The DIsgust-RelaTed-Images (DIRTI) database: Validation of a novel standardized set of disgust pictures

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ABSTRACT

Selecting appropriate stimuli is a major challenge of affective research. Although several standardized databases for affective pictures exist, none of them focus on discrete emotions such as disgust. Validated pictures inducing discrete emotions are still limited, and this presents a problem for researchers interested in studying different facets of disgust. In this paper, we introduce the DIsgust-RelaTed-Images (DIRTI) picture set. The set consists of 240 disgust-inducing pictures divided into six categories (*food*, *animals*, *body products*, *injuries/infections*, *death*, and *hygiene*). Additionally, we included 60 matched neutral pictures (10 per category). All pictures were rated by 200 participants on nine-point rating scales measuring *disgust*, *fear*, *valence*, and *arousal*. The present validation study covered a wide age range (18 —75 years) with a balanced number of participants in each decade of life. For each picture, we provide separate ratings on the four scales for men and women. In addition to the original pictures, we also provide a luminance-matched version for experiments that require control of the physical properties of the pictures. The standardized DIRTI picture set allows researchers to chose from a wide set of disgust-inducing pictures and may enhance researchers' ability to draw comparisons between studies on disgust. (Download DIRTI picture set: http://dx.doi.org/10.5281/zenodo.167037).

1. Introduction

Disgust has been counted among the basic emotions[1] since Darwin (1872), and like other basic emotions, elicits a stereotypical facial response (Ekman & Friesen, 1986), a characteristic physiological response (nausea), a specific behaviour (avoidance), and an emotional state (revulsion). Disgust-evoking objects tend to be those that are most likely contaminated by bacteria and viruses (Curtis, Aunger, & Rabie, 2004). Thus, disgust has a protective function for humans and animals. Several classification systems of disgust exist (Olatunji, Haidt, McKay, & David, 2008). The most

widely accepted system was described by Rozin, Haidt, and McCauley (2000), who suggests a family of specialized forms of disgust, all of which are thought to have originated from the ancestral basic emotion. The authors distinguish between *core disgust* (i.e. (perceived) threat of oral incorporation elicited by rotten food, waste, body products and certain animals), *animal-reminder disgust*, which is said to remind us of our mortality (i.e. violations of the body, death), *interpersonal disgust* (i.e. contact with unknown persons, potentially carrying a disease), and *moral disgust* (i.e. moral violations; for a review see Chapman & Anderson, 2012). The latter form of disgust most likely also comprises other distinct emotions (i.e. anger and contempt; Olatunji et al., 2012).

In clinical research, disgust plays a major role in psychiatric disorders such as contamination-related obsessive-compulsive disorder (OCD) and several specific phobias (e.g. spider phobia or blood-injury-injection phobia; Cisler, Olatunji, Lohr, & Williams, 2009). In recent years, many clinical studies have investigated different aspects of disgust, using various methods to induce this emotion: for example, showing disgust-related videos (e.g. Sawchuk, Lohr, Lee, & Tolin, 1999) or pictures (e.g. Haberkamp & Schmidt, 2014), administering a bitter taste (Eskine, Kacinik, &

Prinz, 2011), or using autobiographical recall (Fitzgerald et al., 2004).

It has been previously shown that visual material is effective in eliciting specific emotions (Lench, Flores, & Bench, 2011). When using pictorial stimuli, experimenters interested in inducing emotion in laboratory settings have to decide which pictures are suitable for that purpose. Researchers can use pictures from validated picture sets or can search for suitable pictures on the internet, and both methods have advantages and disadvantages; A number of validated, standardized sets of affective pictures with diverse content are available, including the International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 1999), the Nencki Affective Picture System (NAPS) (Marchewka, Żurawski, Jednoróg, & Grabowska, 2014), the Geneva Affective Picture Database (GAPED) (Dan-Glauser & Scherer, 2011), and the Emotional Picture System (EmoPicS) (Wessa et al., 2010).

