

Abstract

The present study examined mother-child talk about disgust. A total of 68 mothers and their 4-, ($M_{age} = 55.72$ months, $SD = 4.13$), 6- ($M_{age} = 77.70$ months, $SD = 5.45$), and 8- ($M_{age} = 100.90$ months, $SD = 4.61$) year-old children discussed four tasks relating to moral and pathogen disgust. Tasks comprised labelling facial expressions of emotions, generating items that would make participants disgusted or angry, identifying moral and pathogen transgressions as either causing anger or disgust, and finally rating the degree to which moral and pathogen transgressions were disgusting and justifying their responses. Mother-child dyads recognized the facial expression of happiness more accurately than that of disgust, but disgust was recognized equally well as expressions of sadness and anger across all age groups. Dyads associated moral transgressions with anger, whereas they associated pathogen transgressions with disgust. Finally, mothers and children and mothers individually rated pathogen transgressions as more disgusting than moral transgressions. Taken together, findings show that moral disgust is understood at a later age and is only used metaphorically, if at all, in children as old as 8 years old.

Keywords: moral disgust, pathogen disgust, emotion fallacy, parent-child talk, emotion

Is Moral Disgust Socially Learned?

Disgust is a universal human emotion linked to physiological, behavioural, and cognitive responses. Disgust has been studied as both a state emotion that we experience, and as an individual difference, in which some people are more prone to experiencing disgust than others (Haidt et al., 1994; Tybur et al., 2009). Disgust may have evolved to protect individuals from ingesting toxins and avoiding contact with infectious diseases (e.g., Curtis et al., 2011; Oaten et al., 2009; Rozin et al., 2008). In this way, disgust serves to protect people from negative and dangerous outcomes. According to Tybur et al. (2013) disgust has three main domains, namely: pathogen, sexual, and moral disgust. Pathogen disgust is elicited by food, animals, body products, strangers, hygiene, death, and envelope violations. It is activated to avoid physical contact with organisms that can be infectious. Sexual disgust is triggered to avoid sexual contact with low sexual value mates. Finally, moral disgust is elicited by moral transgressions with the function of endorsing rules and norms. In the domain of pathogen disgust, food disgust may be a particularly potent disgust response (Hartmann & Siegrist, 2018), in which food disgust sensitivity is related to general disgust sensitivity, but still an independent predictor of food avoidance.

In addition to pathogen disgust protecting people from harm, disgust may also function to prompt individuals to endorse certain moral rules in societies (e.g., Graham et al., 2009; Horberg et al., 2009; Rozin et al., 1999). Indeed, disgust may have expanded from having an oral nature and being elicited only by physical objects to avoid the ingestion of contaminants to being triggered by socio-moral concerns (Rozin et al., 2008). Socio-moral disgust can occur in response to moral violations, including injustice, harm, and perception of individuals or groups having a bad moral character. Socio-moral disgust is also an extension of Rozin et al.'s (2008) interpersonal disgust, involving concerns with contamination from other people, which may play a central role in discrimination and stereotyping (Vartanian et

al., 2013, 2016). Scholars generally agree on which objects elicit pathogen disgust. However, the extent and existence of other types of disgust, such as injury disgust resulting from body envelope violations (Kupfer, 2018) and moral disgust (Russell & Giner-Sorolla, 2013) are questioned. Work on moral disgust, which was the focus in the present study, results in four main positions (Russell & Giner-Sorolla, 2013). The metaphorical use position argues that moral disgust serves as a synonym for the true emotion of moral anger (Nabi, 2002), and when we say that a moral issue disgusts us, what we really mean is that it makes us very angry. Indeed, Royzman et al., (2017) found that undergraduate students in the U.S. used the terms ‘disgust’ and ‘disgusting’ as proxies for general dislike, disapproval, and discomfort. Along the same lines, Fiske (2020), in his critique of the lexical fallacy in emotion research, suggests that the same emotion’s vernacular word, such as disgust, may be used to refer to different scientific entities (e.g., anger, disgust, outrage), depending on the context and individuals’ characteristics. These differences may lead to the study of an incoherent construct (Armstrong et al., 2021). On the other hand, the general morality position postulates that disgust is central to moral judgements and can result from a range of different moral violations, from cheating to injustice (Rozin et al., 2000, 2008; Jones & Fitness, 2008; Schnall et al., 2008; Wheatley & Haidt, 2005; Hutcherson & Gross, 2011). The purity position argues that disgust is uniquely elicited by purity violations, which includes acts that pollute the body and/or mind, including when people do not practice self-restraint (Rozin et al., 1999; Horberg et al., 2009). Finally, the bodily norm position argues that disgust is most unique from anger in the context of bodily norm moral violations (e.g., eating taboo foods and certain sexual acts; Russell & Giner-Sorolla, 2013). In the context of bodily norm violations disgust responds to concrete violations, which are categorical in nature (e.g., something is disgusting or not). Therefore, unlike anger which responds to contextual or situational appraisals (e.g., how harmful the situation is), disgust responds to concrete

features of the disgusting object (Royzman & Sabini, 2001). Related to this, according to the bodily norm position (Russell & Giner-Sorolla, 2013), disgust tends to be less flexible and responsive to the situation. Additionally, individuals struggle to justify their disgust, resulting in tautological responses for their disgust (e.g., *“It’s just disgusting”*). Disgust also tends to have straightforward avoidance tendencies. In summary, according to three of the four positions (general morality, purity, and bodily norm) disgust can extend into the moral realm; however, the positions differ in which moral violations truly elicit disgust.

Social Domain Theory

Moral emotions, such as disgust, would thus be experienced when individuals conceive of a situation as violating moral norms. One theory used to understand the development of morality in children comes from the social domain perspective (Smetana, 2006). The social domain perspective suggests that young people’s social knowledge arises out of their everyday experiences (Helwig & Turiel, 2016). From the social domain theory, individuals bring to bear multiple forms of reasoning to understand a wide variety of situations. Situations that serve to protect individuals from harm may stimulate a focus on negative outcomes (Tenenbaum & Ruck, 2012). Situations perceived as morally disgusting may involve the coordination of different types of reasons, including moral and social conventional reasoning. Moral reasoning involves consideration of the welfare and rights of others, whereas social conventional reasoning involves consideration of the rules and norms of cultures and communities (Yucel et al., 2020). These reasons are conceived of as distinct (e.g., Malti et al., 2012).

