

Where do people feel emotions in their body? A quantitative implementation of the Emotionally}Vague project

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Abstract The present paper presents the results of a collaborative project between an artist and two scientists interested in the embodiment of emotion. In the qualitative Emotionally}Vague project participants were asked to draw on a body outline where or how they felt anger, joy, fear, sadness and love. Inspired by the results of the Emotionally}Vague project, a quantitative study was performed to further examine people's body-emotion associations. For twenty-one emotions participants could choose a location and a possible second location on a body outline to indicate where they felt that emotion. The results demonstrated that emotions differed in where in the body they were felt. Notably, pride, anger, contempt and curiosity were associated with higher positions in the body as compared to pleasure, fear, guilt and disgust. Furthermore, as expected, there was individual variation in body-emotion associations. For all emotions, there was a sub-set of people that reported a body-emotion association not mentioned by another subset of people. These results support a view that emphasizes individual variability in the embodiment of emotional experience. Both scientific and practical applications of the task used to collect this data are discussed.

Keywords *Emotion, Bodily states, Embodiment, Visual design*

Introduction

Emotions are embodied. When people experience emotions, changes may occur in the activation of the autonomic nervous system, hormones may be released and facial or bodily muscles may contract (see for an overview Mauss & Robinson, 2009). These bodily sensations become part of people's personal beliefs or concepts about what emotions are and how emotions affect people (see Oosterwijk & Barrett, 2014; Oosterwijk, Mackey, Wilson-Mendenhall, Winkielman, & Paulus, 2015).

Even though the link between emotions and the body is well-established (Barrett, 2012; Damasio, 1999; Craig, 2008), it is debated whether the representation of emotions in the body is stable across people (i.e., the universal or "basic" emotion view; see Ekman, 1992; Nummenmaa, Glerean, Hari, & Hietanen, 2014) or whether there is meaningful variation in how people represent emotions in their body (i.e., a constructionist view of emotion; see Barrett, 2009; 2012). One way to test these opposing ideas is to map where people feel emotions in their body and to examine differences and commonalities.

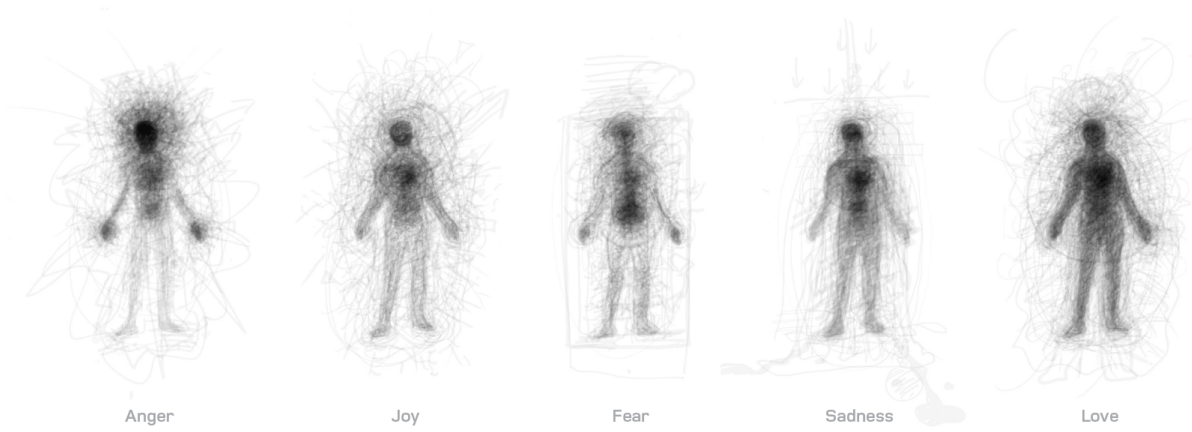
The present paper describes a collaboration between a visual designer and two emotion scientists interested in the embodiment of emotion. The visual designer developed a survey method to explore in a qualitative fashion where people felt emotions in their body. This survey method was subsequently implemented in a quantitative study to test differences and

commonalities in where people felt emotions in their body. The present paper presents these results to forward new insights into the individual differences of body-emotion associations, but also to show, as a proof of principle, that experimental design projects can be applied in a scientific context.

