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ABSTRACT

Disgust is a strong emotion of aversion. In the context of food, it is often referred to as a guardian of the mouth, preventing close contact with pathogens and the accidental consumption of poisons. However, disgust can also create a certain level of attraction and be part of positive experiences, even in the context of food. In this article, we discuss different ways of using disgust to influence eating behaviour and contribute to healthier food consumption. We outline ten different bridging concepts accompanied by various design exemplars on how to use disgust in the context of critical food design. In addition, we present four different lenses that can help to refine the design concepts.

KEYWORDS

disgust
food design
critical design
speculative design
design practice
bridging concepts

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INTRODUCTION

The celebrity chef Jamie Oliver advocates healthy eating for children inside and outside the classroom. In his prize winning TED talk, he showed the amount of fast food consumed by an average family by piling up the family's frozen convenience food products that contribute to physical and mental health care problems, including obesity and the social stigmatization of children (Oliver 2010). He further exemplified how much sugar schoolchildren take in when consuming products such as flavoured chocolate milk instead of regular milk, and he showed that a lot of young children are unable to name common vegetables and fruits. In this 20-minute talk, Jamie Oliver focused on eliciting some sort of disgust about the way children are educated and fed in the UK and US school systems.

The use of disgust to influence food consumption is not a novel approach and has been relied upon since centuries, often with the incentive to encourage people to lose weight. For example, disgust has a long-standing tradition in the context of advertising and public health campaigns that try to tackle obesity, which is seen as one of the worldwide biggest health care problems today. Despite its common use, it has been pointed out that disgust can have a stigmatizing effect on the targeted people, causing shame and humiliation. This, in turn, can affect people's education and career prospects, their interactions with health professionals as well as interpersonal relationships (Puhl and Heuer 2009). Jamie Oliver, in contrast, uses disgust in a slightly different form by drawing attention towards the products and systems that promote and enable the consumption of food items that contain high sugar and fat levels, rather than associating disgust with physical signs of obesity.

From the above, we can see that disgust can be used in various ways, and questions of ethics may differ depending on the context. Making statements about the appropriateness of designing for disgust with health promotion purposes thus requires a nuanced understanding of how disgust functions and how it could be incorporated into a design. This article 'unpacks' the various ways in which design for disgust can take shape, thereby contributing to this more nuanced understanding. To be sure, the claim of this article is not that disgust *should always* be used to promote specific food behaviour, but rather an exploration of how it *could be* used. We believe this exploration can contribute to a distinct understanding of disgust and inform future discussions with consumers, public health officials, medical staff, the food industry and designers. We specifically see a role for critical and speculative designs in this context, as such designs can prompt a discussion that can help to identify strategies that might be appropriate when used in particular contexts.

We will focus in this article on applying disgust in food design. We intentionally provide concrete examples for using disgust to shift one's eating pattern in a particular direction (eating more or less of a specific item). Rather than proposing the actual use of these tools to address issues of health directly, our intention is of a more provocative nature. The tools can contribute to the development of critical designs that can instigate discussions with the public (Dunne and Raby 2001; Bardzell et al. 2012). The tools, and the examples that

we use to illustrate them, are likely to elicit a slight feeling of uneasiness in order to be provocative and contribute to the discussion.

This article is outlined as follows: We first describe the functional role of disgust in general, followed by a description of its implementation in the context of food and eating. We will highlight that disgust can evoke aversion as well as attraction. In the subsequent section, we outline various food-related topics and domains in which disgust plays a functional role. Based on our reflections on the different topics and domains, we develop concrete tools for designers in the form of *bridging concepts* (Dalsgaard and Dindler 2014). Subsequently, we outline four different *lenses* that can be used as part of the design process as a brainstorming tool, to tweak the design and enrich the discussion they want to stimulate. We also discuss three critical design examples that illustrate how the presented bridging concepts and lenses can be used. We conclude the article with a discussion and reflection on disgust as an approach to improve food consumption, and how the bridging concepts and lenses add value in this respect.

DISGUST AS A BASIC HUMAN EMOTION

We refer to disgust as a basic human emotion (Ekman 1999) that ‘contains a range of states with varying intensities from mild dislike to intense loathing [and that] are triggered by the feeling that something is aversive, repulsive and/or toxic’ (Paul Ekman Group 2020). Basic emotions correspond to distinct physiological activity patterns in the brain that have a quick onset and a brief duration, and are expressed in distinctive universal and involuntary behaviour patterns that signal the inner state to others, for example, smiling when one feels joy. The distinct physiological changes of disgust aim to remove the disgusting stimulus far away from the body. They include lowered blood pressure, the typical *gape face* including tongue protrusion, frowning, nose wrinkling (Figure 1), dropping the disgust stimulus, as well as a feeling of nausea and revulsion.

Basic emotions are automatically triggered and can have an intrinsically or extrinsically learned component to them. In the context of disgust, this offers an explanation why some elements evoke an automated body response, for example, the taste of a bitter substance causing the typical gape face. Other stimuli are taught and reinforced by social and cultural structures. For example, in western society, pets are seen as unsuitable for food consumption. The recognition of disgust stimuli seems to be influenced by a distinctive development process, which aligns with a child’s increased mental capacities to make conscious decisions. Apparently, children do not develop the awareness to avoid disgust elicitors before the age of 4–8 years (Rozin and Fallon 1987), and the number of disgust stimuli seems to peak during adolescence, before slowly declining during middle and late age (Miller 1998).

At first glance, the emotion of disgust might serve the primary purpose to guide people’s eating behaviour, but numerous studies have broadened our understanding of disgust-relevant domains and stimuli (Rozin and Fallon 1987; Olatunji et al. 2008; Tybur et al. 2013). Despite an increased research interest in the topic, there is a lack of a universally accepted theory of disgust. In the following section, we will focus on the complex relationship between disgust and food.

