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Identifying a subset of fear-evoking pictures from the IAPS on the basis of dimensional and categorical ratings for a German sample

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ABSTRACT

Background and objectives: The International Affective Picture System (IAPS) is a set of colour photographs depicting a wide range of subject matters. The pictures, which are widely used in research on emotions, are commonly described in terms of the dimensions of valence, arousal and dominance. Little is known, however, about discrete emotions that the pictures evoke. Our aim was to collect dimensional and categorical ratings from a German sample for a subset of IAPS pictures and to identify a set of fear-evoking pictures.
Methods: 191 participants (95 female, 96 male, mean age 23.6 years) rated 298 IAPS pictures regarding valence, arousal and the evoked emotion.
Results: 64 fear-evoking pictures were identified. Sex differences for categorical and dimensional ratings were found for a considerable number of pictures, as well as differences from the US norms.
Conclusions: These differences underscore the necessity of using country-specific and sex-specific norms when selecting stimuli. A detailed table with categorical and dimensional ratings for each picture is provided.

1. Introduction

Fear is a normal and essential human emotion that confers a survival advantage by motivating its owner to withdraw from situations perceived as dangerous. People differ in their susceptibility to fear and the situations they perceive as fear-evoking. If fear and anxiety exceed adaptive levels, they can become dysfunctional, as is the case in anxiety disorders. A recent systematic review of epidemiological studies estimated the worldwide lifetime prevalence of anxiety disorders as 16.6% (Somers, Goldner, Waraich, & Hsu, 2006). Research into normal, adaptive fear, as well as fear exceeding functional levels, requires stimulus material that evokes fear in an ethically acceptable manner in a laboratory setting. A well-established set of stimuli, which is widely used in research on emotions in general, is the *International Affective Pictures System* (IAPS); a series of photographs depicting a wide range of subject matters (Lang, Bradley, & Cuthbert, 2008). Owing to the high relevance of fear in clinical research, a major purpose of the present study is to identify a valid set of fear-evoking stimuli from this system.

Within the area of research on emotions, two conceptual frameworks for the description of emotions coexist: the categorical and the dimensional approach. The categorical approach resembles our everyday conception of emotions as discrete states characterized by their content, such as disgust, fear, joy or anger (Ekman, Levenson, & Friesen, 1983; Ekman & Oster, 1979; Murphy, Nimmo-Smith, & Lawrence, 2003). It also plays a central role in the description of mental disorders and psychopathological symptoms (American Psychiatric Association, 2000; Kring, Davison, Neale, & Johnson, 2006). The dimensional approach on which the IAPS is based, aims at a more parsimonious characterisation of emotional states by describing such states on the basis of two dimensions (valence and arousal), or sometimes three dimensions (additional dimension of dominance; Bradley & Lang, 1994). There is a wide discussion regarding the theoretical issues and the most useful way of describing emotions (for details see e.g. Barrett, 1998, 2006a, 2006b, 2006c; Barrett & Wager, 2006).

Within the dimensional framework of the IAPS, its authors supply US norms for each picture with regard to valence, arousal and dominance. Norms for various other countries are also available (e.g., Castillo-Parra, Jesús, Ostrosky-Solís, & Ostrosky-Solís, 2002; Grühn & Scheibe, 2008; Ribeiro, Pompéia, & Bueno, 2004, 2005; Shao-hua, Ning, & Wen-tao, 2005; Verschuere, Crombez, & Koster, 2001; Vila et al., 2001; Yi, Liu, Luo, & Yao, 2006; Yuxia &

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Yuejia, 2004), as are norms for children (Müller, Winter, Schürkens, Herpertz-Dahlmann, & Herpertz, 2004; Sharp, van Goozen, & Goodyer, 2006) and older adults (Grühn & Scheibe, 2008). For Germany, a recent study by Grühn and Scheibe (2008) collected dimensional data for 504 pictures (168 positive, 168 negative and 168 neutral pictures) of the 1998 version of the IAPS.[1]

The IAPS has served as stimulus material in numerous studies in areas as diverse as general psychology, cognitive science, clinical psychology and psychiatry. Many studies are interested mainly in the valence and arousal of the stimuli and the available norms are sufficient to guide the selection of stimuli. Some study designs, however, require stimuli that belong to a particular emotional category, such as joy, fear or sadness (e.g. Baumgartner, Lutz, Schmidt, & Jäncke, 2006; Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003; Schienle, Schäfer, Stark, Walter, & Vaitl, 2005; Wolf et al., 2005). Owing to the picture system's theoretical provenance, little is known about the categorical emotions the pictures evoke. Currently, three studies exist that provide ratings of the category membership of the pictures: Davis, Rahman, Smith, and Burns (1995); Mikels et al. (2005); and Libkuman, Otani, Kern, Viger, and Novak (2007).