Children begin distinguishing moral and social conventional reasoning by the age of 3 years (Yucel et al., 2020) and generally consider moral transgressions (e.g., hitting a child) as more serious than social conventional transgressions (e.g., jumping a queue; Smetana et al., 2018; Yucel et al., 2020). Children attribute emotion to individuals involved in contexts that

invoke social conventional and moral reasoning (Malti et al., 2012). However, moral transgressions cause stronger emotional reactions than social conventional transgressions in children as young as 3 years (Hardecker et al., 2016; Yucel et al., 2020). In sum, young children differentiate between different types of norm violations, and different norm violations elicit emotional reactions of different intensity, but what it is not yet well understood is if different types of transgressions invoke specific emotions in children.

In addition, children and adults recruit other types of reasons to situations that may also be deemed involving physical and/or psychological harm (Alsamih et al., 2021). For example, young people often invoke dimensions related to psychological aspects (referring to psychological aspects of the actors involved), outcomes (concerning the consequences of the situation), physical (referring to physical aspects of the situation), and authority (concerning aspects related to hierarchy and power) in situations in which exclusion and rights are entailed (Alsamih et al., 2021). Because social knowledge is embedded in social situations, people often negotiate their understanding of a situation with recourse to multiple domains of reasoning (Besirevic & Turiel, 2020; Ruck & Tenenbaum, 2014). In the present study, we examined how mothers and children discussed situations that involved pathogens, food, and moral norms. We focused on how mothers and children would conceive of these situations using previous reasoning from the social domain theory (Turiel, 2015), and whether these situations would invoke disgust.

Development of Disgust

Unlike other primary emotions (e.g., happiness) examined in parent-child talk (e.g., Fivush et al., 2000), disgust may not be experienced until later in childhood (Rozin & Fallon, 1987). Children label happiness, sadness, and anger by 3 years from facial expressions. In contrast, children are unable to label disgust until almost 4 and a half years (Widen & Russell, 2008). Although children may be unable to identify disgust, many researchers posit

that children experience disgust between the ages of 3 and 5 (Bloom, 2004; Stevenson et al., 2010).

Some developmental research suggests that both physical objects (e.g., faeces, vomit) and socio-moral concerns (e.g., stealing from a neighbour) are perceived as disgusting (Danovitch & Bloom, 2009). Research suggests that the experience of disgust undergoes revision with 7-year-old children's understanding of disgust extending to moral disgust. For example, Danovitch and Bloom (2009) found that children linked the term, disgusting, less often to moral violations than to physically disgusting acts. At the same time, children linked facial expressions of disgust with moral violations. Both moral and pathogen disgust have been found to elicit the same facial expression (Cannon et al., 2011; Chapman et al., 2009). In a task in which aliens engaged in unfamiliar/weird actions, 7-year-old children were more likely to perceive these actions as wrong if they elicited disgust than if they did not (Rottman & Kelemen, 2012). Although children have a good understanding of morality from a young age (Killen & Stangor, 2001), not until later are children able to identify emotions resulting from moral violations (Pons et al., 2004; Tenenbaum et al., 2004). At age 9 years, only half of children report that a child would feel sad from not reporting a misdemeanour. At 11 years, most children correctly identify moral emotions (e.g., shame, guilt). Given the late age at which disgust, and in particular moral disgust appears, socialization may partially account for disgust. To answer whether socialization may partially account for the appearance of disgust in children, the present study examined parent-child talk about disgust.

Socialization of Disgust

The late emergence of disgust compared to other emotions (Widen & Russell, 2008), suggests a social component to its development. Moreover, children develop as apprentices into the values of their cultural communities in everyday situations (Rogoff et al., 2018). Parents play a central role in these everyday interactions and may be one means of the

socialisation of disgust. Support for this proposal comes from Rozin et al., (1984) who found a large relation between parents' and children's disgust sensitivity. Further, studies on disgust proneness have found a higher correlation between mothers and children than between fathers and children (Muris et al., 2012), suggesting that maternal disgust proneness may be of special relevance in children's socialization of disgust (Olatunji & Viar-Paxton, 2020).

However, it is important to note that parent-child relations in disgust sensitivity may also be due to genetics, especially because the majority of studies have examined parents and their biological children, making it impossible to differentiate between environmental and genetic influences. Parent-child relations in disgust may be due to genetics, the environment, or a combination of both (Sherlock et al., 2016). Twin studies are a useful methodology to explore this issue further. Sherlock et al., (2016) examined disgust sensitivity in female twins and their siblings. Findings show that half of the variation in moral, pathogen, and sexual disgust was due to genetic effects. No evidence for shared environmental effects was found. Although Sherlock et al. (2016) is informative in disentangling genetic influences, participants were adults by which time shared environmental influences may have waned. In addition, the research did not include parents.

Other work suggests that parents are central to children's emotional development. For example, Eisenberg proposed that children learn about emotions from parents' reaction to their emotions, parents' emotion expression, and parent-child emotion talk (Eisenberg, 2020; Eisenberg et al., 1998). The present study focuses on parent-child emotion talk because everyday conversations support children in appropriating the cultural norms of their communities (Aznar & Tenenbaum, 2015; Tenenbaum & Hohenstein, 2016). Through conversations parents socialize children's general emotion understanding (Aznar & Tenenbaum, 2020; Aznar & Tenenbaum, 2013; Laible & Song, 2006), moral understanding (Eisenberg, 2000), and values (Alsamih et al., 2021). After controlling for children's previous

emotion understanding, mothers' use of emotion words in conversations with their children predicted children's future emotion understanding (Aznar & Tenenbaum, 2013). However, research on parent-child conversations has mostly been focused on more general emotion understanding rather than on specific emotions, such as disgust. No prior research has examined how parents and children talk about pathogen and moral disgust. For this reason, this study examined how mothers and their children invoked pathogen and moral disgust in a variety of situations. We targeted children who were 4-, 6-, and 8-years-old because prior work has suggested that children can identify pathogen disgust by about age 4 years (Widen & Russell, 2008) and moral disgust at around age 7 years (Stevenson et al., 2010).

Hypotheses

Parent-child conversations may invoke pathogen, food, and moral aspects of disgust because disgust may be felt in all of these situations. Based on the late emergence of disgust compared to other emotions (Widen & Russell, 2008), we expected parents and children to identify faces of disgust less accurately than the more prototypical emotions of anger, sadness, fear, and happiness. We expected this effect to be most pronounced in the youngest age group, who are below the age at which children label faces displaying disgust correctly (Russell & Widen, 2003; 2008). Given that moral disgust is identified at a later age than pathogen disgust in children (Stevenson et al., 2010), we expected that dyads would generate more pathogen and food than moral examples for disgust. Second, we coded mother-child dyads' examples of disgust and anger to examine the different hypotheses for disgust. If disgust is used metaphorically (e.g., Nabi, 2000; Fiske, 2020), we would expect mothers and children to generate more moral examples for anger than disgust. We would also expect mother-child dyads to be more likely to identify anger as a response to a moral than a pathogen violation and disgust for a pathogen than a moral violation. Third, we hypothesized that mother-child dyads would rate pathogen violations as more disgusting than moral

violations. We also expected mothers and children to use more moral (e.g., “*It is not fair to behave that way*”) and social conventional (e.g., “*You cannot behave that way because it goes against the school’s rules*”) reasons for moral violations than physical, and more physical (e.g., “*Do not touch that dog’s poop because it is bad for you*”) and outcome (e.g., “*You cannot eat that because you will get sick*”) than moral reasons for the pathogen violations. Finally, following the metaphorical use of disgust, we expected mothers on their own to also rate pathogen violations as more disgusting than moral violations.