DISGUST AND FOOD

The primary function of disgust could be described as a *guardian of the mouth*, a gatekeeper emotion that helps to balance the need to obtain nutrition against the risk of a toxic indigestion. Food items that are potentially harmful

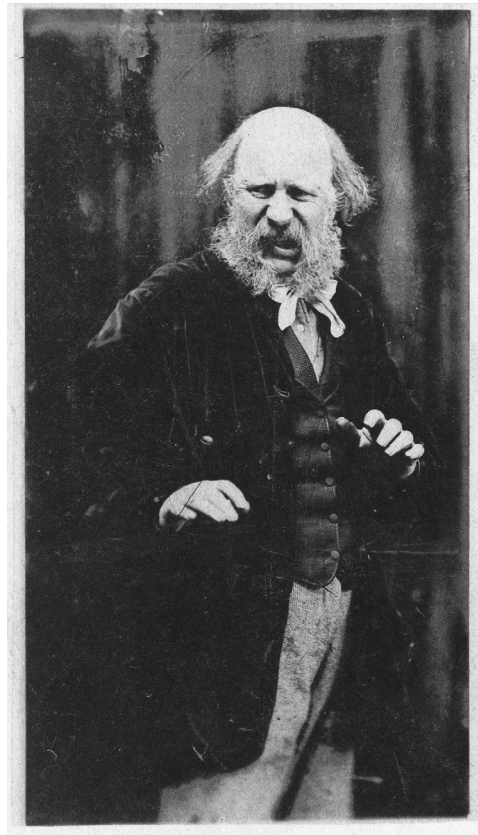


Figure 1: A typical facial and body expression of disgust, n.d. Credit to Wellcome Collection; licensed under CC BY 4.0.

often contain aversive sensory properties that can be detected by the human senses, such as a particular smell (decay), taste (toxins tasting bitter), visual appearance (mouldy) and consistency (slimy). Even food items that are safe for consumption can possess such characteristics and elicit disgust. For example, blue cheese often has a unique smell that some people experience as evoking disgust. Food items can, furthermore, pose a real or perceived threat to one's health or the environment. The knowledge of the potential threat can be based on personal learning experiences or reinforced through social influences including religion. For example, pigs are considered to be unclean and unfit for consumption according to Islam.

Nonetheless, disgust seems to be an integral part of human food consumption and is even sought as part of culinary and fine dining experiences. The experience of disgust in this context is overcome or cultivated if a food item contains a unique flavour or health value (Korsmeyer 2011). A phenomenon called *benign masochism* offers a potential explanation for this behaviour. It refers to the enjoyment of an initially negative experience that the body falsely interprets as threatening. Benign masochism requires the conscious meta experience of distancing oneself from the perceived negative stimulus and recognizing it as non-threatening. An example is the acquisition of *Haut Gôut*, which refers to a process by which game meat is left to hang and consequently starting to decompose to intensify the flavour (Korsmeyer



Figure 2: Image showing a Halloween snack that is shaped like a human hand, 2008. Credit to Ser Amantio di Nicolao; licensed under CC BY 2.0.

2011). Other examples include certain kinds of cheese with a strong smell or a mouldy appearance, the Kopi luwak coffee beans that are first digested and excreted by a civet cat to give it its smoky smoothness (Marcone 2004), the 'Caviar of the East', which is an edible bird's nest soup (Marcone 2005) or the saúva ants that are collected by the legendary Baré Indians.

The enjoyment of 'disgusting' food items can be part of a typical occasion that render the emotion acceptable or even essential as part of the experience. Examples include events such as Mardi Gras meaning 'Fat Tuesday', which is a day dedicated to eating large amounts of fatty and rich foods that are forbidden during the religious fasting season. Another example is Halloween, which uses elements of horror that rely on a combination of fear and disgust (Figure 2).

Disgust is furthermore used as part of food challenges, in which participants have to compete and expose themselves to disgust elicitors. For instance, the 'Belly Bean Boozle Challenge' by JellyBean offers disgusting food taste experiences, such as baby wipes, rotten egg or vomit, as part of a party game challenge. The TV format *I Am a Celebrity... Get Me Out of Here!* uses disgust in a similar vein. Participants are asked to eat live bugs, spiders and various animals' anuses, brains or testicles to win. The use of disgust in this context can be referred back to being part of rubbernecking, which involves an often morbid and curious way of staring at events or people of interest.

We have highlighted in this section that disgust is not just a food rejection response to poison and pathogens, but can also be part of a positive eating experience and even be used as a way to attract attention to specific food items. We will describe in the next section how disgust has been used as part of behaviour change approaches to promote healthier food consumption.

DISGUST AND THE PROMOTION OF HEALTHIER FOOD CONSUMPTION

The use of disgust as part of behaviour change interventions to influence food consumption is not a novel idea and can be positioned between coercion and persuasion (Haslam and Haslam 2009; Michie et al. 2011). Approaches have focused on the physical experience of disgust as well as establishing moral norms that were reinforced through disgust. Examples for the use of physical elements of disgust include biting and eating lemons as well as using citric acid as part of remedies. Ancient forms of so-called 'medication' often

contained poisonous substances, such as mercury or arsenic that evoked feelings of physical discomfort. This contributed to weight loss, but it also often caused negative mental and physical side effects (Haslam and Haslam 2009).

Disgust has also been used as part of establishing moral norms that associated being obese with feelings of disgust. This 'pedagogy of disgust' is based on the moral perception that a lean body equals a healthy body. Health campaigns aim to persuade by eliciting disgust in the context of specific food items (fat and sugar content), eating behaviours (excessive amounts of unhealthy food) and the obese human body (physical signs of increased body weight). However, these approaches have been highly criticized, because they stigmatize and dehumanize the depicted people, and it remains unclear if they promote a sustained behaviour change (Lupton 2015).

Some recent studies use disgust in a more concealed form. Research in the context of implicit priming investigates the use of disgust stimuli to alter high-calorie food preferences. Images used as part of the study show themes of contamination and mutilation, for example in the form of a cockroach on a slice of pizza. These images are presented for a very short time, so that participants do not become consciously aware of them. Such approaches show positive results by altering high-calorie food preferences (Legget et al. 2015). However, little is known about the long-term influence of such implicit priming approaches and if the effects could be reversed if unanticipated side effects are observed.

In conclusion, the use of disgust to influence food consumption has relied on a physical response of disgust or the promotion of a certain body ideal. We will outline in the next sections how disgust could be used in the context of food design and provide actionable tools for designers.

DEVELOPMENT OF BRIDGING CONCEPTS

We used the conceptual map of disgust developed by Strohming (2014) as the theoretical starting point to develop concrete tools that other designers can refer to. We chose this map because Ekman's definition of disgust is unclear on what domains are relevant in the context of disgust and food. These domains also seem to vary, depending on the knowledge and moral stance of the individual, as well as on temporal and environmental factors. For example, pork meat can elicit disgust in the viewer, because it resembles human flesh; is subject to religious norms forbidding its consumption; is perceived to harm one's health or damage the environment or requires the animal to die as part of the manufacturing process. Hence, a single food item can elicit multiple types of disgust responses among one or multiple observers, originating out of different domains. The conceptual map by Strohming (2014) combines various comprehensive theories of disgust to illustrate the complex and overlapping areas of influence. The map includes disgust as part of enjoyable experiences and even creating attraction, which is an element that is missing in most frameworks and definitions of disgust.

