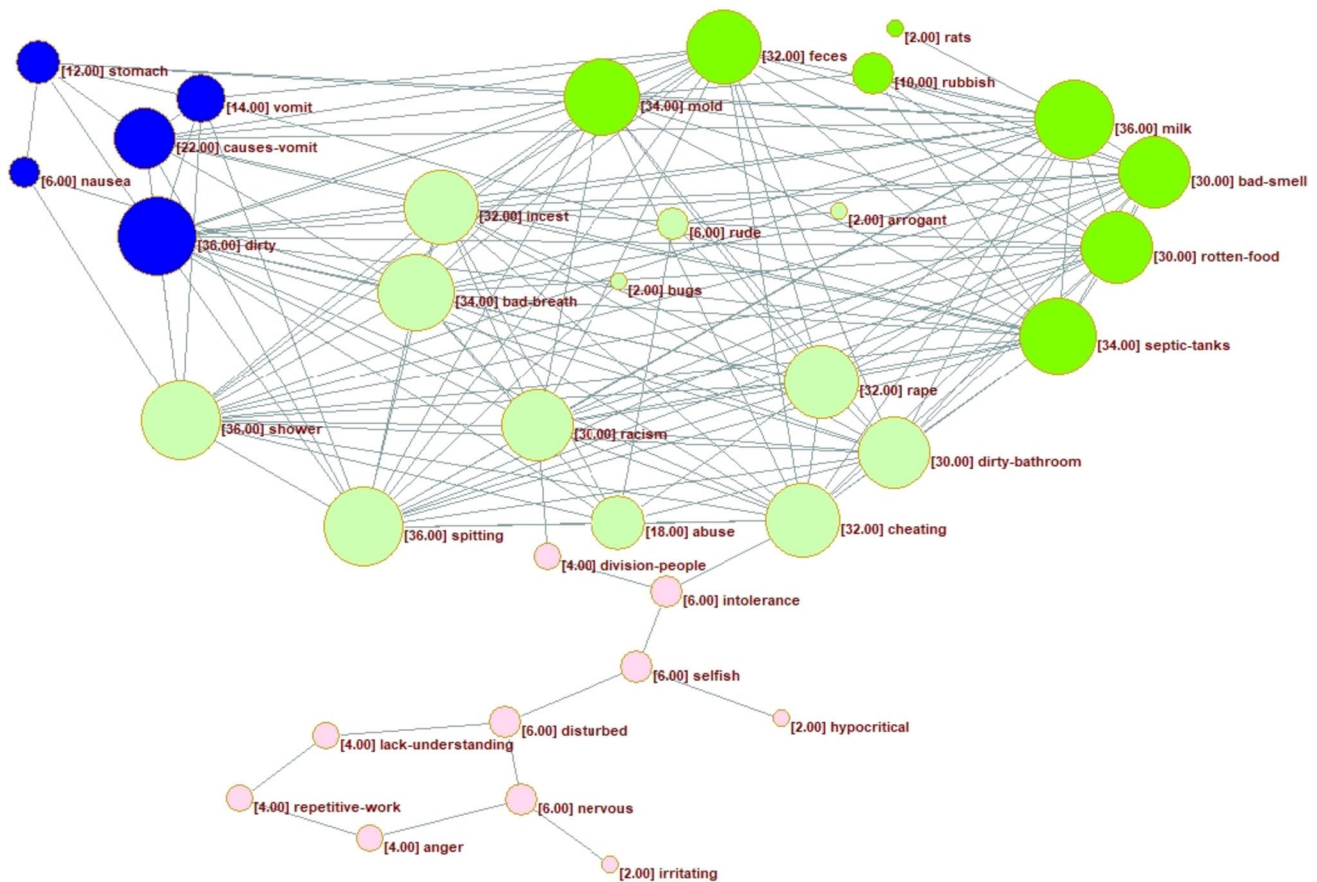
and Kawai (1989). In line with past research, we established $\theta=0.5$ as the threshold (e.g., Xu & Zhang, 2012). Finally, we centered on the role of individual features (i.e., the vectors) by analyzing their centrality (i.e., their importance or prominence within the network).

The mean network density of the *Chinese* network was $D=0.04$ and the lowest of the five networks. Thus, it showed the lowest cohesion of the five networks. The network was composed by ten communities, with the largest group containing 14 nodes (22.22% of the network). This largest group was formed by two subgroups, one entailing 9 nodes and the other subgroup 5 nodes: The first subgroup included features belonging to animal-reminder disgust and specifically to poor hygiene (e.g., “bad smell”, $C_B=0.009$), as well as core disgust (food and body products such as “feces”, which was characterized by the second highest degree centrality, $C_B=0.009$, $C_D=16$). The second subgroup represented physiological reactions (e.g., “sickness”) and a body product with the highest between centrality and degree centrality of the whole network (i.e., “vomit”; $C_B=0.018$, $C_D=16$). Thus, the feature of “vomit” had the strongest position within the network, with more nodes (i.e., features) linked to it than any other feature and represented a prominent influence over the flow of information within the network. Finally, the second community was formed by three features belonging to the physiological/feelings domain, with “trembling” having the highest betweenness and degree centrality in this community ($C_B=0.001$, $C_D=4$). The remaining communities were all formed by two nodes, thus attesting to the fragmentation of the whole network.