Method

Participants

Sixty-eight mother-child dyads took part in the study. A total of 21 4- ($M_{age} = 55.72$ months, $SD = 4.13$; 10 males), 23 6- ($M_{age} = 77.70$ months, $SD = 5.45$; 11 males), and 24 8- ($M_{age} = 100.90$ months, $SD = 4.61$; 11 males) year-old children participated in the study. The number of participants was based on sample sizes in previous literature (e.g., Danovitch & Bloom, 2009 who included about 20 per condition). Fifty-six children were White European, 4 were Afro-Caribbean British, 6 were mixed ethnicity, and 1 was Asian. Mothers’ mean age was 39.83 ($SD = 4.90$) and they were mostly white ($n = 61$). A total of 93.7% of mothers were married. Overall, participating mothers were moderately educated (48 held at least an undergraduate degree). All mother-child dyads had English as their first language. Because mothers and children were left alone, they sometimes skipped tasks. We retained mothers and children for the tasks that they completed.

Procedure and Materials

Ethical approval was received by the University of Blinded RKE Ethics Committee. Participants were recruited via schools and social media. A total of 57 dyads were interviewed in their own homes, 4 were interviewed at the university developmental laboratory, and 7 completed the interview online due to the COVID-19 pandemic. Mothers signed an informed consent form and children provided verbal consent. Participants were told

that the study examined mother-child emotion talk because we did not want to cue them to disgust before they participated in the study. Mother-child dyads completed four tasks, and mothers completed two tasks independently. They were given one task at a time and were asked to inform the researcher once they finished each of them. Participants were told that they could talk for as long as they wanted and that there were no right or wrong answers. Conversations lasted approximately 20 minutes and were audio-recorded (except those conducted online, which were video-recorded). Children received a £10 voucher to thank them for their participation. The study was not pre-registered. Materials, coding scheme, and data can be found in: <https://doi.org/10.5281/zenodo.4905637>

The six tasks were always administered in the same order because they go from more general to more specific. Task 1 asks participants to spontaneously name items that trigger specific emotions and their facial expressions of emotions. Task 2 asks about whether certain moral and pathogen violations were linked with anger or disgust. Tasks 3 and 4 ask directly about specific moral and pathogen transgressions being disgusting or not. Finally, tasks 5 and 6 ask directly about specific moral and pathogen transgressions being disgusting or not and were undertaken by the mothers alone. Tasks 2 to 6 were accompanied by pictures.

Task 1

Mother-child dyads were asked to name items that made them happy, sad, angry, and disgusted (e.g., “*Can you name things that would make you disgusted? You can name as many as you want*”). Dyads could mention as many items as they could think of.

Participating dyads were also asked to label the facial emotion expression of each of these four emotions (e.g., “*Which of these faces shows disgust?*”) from an array of six gender-matched photographs of a child, showing happy, sad, angry, disgusted, neutral, and scared facial expressions of emotion (Real-World Affective Faces Database (RAF-DB); see supplemental materials). Examples of disgusting items mentioned by mothers and their

children were “*blood*”, “*vegetables*”, “*eating things I don’t like*”, “*eating mouldy stuff*”, or “*eating fat from meat*”. Examples of items that cause anger were “*people annoying me*”, “*someone shouting at me*”, “*not being able to do things I want to do*”, “*when mummy shouts at me*”, and “*my sister annoying me*”.

Task 2

Mother-child dyads were given four vignettes and were asked to select the emotion one would feel after a violation. We coded whether they selected disgust or anger. There were two vignettes assessing moral violations, one directly assessing the act (e.g., “*How would Lucy/David feel if she/he jumped the queue? Why?*”) and the other one was towards a person who violated a moral act (“*How would Sebastian/Cheryl feel if he/she plays with another child who stole a snack? Why?*”). The other two vignettes assessed pathogen violations directly, one towards a physical object (e.g., “*How would Rachel/Ollie feel wearing dirty clothes? Why?*”), and the other one towards a person who had committed a pathogen violation (“*How would Emma/Jack feel playing with someone whose house is dirty? Why?*”).

Task 3

Mother-child dyads were given four vignettes and were asked to rate the degree to which something was disgusting from a scale of 1 (not at all disgusting) to 5 (very disgusting) and to justify their decision. There were two vignettes assessing pathogen disgust; one assessed pathogen disgust towards a physical object (e.g., “*How disgusting is it to sit on a dirty chair? Why?*”) and the other assessed pathogen disgust towards a person who committed a violation (“*How disgusting is it to play with someone who has dirty nails? Why?*”). The other two vignettes assessed moral disgust; one assessed moral disgust directly (e.g., “*How disgusting is it to copy someone’s homework? Why?*”) and the other towards a person who

committed a moral violation (“*How disgusting is it to play with someone who has pushed someone else? Why?*”).

Task 4

Mother-child dyads were given two food-related vignettes and were asked to rate the degree to which something was disgusting from a scale of 1 (not at all disgusting) to 5 (very disgusting) and to justify their decision. One vignette asked about unhygienic food (“*How disgusting is it to eat rotting food? Why?*”) and the other asked about a food eaten in a particular culture (“*How disgusting is it to eat a grasshopper? Why?*”).

Task 5

Mothers were given four vignettes and were asked to rate the degree to which something was disgusting on a scale of 1 (not at all disgusting) to 5 (very disgusting). There were two vignettes assessing pathogen disgust; one assessed pathogen disgust towards a physical object (e.g., “*How disgusting is it to sleep on a dirty bed?*”) and the other assessed pathogen disgust towards a person who committed a violation (“*How disgusting is it to play with someone who has dirty hair?*”). The other two vignettes assessed moral disgust; one assessed moral disgust directly (e.g., “*How disgusting is it to take someone else’s toy?*”) and the other towards a person who committed a moral violation (“*How disgusting is it to play with someone who has teased someone else?*”).