In the process, we redesigned the conceptual map for the context of food by deleting topics that we found irrelevant and adding domains and factors that were missing. We used the map and terms to collect images of food designs. As sources, we used different design blogs, image-sharing websites (Pinterest, Flickr and Tumblr) and the search engine Google to find relevant images. We analysed the images in terms of the way disgust was included in food production, preparation or consumption. For example, food created during the Halloween season uses the design element of similarity to known

pathogen transmitters (slime, insects) or body parts as a way to elicit disgust. The collection of images was based on the expected experience of disgust and did not involve the tasting, smelling or touching of the depicted food items. The reflections were clustered and combined into ten bridging concepts.

We focused on eight different domains and nineteen different topics relevant to the topic of food and disgust, see Figure 3. Six domains are based on the original map (blue) and two were added (orange). Two of the domains focus on disgust's role as a guardian of the mouth based on the experience of distaste (1) including *sour* and *bitter* taste experiences and its general strong influence in the context of feeding (2). The distaste domain was extended to include the topic of *flavour combinations* (Veeck 2010), which can be regarded as atypical or extreme if they consist of unusual combinations, such as fries with wasabi, apple pie with cheese or smoked salmon with ice cream. The domain of feeding consists of multiple topics including eating too much food (*overindulgence*), breaking *food taboos*, the *Garcia effect* (conditioned taste aversion of an individual), the previously mentioned *benign masochism* and *rubbernecking*, as well as a phenomenon called the *omnivore's paradox*. This term describes the encounter with an unfamiliar food that can either evoke fascination and the willingness to try the new food (neophilia [3]) or be experienced with disgust (neophobia [4]), because the unfamiliar food item can pose a potential risk of ingesting a hidden pathogen (Veeck 2010).

Disgust also plays a major role in the context of avoiding any contact with pathogens (5), which concurs with avoiding *waste* and known *disease vectors*. In addition, disgust may relate to a lack of *hygiene*, but also to the practices that aim to remove any potential pathogens, such as *washing*, *grooming* and *nitpicking*, or to practices that may signal the presence of pathogens, such as *scratching*. The added domain called animalness (6) is based on the original description of disgust by Rozin and Fallon (1987) stating that most things that elicit disgust are based on the characteristics of animals.

The domain of moral violations (7) focuses on the moral perception of food items and practices. This domain includes the ability to sense the

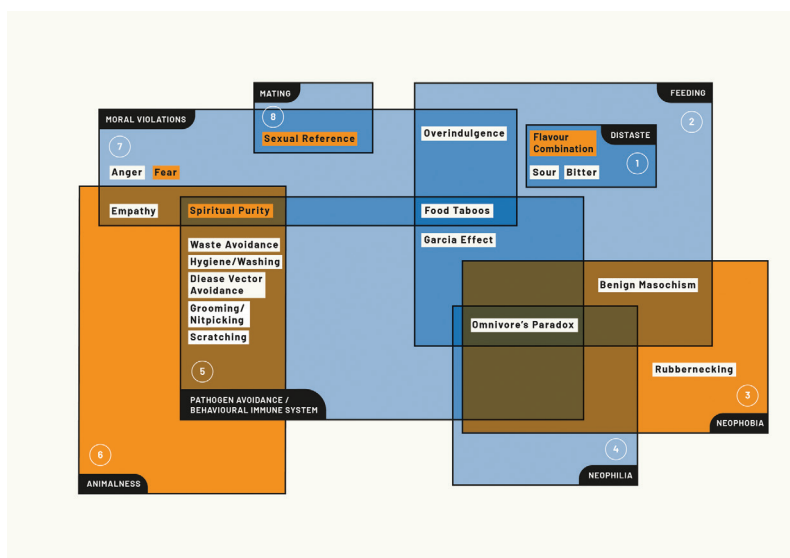


Figure 3: Conceptual map of disgust domains and factors in the context of food, 2021. Credit to authors.

emotion of others through *empathy* and the experience of additional emotions taking place alongside disgust including *anger* and *fear*. The latter is relevant, for instance, in the context of food for Halloween. We added the factor *spiritual purity*, which relates to food practices like the customs around kosher meat. The domain of mating (8) includes the topic of *sexual references*, which can be subject to disgust, for example, when shaping chocolate in the form of human sex organs.

BRIDGING CONCEPTS

In the following section, we will describe the different bridging concepts that we developed. Eight concepts use disgust to avoid a specific food item (aversion strategies) and two increase the likelihood to eat a healthy item (attraction strategies). Bridging concepts were originally introduced in human-computer interaction research and positioned in the middle ground between abstract theory and concrete design examples. They can arise out of both sides to facilitate an exchange between the two (Dalsgaard and Dindler 2014).

The bridging concepts describe specific ways in which disgust can be used to promote a specific behaviour. *Design articulations* accompanying the bridging concepts describe some relevant parameters. Each bridging concept is also accompanied by *exemplars* to illustrate how the bridging could be applied in context (Dalsgaard and Dindler 2014). See Table 1 for an example of the bridging concept *exposure* including one exemplar.


Bridging concept	Design articulation	Exemplar
Exposure	Exposure of environmental consequences	<div>The way meat is produced can cause environmental pollution, including water pollution leading to increased algae growth if the manure reaches the water body (Credit: Wildlife Terry 2019; Licensed under CC0 1.0).</div> 

Table 1: Structure of the proposed bridging concepts, design articulations and exemplars.