The mean network density of the *German* network was $D=0.11$. The network was composed by five communities and the analysis of the community structure revealed that the largest group contained 20 nodes (31.75% of the network) and was thus greater than the main community in the *Chinese* network. This main community was formed by two subgroups with 16 and 4 features, respectively. While the first subgroup included features belonging to interpersonal disgust (e.g., “arrogant”), moral offenses (e.g., “intolerance”), and also a feeling (i.e., “boredom”), the second subgroup was composed mainly by features related to sexual behavior (e.g., “rape”, $C_B=0.001$, $C_D=8$), as well as one interpersonal disgusting feature (i.e., “disturbed”). Importantly, the feature with both the highest betweenness and degree centrality was a moral offense, namely “racism” ($C_B=0.029$, $C_D=32$), and was included in the first subgroup. Thus, the feature of “racism” had a high impact within the network, activating other features within the network and controlling the access to other features. The second community included features referring to core disgust and animal-reminder disgust: body products (“vomit”, $C_B=0.017$, $C_D=14$), food (e.g., “rotten food”), poor hygiene (e.g., “dirty bathroom”), as well as physiological features (e.g., “nausea”). A further community with six features included physiological features (“rejection”, $C_B=0.004$, $C_D=10$). Two final communities entailed two features referring to socio-moral offenses (i.e., “studying”, $C_D=2$) and interpersonal disgust, on one side, and a physiological feature (i.e., “trembling”, $C_D=2$) and feeling, on the other.

Table 3 Comparisons of the shared central prototypical features of the internal structures of *Disgust, Ekel, Garaf, Asco* and *Yanwu* (Study 2)

Feature	Network (I)	Country (J)	Mean Difference (I-J)	Std. Error	Cohen's d	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
It causes vomit	China	Germany	.87	.29	0.41	.07	-0.04	1.78
		USA	.92	.29	0.41	.04	0.02	1.81
	Germany	Spain	-1.31	.31	-0.59	.00	-2.25	-0.36
	Palestine	Spain	-.99	.30	-0.39	.03	-1.90	-0.08
	Spain	USA	1.35	.30	0.58	.00	0.42	2.29
It is bad breath	China	Germany	-0.87	.29	-0.42	.06	-1.75	0.02
		Palestine	-0.97	.27	-0.36	.01	-1.82	-0.13
		Spain	-1.39	.27	-0.69	.00	-2.23	-0.55
	Spain	USA	1.08	.29	0.54	.01	0.17	1.99
It is bad smell	Palestine	Spain	-1.04	.28	-0.40	.01	-1.89	-0.18
It is child abuse	China	Spain	-1.36	.31	-0.59	.00	-2.31	-0.41
		USA	-1.04	.32	-0.45	.03	-2.02	-0.05
	Germany	Spain	-1.76	.34	-0.65	.00	-2.81	-0.72
		USA	-1.44	.35	-0.53	.00	-2.52	-0.36
	Palestine	Spain	-1.47	.33	-0.56	.00	-2.48	-0.47
It is hair in the food	China	Spain	-1.43	.31	-0.58	.00	-2.38	-0.48
		Germany	Palestine	-1.30	.34	-0.44	.00	-2.36
	Germany	Spain	-1.88	.34	-0.81	.00	-2.93	-0.83
		USA	-1.26	.35	-0.53	.01	-2.34	-0.18
It is incest	China	Germany	1.51	.36	0.53	.00	.39	2.63
	Germany	Palestine	-1.96	.38	-0.61	.00	-3.14	-0.78
		USA	-1.92	.39	-0.64	.00	-3.13	-0.72
It is people no shower	China	Palestine	-1.02	.27	-0.39	.01	-1.87	-0.18
		Spain	-1.18	.27	-0.57	.01	-2.01	-0.34
	Germany	Palestine	-0.90	.30	-0.35	.07	-1.83	0.03
		Spain	-1.05	.30	-0.57	.02	-1.98	-0.13
	Palestine	USA	.93	.30	0.34	.05	0.01	1.85
It is rape	China	Spain	1.08	.29	0.51	.01	.17	1.99
		Germany	Germany	1.03	.34	0.37	.05	-0.01
	Germany	Palestine	-1.15	.35	-0.37	.03	-2.25	-0.06
		Spain	-1.47	.35	-0.53	.01	-2.55	-0.38
	USA	-1.81	.36	-0.72	.00	-2.93	-0.69	
It is something dirty	China	Germany	1.64	.29	0.75	.00	0.73	2.55
		Germany	Palestine	-1.68	.31	-0.60	.00	-2.63
	Germany	Spain	-1.14	.31	-0.50	.01	-2.09	-0.20
		USA	-1.00	.32	-0.46	.04	-1.98	-0.02
It is smell of milk gone off	China	Spain	-1.12	.30	-0.44	.01	-2.05	0.18
		USA	-1.16	.32	-0.46	.01	-2.14	-0.19
It is septic tanks	China	Germany	1.37	.29	0.73	.00	0.49	2.25
		Palestine	1.01	0.27	0.41	.01	0.17	1.86
	Germany	Spain	-1.32	0.30	-0.64	.00	-2.24	-0.40
		Palestine	Spain	-0.96	0.29	-0.36	.02	-1.85
It is vomit	Palestine	Spain	-1.08	.28	-0.42	.01	-1.96	-0.20