Task 6

Mothers were given two food-related vignettes and were asked to rate the degree to which something was disgusting from a scale of 1 (not at all disgusting) to 5 (very disgusting). One vignette asked about unhygienic food (“*How disgusting is it to eat rotting chicken?*”) and the other asked about a food eaten in a particular culture (“*How disgusting is it to eat crickets?*”).

Transcription and Coding

Recorded conversations were transcribed verbatim by a research assistant.

Conversations were coded at the dyad level. In task 1, we coded whether dyads mentioned something related to pathogen disgust, which refers to physical objects (e.g., “poo”, “bogies”); moral, which refers to fairness violations (e.g., “when my brother cheats playing chess”); or food (e.g., “broccoli”, “peas”). Answers were coded as 0 when not using a category and 1 when using a category. Please note that based on the coding scheme we refer to ‘physical’ and not ‘pathogen’ when discussing participants’ reasoning about disgust. Physical included pathogen items, but because we could not be sure that the participants were referencing pathogen in some cases (*‘porridge is lumpy’*), we used the larger category of physical to not make assumptions about participants’ answers.

In task 2, we coded whether mother-child dyads were more likely to view moral violations as invoking anger more than pathogen violations and pathogen violations as invoking disgust more than moral violations (as measured by identifying the facial expression of emotions that the vignette’s protagonist would feel). Answers were coded as 0 when not using a category and as 1 when using a category.

In tasks 3 and 4, we examined the reasons given by participants to support their ratings. Based on past research (Tenenbaum et al., 2018) and a close reading of the transcripts, a coding system was developed. The coding scheme had 6 categories: a) moral, which refers to equality of rights and fairness (e.g., “*It is not fair to copy someone’s homework, you have to do it yourself*”), b) social conventional, which refers to cultural norms (e.g., “*In some countries they eat grasshoppers but not in my country*”), c) physical, which refers to physical aspects (e.g., “*I wouldn’t sit on a dirty chair because my clothes will also get dirty*”), d) authority, which refers to hierarchy (“*We are not allowed to push someone and you might get told off*”), e) outcomes, which refers to consequences (“*You shouldn’t eat rotten food because you will get sick*”), and f) psychological, which refers to volition or

emotional aspects (“*She can copy someone’s homework if she wants to*”). Although authority often falls under social conventional reasoning in the domain theory (Turiel, 2015), authority may play a central role in other theories of morality (Graham et al., 2009), which is why we examined it separately. Answers were not coded in a mutual exclusive way. In other words, mother-child dyads’ answers could be coded into more than one category. Answers were coded as 0 when not using a category and 1 when using a category.

Reliability

Inter-rater reliability was established separately for tasks 1, 3, and 4. To calculate inter-rater reliability, the first and second authors discussed the coding scheme. They then separately coded 20% of the transcripts. Discrepancies were resolved through discussion. Reliability was achieved with a K of .94 for Task 1, a K of .85 for Task 3, a K of .76 for Task 4, indicating a good level of agreement (Bakeman & Gottman, 1997). The first author coded the remaining transcripts.

Results

Task 1.

Labelling of Emotion Faces.

We first examined mother-child labelling of emotion faces to investigate whether mother-child dyads were less accurate in identifying disgust than the other four emotions. We expected that this effect would be most pronounced in the younger age group. We conducted an Age x Emotion mixed design ANOVA. Age served as a between-subjects variable and emotion served as a within-subjects variable. Labelling (correct or not) served as the DV. Although there was a main effect of age, $F(2, 65) = 3.54, p = .04, partial \eta^2 = .10$, none of the follow-up tests were statistically significant with the protected alpha. There was a main effect for emotion, $F(3, 195) = 6.75, p = .001, partial \eta^2 = .31$, but no significant Age x Emotion interaction effect, $F(6, 195) = .39, p = .83$. To examine the main effect of emotion,

we conducted six repeated measures ANOVAs with a protected alpha of .008 (.05 divided by 6). Mother-child dyads less accurately labelled disgust than happiness, $F(1, 67) = 12.53, p = .001, \text{partial } \eta^2 = .16$, but not sadness, $F(1, 67) = 4.37, p = .04, \text{partial } \eta^2 = .06$, or anger, $F(1, 67) = .00, p = 1.00$. Mother-child dyads did not more accurately identify happiness and anger, $F(1, 67) = 16.19, p = .02, \text{partial } \eta^2 = .10$, or happiness and sadness, $F(1, 67) = 16.19, p < .001, \text{partial } \eta^2 = .07$. Finally, mother-child dyads did not more accurately identify anger or sadness, $F(1, 67) = 4.80, p = .03, \text{partial } \eta^2 = .07$. Table 1 breaks the pattern down by age. Binominal tests indicate that only mother-child dyads in the older age group were able to identify disgust and anger at above chance levels.

Table 1. Mother-child dyads facial expression of emotion labelling frequencies.

	Faces			
	Happy	Sad	Anger	Disgust
Age				
4 ($n = 21$)	19*	17*	14	15
6 ($n = 23$)	22*	20*	15	15
8 ($n = 24$)	24*	23*	21*	20*
Total percent	95.60%	88.24%	73.53%	73.53%
	(12.69%)	(32.46%)	(44.45%)	(44.45%)

Note. * $p < .01$.

Naming of Disgusting and Moral Examples.

Next, we examined whether dyads were more likely to generate physical and food than moral examples for disgust and whether there were differences in moral examples between anger and disgust in Task 1. We also explored age effects. To examine this hypothesis, we conducted a 3 (Age: 4, 6, 8) x 2 (Emotion: anger, disgust) x 3 (Type: physical

moral, food) mixed-design ANOVA. Age served as a between-subjects factor and Emotion and Type served as within-subjects factors. Participants were coded as either using physical moral, food examples, or not. There was main effect of Type, $F(1.82, 118.14) = 30.85, p < .0001, \text{partial } \eta^2 = .32$, which was subsumed by an Emotion x Type interaction effect, $F(2, 130) = 22.51, p < .0001, \text{partial } \eta^2 = .26$. There was no effect of Age x Type, $F(3.64, 118.14) = 1.22, p = .31$ or Age x Emotion x Type, $F(3.74, 121.45) = 1.88, p = .24$. There was a main effect of Age, $F(2, 65) = 7.17, p = .002, \text{partial } \eta^2 = .18$. Mother-child dyads generated a smaller range of categories when children were 4-year-olds ($M = 1.71, SD = .96$), $F(1, 67) = 70.16, p < .0001, \text{partial } \eta^2 = .51$, and 6-year-olds ($M = 2.52, SD = .85$), $F(1, 42) = 8.84, p = .005, \text{partial } \eta^2 = .17$, than 8-year-olds, ($M = 2.54, SD = .66$), $F(1, 43) = 11.67, p = .001, \text{partial } \eta^2 = .21$. There were no differences between 6-year-olds and 8-year-olds, $F(1, 45) = .008, p = .93$. To examine disgust separately, we conducted a repeated-measures ANOVA for the disgust situations, which was statistically significant, $F(1.65, 110.78) = 28.59, p < .0001, \text{partial } \eta^2 = .30$. We used a corrected alpha of .01 for follow-up tests (.05 divided by 3). As expected, mother-child dyads were less likely to mention a moral example than a physical example, $F(1, 67) = 70.16, p < .0001, \text{partial } \eta^2 = .51$, or food example, $F(1, 67) = 19.59, p < .0001, \text{partial } \eta^2 = .23$. Mother-child dyads were more likely to use a physical than a food example, $F(1, 67) = 9.82, p = .003, \text{partial } \eta^2 = .13$. When looking at the use of a moral example, mother-child dyads were more likely to include one for anger than disgust, $F(1, 67) = 24.12, p < .0001, \text{partial } \eta^2 = .27$.