The Emotionally}Vague project

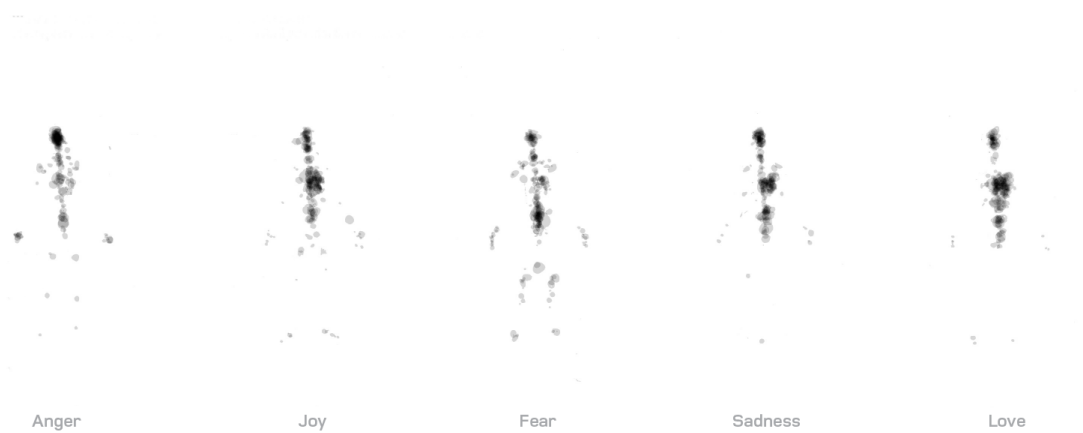
In the project Emotionally}Vague (O'Brien, 2007; <http://www.emotionallyvague.com>) the focus was to qualitatively explore the question: "Do people feel emotions in their bodies?". The project involved the development of an original method in which participants were asked to draw on a paper body outline where or how they felt anger, joy, fear, sadness and love. The test phase included texture use, value, space selection, and alternative media such as stickers. The final survey had three variations of body map questions: fully open, "one spot only" and arrows to indicate direction. A sample of 250 people was gathered which included 38 nationalities with ages ranging from 6 to 75 years old.

To aggregate the results, each drawing was scanned. Then, the body outline was stripped away and all drawings were layered in Adobe Photoshop. The opacities were reduced to 15% in order to allow for the 'onion-skin' effect. This allowed for the highest and lowest densities of aggregated locations to be revealed. Figure 1, 2 and 3 demonstrate the results for the fully open questions, "one-spot only" questions and the directional questions, respectively. For the