Of the four general picture sets (IAPS, NAPS, GAPED, EmoPicS), the IAPS is the most widely used picture system (Marchewka et al., 2014). It is based on a dimensional approach to emotion (Osgood, Suci, & Tannenbaum, 1957; Wundt, 1896) and focuses on the dimensions of valence, arousal, and dominance. Additionally, a number of researchers have sought to classify the IAPS pictures into discrete categories of emotion (e.g. Barke, Stahl, & Kröner-Herwig, 2012; Davis et al., 1995; Libkuman, Otani, Kern, Viger, & Novak, 2007). However, despite its widespread use and established properties, the IAPS has certain disadvantages. First, contemporary clinical research mainly focuses on the study of distinct emotions (e.g. Barlow, 2000; Lawrence et al., 2007; Olatunji, Lohr, Sawchuk, & Tolin, 2007), which is not easily reconciled with the dimensional approach of the IAPS. Second, even if IAPS pictures are assigned to distinct emotional categories, the number of pictures per category is rather limited. This is especially problematic because many contemporary research methods such as fMRI and EEG studies typically require a large number of pictures and may result in repetitive use of the same pictures. This may reduce the emotional induction effect (Marchewka et al., 2014) and introduce unwanted recognition effects. Third, the picture quality of IAPS pictures varies considerably. This may produce experimental artifacts, for example, if the picture quality of one emotional category is significantly poorer than the quality of a comparison category (Marchewka et al., 2014). Fourth, IAPS pictures also vary considerably with respect to basic features such as size, luminance, and complexity, which might also influence the emotional processing of these pictures (e.g. De Cesarei & Codispoti, 2006). Fifth, the original purpose of the IAPS pictures was to induce affective responses in non-clinical samples. As a consequence, some pictures show violent scenes (e.g. severely injured people, dead bodies), which creates two problems. First, using these pictures may raise ethical concerns. Second, because of their severity, these pictures tend to yield uniform emotional reactions regardless of participant characteristics; thus, patients — e.g. with anxiety disorders — as well as healthy controls are likely to respond in the same way, thereby obscuring potential differences between groups (Lissek, Pine, & Grillon, 2006).

Researchers have tried to overcome the physical disadvantages of the IAPS pictures by providing pictures in high-definition quality (see NAPS, GAPED and EmoPics). Furthermore, Riegel et al. (2015) provided ratings of basic emotions (happiness, anger, fear, sadness, disgust, and surprise), which facilitate the choice of appropriate images for researchers interested in these emotions and provide 51 images for disgust. However, since the Nencki Affective Picture System was not developed to address disgust specifically, the number of pictures per emotion is still limited, and is even smaller for categories of disgust (e.g. food, animals, hygiene). Consequently, for any researcher specifically interested in studying different categories of disgust, the existing sets (NAPS, GAPED, and EmoPics) fall

short with respect to number of pictures and some (GAPED and EmoPIcs) have not been validated for discrete emotions.

In this situation, many researchers resort to collecting pictures from the internet and compile their own custom-made stimulus set (e.g. Buodo, Peyk, Junghöfer, Palomba, & Rockstroh, 2007; Haberkamp & Schmidt, 2014). However, this approach is time-consuming and may cause problems with copyright legislation. More importantly, each researcher might collect pictures relying on his or her own conception of the particular emotion, which may well differ from the participants' views (Barke et al., 2012). Although the stimulus material is often rated in the course of the experiment, these ratings are post hoc and cannot guide picture selection. Finally, the use of custom-made stimulus sets necessarily jeopardizes comparability across studies.

To resolve these issues, we developed a picture set to study the emotion of disgust. To our knowledge, this is the first validated picture set for the induction of disgust. We decided to include pictures for those disgust categories that fulfill the following criteria: each category should (1) primarily address the emotion of disgust, (2) be unambiguously related to its content (e.g. not include complex interpersonal situations), and (3) play a major role in psychiatric disorders (i.e. OCD, specific phobias). These criteria were fulfilled by six disgust categories: (a) *food* (e.g. spoiled food), (b) *animals*[2] (e.g. worms, cockroaches), (c) *body products* (e.g. feces), (d) *injuries/infections* (e.g. skin rashes, lesions), (e) *death* (e.g. animal cadavers, bones), and (f) *hygiene* (e.g. dirty bathrooms). We aimed to cover a broad range of disgust intensity in each category, from mildly to moderately to highly disgusting pictures. However, we avoided extremely disgust-provoking pictures for ethical and experimental reasons (e.g. provoking uniform responses for these pictures across experimental and control groups; Lissek et al., 2006).

2. Methods

The study was approved by the Ethical Committee of the Faculty of Psychology (Philipps-University Marburg).

2.1. Selection of pictures

The majority of pictures were collected from the internet (www.flickr.com), and some additional photographs were taken by one co-author (AB) and two graduate students. All pictures are copyright-free and covered by creative commons licences (i.e., there are no restrictions on these pictures with regard to copying, editing, and distribution). Additionally, the photographers and the individuals in the photographs gave written informed consent for the use of the pictures for scientific purposes. A large pool of pictures was chosen according to their content (i.e., whether they represented one of the six disgust categories of *food, animals, body products, injuries/infections, death, or hygiene*) and picture quality (i.e. sharpness, noise, luminance, contrast, distortion etc.). All pictures were in landscape format, and pictures with visible commercial logotypes were removed. Large written words were removed to avoid attentional effects and to make the picture sets less culture-specific. For ethical reasons, the category death only contained dead animals (rather than people).

The initial picture pool preselected by the authors resulted in 356 potentially disgust-provoking pictures covering the six categories. These pictures were edited to achieve a uniform size (1024 × 768 pixels) and to adjust the picture parameters to ensure

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[2] Note that spiders and snakes were excluded from this category because rated pictures of those stimuli are already covered by the GAPED database.