Table 2. Frequencies of mother-child naming of physical, moral, and food examples when asked about anger and disgust.

Anger			Disgust		
Physical	Moral	Food	Physical	Moral	Food

Age						
4 ($n = 21$)	12	6	0	11	0	7
6 ($n = 23$)	16	8	2	18	4	10
8 ($n = 24$)	12	17	1	18	3	10
Total percent	58.8%	45.6%	4.4%	69.12%	10.29%	39.71%

Task 2.

Identification of Disgust and Anger

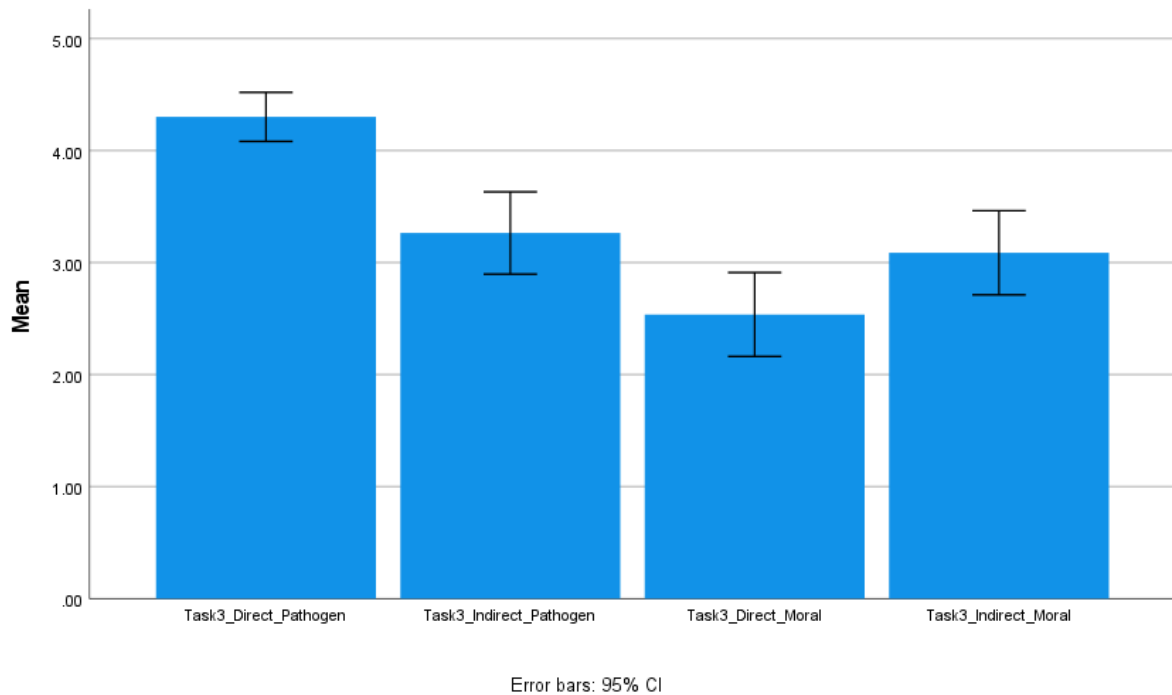
We examined whether mother-child dyads were more likely to view moral violations as invoking anger more than pathogen violations and pathogen violations as invoking disgust more than moral violations (as measured by identifying the facial expression of emotions that the vignette's protagonist would feel) collapsing across age groups. We conducted four separate McNemar's test with a protected alpha of .01. We found no differences in anger across the two types of vignettes based on whether the contact was direct or toward a person who had committed the violation. In the wearing of dirty clothes ($n = 8$) compared to jumping a queue ($n = 5$) vignette, mother-child dyads were equally likely to invoke anger ($n = 66$), $p = .55$. Similarly, there was no difference in anger whether the vignette involved associating with someone who lived in a dirty house ($n = 7$) or stole a snack ($n = 16$) ($n = 62$), $p = .06$. In contrast, they were more likely to invoke disgust for wearing dirty clothes ($n = 23$) than jumping a queue ($n = 6$) ($n = 66$), $p = .002$. Similarly, they were more likely to invoke disgust for associating with someone who lived in a dirty house ($n = 23$) than jumping a queue ($n = 61$), $p < .001$.

Task 3.

Pathogen versus Moral Ratings of Disgust

To examine whether mother-child dyads rated pathogen or moral violations differently both directly and indirectly (e.g., whether they conducted the violation), we conducted a 3 (Age: 4, 6, 8) x 2 (Type of Violation: pathogen, moral) x 2 (Relational: direct, indirect) ANOVA on ratings of disgust. Ratings for each item ranged from 1 (not at all disgusting) to 5 (very disgusting). There were no interactions with Age. There was a main effect of Type, $F(1, 65) = 28.55, p < .0001, \text{partial } \eta^2 = .31$, in which mother-child dyads rated pathogen violations ($M = 3.78, SD = .92$) as more disgusting than moral violations ($M = 2.81, SD = 1.40$). This effect was qualified by a statistically significant Type x Relational interaction effect, $F(1, 65) = 45.06, p < .0001, \text{partial } \eta^2 = .41$. Participants rated it more disgusting to directly touch the chair ($M = 4.30, SD = .90$) than to associate with someone with dirty nails ($M = 3.26, SD = 1.52$), $F(1, 67) = 25.89, p < .0001, \text{partial } \eta^2 = .28$. In contrast, participants rated it more disgusting to associate with someone who pushed ($M = 3.09, SD = 1.55$) than to copy someone's homework, ($M = 2.54, SD = 1.57$), $F(1, 67) = 11.54, p = .001, \text{partial } \eta^2 = .15$. Participants rated it more disgusting to touch the chair than to copy homework, $F(1, 67) = 89.78, p < .0001, \text{partial } \eta^2 = .58$. In contrast, participants did not rate it more disgusting to associate with someone who pushed than playing with someone with dirty nails, $F(1, 67) = .50, p = .48$.