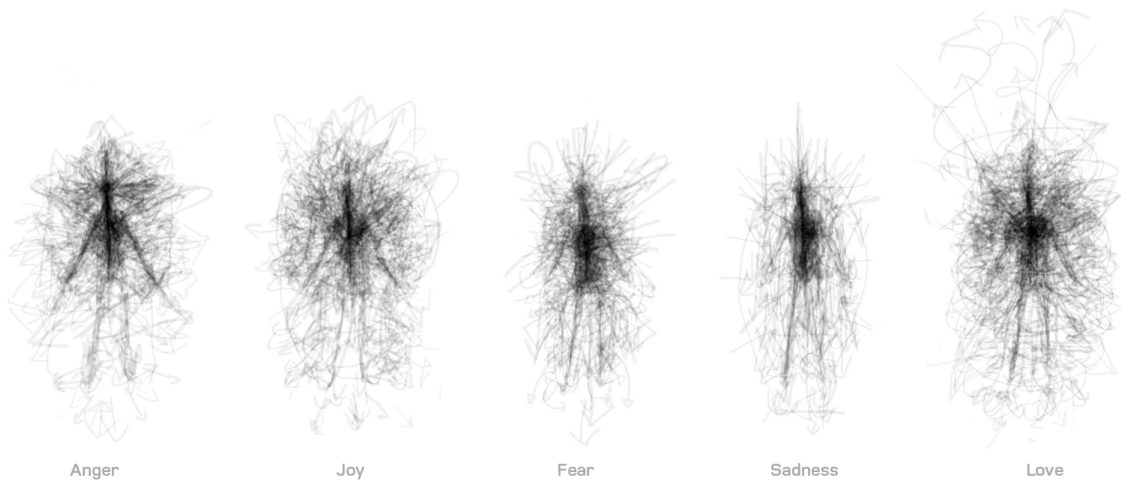
Anger Joy Fear Sadness Love

Figure 1. Original representation of the results from the EmotionallyVague project (Fully-open responses).



Anger Joy Fear Sadness Love

Figure 2. Original representation of the results from the EmotionallyVague project ("One spot only" responses).



Anger Joy Fear Sadness Love

Figure 3. Original representation of the results from the EmotionallyVague project (Directional responses).

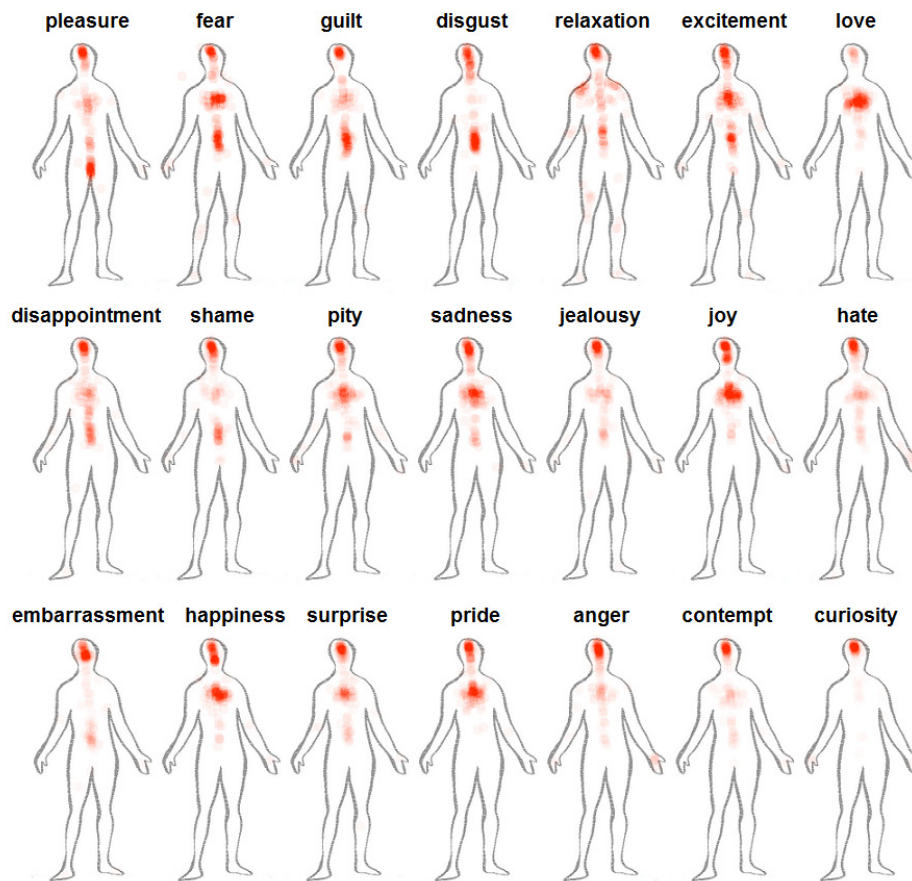


Figure 4. Overview of first locations for each discrete emotion category.

one-spot only questions undeniable patterns were revealed, despite many participants adding many more spots. The directional question revealed how the experience of emotion was one of a shifting pattern where movement was integral to the experience. Anger was represented mainly in head and chest and moved outwards from the head; joy emanated from the chest and filled the whole body; fear moved inwards to the abdomen; sadness had a downward direction and love was an all-body experience moving outward.

