

## Introduction

### Utility of Pictorial Emotion Stimuli

- The number of experimental studies using pictorial stimuli has been increasing rapidly (see Figure 1).

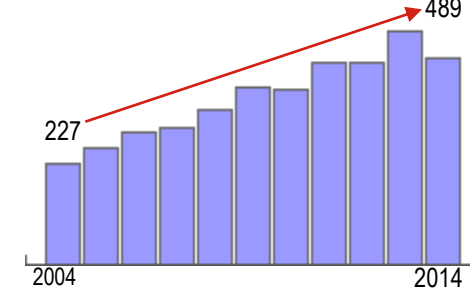


Figure 1. Number of Publication from 2004 to 2014 (PsychInfo)

- Pictorial stimuli have been used in various types of experimental studies ranging from behavioral to neuroimaging.
- This increase is due to the practical nature of pictorial stimuli.
  - Pictorial stimuli have been useful in eliciting target emotions and allied physiological responses.
  - Due to their ease of implementation, they have been used in various types of experimental studies ranging from behavioral study to neuro-imaging.

### Previously Developed Pictorial Emotion Stimuli Systems

- International Affective Pictorial (Lang, Bradley, & Cuthbert, 1999)
  - The most widely used pictorial emotion stimuli set
- Geneva Affective Picture Database (Dan-Glauser & Scherer, 2011)
- Nencki Affective Picture System (Marchewka et al., 2014)

### Limitations of Previously Developed Pictorial Emotion Stimuli Systems

- Absence of test of retest reliability (stability of stimuli across time)
  - Previous studies have never been tested for stability across time, an important consideration when presenting stimuli more than once within the same individual (e.g., repeated design experimental studies, longitudinal emotion studies, etc.).

### Purpose of the Current Study

- The purpose of the present study was to develop a new set of reliable pictorial stimuli, which elicited target emotions stably over time.

## Methods

### Initial Screening Phase

- 10,696 images were collected from the biggest image hosting website, "flickr" based on their emotional labels and categorization.
- 179 participants rated these images twice (across a 1-week interval) along four emotional dimensions (valence, arousal, dominance, & likeness).
- Rating scales consisted of 7-point Likert scales adopted from Lang (1980)'s Self-Assessment-Manikin(SAM) Scale (see Figure 2).
- All images, instructions and scales were presented on the same monitors and all participants' responses were saved onto a passcode protected server.