Figure 1. Mother-Child Ratings of Disgust Of Direct and Indirect Pathogen and Moral Violations



Note. Direct pathogen comprised touching a dirty chair, indirect pathogen comprised playing with someone with dirty nails, direct moral comprised copying homework, and indirect moral comprised playing with someone who pushed.

Reasoning about Disgust

Only moral, physical, social conventional, and outcomes were used at least 10% for at least one situation. Note not all mother-child dyads gave a reason so we have 63 dyads for this part of the study. To understand which type of reasoning was used the most for each vignette, we conducted four one-way repeated-measures ANOVA with scores on the reasons as a DV with a protected alpha of .01. For the vignette involving physical touch with something unhygienic (e.g., a dirty chair), moral and social conventional reasons were not used and thus, could not be included in the ANOVA model. Physical and outcomes did not differ, $F(1, 62) = 1.20, p = .28$.

For the vignette involving indirect physical touch with something unhygienic (e.g., a person with dirty nails), there was a significant difference in reason, $F(2.26, 139.82) = 19.30, p < .0001, partial \eta^2 = .24$. Mother-child dyads used more physical than moral, $F(1, 62) =$

33.48, $p < .0001$, $partial \eta^2 = .35$, or social conventional reasons, $F(1, 62) = 39.46$, $p < .0001$, $partial \eta^2 = .30$. The use of physical and outcome reasons did not differ from each other, $F(1, 62) = 4.77$, $p = .03$. Outcomes was used more than moral, $F(1, 62) = 12.71$, $p = .001$, $partial \eta^2 = .17$, or social conventional, $F(1, 62) = 15.81$, $p < .0001$, $partial \eta^2 = .20$. Moral and social conventional reasons did not differ from each other, $F(1, 62) = .20$, $p = .66$.

For the vignette involving an immoral act (e.g., copying homework), there was no significant difference in reasons, $F(3, 186) = 3.18$, $p = .03$. However, for the vignette involving contact with someone who committed a moral violation (e.g., someone who pushed), there was a significant difference in reason, $F(2.16, 133.92) = 5.90$, $p = .003$, $partial \eta^2 = .09$. Moral was used more than physical, $F(1, 62) = 14.35$, $p < .0001$, $partial \eta^2 = .30$, and the same as social conventional, $F(1, 62) = 2.17$, $p = .15$, and outcomes, $F(1, 62) = .74$. Outcomes was used more than physical, $F(1, 62) = 19.73$, $p < .0001$, $partial \eta^2 = .24$. Social conventional was not used more than physical with the protected alpha, $F(1, 62) = 7.01$, $p = .01$. There were no differences between social conventional and outcomes, $F(1, 62) = 3.67$, $p = .06$.

Table 3. Mean proportion of mother-child dyads reasoning about pathogen and moral violations.

	Reasoning			
	Physical	Moral	Social Conventional	Outcomes
Chair ($n = 63$)	.37 (.49)	.00 (.00)	.00 (.00)	.48 (.50)
Nails ($n = 63$)	.48 (.50)	.05 (.21)	.03 (.18)	.29 (.46)
Homework ($n = 63$)	.08 (.27)	.27 (.45)	.11 (.32)	.14 (.35)
Push ($n = 63$)	.03 (.18)	.27 (.44)	.16 (.37)	.30 (.46)

Task 4.

Mother-child Disgust Ratings in Food Situations.

To compare the two food situations, we conducted a 3 (Age: 4, 6, 8) x 2 (Situation: unhygienic food, cultural food) ANOVA on disgust ratings. There were no interactions with age. Participants rated it more disgusting to eat the unhygienic ($M = 4.82$, $SD = .39$) than cultural food, ($M = 4.38$, $SD = 1.02$), $F(1, 65) = 10.90$, $p = .002$, $partial \eta^2 = .14$.

Mother-Child Reasoning about Disgust in Food Situations.

Only three categories were used at least 10% in at least one vignette, which were social conventional, physical, and outcome. Note not all mother-child dyads gave a reason so we have 65 dyads for this part of the study. We looked at each vignette separately. For the rotting food, only physical and outcome reasons were used. There was no difference in physical or outcome reasoning, $F(1, 64) = 2.11$, $p = .15$. For the grasshopper vignette, $F(1.67, 104.15) = 19.67$, $p < .0001$, $partial \eta^2 = .24$, participants used more physical than social conventional reasons, $F(1, 64) = 15.85$, $p < .0001$, $partial \eta^2 = .20$, and outcome, $F(1, 64) = 34.44$, $p < .0001$, $partial \eta^2 = .35$, than social conventional reasons. There was no difference in the use of physical or outcome reasoning, $F(1, 64) = 2.64$, $p = .11$.

Table 4. Mean proportion of mother-child dyads reasoning about food.

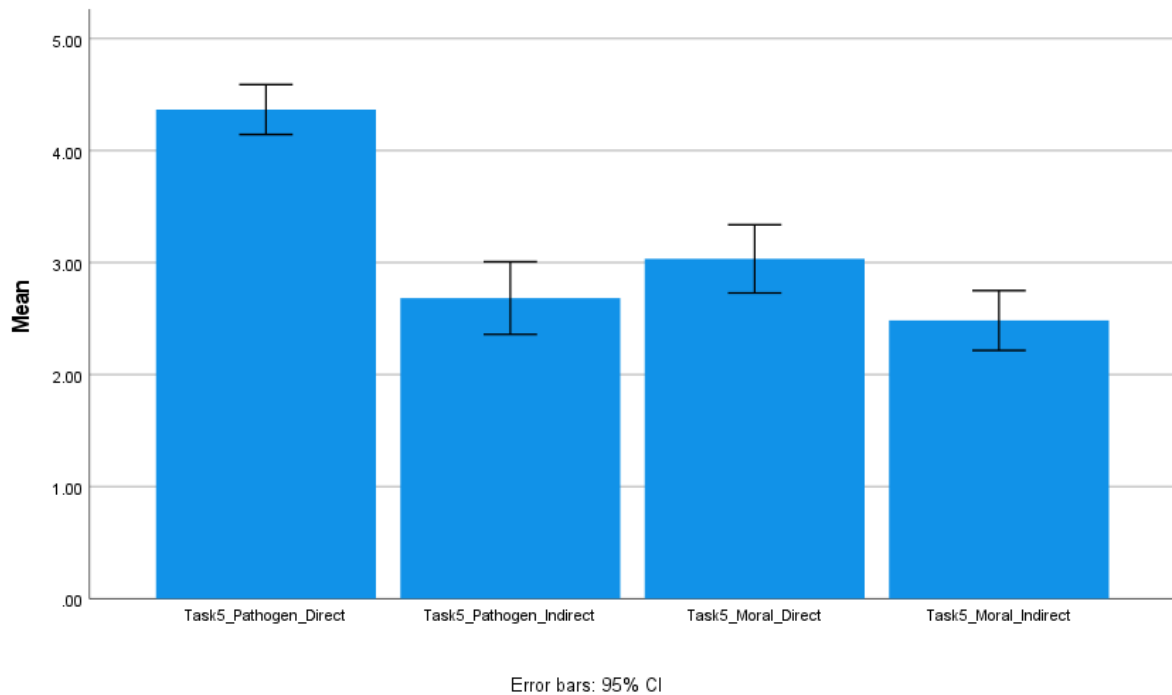
Vignettes	Reasoning			
	Physical	Moral	Social Conventional	Outcomes
Rotting food ($n = 65$)	.47 (.50)	.00 (.00)	.00 (.00)	.33 (.48)
Grasshoppers ($n = 65$)	.51 (.50)	.19 (.30)	.15 (.36)	.06 (.24)