Note. Only connections which are significant at $p < 0.05$ are shown. Nodes belonging to one and the same community are given the same color. Values in square brackets refer to degree centrality scores

Fig. 3 Associative Network for Palestine with Centrality Ratings (Study 2)

group contained 35 nodes, representing 55.56% of the network. This group comprised four subgroups: one subgroup entailed a total of twelve features pertaining to body products (i.e., “spitting”, $C_D = 36$), interpersonal disgust (e.g., “rude”), poor hygiene (e.g., “not shower”, $C_D = 36$), sexual behaviors (e.g., “abuse”) and socio-moral offenses (e.g., “cheating”, $C_B = 0.113$). “Cheating” was also the feature with the highest betweenness centrality, whereas “spitting” was the feature with the highest degree centrality and thus took up a central role in the flow of information, having a higher impact on the activation of other features and getting activated by other features, as well as controlling the access to other features. Attached to it was a second subgroup with ten features representing mainly socio-moral offenses: interpersonal disgust (e.g., “selfish”, $C_D = 6$; “disturbed”, $C_D = 6$), socio-moral offenses (e.g., “intolerance”, $C_B = 0.110$, $C_D = 6$), physiological features (i.e., “nervous”, $C_D = 6$), and feelings (e.g., “anger”, $C_B = 0.001$). This community also included a subgroup with eight features of core disgust and animal reminder disgust: body products (“feces”,

$C_B = 0.003$), food (e.g., “milk”, $C_B = 0.025$, $C_D = 36$), and poor hygiene (e.g., “bad smell”). A final subgroup contained five features pertaining to core disgust and animal reminder disgust (body products: “vomit”, $C_B = 0.001$; poor hygiene: “dirty”, $C_D = 36$) and physiological features (e.g., “nausea”).

The mean network density of the *Spanish* network was $D = 0.05$. The largest connected community of this network contained 12 nodes (19.05% of the network) and was formed by two subgroups entailing all interpersonal (e.g., “frustrated”) features with the exception of two socio-moral features (e.g., “division of the people”). The feature with the highest betweenness centrality of the whole network was “lack of understanding” ($C_B = 0.016$, $C_D = 10$), whereas the feature with the highest betweenness centrality of the second subgroup within this main community was “arrogant” ($C_B = 0.005$). This latter feature had also the greatest degree centrality of the whole network ($C_D = 12$). However, both centrality indices were comparatively lower than the indices in the other networks. Next to this main community, seven