A quantitative implementation of the EmotionallyVague project

In an online study, the body outline from the EmotionallyVague project was used to explore body-emotion associations for twenty-one emotions often studied in emotion and affective science.

Method

Participants

One-hundred-and-sixty subjects (92 females; Mean age = 31.5 years) participated in an online study called "Drawing Emotion" for a small financial reward. The study was approved by the relevant Institutional Review Board, and all participants gave informed consent prior to starting the study.

Task

The task was presented on the website Mechanical Turk and programmed as an online questionnaire

using Qualtrics. Participants were presented with twenty-one emotions each combined with the outline of a body. For the full set of emotions, please see Figure 4. For each emotion participants were asked to choose one location that represented where they felt that emotion the most. When the participants clicked on the body outline a pointer appeared that could be moved around to find the location that best represented where they felt an emotion (first reported y -coordinate). The location was saved as an x -coordinate and a y -coordinate. After they entered the location where they felt the emotion the most, they could enter another location on the body outline (alternative y -coordinate). It was emphasised that there were no right or wrong answers. After finishing the body task, the participants filled in three questionnaires that will not be discussed further in this paper. Finally, participants were asked for their gender, age and ethnic background.

Analyses

We analysed differences between the first reported y -coordinate for the twenty-one emotion categories with a repeated measures ANOVA. Because many participants did not report a second location, this analysis was not performed for the alternative y -coordinate. An analysis of the x -coordinate did not demonstrate consistent results and is not discussed in this paper. To examine individual differences, each first reported y -coordinate and alternative y -coordinate was categorised as belonging to the head,

chest or belly (and lower) area of the body. Based on these variables we categorised the y -coordinate(s) for each emotion as felt only in the head, chest or body (i.e., no alternative y -coordinate was given) or as felt in the head-chest, head-belly or chest-belly. We also created a variable that reported the total number of emotions felt only in the head, chest and belly, or in the head-chest; head-belly and chest-belly.

Results

An analysis of the main y -coordinate demonstrated that emotions were associated with relative different positions in the body along the y -axis, $F(20, 3040) = 17.63, p < .001, \eta^2_p = .10, \epsilon = .73$. In particular, pride, anger, contempt and curiosity were associated with higher positions in the body (i.e., more towards the head), whereas pleasure, fear, guilt and disgust were associated with lower positions in the body (i.e., more towards the belly). See Table 1 for an overview of all paired comparisons. In general, positive emotions were felt more often in the chest than negative emotions, $t(157) = 9.29; p < .0001$, whereas negative emotions were felt more often in the head, $t(157) = -3.29; p < .001$, and belly, $t(157) = -5.99; p < .0001$, than positive emotions.

On average, participants filled in an alternative y -coordinate for 13.7 out of 21 emotions. This alternative location was combined with the first reported location to map individual differences in body-emotion associations. Figure 5 clearly demonstrates that participants vary in their associations between emotion categories and locations

in the body. For all emotions, there is a sub-set of people that reports a body-emotion association that is not mentioned by another subset of people. For example, some participants felt disgust, disappointment and embarrassment only in the head (22%, 19% and 30% respectively); whereas other participants felt these same emotions only in the belly (27%, 16% and 17% respectively). Even though many emotions demonstrated variety in body-emotion associations, other emotions were relatively strongly associated with particular areas of the body. For example, 75% or more of the participants mentioned only the chest, or a head-chest or belly-chest combination for joy, happiness, love and pride.

