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Bodily Sensations Associated with Emotions: An Exploratory Self-Report Study

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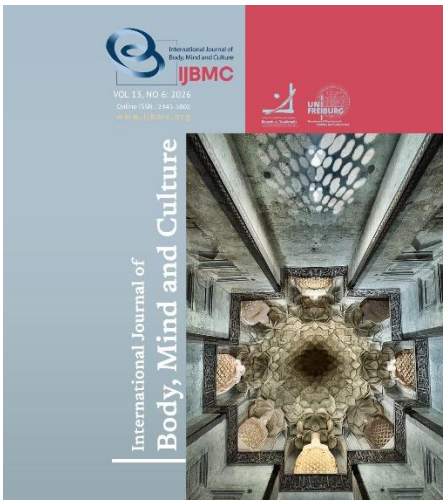

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ABSTRACT

Objective: This study aimed to explore self-reported bodily sensations associated with positive and negative emotions and discrete emotional categories.

Methods and Materials: An exploratory self-report study with quantitative analysis was conducted among 45 adults aged 18–35 years without neurological or psychological disorders. Participants were recruited online and interviewed using an autobiographical recall method. They were asked to recall bodily sensations experienced during ten emotions, including joy, tenderness, surprise, sadness, anger, contempt, disgust, fear, shame, and guilt, and to identify emotions associated with sensations in specific body parts. Interview responses were transcribed into emotion–body pairs, yielding 881 entries. Associations between discrete emotions, emotional valence, and body parts were examined using chi-square tests, adjusted residuals, and Cramer's V.

Findings: A significant association was found between discrete emotions and body parts, $\chi^2(45, N = 655) = 205.56$, $p < .001$, $V = .251$. Fear was associated with sensations in the stomach, heart, and limbs; sadness with the throat and chest; joy with the chest and whole body; anger with the jaw; shame with the face; and guilt with the throat. Emotional valence was also significantly associated with body sensations, $\chi^2(14, N = 881) = 53.65$, $p < .001$, $V = .247$. Positive emotions were more often linked to the chest, limbs, and whole-body activation, whereas negative emotions were more often linked to the jaw, throat, and ears.

Conclusion: Self-reported bodily sensations showed distinct patterns across emotional categories and valence. These findings may inform future psychophysiological research on peripheral markers of emotion.

Keywords: Emotion, Bodily Sensations, Self-Report, Interview, Autonomic Nervous System.

Introduction

Bodily manifestations of emotions are crucial for both emotion recognition and self-awareness. The processes in the body that accompany emotional experience can be observed from three angles: self-reported changes, physiological measurements, and linguistic analysis. Self-reported physiological changes were primarily investigated using body mapping techniques, which facilitated the acquisition of topographies of bodily sensations during basic emotions. First investigations of reported body experience associated with different emotions were held in an attempt to find sources of differential emotion awareness, that is how one knows which emotion he or she is experiencing (Mason, 1959).

In a study of Nieuwenhuyse et al. (1987) participants filled schematic body drawings immediately after a case of emotion outside the laboratory. Disgust was felt in the stomach and throat, shame – in the face, guilt – back of the head, stomach and forehead, surprise – on the lower parts of the back, joy – in arms and legs, finally, fear and anger were felt almost everywhere. In this line, several studies utilizing similar methods with open ended questionnaires were conducted and yielded consistent results. For example, joy was associated with increased temperature, heart rate, and a lump in the throat, while anger – with abrupt temperature increase, heart rate, respiration and muscle tension (Molaeinezhad et al., 2025; Philippot & Rimé, 1997).

Philippot & Rimé (1997) suggested that reported sensations are rather a social construct, since in their research bodily sensations were poorly predicted by physiological measures. However, interviews in three countries pointed to cross-cultural similarities in bodily sensations, leaving reasons for interpreting the latter as indicative of real peripheral changes, rather than socio-cultural conventions (Breugelmans et al., 2005). Another approach was proposed by Nummenmaa et al. (2014), whose participants colored body regions during different emotions in different emotion induction conditions. Thus, they built bodily maps for 14 emotions. For example, sadness was associated with a decreased activity in legs, while many emotions activated the chest. What is more interesting, bodily maps for conditions of emotional words and direct emotion induction via movies and stories did not differ. This, once again, points to the conclusion that reported bodily sensations reflect universal activation patterns, rather than language-based stereotypical mental representations of emotion related bodily sensations.