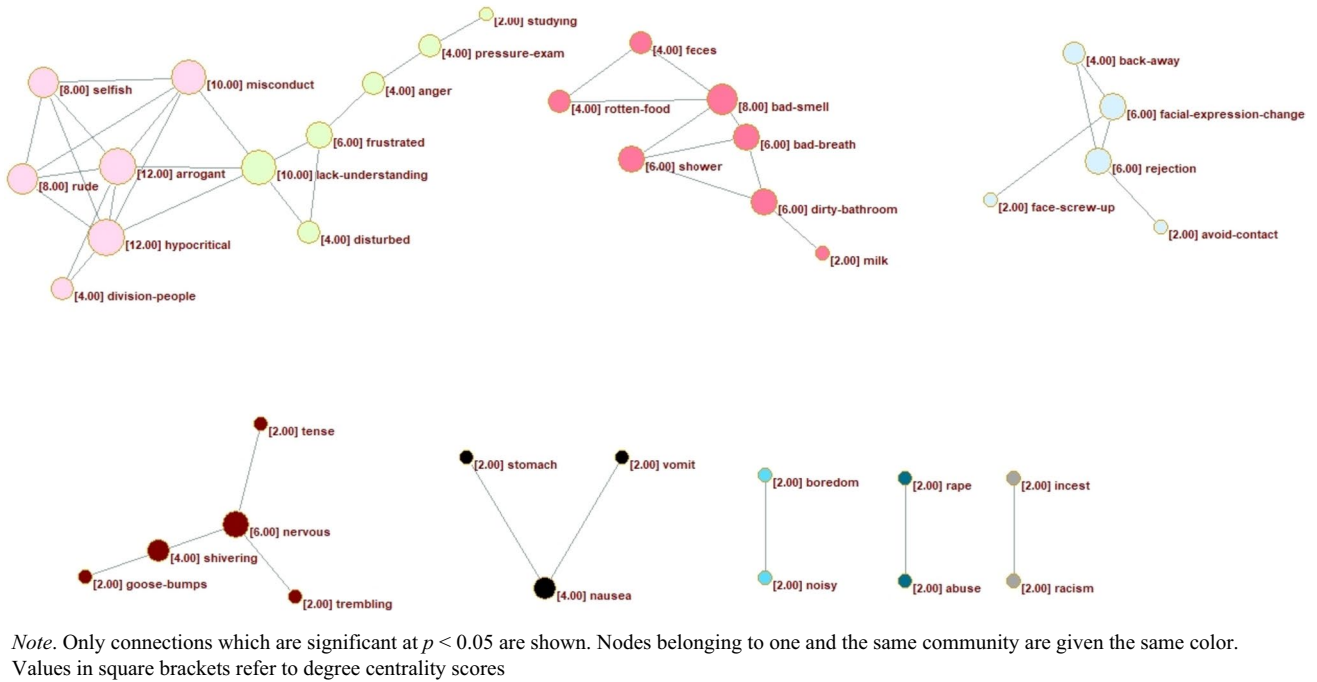


Fig. 4 Associative Network for Spain with Centrality Ratings (Study 2)

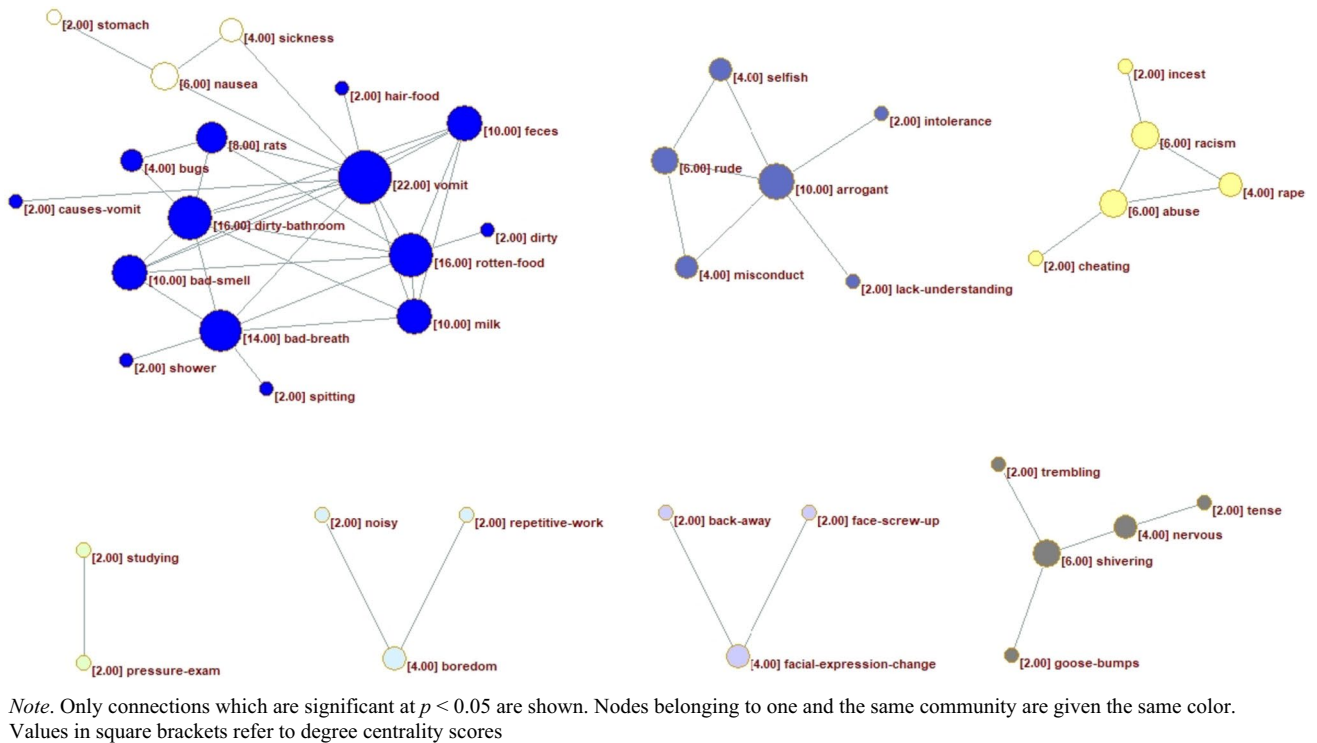


Fig. 5 Associative Network for USA with Centrality Ratings (Study 2)