Task 5.

Mothers' Ratings of Disgust.

To examine whether mothers on their own rated pathogen or moral violations differently both directly and indirectly, we conducted a 2 (Type of Violation: pathogen, moral) x 2 (Relational: direct, indirect) ANOVA on ratings of disgust. Ratings for each item ranged from 1 (not at all disgusting) to 5 (very disgusting). Following the parent-child conversations, there was a main effect of Type, $F(1, 59) = 31.90, p < .0001, \text{partial } \eta^2 = .35$, in which mothers rated pathogen violations ($M = 3.53, SD = .84$) as more disgusting than moral violations ($M = 2.76, SD = .87$). There was a main effect of Relational, $F(1, 59) = 69.32, p < .0001, \text{partial } \eta^2 = .54$, in which mothers rated direct violations ($M = 3.70, SD = .80$) as more disgusting than indirect violations ($M = 2.58, SD = .90$). These effects were qualified by a statistically significant Type x Relational interaction effect, $F(1, 59) = 24.59, p < .0001, \text{partial } \eta^2 = .29$. Participants rated it more disgusting to directly touch the bed ($M = 4.37, SD = .86$) than to associate with someone with dirty hair ($M = 2.68, SD = 1.26$), $F(1, 59) = 93.76, p < .0001, \text{partial } \eta^2 = .61$. Similarly, participants rated it more disgusting to take a toy ($M = 3.03, SD = 1.18$) than to play with someone who teased, ($M = 2.48, SD = 1.03$), $F(1, 67) = 11.54, p = .001, \text{partial } \eta^2 = .15$. Participants rated it more disgusting to touch the bed than to take someone's toy, $F(1, 59) = 89.78, p < .0001, \text{partial } \eta^2 = .58$. Although participants rated it more disgusting to take a toy than playing with someone with dirty hair, $F(1, 59) = 9.49, p < .0001, \text{partial } \eta^2 = .14$, the effect size was smaller.

Figure 2. Mothers' Rating of Disgust Of Direct and Indirect Moral and Pathogen Violations



Note. Direct pathogen comprised touching a dirty bed, indirect pathogen comprised playing with someone with dirty hair, direct moral comprised taking a toy, and indirect moral comprised playing with someone who teased.

Task 6.

Mothers' Ratings of Disgust in Food Situations.

Mothers rated it more disgusting to eat the unhygienic ($M = 4.90$, $SD = .30$) than cultural food, ($M = 3.35$, $SD = 1.38$), $F(1, 59) = 79.60$, $p < .001$, $partial \eta^2 = .57$.

Discussion

The present study focused on mother-child talk about disgust. First, we found that the facial expression of happiness was more accurately recognized than disgust, but disgust was recognized equally well as expressions of sadness and anger across all three age groups. Mothers and children generated more moral examples for anger than they did for disgust. For disgust, dyads primarily generated physical examples (e.g., vomit, boogies) than moral examples. Second, dyads identified anger more frequently as a response to moral than pathogen violations, and they identified disgust more frequently with pathogen than moral

violations. Third, mother-child dyads as well as mothers alone rated pathogen violations as more disgusting than moral violations. They also rated rotting food as more disgusting than food that is eaten in different cultural communities. Finally, mothers and children used more moral and social conventional reasons to explain moral transgressions than hygiene reasons and more physical reasons and outcome than moral reasons to explain hygiene violations. These findings have implications for the debate about the nature of moral disgust, which are discussed below.

Mother-child dyads were more accurate in labelling the facial expression of happiness compared to disgust irrespective of children's age. The standard account of disgust (Ekman & Cordaro, 2011; Izard, 2011) posits that children are able to label the facial expression of disgust from a very early age, suggesting that it is an innate ability. In contrast, other research has found that before age 8 years, few children are able to correctly label the facial expression of disgust correctly and that this ability continues to develop through adolescence (for a review, see Widen & Russell, 2013). Children may fail to identify the disgusted face because they do not know what the term, disgust, means (Widen & Russell, 2013). As a result, the problem may be one of vocabulary. Existing research is not entirely clear about when and to what extent children acquire an understanding of the term, disgust. Although by age 3 years, almost all children have some word for disgust (e.g., gross, yucky) in their vocabulary, a smaller percentage of 3- to 4-year-olds managed to produce the correct answer when asked to link the word, disgust, with a cause for someone feeling that way (Widen & Russell, 2013). Our findings suggest that 4-, 6-, and 8-year-old children seem to know the meaning of the term, disgust, given that they were able to identify the facial expression of disgust equally well as they were able to identify angry and sad faces. However, in our study, children were asked to identify the facial expression of disgust after being asked to provide examples of disgusting items while in conversation with their mothers. Thus, the previous

activity may have helped them to identify the facial expression. Indeed, past research suggests that priming the term, disgust, may help the children to label the correct emotion expression but only enough to remember the correct term (Markham & Wang, 1996; Vicari et al. 2000). Alternatively, in our study their mothers may have supported their understanding.