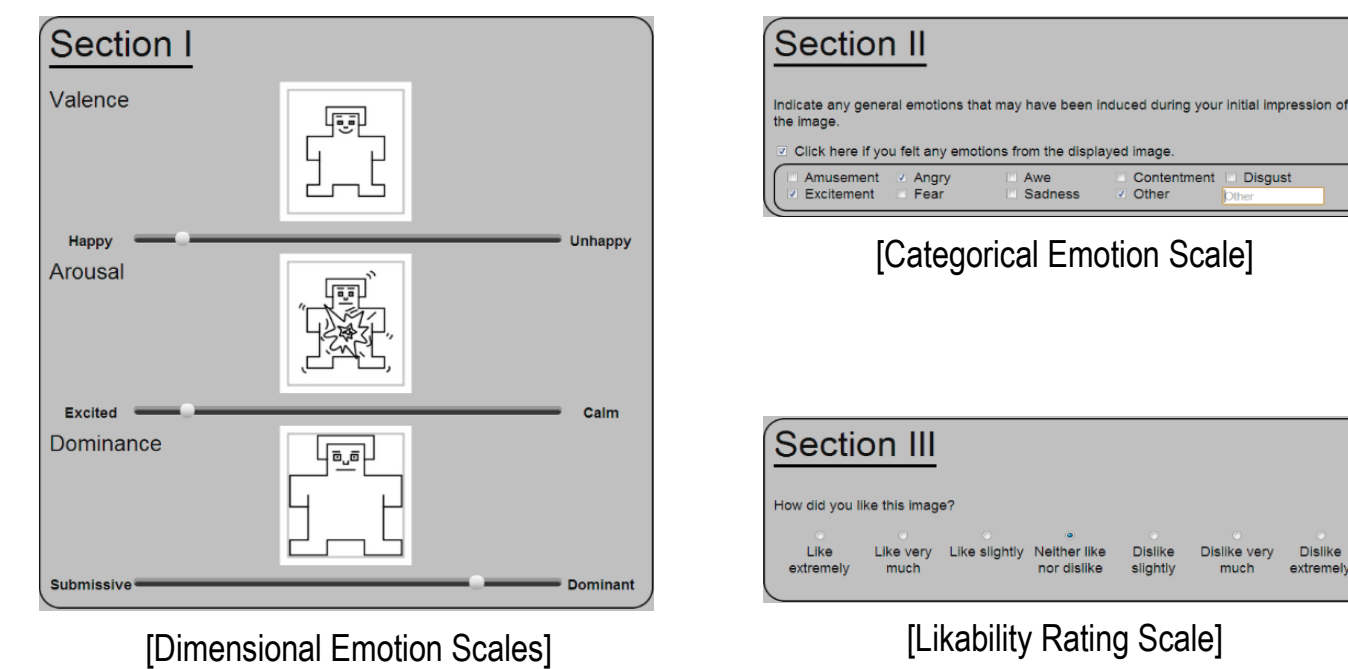


Figure 2. Scales Used in the Present Study

- In each session, Individual images were rated an average 3.14 times ranging from 1 to 11.

### Second Screening Phase

- Based on initial retest reliability (correlation coefficient greater than or equal to .60), at least 5 ratings per image, and distribution across emotion combinations, a total of 1,080 images were selected as the preliminary set of stimuli.
- In each session of the second phase study, each image received an average of 62 ratings ranging from 26 to 92.

## Results

### Final Set of Reliable Pictorial Stimuli

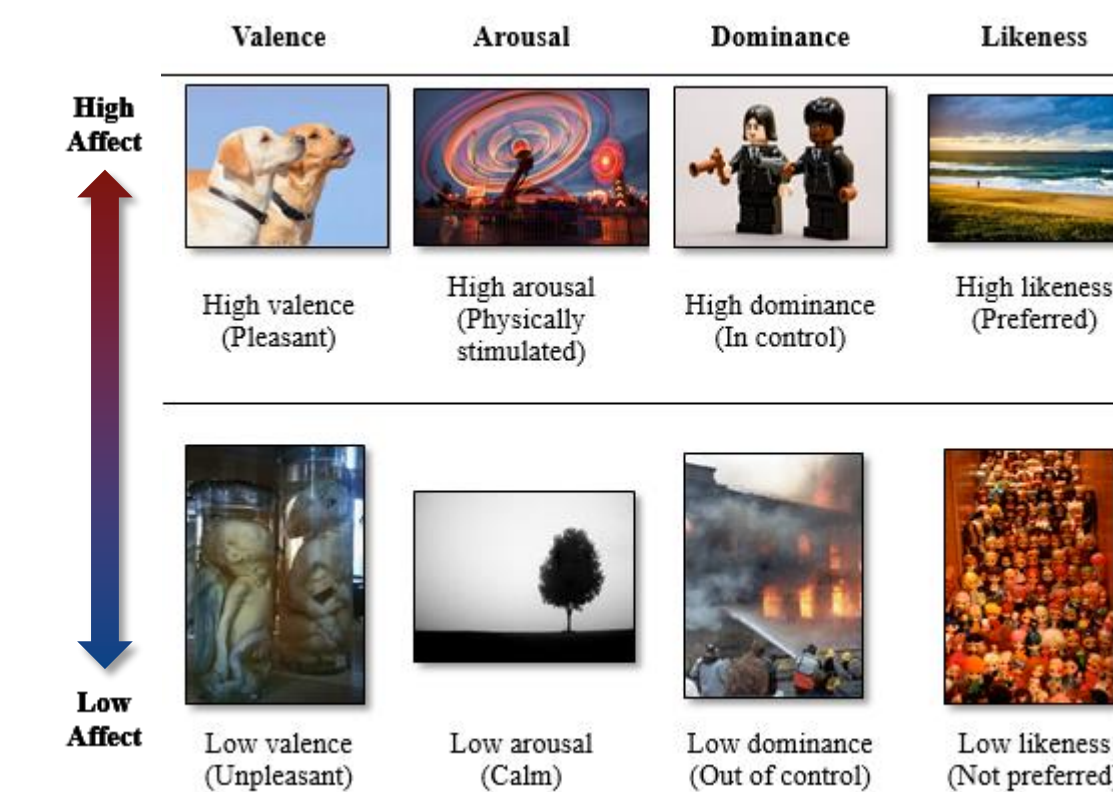


Figure 3. Representative Images of the ISEE

- Based on their retest reliability (correlation coefficient great than or equal to .60) and degree of emotion induction (high: higher than 67<sup>th</sup> percentile & low: lower than 33<sup>rd</sup> percentile), a total of 356 images were chosen as the final group of reliable pictorial stimuli (see Figure 3).