Davis et al. (1995) using the original version of the IAPS (Lang, Vaitl, & Öhman, 1988; 114 pictures), were the first researchers to acknowledge the importance of establishing the relationship between dimensional and categorical approaches. They asked 40 participants to rate the valence (no arousal ratings were collected) and record a categorical self-report for each picture using the 'six universal' categories — anger, disgust, fear, happiness, sadness and surprise — derived from Ekman's categories (Ekman & Friesen, 1975, 1978; Ekman, Friesen, & Ellasworth, 1972), plus a seventh category of love (affectionate and erotic). Mikels et al. (2005) asked 60 college students to rate a subset of 203 negative pictures (determined on the basis of the US norms supplied with the IAPS). Each picture was rated on a 7-point Likert scale with regard to a set of 4 emotions generated in a pilot study; namely fear, anger, sadness and disgust. In a second study, the authors investigated 187 positive pictures with regard to the categories of awe, excitement, contentment and amusement. By far the most extensive study in this area was published by Libkuman et al. (2007), who collected ratings on 9-point Likert scales for 703 pictures from the 1999 version of the IAPS (Lang, Bradley, & Cuthbert, 1999). Over three years, 1302 students each rated a subset of 18 pictures (in groups ranging from 2 to 20 students) with regard to 14 dimensions, namely valence, arousal, the six emotional categories of anger, disgust, fear, happiness, sadness and surprise, as well as the further dimensions of consequentiality, meaningfulness, familiarity, distinctiveness and memorability (see Table 1 for a synopsis of studies concerned with categorical ratings.)

So far, categorical studies have gathered data exclusively from American participants. Although there is evidence suggesting cross-cultural similarities in emotion processing, differences are also well-documented (van Hemert, Poortinga, & van de Vijver, 2007). Therefore, the usefulness of country-specific norms is widely acknowledged with regard to dimensional ratings. Extending this reasoning to the categorical ratings, it was the aim of the present study to provide both categorical and dimensional ratings for a German sample.

In the present study we further investigate sex differences in the categorical and dimensional ratings of IAPS stimuli, in order to account for sex-related variations in emotional processing. These kind of sex differences are well-documented; for example, in self-reports about emotions (Bradley, Codispoti, Sabatinelli, & Lang, 2001), in emotion-recognition tasks (Hall & Matsumoto, 2004; Montagne et al., 2008), the startle paradigm (Gard & Kring, 2007) and fear conditioning (Kelly & Forsyth, 2007; Merz et al., 2010). They were identified by different physiological methods, such as electromyogram (Bradley et al., 2001; Huang & Hu, 2009), electroencephalogram (Knyazev, Slobodskoj-Plusnin, & Bocharov, 2010), evoked potentials, (Sass et al., 2010) as well as in brain-imaging studies (Domes et al., 2009; Wager, Phan, Liberzon, & Taylor, 2003). Regarding fear and anxiety, women generally show greater susceptibility to fear (Craske, 2003; McLean & Anderson, 2009) and regard more situations as potentially threatening than men (Arrindell et al., 2003; Davey, 2008). The prevalence of affective and anxiety disorders are higher in women (Arrindell et al., 2003; Craske, 2003; Yuan et al., 2009) and sex differences are also found in the processing of disorder-relevant stimuli (Felmingham et al., 2010; Ohrmann et al., 2010). On the basis of these results, it is expected that women rate potentially threatening pictures as more negative and more arousing than men, and classify more pictures as fear-evoking.

Thus, we wanted to identify a set of fear-evoking IAPS pictures and provide general and sex-specific norms for a German sample, as a helpful tool for researchers' stimulus selection, by collecting categorical and dimensional ratings from German participants.

2. Method

2.1. Participants

191 persons (96 men, 95 women) with a mean age (±standard deviation) of 23.6 ± 2.8 years took part in the study. 167 of the participants were students in different fields, whereas 8 were employees of different occupational areas (16 participants did not provide information). The participants reported normal or corrected-to-normal vision and they were naïve regarding the specific aims of the study. The study was conducted according to the ethical guidelines of the German Psychological Society (1998). Informed consent was obtained and, at the beginning, participants were told that they could terminate their participation at any point if they wished. After the ratings were collected, the purpose of the study was explained to all participants.

2.2. Stimulus material

From the 2008 IAPS set (Lang et al., 2008) of 1182 pictures[2], 6 raters judged each picture independently, to assess whether it was fear-evoking or not. The raters were seated in a quiet room and viewed the pictures in their own time on a computer screen. All images (214 pictures) that were regarded as fear-evoking by the majority of the raters (4 or more) were included in the set of pictures for this study. As the participants had to evaluate the pictures according to seven emotional categories (see Procedure) twelve pictures for each remaining category (anger, sadness, disgust, joy, love, surprise, and neutral) were added. These pictures were selected in the following manner: after removing those pictures that had been rated as fear-evoking by at least one person (482 pictures), the same raters chose, independently, all the

[1] Different versions of the IAPS differ in the number of pictures included because pictures have been added continually over the years.

[2] 1182 refers to the actual number of pictures contained in the authorized download from the IAPS website. The data set included in the download also contains data for 1194 pictures; the number quoted by Lang et al., 2008 in the related Tech-Report is 1196.