As for the objective physiological measurement, the relation between emotions and the autonomic nervous system (Breugelmans et al., 2005), claimed by William James, has a controversial history of studying. Modern approaches vary from those completely denying any possibility of specific ANS activation patterns for different emotions (Barrett, 2006) to those that consider this relation as natural, on the grounds that emotions have distinct functions, and, thus, evoke different ANS activity patterns for body preparation (Stemmler, 2004). Two approaches can be distinguished in the field. The first unites studies searching for the unique autonomic manifestations of discrete emotions. The first evidence of the autonomic specificity reveals fear and anger differentiation in some of ANS measures (Ax, 1953). More recent studies report different ANS response patterns for six basic emotions (Stephens et al., 2010) and discrete positive emotions (Shiota et al., 2011). However, a consensus regarding the convergence of these results supporting the emotion-specific ANS activation is still lacking (Siegel et al., 2018). The second approach focuses on the emotional arousal and valence markers in the ANS activation (Bradley et al., 2001). The link between the ANS and emotional arousal is straightforward: higher values of ANS activity indicators signify the higher intensity of an emotion. This is broadly used to reveal the role of emotional arousal in other psychological processes. Emotional arousal has been reliably related to many indices of the ANS, like skin conductance and heart rate. As for valence, its markers are primarily reflected in the somatic system activity (Ekman et al., 1999). The startle blink reflex, for example, is larger for negative emotions and smaller for positive emotions, compared to neutral (Grillon & Baas, 2003). The post-auricular muscle response, conversely, is greater for pleasant emotions, compared to negative and neutral (Gable & Harmon-Jones, 2009). Also, differences between head motion in response to pleasant and unpleasant stimuli have been reported recently (Kosonogov et al., 2017). In the autonomic domain, facial temperature was found being indicative of valence (Goulart et al., 2019). Despite Dutta & Bandyopadhyay (2024) fair notion about the inconsistency of thermal facial expression of emotions, sustainable is the finding that nose tip temperature is

lower for low arousal negative emotions, compared to neutral (Kosonogov et al., 2017). As for components of the cardiac activity, heart rate was shown to be higher in response to unpleasant stimuli over neutral, while heart rate variability decreases for positive stimuli over negative (Costa et al., 2022). Finally, a greater pupil size for positive and the opposite for negative emotions was reported (Babiker et al., 2013).

Several studies also report ANS response patterns for discrete emotions (Stephens et al., 2010). However, recent meta-analyses conclude that no ANS index can consistently predict valence or discrete emotions (Siegel et al., 2018). Despite this, contemporary studies continue seeking autonomic markers of emotional valence. More importantly, their findings prove valuable, as they are being widely implemented for automatic emotion recognition algorithms development (Fu et al., 2022). As speculated by Levenson (2014), deliberate methodological enhancement can ensure discovering autonomic activation patterns for 4-6 basic emotions. Among other obstacles in advance of research on the ANS specificity of emotions, he considers a narrow assessment of the ANS functions.

As a matter of fact, the vast majority of relevant studies address easily obtainable and quantifiable markers, such as cardiac and electrodermal activity, while respiratory, thermal and gastrointestinal measures are left on the sideline.

At the same time, in everyday language, there are numerous common metaphors such as “take one’s breath away”, “butterflies in the stomach”, and other “gut feelings” which describe the bodily experiences of emotion. are in, insufficiency of the current research tendencies in this field is even more evident. Possible measures of discrete emotions or emotional valence can be inferred from basic emotions’ functions. Levenson proposes selecting measures based on the associated behaviors. We suppose that self-reported bodily changes during certain emotions can be indicative of the ANS changes associated with given emotions.

A recent review of physiological feelings, from the neuroscience perspective, states the dynamic interaction between autonomic and central nervous systems in shaping emotional experience, which also justifies the theoretical significance of searching for new ANS markers of emotions (Pace-Schott et al., 2019). Particularly, such markers would allow elaborating a more relevant set of measures in experimental studies of ANS correlates of the valence or discrete emotions. The qualitative description of sensations can be informative in determining which ANS features can be measured in this part of the body (e.g., skin response, blood circulation etc.). All the studies above had different objectives and did not explicitly focus on peripheral activation, nor did they approach the problem of valence dimension reflected in bodily sensations.