In terms of language use, mother-child dyads did not tend to use disgust metaphorically. Instead, in the generation task, they tended to restrict their use of disgust to pathogen rather than moral exemplars. When asked to mention examples of items that would make them disgusted and angry, mother-child dyads mentioned more pathogen items for disgust than for anger and more moral items for anger than for disgust. In addition, when asking mother-child dyads whether certain moral (e.g., jumping a queue) and pathogen (e.g., wearing dirty clothes) violations were more likely to provoke disgust or anger as measured by the identification of facial expression of emotions, mother-child dyads linked pathogen transgressions and not moral transgressions with disgust, whereas they linked moral transgressions with anger and not disgust. Taken together, these findings confirm some past research. For example, Pochedly et al. (2012) asked 4- to 12-year-old children to match a disgusted or an angry face to pathogen and moral disgusting stories. They found that participants linked the disgusted face with the physical disgust stories and the angry face with the moral disgust stories. A similar pattern was found by Danovitch and Bloom (2009) who told 4- to 9-year-old children stories involving pathogen disgust and moral violations. Children linked the pathogen disgust stories with the facial expression of disgust but only around 30% of children linked the moral violations with the facial expression of disgust. Similarly, adults linked moral transgressions with angry faces and not disgusted faces (Yoder et al., 2016). Consistent with past research, anger tends to be linked with moral violations and disgust is more likely to be linked with pathogen violations. However, the exact role that anger and disgust play in the moral domain remains unclear (Rottman et al., 2017). Research

with adults has either found that anger and disgust play different roles in moral cognition (Horberg et al., 2011; Russell & Giner-Sorolla, 2013) or that concrete emotions have no specific effects in the moral domain (Kayyal et al., 2015; Cameron et al., 2015). Our findings suggest that anger and disgust may play different roles in the morality domain, in relation to violations that are linked with fairness and harm.

Supporting different roles for the anger and disgust, pathogen violations were rated as more disgusting than moral violations by mother-child dyads and mothers alone. These findings are consistent with those of Danovitch and Bloom (2009) who found that 4- to 9-year-old children rated pathogen acts (e.g., putting your hand in slime) as disgusting, whereas less than 30% found moral violation to be disgusting (e.g., being very mean to someone). Further, our findings show that perceptions of the characters' involvement in the transgression impacted this relationship, because there was a significant interaction between type of act and directness. Mother-child dyads and mothers alone found it more disgusting to directly contact a physically disgusting object than to play with someone who can evoke pathogen disgust. This finding supports previous research that disgust transfers through direct contact (Rozin et al., 1986). Overall, it seems that 4-, 6-, and 8-year-olds are less concerned with coming into contact with disgusting objects indirectly than directly.

Beyond facial endorsement and emotions, we also found that mother-child dyads used different reasons for justifying pathogen versus moral violations. When reasoning about pathogen transgressions (both direct and indirect), mothers used more physical and outcomes reasoning than moral and social convention reasons. For the moral violations, there was no difference in reasons for why cheating was disgusting. However, when considering contact with someone who caused direct harm, both moral reasons and outcome reasons were used more than physical reasons, but social conventional reasons were used the same as physical reasons. Mother-child dyads invoked moral reasons the same amount as social-conventional

reasons and outcome reasons, in which the two latter type of reasons did not differ from each other. Perhaps, children perceived the act of playing with someone who harms as both a moral and social conventional violation. Thus, they seem to be judging the moral violation as well as the act of choosing to come into contact with the person who committed the violation. The social domain theory argues that children often combine multiple forms of reasoning when evaluating a social situation (Killen & Rutland, 2011).

Finally, when examining food related issues, participants rated it as more disgusting to break unhygienic norms than cultural norms. Thus, children distinguish between the likelihood of contamination and novelty. Adults are often reluctant to try novel foods, particularly insects (Russell & Knott, 2021; Tuorila & Hartmann, 2020). This finding may suggest that children would be less reluctant to try novel disgusting foods, as long as they do not possess cues to contamination or are actually dangerous. When examining the reasoning behind these ratings of disgust, mother-child dyads primarily gave physical reasons for both food types; however, they gave no social conventional reasons for the unhygienic foods but gave some social conventional reasons for the cultural norm foods. Thus, the dyads were attuned to differences between norms and danger.

Limitations and Future Research

Contrary to our expectations, mother-child dyads did not differ in their ability to identify the facial expression of disgust, rate their emotions, or provide reasons, across the three age groups. Perhaps, mothers supported younger children more than older children so that they could answer the questions. Future research may wish to examine mothers' role more closely in facilitating the children's disgust response, through facial expressions and bodily cues. Mothers may have restricted their use of disgust to physical objects because they might have believed that young children do not understand metaphors despite evidence to the contrary (Vosniadou, 1987). Alternatively, the small sample size, resulting in a lack of

statistical power, may explain why some of the hypothesised interaction effects were not detected.

Our study relies heavily in the use of language by mothers and their children. This may be problematic as polysemy with disgust is very common and thus, disgust is used to describe different forms of discomfort and disapproval. Future studies should rely less heavily on language and examine children's understanding of disgust using novel methods in this field, such as eye-tracking (Armstrong et al., 2021).

Another methodological weakness may have been the use of the fixed order of tasks. The tasks in the present study were presented in a set order, starting from more generally asking about different emotions, to more specifically asking about disgust. However, the fact that participants were asked to mention disgusting items in task 1 may have influenced later task responses. Perhaps by discussing disgust early on, children may have been more knowledgeable about it when discussing subsequent tasks. However, given the younger age groups used in the research it seemed suitable to use this method to familiarize them with the task.

In this study we examined moral violations that are common; however, in moral psychology, extreme violations are often examined (Ellemers et al., 2019; Hester & Gray, 2020). Perhaps if we had included more severe moral violations, the difference between pathogen and moral disgust would disappear. We used these types of moral violations because we wanted them to be relevant for our age groups. However, future research may wish to examine whether children make more attributions of disgust when moral violations are extreme, novel, or more directly related to the purity domain.

Finally, as mentioned previously, moral disgust is not the only form of disgust that is perceived as controversial in disgust research. In contrast to pathogen disgust, which is oral in nature, other forms of disgust, such as injury disgust (e.g., body envelope violations), and

disgust towards spiders and insects are also controversial. Rather than being forms of disgust, the former may be an empathic pain response (Kupfer, 2018) whereas the latter may be considered as an ectoparasite defence mechanism (Kupfer & Fessler, 2018). Future research needs to examine these different kinds of disgust specifically in parent-child talk.

Conclusions

In conclusion, findings from the present study contribute to the ongoing debate over the scope of moral disgust. Whereas some academics claim that moral and pathogen disgust are two different emotions (e.g., Yoder et al., 2016), others claim that they are the same emotion (e.g., Chapman & Anderson, 2014; Danovitch & Bloom, 2009). Our findings help disambiguate the evidence and provide support for the former more than the latter explanation. We found that mothers and children tend to link pathogen violations with disgust and moral issues with anger. These findings support the hypothesis that we use the term, disgust, in relation to morality as a metaphor, and that anger and disgust may play separate roles in the development of morality.

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