further communities were identified, whereby three of them were composed by two features only. The features in the second community referred to a heterogeneous set of features: food (e.g., “rotten food”), poor hygiene (i.e., “bad smell”, $C_B = 0.004$, $C_D = 8$), and a body product (i.e., “feces”), whereas the third and fourth community were formed by physiological/feeling features only (e.g., “change of facial expression”, $C_B = 0.002$, $C_D = 6$ and “rejection”, $C_D = 6$, in the third community and “nervous”, $C_B = 0.003$, $C_D = 6$, in the fourth community). Finally, the fifth community contained three features around stomach and oral ingestion (e.g., “nausea”, $C_B = 0.001$, $C_D = 4$).

The mean network density of the *US* network was $D = 0.06$. The analysis of the community structure also revealed that the network included seven differentiated communities. In the largest group of the network (17 nodes; 26.98% of the network), two subgroups were identified: The main subgroup included features from the whole core disgust domain (e.g., animals: “rats”; body products: “vomit”, $C_B = 0.03$, $C_D = 22$; and food: “rotten food”), as well as poor hygiene features (e.g., “dirty bathroom”), and a physiological feature (i.e., “causes vomit”), whereas another subgroup featured physiological features only (e.g., “nausea”, $C_B = 0.008$, $C_D = 6$). Importantly, the feature with the highest betweenness and degree centrality, “vomit”, was included in the first subgroup. The second community was formed by interpersonal features (e.g., “arrogant”, $C_B = 0.004$, $C_D = 10$) and one socio-moral feature (i.e., “intolerance”); the third community by all three sexual behaviors (e.g., “abuse”, $C_D = 6$) and two socio-moral offenses (e.g., “racism”, $C_B = 0.002$, $C_D = 6$); the fourth community by two features from the interpersonal and socio-moral domain; the fifth community by the physiological/feeling features (e.g., “boredom”, $C_B = 0.001$, $C_D = 4$) and features from the socio-moral domain (i.e., “repetitive work”); and both the sixth and seventh community by features from the physiological domain only (e.g., “change of facial expression”, $C_B = 0.001$, $C_D = 4$, in the sixth community and “shivering”, $C_B = 0.003$, $C_D = 6$, in the seventh community).

Discussion

Support for our assumption that the concept of *disgust* is used differently in each country is provided by a series of observations: First of all, we found that the features regarded as being central in all the five countries included all animal-reminder features of poor hygiene extracted from the first study with the exception of the feature of “rubbish”, along with features belonging to the core disgust (i.e., body product and food) and sexual behavior. However, all but two of these features (i.e., “mold” and “dirty bathroom”)

differed in terms of the rated prototypicality. Differences between countries were also found for features stemming from the same disgust domain, such as sexual behaviors (e.g., “child abuse”) or poor hygiene (e.g., “no shower”).

Further, the network analyses uncovered differences in the communities of features, both with regard to the number of communities and the groups of features (ranging from one single community in the case of the Palestinian network to 10 communities forming the Chinese network). Importantly, the features which represented a greater influence in the flow of information and links to other features within the respective networks did also vary from country to country, ranging from features of core disgust (i.e., body products) as in the case of the Chinese and US network to socio-moral features or interpersonal features in the case of the German, Palestinian or Spanish network (e.g., the feature of “racism” showed the greatest degree centrality in the German network). These analyses also revealed that none of the central features identified by prototype analyses were included in the main networks of all five countries. If anything, the features were shared by three or less countries. Interestingly, however, whenever a feature identified as a central feature by prototype analyses was included in the main network by three of the countries (e.g., “bad smell”, “dirty bathroom”, “feces”, “milk”, “vomit”), it was shared by the same three countries: China, Palestine, and USA.

General discussion

Following Russell (1991a) who succinctly summarized “I take it for granted that psychologists are interested in the emotions of all people, not just those who speak English” (p. 428), the present research contributes to contemporary emotion research by focusing on the experience of disgust in three Western (Germany, Spain, USA) and two non-Western cultures (China, Palestine) and thus exceeds traditional two-culture comparisons. Charting the internal structure of the emotion concept of *disgust* in different countries was deemed as necessary, as there is still a paucity of research addressing the concept of *disgust* in non-American cultures, and even less so, for example, Spain and Palestine, which were included in our studies.

Complementing research questioning that *disgust* is a homogeneous category, the present research observed that the participants of all five countries did not agree in general on the features describing *disgust* and its translation equivalents, nor in terms of the perceived prototypicality. It is also relevant that no death-related features were generated by a representative number of participants, while the role of envelope violations also deserves mention: Both items (“gore

movies” and “open wound”) received relatively low ratings by the participants of all five countries, and were not connected to any nodes in all five networks. These findings are thus in line with research by Kupfer (2018) suggesting that stimuli representing injuries elicited empathic feelings of pain rather than disgust feelings.