DISGUST AS AN AVERSION STRATEGY

Bridging concept 1: Contamination

One feature of disgust is that its elicitors can contaminate a neutral object in an actual or even just perceived way. For example, studies have shown that participants refused to drink orange juice that had come into contact with a dead and sterilized cockroach, due to their perception of the orange juice as contaminated (Rozin et al. 1986). Universal disgust elicitors include body waste products, death and decay, pus, as well as menstrual blood. The unique ability of disgust to contaminate might be due to its role to prevent any contact with and indigestion of potential disease transmitters following the mantra ‘better safe than sorry’. Rozin et al. (1986) provided an explanation



Figure 4: Robert Gober's sculpture shows cheese with attached long human hair. As a food item, the cheese would likely be regarded as contaminated and unfit for consumption, 2013. Credit to Rocor; licensed under CC BY-NC 2.0.

for this unique feature in the form of *the law of contagion*, which describes the phenomenon that a neutral food object is perceived as being contaminated once it has come into contact with known disease transmitters. In this context, it is irrelevant if the neutral food item has become an actual threat due to the contact with the disgust stimulus. For example, children might feel reluctant to eat a specific food item on their plate if it has been in contact with another item that they do not want to eat.

Design articulations: show that food has come into contact with pathogens, which are known sickness transmitters including contact with waste (Figure 4), or an obvious lack of hygiene during the production, preparation and consumption of the food items, for example, food wrapping damages or someone with a flu preparing a food item; show that it has been in contact with unfamiliar or morally tainted entities, which can include people, companies, countries and specific animals and insects, including snakes and spiders, rats, flies, cockroaches (Figure 5), worms and maggots; highlight that there are signs of decay, such as mould (Figure 6), which indicates a contamination.



Figure 5: Studies have shown that once a cockroach touches food, it is rendered contaminated. The contamination effect is not dependent on the length of contact and if pathogens have really been transmitted. The contamination is a lasting effect and irreversible in most cases, 2020. Credit to Karits; licensed by Pixabay.



*Figure 6: Food items with mould should be discarded since they are likely to be contaminated throughout. There are a few exceptions to the rule, including firm vegetables and fruits, as well as hard cheese, which are all still edible once the mould is cut off. In addition, specific kinds of soft cheese are actually made with the mould *Penicillium*, 2020. Credit to Pxfuel; licensed by Pxfuel.*

Bridging concept 2: Similarity

When a food item has the visual appearance of a known disgust elicitor, then people are likely to experience disgust when encountering it (Rozin et al. 1986). This bridging concept focuses on creating this shared similarity to evoke a disgust response. The strategy is commonly used as part of food made for Halloween.

Design articulations: make food look like a natural or bodily waste product (Figures 7 and 8); make it look like a known disease transmitter including insects, rodents, soil or slime; make it look like a product that is known to be unfit for consumption, such as wood or stone (Figure 9).



Figure 7: Snacks and food for Halloween events often use similarity to evoke a level of disgust. The food in the jars and labels creates a certain level of horror. The food items are chosen, because they resemble anatomical parts such as fingers (sausages), brain (jackfruit) or eggs (tapioca pearls), 2011. Credit to Oskay W.; licensed under CC BY 2.0.



Figure 8: Baking a cake that looks like a litter box filled with cat droppings is likely to elicit feelings of disgust, 2009. Credit to Charlet III; licensed under CC BY-NC-SA 2.0.



Figure 9: This chocolate is made in a way that it resembles mechanical tools that cannot be eaten. These kinds of food items are sometimes referred to as pictorial food items, 2009. Credit to Moren; licensed under CC BY-SA 2.0.

Bridging concept 3: Unknown

This bridging concept is based on principles of *neophobia* referring to the natural distrust of everything unfamiliar (Veeck 2010) and *fussy eating habits* of children, which seem to partially overlap with the definition of neophobia. The term describes the rejection of certain food items (Cooke et al. 2006). Disgust works in this context as a barrier that prevents the consumption of a new food item that could contain a potential disease transmitter.

Design articulation: withhold or obscure information about the way the food item is produced, prepared or if and how it should be eaten, as well as its taste (Figures 10–12); present food in an ‘unnatural’ colour (Figure 13), such as the colour blue, or a colour that indicates an unripe or rotten state.



Figure 10: Many flowers are edible, including violets, orchids and roses. They are often not regarded as suitable food sources and consequently not eaten, except cauliflowers, artichokes and broccoli, which are technically flowers, 2006. Credit to Geller-Grimm; licensed under CC BY-SA 2.5.



Figure 11: Humanitarian daily rations are provided to starving populations during times of humanitarian crisis including war. The mass-produced, ready-to-eat rations have been criticized to be unfamiliar to the population receiving them and who consequently do not eat them, 2008. Credit to MadeYourReadThis; licensed under CC BY-SA 3.0.



Figure 12: The consumption of raw meat can be unfamiliar for consumers. Dishes such as the depicted 'Mettigel' (minced meat shaped like a hedgehog) consist of raw meat and onions and are likely to evoke disgust in consumers who are unfamiliar with eating raw meat, 2006. Credit to Studio Kumicak+Namslau; licensed under CC BY-SA 3.0.



Figure 13: The colourful 'Flint Corn' has its name because of its texture referring to the corns being as hard as a flint. Native Americans grew the corn for its high nutritional value. Nowadays, they are not a commonly used staple food, 2005. Credit to Fentress; licensed under CC BY-SA 2.0.

Bridging concept 4: Excess

The concept of *excess* is based on the principles and behaviour pattern of gluttony and overindulgence (Haslam and Haslam 2009). Especially sweet and greasy food items are likely to evoke a feeling of disgust if consumed in excess and may lead to feelings of nausea (Korsmeyer 2011).



Figure 14: Freakshakes consist of a milkshake that is topped with additional high-calorie food items including ice cream, doughnuts and even cakes. The shake is then decorated with whipped cream, chocolate, cookies and sweet sauces that most of the time even run over the glass. They are excessive forms of milkshakes, and the sweetest versions can contain up to 39 spoons of sugar, 2017. Credit to Heftiba; licensed by Unsplash.



Figure 15: Eating contests such as the pie-eating contest depicted here were often a part of county fairs, but are criticized nowadays for promoting gluttony in a time where obesity levels are increasing worldwide, 1923. Credit to Library of Congress – Prints & Photographs Division.

Design articulations: present the food item in a large amount or size (Figure 14); require the food item to be eaten at enhanced speed (Figure 15); show manifestations of food spoilage on a face or require the use of bare hands to 'dig into' the food; highlight that seeking delicacies and luxurious food products for one's pleasure is an expression of gluttony (Figure 16).



Figure 16: The concept of gluttony does not just refer to the amounts that are eaten and drunk, but can also involve food that exceeds a standard that would be regarded appropriate to fulfil physical needs, for example, eating just delicacies, 1804. Credit to Opiz; public domain in the United States.