### Relationship across Emotional Dimensions

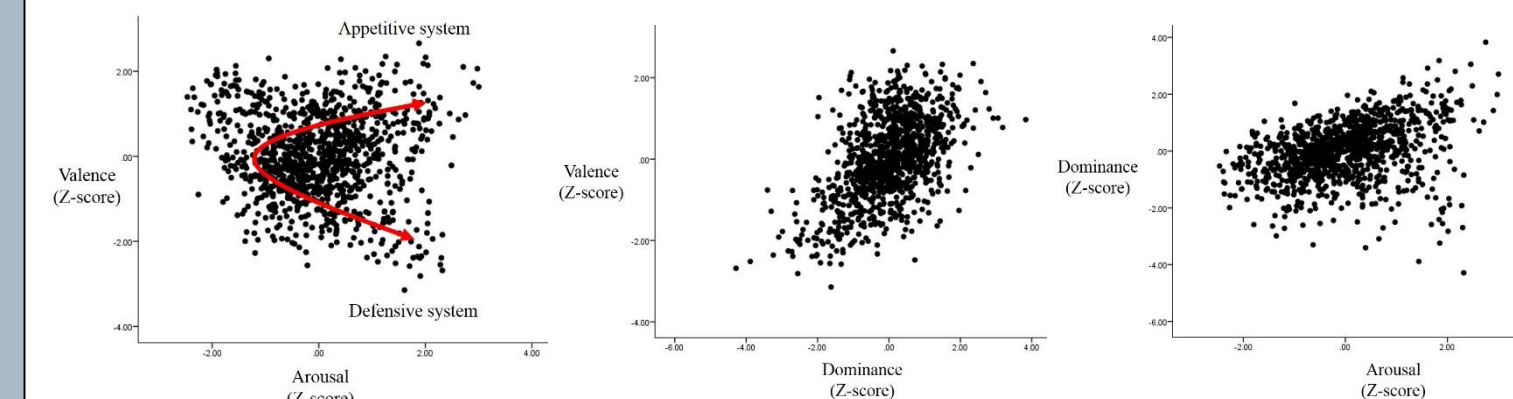


Figure 4. Scatterplots

- The present study revealed that correlations between valence, arousal and dominance were similar in direction to correlations found in previous studies (i.e., Bradley et al, 2001; Dan-Glauser & Scherer, 2011; Lang et al., 1999) (see Figure 4).

- Square transformation of each correlation coefficient revealed a significant curvilinear configuration between valence and arousal (Appetitive system)
  - When a specific stimulus is perceived as pleasing, an increase in the intensity of emotion can amplify the degree of pleasure.
  - On the other hand, aversive stimuli often activate the defensive system in a way that increases the intensity of unpleasant stimuli and often makes a person feel more avoidant.
- Correlation between dominance and other emotions indicated strong simple linearity.
  - Previous studies have indicated positive linearity between dominance and valence, and negative linearity between dominance and arousal.
  - This tendency reflects a preference (high valence) for having control (high dominance).
- Relationship between likeness and the other two emotions were identical to those of valence in the direction of the correlation.
  - Valence and likeness can be judged as two neighboring emotional domains.

## Discussion

### Limitations of the Current Study

- Participants were undergraduate students enrolled in the same university.
  - More studies need to be conducted in different countries and different cultures.
- Through the first screening process, a large number of images were excluded due to the limited number of ratings.
  - More ratings on those excluded images need to be collected.

### Advantages of the Current Study

- The stimuli set developed in the current study has the advantage of eliciting target emotions more stably over time.
- The initial images were selected based on computing methods as opposed to using face validity.
  - This study minimized human bias which can operate when the initial images are selected by experimenters based on their subjectivity.