The network analyses also showed that the features with the strongest position within the respective network varied between countries: Whereas a feature belonging to the domain of core disgust (i.e., the body product “vomit”) exerted a great influence over the information flow in the Chinese and US network and was characterized by a strong position within the network, this position was filled by a social-moral feature in the German network, by two interpersonal features in the Spanish network, or by a socio-moral feature and core disgust feature (i.e., body product) in the Palestinian network. Importantly, the networks did also vary with regard to their underlying communities of features, both in terms of its content and structure. With respect to core disgust features, body products and food were included in the communities of all five countries, whereas this did not hold true for animals (with the exception of the US network). A specific mention deserve also the socio-moral features, as these were relegated in the Chinese network to a single pair of nodes, whereas they took up a central role in the German and Palestinian networks. In the case of the Spanish and US networks the socio-moral features were characterized by fewer connections between nodes. Thus, our results suggest that not only socio-moral disgust features, but also those of core disgust varied cross-culturally. As core disgust elicitors have been mostly regarded as being common across cultures (Rozin et al., 2008, 1999b), our findings inform the future use of the *disgust* concept, both in the English as well as in different languages.

The role of moral disgust

An intriguing sequel of the present studies refers to the moral component of disgust and its importance, on which research on disgust has agreed so far. Our results are in line with findings suggesting that socio-moral disgust exists across different cultures (Oaten et al., 2009), though varying in the degree to which it is considered to be central for the respective concept of *disgust*, as well as differing with respect to its elicitors: Even though certain elicitors, such as racism or incest, have been stated to be among the most common examples of moral disgust (Olatunji & Sawchuk, 2005), we found both differences with regards to the moral offenses generated by each of the five cultures and the importance of each of the features. The cultural variations manifest themselves, for example, when it comes to analyzing the relevance of racism, as this feature was

generated by Spanish and English speaking participants only, and did also vary in terms of the relevance given in each of the five cultures.

Our results are seemingly in line with theories positing global correspondences between moral content and specific emotions instead of one-to-one correspondences. In fact, we found not only contents related to the domain of divinity (e.g., incest) to be in the main group of some networks; rather, contents related to the domain of autonomy such as cheating were also included in the main group of some of the networks. Further support for the theories positing global rather than exclusive correspondences between morality contents and emotions are also provided by Kollareth et al. (2022), who found that autonomy violations elicited both anger and disgust and suggest that it is the severity of a violation rather than the domain which determines the extent to which a violation is anger provoking or disgusting. Another interesting approach has been provided by P. S. Russel and Giner-Sorolla (2013), who argued that disgust versus anger is elicited depending on whether the violations are related to the body (e.g., sexual behaviors) or nonbodily violations (e.g., harmful behaviors).

In sum, our results do not seem to support an exclusive purity-disgust relationship and thus a specific morality–emotion correspondence, but fuzzy borders between moral content and emotions. Nevertheless, as our research did not target specifically the correspondence of moral content and specific emotions such as anger as compared to disgust, these findings have to be taken with caution. In fact, our findings do not exclude that contents related to autonomy may also – even predominantly – elicit anger.

While the present research results point to the interest of reconsidering the conceptualization of the emotion-morality link in future research, the present research also has practical implications deserving mention. These entail the importance of specifically addressing which characteristics belong to the moral domain in each culture and what might be regarded as a moral transgression. Indeed, the differences in conceptualizing morality may ultimately affect which behaviors are condemned and might as well help explain differences in moral behavior. Moreover, moral education might benefit from these results, as they aid in specifying with greater precision the constitutive features of *disgust*, as well as from the outlined methodology when it comes to addressing the moral component of the equivalents of the concept of *disgust* in other languages. The knowledge about the constitutive features of disgust, and specifically moral disgust, may ultimately serve as a basis for the development of school curricula that help to reduce racism and sexism.

Methodological insights

As compared to research where cultural differences are analyzed using a questionnaire with predesigned answers, we constructed a questionnaire that asked participants of 5 countries to freely provide information. Thus, participants generated the data by themselves (i.e., characteristics and features), which allowed us to assess directly (rather than derive) the structure of the concept of *disgust* and making claims about its underlying characteristics. Importantly, the present research addressed the internal structure of the emotion concepts of *disgust*, including not only elicitors but also features belonging to the definition of *disgust* and its physiological concomitants.

The inclusion of network analyses has also allowed for addressing how the features were grouped in communities, as well as the structure, structural connections, and characteristics of single features within each of the networks. The present research bears the advantage of not only identifying the relevance of single features, but also the underlying structure of emotion concepts (i.e., the community structure), thus revealing how the features are clustered and uncovering modules of features within networks. The use of network representations in future emotion research might also shed light into further emotion concepts as important as, for example, fear or sadness. Network representations may therefore complement other traditional methodologies of analyzing emotion concepts both within and between cultures.