Bridging concept 5: Bodily response to disgust

This concept is based on the display of facial expressions and the body responses associated with disgust and distaste. The recognition of disgust in other humans is automated, partially unconscious and involves elements of empathy. This means that the display of typical disgust responses, such as a gape face, often causes a feeling of disgust in the viewer themselves (Kelly 2013).

Design articulations: display the gape face as part of the design, including drawn-down brows, wrinkled nose and forehead, lowered eyes and eye squinting, deep nasolabial folds with raised cheeks, mouth open with a raised upper lip and the upper lip forward or out (Figure 17) and in some cases an extended tongue; use the sound of gagging and throwing up (Figure 18).



Figure 17: The facial expression of disgust can be expressed in so-called micro-expressions including the rising of the upper lip, wrinkling of the nose and raising of the eyebrows, 2021. Credit to Zlikovec; licensed by stock.adobe.com.



Figure 18: *The sound and display of a bodily disgust response can cause feelings of disgust in the perceiver, 1773. Credit to Wellcome Collection; attribution CC BY 4.0.*

Bridging concept 6: Animalness

This bridging concept is founded on elements of *animalness* based on Rozin and Fallon's observation that most things that humans experience as disgusting have an animal origin (1987). Animals that are physically similar to humans (e.g. gorillas) or are in a close interactive relationship with humans (e.g. dogs and cats) are often seen as unfit for human consumption. Animalness differs from the bridging concepts *exposure* and *similarity*, because it does not allude to changing the appearance of the food to look like an animal, nor does it reveal where the food has come from. This concept aims to evoke a point of conflict in the viewer by displaying the animal's main features.

Design articulations: present the food item so the animal is still recognizable, for example, by including the head and especially the eyes and mouth (Figure 19); show that the animal is alive when eaten or produced (Figures 20 and 21); include fur and skin as part of the food item; emphasize the physical resemblance or emotional connection to humans (Figure 22).



Figure 19: *Showing the animal as a whole or parts of it that allows recognizing its features, such as the head, extremities or eyes, can evoke a feeling of disgust in the viewer, 2011. Credit to Hansiline; licensed by Pixabay.*



Figure 20: Oysters are alive up until the point that they are eaten, 2016. Credit to Photo-graphie; licensed by Pixabay.



Figure 21: Snake wine is believed to reinvigorate a person according to traditional Chinese medicine. However, the practice has been criticized to promote animal cruelty, and the snakes that are often alive when stuffed into the bottles can survive multiple months inside the alcohol and jump out of the bottle once opened, 2014. Credit to Shankar; licensed under CC BY 2.0.



Figure 22: The consumption of pets such as dogs is a taboo in western cultures due to the emotional bond that the owner often has with their pet, 2012. Credit to Calfler; licensed under CC BY-SA 2.0.

Bridging concept 7: Establishing and emphasizing food-relevant norms

This bridging concept is based on the norms and the moral perception of specific food items that pose a spiritual, physical or social threat. The concept entails different *folkways*, *mores*, *taboos* and *laws* relevant to food. Some of them are crucial to a society's moral understanding and can originate out of religious domains, focus on specific stages of life (pregnancy) or relate to certain classes of people. Some simply mark the border between rude and polite behaviour. For example, sitting on the floor to eat violates a folkway in western societies. Some of these norms define which food and food combinations are fit for consumption and how animals are to be slaughtered and prepared. They can – but do not have to – be based on medical or ecological considerations, which aim to protect the physical and spiritual integrity of the group and individual. For example, the consumption of specific animals, plants or fungi can help to prevent negative health effects for the population or environment, like the extinction of a species.

Design articulations: combine food items into a seemingly unfit taste combination (Figure 23); use sex-related or death-related associations as part of the design; use food with a human origin such as breast milk; emphasize or introduce food mores and taboos in the way the food is prepared, presented and consumed (Figure 24); highlight temporary or permanent religious dietary norms and taboos that relate to the food item (Figure 25); highlight that the food item breaks laws that apply to the context of production (Figure 26), labelling and purchase of the food item; highlight that the food item threatens endangered species or that its consumption leads to their extinction; emphasize that the food item does not meet requirements of specific social groups or dietary regimes (Figure 27).



Figure 23: Unfamiliar flavour combinations can be subject to folkways and can elicit disgust, such as the combination of jam and bologna on a sandwich, 2021. Credit to authors.



Figure 24: Finger licking during eating as well as eating food with your hands (except finger food) can be seen as folkway or mores that evoke disgust. In some cultures, eating with the left hand is a taboo, since this hand is reserved for body maintenance. Children need to learn such norms as part of their developmental process, 2021. Credit to Jandrie Lombard; licensed by stock.adobe.com.



Figure 25: Some cultures regard cows as a sacred symbol of life that needs to be protected, rendering their meat unfit for consumption, 2012. Credit to Waddington; licensed under CC BY-SA 2.0.



Figure 26: Worldwide most hens are kept in battery cages. In the European Union, those cages have become banned by law since January 2012, 2010. Credit to Rader; licensed under CC BY-SA 4.0.



Figure 27: Gummi bears contain gelatine, which is made out of hoofs, skin and animal bones, making them unsuitable for vegetarian and vegan diets, 2019. Credit to Castellon; licensed by Unsplash.

Bridging concept 8: Exposure

This bridging concept focuses on exposing particular information that gives rise to disgust. The concept either exposes a moral point of conflict or a health threat. Such information is sometimes not perceived or even accessible to consumers. When this information gets revealed, it becomes clear how a food item contradicts the moral standards of the viewer. The exposed disgust elicitors can pose an actual threat or a moral issue. For example, the exposure of the mislabelling of horse meat as beef and selling it to consumers has led to several food scandals.

Design articulations: reveal short-term and long-term health risks that are associated with the specific food item (Figure 28); reveal that the food item causes political, ecological, social and trust issues due to its production (Figure 29), when it is transported, consumed or because of the way it is wasted; highlight that there are animal welfare issues involved in the production of the food item.



Figure 28: Reports of infant formula to contain traces of mineral oil have exposed that this alternative form of breastfeeding poses a potential health risk for babies, 2021. Credit to Dragana Gordic; licensed by stock.adobe.com.



Figure 29: The revelation that popular food items consist of undisclosed food colouring, including crushed cochineal insects, caused shock and outrage among French consumers, 2010. Credit: Cyclonebill; licensed under CC BY-SA 2.0.