Our literature review shows the scarcity of contemporary research addressing the question of patterning in self-reported emotion related bodily sensations. Therefore, our objective was to explore self-reported bodily sensations during different emotions. For this purpose, we interviewed participants after emotion induction with the autobiographical method. They were asked to recall what sensations they had during certain emotions and during what emotions they had sensations in certain body parts. This design was supposed to explore potential associations between different bodily parts (sensations) and emotions (valence and discrete categories).

Methods and Materials

Study Design

An exploratory self-report study with quantitative analysis was conducted among 45 adults aged 18–35 years without neurological or psychological disorders.

Participants

Forty-five adults between 18 and 35 years old without neurological or psychological disorders (25 females, M_{age}=23.15, SD = 4.22) were recruited from the general sample via online platforms (mostly through advertisements in *Telegram* channels). To calculate if our sample size was sufficient, we chose a post hoc power analysis for crosstabs (in the case of positive\negative emotions) which reveals a critical value of χ^2 to reach a sufficient level of power (.80). All participants were Russian native speakers, residents of Moscow (> 13 mln inhabitants) with higher education or students pursuing it. To ensure cultural homogeneity, only native Russian speakers were selected. With experiment ending, participants were paid a monetary equivalent of 10 USD (at purchasing power parity). The study was approved by the university ethics committee (#52) according to the Helsinki declaration.

Materials and Procedure

As a pre-test, eight volunteers with a bachelors in psychology (5 females, M_{age} =24.0) were asked to choose up to ten most frequently experienced emotions and describe sensations during these emotions in a blank form. Emotions mentioned more than once and all mentioned body parts were selected. Thus, ten emotions (joy, tenderness, surprise, sadness, anger, contempt, disgust, fear, shame, guilt) and ten body parts (nape, eyes, jaw, face, ears, neck/throat, shoulders, chest, stomach, limbs) formed the basis of the interview protocol. Joy, surprise, sadness, disgust, fear and anger were left in the protocol, as they correspond to Ekman's six basic emotions. Contempt, shame and guilt are included in Izard (1977) list of basic emotions. Tenderness was examined more thoroughly and included to a final list based on recent experimental findings that subjective experience of tenderness is distinct both from joy and sadness (Kalawski, 2010).

Once being invited to the laboratory, they signed a written consent. Then the interviewer (FK) and participants sat in front of each other at the table. The interviewer explained the study objective. During the interview, answers were written down manually. If an answer was not sufficient (e.g., psychological details without bodily sensations), the interviewer asked clarifying questions. The clarifying questions included: "Did you feel something else in any other parts of your body during this (each) emotion?" and "Were there any other emotions you felt in your body?" Also, the interviewer asked about the surprise whether it was a pleasant emotion or not.

To induce emotions, we used the autobiographical recall method. The interview protocol consisted of 20 questions about emotional experiences (Suppl. Mat. 1). For the first part, participants were asked to recall the recent memory of experiencing each of ten emotions. They were asked to concentrate on that memory and to remember sensations in the body which accompanied the given emotional state. After this, they were asked where in the body they felt physiological changes when experiencing a certain emotion (e.g., "What were your sensations during sadness?"). The second part consisted of the questions about sensations in each of ten body parts (e.g., "Do you have unusual/strange sensations/ changes in the jaw? During which emotion? What sensations?") For both stages, clarifying questions were allowed, where needed.