Contributions and Implications of the Present Research

The contributions of our two studies align with the proposed aims of the present research as follows: Linked to the *first* aim of extending prototype theory and methodology to explore and identify the features that constitute the concept of *disgust*, we provide insights into the *disgust* concept in five different cultures and thus how *disgust* is conceived of in the respective everyday language. Moreover, we identified the central and peripheral features of the everyday concept of *disgust* and its equivalents. Our results confirm that a prototype approach (e.g., Russell, 1991a) is useful for studying the internal structure of emotion concepts and thus for unraveling their constitutive features and degree of overlap with respect to a given emotion concept, both within and between different countries. As compared to a traditional perspective, a prototype approach allows to flexibly consider each of the five *disgust* concepts as varying in the degree to which they are members of the category of *disgust*. While studies based on one-to-one translations of the *disgust* concept assume that emotion concepts refer to a unitary emotion, a prototype approach allows for

exploring the different features that make up *disgust* concepts. In fact, the prototype approach was useful in revealing that the *disgust* concepts in the five countries studied are based on different clusters of conceptual features, and in pointing to the link of the experience of disgust to that of anger. Albeit this latter feature was considered in all five cultures as a peripheral feature, this finding not only informs disgust research specifically, but also emotion research in general.

On a cross-cultural level, and in line with the *second* proposed aim, we also contribute to emotion research – and specifically research on disgust – complementing and extending previous research on disgust in predominantly Western countries by identifying the features of the emotion concept of *disgust* in two non-Western countries. Importantly, rather than applying a model stemming from one culture (e.g., American cultures) to other cultures, we followed a participant-based and culture-specific approach in examining the internal structure of *disgust* in the respective countries. The characteristics of the *disgust* concept for each of the countries may therefore inform future research on a theoretical level, while mapping each of the *disgust* concepts also offers practical implications, such as when it comes to designing studies aimed at inducing disgust (e.g., to analyze the effectiveness of self-regulation strategies on the down-regulation of disgust), as well as targeting the analysis of disgust sensitivities in both the general population or specific populations.

Third, despite the importance of the construct of *disgust* and the literature pointing to the lack of homogeneity both within the construct of *disgust* and with regards to the *disgust* construct in other languages, comparatively little is known about the concept of *disgust* and some of its translation equivalents. Thus, following a recent call to address the equivalence of the meaning of emotion terms across cultures (Fontaine & Breugelmans, 2021), the present research also adds to the literature on disgust by analyzing the *disgust* term and four equivalent terms in order to address whether or not the meaning of the five terms of *disgust* can be regarded as being conceptually equivalent across cultural groups and whether or not they capture adequately the respective *disgust* concept. The differences found with respect to the structure of the five emotion concepts support previous research suggesting that results obtained in North America should be taken with caution when it comes to generalizing them to other cultures (Han et al., 2016). In line with the results by Hurtado de Mendoza et al. (2010), who showed across three studies that the emotion terms of *shame* and *vergüenza* differ in their internal structure, constitutive features, and degree of overlap of the two categories, the present findings also have intriguing implications as they raise questions about the use of common translation equivalents of *disgust* and about the accuracy of a direct translation (and back-translation) methodology of equivalent emotion terms in cross-cultural studies. Future

research on emotions may assess whether or not applying a direct translation methodology may be leading to a significant loss of information about the underlying concepts.

In sum, the present research addresses an emotion that has received less attention than other emotions such as fear or anger (Olatunji & Sawchuk, 2005). This research is expected to aid future research by providing insights into how disgust is conceived of in different cultures and thus how to use the concept when it comes to assessing and measuring disgust. Importantly, most of the research on emotions relies on self-report measures. Thus, the knowledge about the features that compound an emotion concept are of particular relevance for the adequate conceptualization and operationalization of an emotion. Both theoretical and applied intra-cultural, as well as cross-cultural research, should benefit from the obtained findings.

Limitations and future prospects

Great care was taken in properly assessing disgust in each of the cultures: The terms were chosen by the responsible investigators in each of the cultures, all of whom happened to be native speakers, drawing specifically from the scientific literature of disgust. However, one might argue that the terms used in the present research in cultures other than the USA do not closely match the English word of *disgust*. This may be especially the case with the Chinese term *yanwu* (厭惡), as at least five Chinese translations for *disgust* have been used in past research. Translations were obtained using the back translation procedure (e.g., Elfenbein & Ambady, 2003) or analysis of themes in written essays (Barger et al., 2010). Though it has also been suggested that *otu* best captures nausea-related disgust in China (Barger et al., 2010), findings have not been converging on one single answer. However, *yanwu* is the most popular concept for *disgust* in Chinese and has been commonly referred to as disgust elsewhere (Elfenbein & Ambady, 2003). Indeed, there are various hints that the central features and themes of *disgust* have been properly assessed with *yanwu*: first of all, 19% of the Chinese participants in Study 1 mentioned that *disgust* “causes someone to vomit”, 35% described it as “something repugnant”, and 33% as “something people dislike”. With respect to *yanwu*, Chinese participants also mentioned features belonging to the core of disgust (e.g., 36% mentioned “something dirty” belonging to poor hygiene, and 19% referred to animals). In addition, our data suggest that *yanwu* might represent an accurate translational equivalent: not only the features such as “feces” have obtained a high prototypical rating but also the features of socio-moral disgust (“rape”, Study 2).