DISGUST AS AN ATTRACTION STRATEGY

Bridging concept 9: Overcoming initial disgust

This concept is based on the principle of neophilia, which is a term describing the enthusiasm for everything that is new, and elements of benign masochism. Disgust in this context attracts attention, rather than the rejection of a specific food item. However, the individual still has to overcome an initial disgust response, which, once under control, leads to a positive eating experience. The design articulations overlap partially with the bridging concept of *unknown*.

Design articulations: create a food item with an ‘unnatural’ form (Figure 30) or colour such as blue or black (Figure 31); make novel food combinations, combining ingredients or food items in ways that people are not familiar with; make a food item extremely spicy, smelly, bitter or sour; create food with an unfamiliar texture, novel taste, smell or overall shape (Figures 32 and 33).

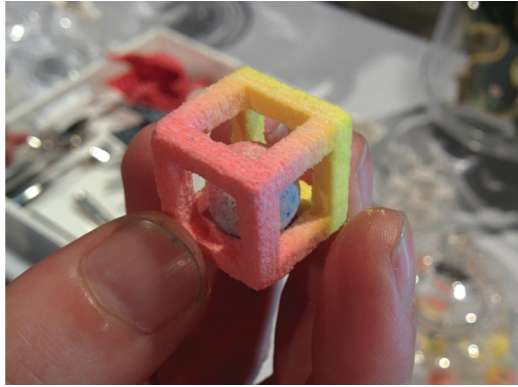


Figure 30: Food can be three-dimensional (3D) printed, such as chocolate, pasta, crackers and candy. The 3D printer allows to give the food shapes that would be difficult to achieve with traditional methods, 2015. Credit to Grendelkahn; licensed under CC BY-SA 3.0.



Figure 31: Burger King in the United States introduced a black burger as a Halloween special in 2015. The colour black, which normally indicates a rotten or burned stage, is used in this case to create attraction, 2015. Credit to Mozart; licensed under CC BY 2.0.



Figure 32: Lab-grown meat can fascinate consumers as part of neophilia and wanting to try new things. Consumers potentially initially have to overcome a level of disgust when trying such lab-grown meat products based on unfamiliar production methods, 2015. Credit to World Economic Forum; licensed under CC BY 3.0.



Figure 33: Many insects are considered a healthy source of nutrients, but consumers from Europe and North America might face an initial feeling of disgust, 2021. Credit to authors.

Bridging concept 10: Thrill seeking

The concept of *thrill seeking* uses disgust by attracting attention, and the consumption of the food item might pose physical, social or spiritual challenges and have potentially negative consequences. The actual consumption of the food item can – but does not need to – be linked to specific benefits such as pleasant flavour profile or medical benefits. The experience of disgust as part of this concept is twofold. It either entails a strong physical disgust response of the individual, which cannot be controlled sufficiently, or other people expressing a strong disgust response condemn the specific eating practice or food item. Both elements can contribute to the thrill-seeking experience.

Design articulations: highlight that the food item is subject to a norm, making it ethically, socially and legally questionable or forbidden (Figure 34); use the food item as part of a food challenge, including physical and olfactory challenges (Figure 35); indicate that eating the food can have dangerous or even life-threatening consequences (Figure 36).



Figure 34: Eels, which used to be a source of food, have been nearly extinct in Europe. They are one of the most prominent endangered species and have experienced a 90 per cent decline since the 1960s according to the WWF, but, are regarded as a delicacy by some and are even smuggled from Europe to Asia. Image shows the New Zealand eel, 2021. Credit to authors.



Figure 35: The brand 'warheads' uses facial expression in response to sour tastes to express the core characteristics of the product, 2014. Credit to Mozart; licensed under CC BY 2.0.



Figure 36: Fugu sashimi is made out of the poisonous pufferfish, and the untrained preparation can cause death. Nonetheless, the dish is one of the most celebrated dishes in Japanese cuisine, 2007. Credit to Johnia!; licensed under CC BY-NC 2.0.

We have summed up the ten proposed bridging concepts in Table 2.

LENSES OF DISGUST

In the following section, we will outline four different lenses that designers can use as part of the design process. The lenses can be used to tweak the design as well as to provide points for discussion that help to reveal potential issues, areas of tension and questions that the critical design concept could raise.

1. Level of abstraction

The first lens comprises different aspects related to the level of abstraction of a disgust stimulus. Food stimuli can be designed to raise a particular issue in a more abstract, implicit and subtle way, or in a realistic, explicit and, as a result, more confronting way. In a packaging design, for example,

	Name	Summary
Aversion	Contamination	The design highlights that the food is potentially contaminated through real or perceived contact with an established disgust stimulus
	Similarity	The design shares the visual appearance of a known disgust stimulus
	Unknown	The design withholds or conceals information about the food
	Excess	The design requires food to be consumed excessively in terms of quantity and quality
	Bodily response to disgust	The design uses disgust indicators, such as facial expressions or sound
	Animalness	The design highlights that the food is coming from an animal source
	Establishing and emphasizing food-relevant norms	The design violates food-related mores, folkways, norms, taboos or laws
	Exposure	The design exposes an unknown health or moral threat
Attraction	Overcoming initial disgust	The design requires overcoming an initial disgust response
	Thrill seeking	The design requires breaking food-related norms

Table 2: Overview of bridging concepts.

an abstract stimulus could be a text or icon that warns about certain animal welfare conditions, while a more realistic stimulus would consist of photos of how pigs are raised for meat consumption. Also, when food itself is used as design material, abstraction plays an important role – think, for example, of how chicken drumsticks refer more explicitly to what it is made of compared to chicken nugget. The extent to which a disgust stimulus is abstracted will influence the quality and effect of the disgust experience.

2. *Experiential effect*

A disgust stimulus can be designed to have a range of experiential effects on people. Disgust's main function is to prevent close contact with pathogens and poisons. But not every encounter with a disgust stimulus will lead to physical discomfort and potential death. This lens addresses the complexity and variety in the experience of encountering a disgust stimulus, which can vary from joy and amusement to wariness and lasting mental and physical discomfort. A dangerous stimulus can give rise to feelings of stress and anxiety, for example when eating a pufferfish prepared by an untrained chef. A harmless stimulus, on the other hand, can contribute to a feeling of joy, such as making food look like human body parts during Halloween to entertain guests. The more dangerous a stimulus is, the more intense the feeling of disgust is likely to be.