Data analysis

The data, obtained as the answers to interview questions, were then manually transcribed in the following way. One subject was deleted, since she did not provide any relevant answer. Each time the bodily sensation was mentioned for describing an emotion, the pair was added to the table as an entry. For example, if a participant reported to have a tension on the nape and heightened temperature on the face when experiencing anger, "anger – head" and "anger – face" pairs were added to the table as two separate entries. Thus, a table of two columns was obtained. Each row corresponded to each observed emotion-body pair (881 entries). Indeed, the interview protocols contained more detailed body parts such as "solar plexus", "lips", etc. They were assigned to the appropriate broader category (see Suppl. Mat. 2 for codification rules and Suppl. Mat. 3 for qualitative descriptions of each entry). The final list consisted of 15 body parts (chest, heart, head, face, jaw, stomach, neck, throat, limbs, shoulders, ears, eyes, mouth, and the whole body). Thus, the first crosstab was built for discrete emotions and contained 10 discrete emotions × 15 body parts. Then it was reduced to 6 discrete emotions × 10 body parts after deleting categories where the highest expected value was <5. The final crosstab had only 8% of cells with expected values <5 and contained 655 entries. The second crosstab was constructed for valence, represented 2 valence categories (negative and positive) × 15 body parts and contained 881 entries. Emotions were categorized into positive (happiness, tenderness, surprise) and negative (sadness, contempt, disgust, fear, anger, shame and guilt). Each case of surprise was assigned to positive emotions, based on participants' clarification. As we were interested in finding associations of body parts with discrete emotional categories or positive and negative emotions, chi-square tests were conducted with Cramer's V for crosstabs with the correction for high degrees of freedom as a measure of effect size (Cohen, 2013; Kim, 2017). Pairs with adjusted residuals >1.96 and <-1.96 were considered significant. This type of analysis allowed us to identify only statistically significant associations of emotional categories with body parts, where a sensation was felt, without accounting for the quality of this sensation (tension, thermal, etc.).

Findings and Results

We found a large association between discrete emotions and body parts, $\chi^2(45, N = 655) = 205.56$, $p < 0.001$, $V = 0.251$ (Table 1). Fear was associated with sensations in the stomach, heart and limbs. Sadness showed an association with the throat and chest, while joy was felt in the whole body and chest, in particular. Anger, shame and guilt were more often associated with sensations in the jaw, face and throat, respectively.

Interestingly, some body parts appear only in bound with one emotion category, while others are shared between two. The count of chest and limb appearances in emotion descriptions is maximal among body parts. The chest was mentioned significantly more in both sadness and joy descriptions. The throat sensations are associated with both sadness and guilt. Anger and shame have more specific bodily representations pairing with jaw and face accordingly. Sensations in heart, stomach and limbs were specific for fear solely.

Table 1

The crosstab for the association between discrete emotions and body parts.

		sadness	joy	anger	fear	shame	guilt	Total count
throat	Count	14	0	9	9	5	9	46
	Expected Count	7.44	5.76	11.52	10.82	6.18	4.28	
	Adjusted Residual	2.72[a]	-2.66[b]	-0.89	-0.65	-0.53	2.48[a]	
chest	Count	26	23	19	12	9	11	100
	Expected Count	16.18	12.52	25.04	23.51	13.44	9.31	
	Adjusted Residual	2.90[a]	3.44[a]	-1.51	-2.95[b]	-1.41	0.63	
whole body	Count	18	22	17	16	15	4	92
	Expected Count	14.89	11.52	23.04	21.63	12.36	8.57	
	Adjusted Residual	0.95	3.56[a]	-1.57	-1.49	0.87	-1.77	
jaw	Count	5	0	33	7	2	0	47
	Expected Count	7.61	5.88	11.77	11.05	6.31	4.38	
	Adjusted Residual	-1.07	-2.69[b]	7.42[a]	-1.45	-1.92	-2.28[b]	
heart	Count	3	5	14	20	2	4	48
	Expected Count	7.77	6.01	12.02	11.29	6.45	4.47	
	Adjusted Residual	-1.94[b]	-0.46	0.69	3.08[a]	-1.96	-0.24	
stomach	Count	5	2	5	19	4	5	40
	Expected Count	6.47	5.01	10.02	9.40	5.37	3.73	
	Adjusted Residual	-0.65	-1.48	-1.89	3.69[a]	-0.66	0.72	
limbs	Count	14	15	27	34	9	6	105
	Expected Count	16.99	13.15	26.29	24.69	14.11	9.78	
	Adjusted Residual	-0.87	0.60	0.17	2.34[a]	-1.59	-1.38	
face	Count	2	5	21	3	23	6	60
	Expected Count	9.71	7.51	15.02	14.11	8.06	5.59	
	Adjusted Residual	-2.84[b]	-1.03	1.87	-3.55[b]	5.93[a]	0.19	
shoulders	Count	7	6	5	10	8	6	42
	Expected Count	6.80	5.26	10.52	9.87	5.64	3.91	
	Adjusted Residual	0.09	0.36	-2.03[b]	0.05	1.10	1.15	

head	Count	12	4	14	24	11	10	75
	Expected Count	12.14	9.39	18.78	17.63	10.08	6.98	
	Adjusted Residual	-0.05	-2.00[b]	-1.35	1.84	0.33	1.27	
Total		106	82	164	154	88	61	655