Another interesting methodological question relates to measurement errors in cross-cultural research and specifically to cross-cultural differences in response styles. Indeed, one might wonder whether the observed cultural differences

in Study 2 originate from cultural differences in response styles or represent genuine cultural differences. Unfortunately, however, the cognitive, contextual and cultural factors underlying response styles have not been systematically addressed (Benítez et al., 2016). One form of response style which has gathered attention is the extreme response style (i.e., the tendency to use the extreme options of response scales; e.g., Bachman & O’Malley, 1984). Despite the interest in extreme responses, however, evidence about its effects on cross-cultural comparisons, as well as the effectiveness of the approaches to measure and control for extreme responses have been mixed. In the present research, we took care in constructing response scales which could help avoiding ambiguity by providing midpoints in the response scale. Further, as previous findings suggest that choosing a response scale format of multiple points reduces extreme responses in Hispanic samples (Hui & Triandis, 1989), we stayed with 10-point scales.

Nevertheless, in order to address extreme responding in the present research, we followed the procedure of van Herk et al. (2004) and calculated both negative and positive extreme responses by counting the responses rated with 0 or 10 and dividing the number by the number of items. Though there are significant differences between the five countries in extreme responding, $F(4, 648) = 15.28, p < 0.001, \eta^2 = 0.09$, the differences were generated mainly by the diverging scores from Palestinian participants, who scored higher ($M = 0.34, SD = 0.21$) than the participants of all other four countries and specially China ($M = 0.18, SD = 0.18$). As the scores ranged between 0 and 1, they may be considered as being reasonably moderate. Furthermore, our American participants did not display more extreme scoring than participants from collectivist cultures. Neither did we observe more extreme scoring in South European countries (i.e., Spain) as compared to Western European countries (i.e., Germany), as previously described by van Herk et al. (2004). Thus, no systematic relationship with collectivistic vs individualistic countries, as was found in past research, could be observed.

The sample size also deserves attention. It has been pointed out that the usual sample sizes in psychological research may lead to a loss in accurate network estimations (Epskamp et al., 2018). Indeed, it has been suggested that a 50-node network would require 1275 parameter (Epskamp et al., 2018) and thus a network consisting of 63 items would require an even higher number of observations, rendering it difficult to collect sufficient data at the country-level network.

Another limitation refers to the use of the samples, as the present studies relied predominantly on student samples. One might ask whether or not the findings of our samples are representative and generalizable to a wider population. Some research has for example addressed changes in disgust sensitivity across different ages or age differences in the facial recognition of disgust. In this regard, Widen and Russell (2008) observed that the last emotion category to emerge in children

aged 2 to 5 years was actually disgust. However, little is known about the development of conceptualizations of emotion concepts. Future research might thus want to replicate the present findings with populations differing in their degree of accessibility of the concept of *disgust*, as well as analyze other emotion concepts sharing overlapping features with disgust, as happens to be the case with *grima* (Schweiger Gallo et al., 2017).

Future research should also seek to replicate the present results as well as to extend our findings to other cultures, both Western and non-Western ones. As our findings indicate, even within similar cultures the internal structure of *disgust* varies significantly. Therefore, comparing emotion concepts within the same language family (e.g., other comparisons within Indo-European languages) seems warranted. However, not only looking at the internal structure of *disgust* concepts but also of other emotion concepts is desirable, as is the combination of different methods to assess them.

Conclusion

By combining Indo-European and non-Indo European languages, we relied on the assumption that *disgust* is not a homogeneous construct and tested this assumption using a novel methodological approach. Venturing out beyond cultural comparisons based on two groups and using large samples, our data suggest that the *disgust* concepts in the five cultures included in our studies (Germany, Hong Kong, Palestine, Spain, and USA) are not equivalent. Thus, the concept of *disgust* seems to differ across cultures and should not be regarded as having the same meaning cross-culturally.

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval The two studies are based on questionnaires. The studies were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. Approval was obtained in line with the customs of the participating institutions. In the case of the US samples, the study was approved by the Internal Review Boards of New York University, USA.

Consent to participate Participants tacitly gave their consent by completing and returning the questionnaire or gave written informed consent after being informed of the nature of the study.

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