3. *Behavioural effect*

This lens describes the behavioural changes after encountering the disgust stimulus. Changes can be designed to have a short- or long-term effect on people's purchasing or consumption behaviour, or in the way they prepare or talk about food. An example of a short-term effect would be the avoidance of a particular soup after noticing a fly in it. A long-term effect could be the avoidance of specific food items after learning that they contain crushed insects to give them a vibrant red appearance. Designers can use this lens to evaluate the desirable effect that the disgust stimulus should evoke.

4. *Scope of considerations*

A disgust stimulus may be only of concern to the user, but could also imply consequences or benefits for a wider range of actors. Actors that can be considered are the people with or without a connection to the individual who encounters the disgust stimulus, any animals, plants and fungi, as well as larger systems such as a community or even the entire biosphere. An example of a stimulus with a personal connection to the individual is the exposure of sugar level in drinks to decrease the risk that the consumer gains weight. An example in which a wider range of stakeholders is considered is the highlighting of animal welfare and sustainability issues in factory-raised chicken meat, which could decrease meat consumption, reduce greenhouse gas emissions, and at the same time improve the life of the animals that are saved.

Some of the lenses are likely to be connected, and influence each other. For example, a disgust stimulus with a low level of abstraction (e.g. a photo showing a pig's living conditions) will affect the experiential effect. This, in turn, could influence the behavioural effect and lead potentially to a lasting avoidance of pork meat.

CRITICAL DESIGN EXAMPLES

In this section, we describe three critical design concepts based on the proposed bridging concepts and disgust lenses. Two concepts use aversion and one uses attraction as a basis. We used the lenses during the design process and will outline the points of considerations that they can raise in the context of the different concepts. We plan to present the concepts as part of an exhibition designed to stimulate discussion around the use of disgust in food and eating design.

The diet plate 'Guess who is coming to dinner?'

In 'Guess who is coming to dinner' (Figure 37), we used the concept of *contamination* to develop a product design. The person eating off the plate is given the impression that their food has been in contact with known pathogens, therefore causing a feeling of disgust and limiting food intake. Such an effect could take place on a conscious or subconscious level. We envision the plate to be used as part of a dietary programme for people who would like to lose some weight, but struggle to do so with current approaches. This concept allows for maintaining established dietary preferences while decreasing the overall willingness to eat by evoking disgust.

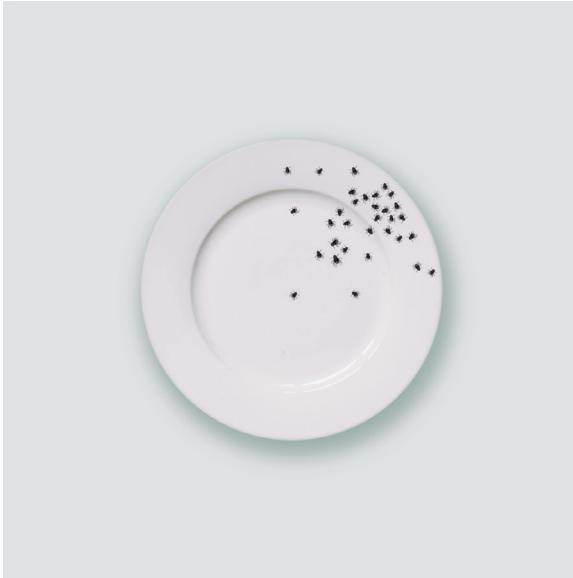


Figure 37: The diet plate ‘Guess who is coming to dinner’ uses visual contamination to reduce food intake, 2021. Credit to authors.

The lens *level of abstraction* allowed a structured reflection on the visual form of the flies, including if they should be photorealistic or drawings. These considerations were linked to the lens of *experiential effect*, which allowed to evaluate if the design should be experienced with amusement by seeing the flies as a form of decoration or if it should evoke a level of wariness due to the realistic perception of the flies. Questions in this context include the possibility that the flies make the consumption of the meal less joyful or the idea to enhance the disgusting effect even further so that it could induce feelings of nausea or even vomiting in the user. The lens *behavioural effect* can help to reflect if the use of the plate should ideally just be used over a short time or contribute to a lasting weight loss and used permanently. The lens *scope of considerations* brings up the question of what will happen if the plate is used as part of a family setting, where family members see the user eat off the plate. Would family members also become disgusted and would such an effect be acceptable?

The ‘Extinction Club’: A high-end fruit brand?

The ‘Extinction Club’ (Figure 38) aims to promote healthier food consumption by encouraging consumers to eat more fruits. It is based on the bridging concept of *thrill seeking* by focusing on the ethically questionable practice of eating an endangered species, as these endangered species will be novel to consumers. The concept uses disgust to attract attention to specific apple species and relies on the consumer being intrigued by it.

The lenses *level of abstraction* and *experiential effect* can help to fine-tune the design while basing it on the elements of disgust and fascination. The encounter of a realistic stimulus (real apple) could potentially be a stronger motivator to eat the fruit compared to an abstract one (drawing of the apple).



Figure 38: The 'Extinction Club' is a high-end food brand that only sells rare fruits that run the risk of becoming extinct in the near future, 2021. Credit to authors.

The actual apple should remain free from any negative disgust stimuli including spots, mould or insects on its surface to evoke a positive experience.

The lenses *behavioural effect* and *scope of considerations* offer points of considerations that could form the basis for a discussion. For example, the concept might be evoking less disgust if the company selling the apples contributes to its protection by planting more apple trees. From a moral perspective, it might be interesting to have a discussion around the perceived difference of eating an extinct fruit compared to an extinct animal. In addition, one may wonder if the ideal behavioural effect should be short term (eat it once and then forget about it) or long term (want to eat it constantly and leading to planting more of these trees).

'Oink Oink': The scared pig packaging design

This critical design concept is based on the bridging concept of *establishing and emphasizing food-relevant norms* by introducing a new law that focuses on promoting healthier eating by reducing meat consumption. The fictional law requires manufacturers and designers to depict the animals involved in meat production on the packaging design in a 'truthful manner' (Figure 39). The design concept for a sausage package outlines the changed regulations, showing how scared pigs get during the manufacturing process to evoke disgust and consequent avoidance of the product.