[a] - significant positive adjusted residual, [b] - significant negative adjusted residual

The association between valence and body parts was also large, $\chi^2(14, N = 881) = 53.65$, $p < 0.001$, $V = 0.247$ (Table 2). Post hoc power analysis revealed a critical value of $\chi^2 = 26.38$ for such data to reach power > 0.80. Positive emotions were more often reported to be associated with sensations in the heart, limbs and whole body activation, while negative emotions in the throat, jaw and ears. Curiously, bodily sensations for negative emotions were reported much more frequently (82%).

Table 2

The crosstab of the association between emotional valence and body parts.

		Emotional valence		Total
		positive	negative	
chest	Count	41	85	126
	Expected Count	22.74	103.26	
	Adjusted Residual	4.57[a]	-4.57[b]	
limbs	Count	33	97	130
	Expected Count	23.46	106.54	
	Adjusted Residual	2.36[a]	-2.36[b]	
the whole body	Count	28	78	106
	Expected Count	19.13	86.87	
	Adjusted Residual	2.39[a]	-2.39[b]	
jaw	Count	2	51	53
	Expected Count	9.57	43.43	
	Adjusted Residual	-2.79[b]	2.79[a]	
throat	Count	3	57	60
	Expected Count	10.83	49.17	
	Adjusted Residual	-2.72[b]	2.72[a]	
ears	Count	1	28	29
	Expected Count	5.23	23.77	
	Adjusted Residual	-2.08[b]	2.08[a]	
stomach	Count	6	42	48
	Expected Count	8.66	39.34	
	Adjusted Residual	-1.03	1.03	
back	Count	4	16	20
	Expected Count	3.61	16.39	
	Adjusted Residual	0.23	-0.23	
neck	Count	2	24	26
	Expected Count	4.69	21.31	
	Adjusted Residual	-1.39	1.39	
shoulders	Count	7	37	44

	Expected Count	7.94	36.06	
	Adjusted Residual	-0.38	0.38	
heart	Count	8	44	52
	Expected Count	9.38	42.62	
	Adjusted Residual	-0.51	0.51	
head	Count	13	80	93
	Expected Count	16.78	76.22	
	Adjusted Residual	-1.08	1.08	
face	Count	9	59	68
	Expected Count	12.27	55.73	
	Adjusted Residual	-1.07	1.07	
eyes	Count	2	18	20
	Expected Count	3.61	16.39	
	Adjusted Residual	-0.95	0.95	
mouth	Count	0	6	6
	Expected Count	1.08	4.92	
	Adjusted Residual	-1.15	1.15	
Total	Count	159	722	881

[a] - significant positive adjusted residual, [b] - significant negative adjusted residual

Discussion and Conclusion

We aimed to reveal patterns of self-reported bodily activation that are associated with positive/negative emotions and distinct emotional categories. The current study did not attempt to get as "objective" (pure from subjective discrepancies) data as possible. We were interested to what extent language-based stereotypical associations between emotions and bodily sensations are consistent among individuals. Previous studies answered this question indirectly, using more standardized procedures and broader categories in terms of body parts. In this study, the interview method allowed revealing detailed associations between emotions and body parts with valuable qualitative clarifications, unlike similar studies, using activation/deactivation terms.

The data were analyzed both through the framework of discrete emotions and along the dimension of valence. As for discrete emotions, we analyzed bodily sensations only for joy, sadness, fear, anger, shame and guilt. Tenderness, surprise, disgust and contempt were excluded due to the insufficient number of entries, so a separate research for these emotion categories might be reasonable. There are two alternative explanations for this finding. First, this can be due to the diverse representations of these emotions in individuals. The study design did not ensure that all participants understood the words describing emotions in the same way. Second, these emotions might be rarely experienced in everyday life, which makes it difficult to collect more representative data.