In terms of demographics, the results demonstrated that adults younger than 40 reported a lower mean y -coordinate across all emotions as compared to adults of 40 years and older, $F(1, 151) = 6.41, p < .05, \eta^2_p = .04 (M = 117.23 \text{ vs. } M = 102.56)$. Furthermore, younger adults felt a larger number of emotions only in their belly than older adults, $F(1, 158) = 9.51, p < .01$. We found no effect of the gender of participants when analysing the first reported y -coordinate. Nevertheless, when analysing the combined variables, we found that males felt a larger number of emotions only in their head, $F(1, 158) = 4.28, p < .05$, whereas females felt a larger number of emotions in the chest-belly region, $F(1, 158) = 4.05, p < .05$.

Discussion

The present paper presents the results of a collaborative project between an artist and two

Table 1. Comparisons between averaged y -coordinate for each emotion category.

	Mean Y	pl	fe	gu	di	Re	ex	lo	di	sh	pi	sa	je	jo	ha	em	ha	su	pr	an	co	cu	
pleasure	161																						
fear	145																						
guilt	145																						
disgust	138																						
relaxation	138																						
excitement	131																						
love	128																						
disappoint.	128																						
shame	113																						
pity	113																						
sadness	111																						
jealousy	106																						
joy	104																						
hate	102																						
embarras.	102																						
happiness	102																						
surprise	101																						
pride	93																						
anger	92																						
contempt	91																						
curiosity	53																						

Note: The first column reports the averaged first reported y -coordinate for each emotion category. The coloured columns represent Bonferroni corrected pairwise comparisons between emotion categories. Yellow cells represent $p < .05$; orange cells represent $p < .01$; red cells represent $p < .001$. Grey cells indicate that the mean y -coordinate did not differ between emotion categories.