The lens *level of abstraction* can point into different directions for representing the pig. On the one hand, an actual photo of a pig that is about to be slaughtered could enhance the realistic character of the depicted animal. On the other hand, a two-dimensional (2D) representation in the form of a cartoon-like pig can enhance the intended meaning of showing how scared the animals are. Which image elicits the most intense disgust response may vary between users and the context of use. The lenses *experiential effect* and *behavioural effect* help to speculate if the confronting image of a pig would have the potential to make consumers feel uncomfortable and consequently reduce the demand for meat in the long term. An alternative use scenario could be that the new law leads to an increased demand for free-range meat with seemingly happier animals. The lens *scope of considerations* puts focus on

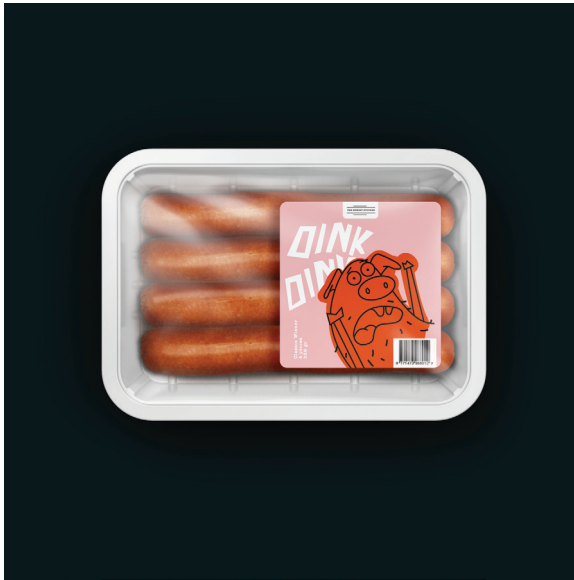


Figure 39: This critical design depicts a ‘more truthful’ representation of the life of animals in meat production as part of packaging designs, 2021. Credit to authors.

potential stakeholders in this context. For example, the new law could not only contribute to animal welfare, but also reduce the carbon footprint of the pork industry with beneficial effects on the quality of the living environment in the countryside. Furthermore, consumers may become more interested in the actual life of pigs on farms, which might increase the number of visitors on pig farms and the chances for rural tourism.

DISCUSSION

Disgust is a strong human emotion, and we think that explorations of disgust-eliciting stimuli are worthwhile, because they offer a rich potential for new design interventions that support healthy and sustainable food behaviours. But, as we have emphasized in this article, the use of disgust in design to influence people’s behaviour is controversial and requires critical evaluation. We believe that critical design concepts based on our proposed bridging concepts and fine-tuned with the help of our disgust lenses could cultivate a critical sensibility around the topic of disgust and food. This could contribute to innovative thinking and the development of safe and pragmatic design approaches to support consumers.

Disgust as an emotion is not good or bad in its core, and a discussion around its implementation in design is difficult if one has only a simplistic understanding of it. This article contributes to the discourse around disgust by offering a nuanced understanding of the many forms that disgust can take on in the context of food and design. The bridging concepts and lenses offer designers a vocabulary to be precise and specific in articulating ways in which disgust can be used in food design.

Even though some of the strategies might seem quite provocative or even absurd, they are employed to some degree already. An example is the

exposure of sugar contents in soft drinks, which aims to inform and consequently encourage consumers to avoid such products. Other examples include the introduction of fat taxes by legislators or the use of fat-shaming initiatives by food activists to confront consumers with their meat consumption. What these examples show is that disgust is actively employed and that a critical discussion about its proper use is desirable.

In this article, we focused on visual designs and also touched upon some additional sensory examples (sound, taste, smell) that elicit disgust. What remained largely outside our scope is the holistic perspective of design for disgust as a sensory experience. We see one of the main challenges in this context in involving all human senses. For example, some people might feel disgusted when eating a soup that misses a smooth consistency, while other people might enjoy a soup with texture. Exploring the senses in designing for disgust would be a relevant endeavour – it will raise new questions about what is appropriate, as users are likely to experience sensory disgust as rather invasive.

We present in this article three provocative design concepts, including a diet plate, a concept for a fruit company and a packaging design. The concepts focus on the point of purchase (e.g. supermarket) and the point of consumption in a private space. Future studies could investigate additional food-related environments, such as the area of production (farm), the public space in which food is consumed (restaurant) or even non-food-related objects (e.g. toys) to promote a specific food behaviour.

We noticed in the design process that the bridging concepts evoking either attraction or aversion seem to address different societal levels. The concepts focusing on aversion often relied on societal and legislative changes. These strategies aim to decrease the consumption of a food item, which consequently leads to financial cutbacks and is unlikely to be welcomed by their manufacturers. The bridging concepts based on attraction seem to work better on a small scale and individual level. For example, the presented concept of eating extinct fruits would solely rely on consumers' willingness to pay for these extinct apples.

The lenses that we propose can facilitate the refinement of the design and are likely to have impact on the discussion with 'viewers'. Some of the lenses work well when they are used in combination. For example, we used the two lenses *level of abstraction* and *experiential effect* often in tandem to consider and refine design elements to increase the anticipated effect on the user. We acknowledge though that the actual experience might be outside of a designer's control and that viewers may decipher design elements differently. For example, for the pork packaging, we developed a cartoon-like representation to enhance the intended meaning and evoke aversion. However, the design could also be interpreted as rather funny and evoke laughter rather than disgust when encountered.

As we have mentioned in the introduction, our design strategies were not originally intended to be used in a pragmatic context. In such a context, it would need to be considered that design for disgust can lead to different responses in society. On the one hand, people might simply ignore the approaches because they appeal to negative emotions that people prefer to avoid. On the other hand, it could lead to undesirable and extreme effects because society incorporates the disgust stimulus into its social structure and relevant food norms. For example, the introduction of insect-based food products in western society seems to be impacted by an established disgust

response, which is rather difficult to overcome. One can imagine many unwanted side effects when disgust is introduced in an uncontrolled way in the context of food. This could potentially lead to more food waste or cause health issues when food items are misinterpreted. With this article, we hope to contribute to the discourse around disgust and food design. In the next step, we intend to present the approaches and concrete design examples as part of an exhibition to facilitate and foster a public discussion around it.

CONCLUSION

Disgust is a basic human emotion of which we know very little. This article offers new insights on how disgust could be used in food design. The presented bridging concepts and lenses can serve critical designers in different design disciplines (e.g. product, graphic or spatial) as a source of guidance and inspiration. The different approaches contribute to a richer understanding of disgust and more effective ways to design for it.

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