Joy was related to the heart and whole body activation. This result fully supports the map for happiness by Nummenmaa et al. (2014). As for the quality of the sensations, heart racing and the sensation of lightness in the whole body were reported most frequently. Sadness was associated with sensations in the throat and chest. The most common qualitative descriptions were "lump in the throat", "dry throat" and "difficulty in swallowing" for the throat and "sinking feeling", "heaviness" and "feeling of pressure" for the chest. However, Rimé & Giovannini (1986), also using self-report in a study, showed that sadness was dominantly manifested in facial changes, but not vegetative or muscular symptoms. Nevertheless, in our study, sadness shared 16% of all sensations. Fear manifestations comprised one fourth of all bodily sensations, being associated with heart, stomach and limbs. This pattern is consistent with the previous findings (Nieuwenhuyse et al., 1987; Nummenmaa et al., 2014). The sensations were described as "heart's racing",

"tension/emptiness" in the stomach and trembling and temperature drop in limbs. Anger-jaw association, to our knowledge, was not reported previously. Participants mostly reported tension in the jaw during anger, but this could rather reflect emotional regulation, than emotional response. However, this could be studied further with the direct control of some emotion regulation variables. Shame was associated with the face, which is also fully supported by previous findings (Nieuwenhuyse et al., 1987). Facial temperature increase was reported most frequently. In contrast, guilt association with throat sensations does not overlap with prior findings. Probably, the number of reported cases was too few to reveal other important associations. Also, this could be related to the ambiguity of this emotion, since given its status as a moral emotion (Haidt, 2003), guilt can be interpreted and experienced by individuals quite diversely.

Concerning valence, positive emotions were associated with the chest and limb sensations and whole body activation. "Warmness", "easiness" for the chest, and "weightlessness" for the whole body were reported most often. Negative emotions were associated with the jaw, throat and ears. The first two were described above. Concerning the ear, "hot", "muffled" and "plugged ears" were reported during shame, fear and anger. In summary, the frequency of reported bodily sensations associated with negative emotions was four times greater than those linked to positive emotions (82% compared to 18%). Although we acknowledge an imbalance in the quantity of emotional categories between the two groups, numerous theoretical perspectives have emphasized the stronger intensity of negative emotions (Cacioppo, 2000).

As a limitation, we accept that the self-report measures of emotions cannot be considered as fully reliable, especially when it comes to reflecting past experience. Autobiographical recall is known to be vulnerable to recall bias, reconstruction based on cultural metaphors and confusion of past and typical experiences. These might have had a significant effect on the results. Perhaps, the same interview would be more fruitful after real-time induction of certain emotions using visual stimuli. However, as stated above, we did not aim to exclude subjective discrepancies at all. Secondly, a criticism could lie in the forced choice of emotions and body parts which could result in the demand effect (more information for the body parts explicitly mentioned by the interviewer). But, in the pretest we noticed that, without such hints, some subjects could not recall their experience. Third, we did not secure a consensus among participants regarding the comprehension of emotional categories. Future methodological enhancements must primarily focus on establishing clear procedures for defining emotions to participants, particularly those that are closely interrelated. However, this approach requires careful consideration since such definitions could lead participants to report not just their personal emotional experiences, but also perceptions derived from observing others' behaviors. However, in our study we assumed that people sharing the same culture and language would have the similar understanding and concept of the listed emotional categories. It was shown that for nuanced understanding of individuals' emotion conceptualization, providing complex emotional categories is beneficial (Zupan et al., 2023). Another significant limitation which is common for all emotion studies is the self-selection bias in participants. In this study, only the volunteers took part, which means that our sample might be skewed towards, for example, individuals with higher introspective ability or consisting of only those who are willing to talk about their emotions openly. Also, in our design, the same participant contributed multiple rows, so observations were not independent. However, this methodological issue is usual in psychology e.g., (Beckers et al., 2016; Carp & Carp, 1981), since no other method seems more compatible for such designs. Lastly, concerning the homogeneity of our sample, we admit that our findings cannot be generalized across cultures and socio-economic contexts. The main reason is the absence of an established paradigm which would be used by different researchers. Further research utilizing the same protocol across diverse cultures is necessary to validate these patterns globally.

To conclude, we have revealed several associations between emotions and sensations. A possible implication could lie in a future search for stable instrumental peripheral indices of valence or discrete emotions using psychophysiological methods. On the other hand, psychosomatic medicine needs reliable self-reported sensations of bodily markers concerning slight emotional reactions. This requires further investigation.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Declaration of Helsinki, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

FK: Data curation, Formal Analysis, Writing – original draft. VK: Conceptualization, Writing – review & editing, Project administration, Supervision.