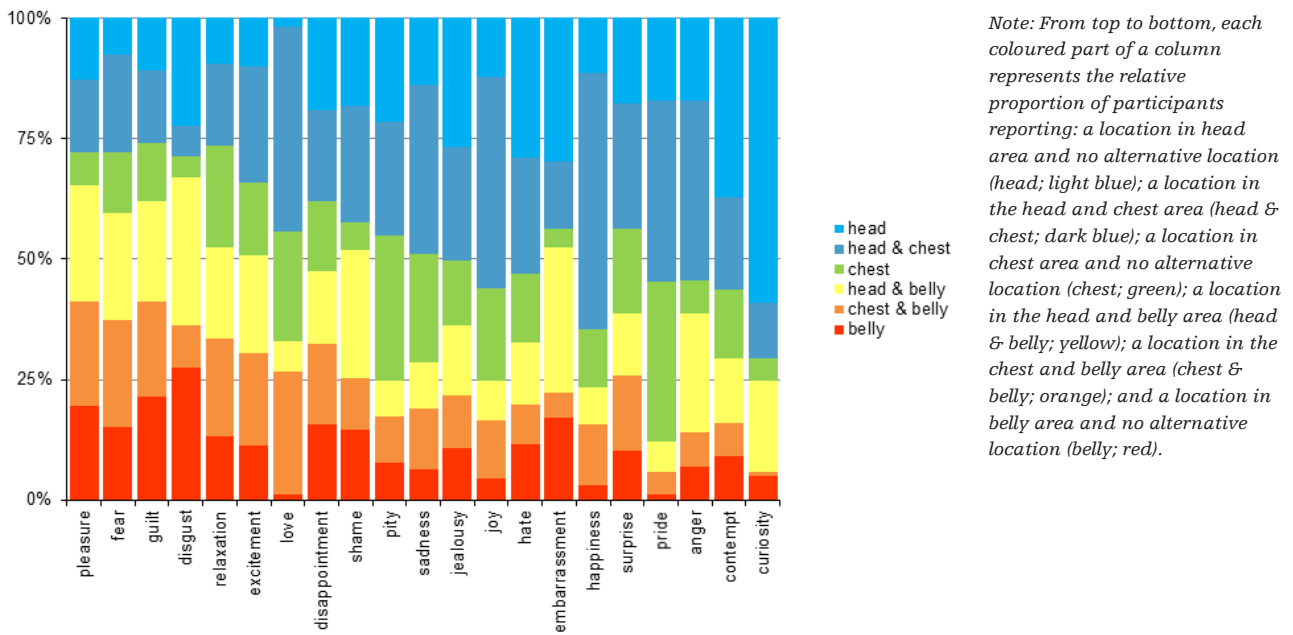


Figure 5. Overview of combined first reported and alternative y-coordinate, categorised into head, chest and belly area.

scientists interested in the embodiment of emotion. The qualitative EmotionallyVague project forwarded interesting visual displays of where people felt anger, joy, fear, sadness and love in their body. This inspired a quantitative, online study into people's body-emotion associations. The findings of this study extend work by Nummenmaa and colleagues (2014) that used a similar method. In those studies the prime aim was to examine aggregated data, whereas the present quantitative study zoomed in on individual variation. Although the present data forwards similar aggregated patterns in the body across emotion categories as Nummenmaa and colleagues, the present data also supports the idea of individual variation in body-emotion associations. Indeed, our analyses show that different people felt the same emotion in different parts of their body (e.g., some people felt disgust, disappointment or embarrassment only in the head whereas others felt these emotions only in the belly). In addition, the present data expands the current knowledge on body-emotions associations by adding a set of emotions that have not been studied before (i.e., pleasure, relaxation, excitement, joy, curiosity, disappointment, embarrassment, pity, jealousy, hate, and guilt).

The results from the present project have several scientific implications. First of all, the present data demonstrates not only that *emotions* differ in where in the body they are felt, but also that *people* differ in where in their body they feel emotions. This latter finding is consistent with views that emphasise individual variability in emotional experience (Barrett, 2009), embodiment (Oosterwijk & Barrett, 2014) and sensitivity to bodily signals (Herbert & Pollatos, 2012). The present data also sheds some new light on the relationship between body-emotion associations and demographics. For example, the finding that older adults associate emotions to a lesser extent with the lower parts of their body, is consistent with the

suggestion that older adults lose sensitivity for the physiological condition of their body (Mendes, 2010).

In terms of future research, it would be relevant to explore whether the body task can indicate *trait* differences (i.e., stable individual differences in associations between emotions and the body) and *state* differences (i.e., situationally dependent variation in associations between emotions and the body) in body-emotion associations. Moreover, future research should examine to what extent the associations that people report reflect measurable physiological sensations, outward bodily expressions or symbolic/metaphoric associations (Kövecses, 2003). In addition, it is an open question what people represent when they choose a location in the head. Do these locations represent a sensation (i.e., a feeling in the throat, see disgust), a behaviour (i.e., smiling, see joy and happiness) or a cognitive representation of an emotion (i.e., angry thoughts, or a mental state of curiosity)? A qualitative approach that asks people explicitly what they portray when choosing a body location may shed more light on these questions.

The results from the present project also have important practical applications. For example, the body task could be used to map people's bodily sensations in a medical setting. It could facilitate non-verbal or distance dialogue between patient and therapist/doctor or as an alternative evaluative module in questionnaires such as for stroke rehabilitation or chronic pain. It could also be a tool for mindfulness and self-monitoring (e.g., a visual mood diary). Furthermore, it may have applications in commercial qualitative market research, as well as a tool for improving HR feedback and engagement. And finally, there are exciting possibilities for the collection of real-time, global responses through a future digital web version, leading to data visualisations on a mass scale. These visualisations

may be interesting as an art piece created by audience inputs, for example as an interactive component of theater, dance or music performances.

In closing, the findings from the present project have potential scientific and practical use. With this, the present project illustrates the importance of interdisciplinary collaborations between psychology and the field of arts and design and demonstrates that such collaborations can be both inspiring and fruitful.

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