References

Ax, A. F. (1953). The physiological differentiation between fear and anger in humans. *Biopsychosocial Science and Medicine*, *15*(5), 433-442. https://doi.org/10.1097/00006842-195309000-00007

Babiker, A., Faye, I., & Malik, A. (2013). Pupillary behavior in positive and negative emotions. 2013 IEEE international conference on signal and image processing applications, https://doi.org/10.1109/ICSIPA.2013.6708037

Barrett, L. F. (2006). Are emotions natural kinds? *Perspectives on psychological science*, *1*(1), 28-58. https://doi.org/10.1111/j.1745-6916.2006.00003.x

Beckers, R., Van der Voordt, T., & Dewulf, G. (2016). Why do they study there? Diary research into students' learning space choices in higher education. *Higher education research & development*, *35*(1), 142-157. https://doi.org/10.1080/07294360.2015.1123230

Bradley, M. M., Codispoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: defensive and appetitive reactions in picture processing. *Emotion*, *1*(3), 276. https://doi.org/10.1037/1528-3542.1.3.276

Breugelmans, S. M., Ambadar, Z., Vaca, J. B., Poortinga, Y. H., Setiadi, B., Widiyanto, P., & Philippot, P. (2005). Body sensations associated with emotions in Rarámuri Indians, rural Javanese, and three student samples. *Emotion*, *5*(2), 166. https://doi.org/10.1037/1528-3542.5.2.166

Cacioppo, J. (2000). The psychophysiology of emotion. In: The handbook of emotion/Guilford Press. https://www.researchgate.net/publication/266385874_The_Psychophysiology_of_Emotion

Carp, F. M., & Carp, A. (1981). The validity, reliability and generalizability of diary data. *Experimental aging research*, *7*(3), 281-296. https://doi.org/10.1080/03610738108259811

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. routledge. https://doi.org/10.4324/9780203771587

Costa, T. G., Duque, L., do Amaral, L. C., Viana, R. B., da Silva, W. F., Vancini, R. L., Andrade, M. S., & de Lira, C. A. B. (2022). Unpleasant pictures exposure evokes different repercussion on emotional state and heart rate response in healthy women and men. *Applied Psychophysiology and Biofeedback*, *47*(2), 85-94. https://doi.org/10.1007/s10484-021-09532-0

Dutta, T., & Bandyopadhyay, A. (2024). Universal Thermal Markers of Human Emotions: Geometric-Biological Invariants for Emotional Transitions. In *Emotion, Cognition and Silent Communication: Unsolved Mysteries* (pp. 83-117). Springer. https://doi.org/10.1007/978-981-99-9334-5_3

Ekman, P., Dalgleish, T., & Power, M. (1999). Basic emotions. *San Francisco, USA*, *1*. https://doi.org/10.1002/0470013494.ch3

Fu, G., Zhou, X., Wu, S. J., Nikoo, H., Panesar, D., Zheng, P. P., Oatley, K., & Lee, K. (2022). Discrete emotions discovered by contactless measurement of facial blood flows. *Cognition and Emotion*, *36*(7), 1429-1439. https://doi.org/10.1080/02699931.2022.2124960

Gable, P. A., & Harmon-Jones, E. (2009). Postauricular reflex responses to pictures varying in valence and arousal. *Psychophysiology*, *46*(3), 487-490. https://doi.org/10.1111/j.1469-8986.2009.00794.x

Goulart, C., Valadão, C., Delisle-Rodriguez, D., Caldeira, E., & Bastos, T. (2019). Emotion analysis in children through facial emissivity of infrared thermal imaging. *PloS one*, *14*(3), e0212928. https://doi.org/10.1371/journal.pone.0212928

Grillon, C., & Baas, J. (2003). A review of the modulation of the startle reflex by affective states and its application in psychiatry. *Clinical neurophysiology*, *114*(9), 1557-1579. https://doi.org/10.1016/S1388-2457(03)00202-5

Haidt, J. (2003). The moral emotions. *Handbook of affective sciences*, *11*(2003), 852-870. https://doi.org/10.1093/oso/9780195126013.003.0045

Izard, C. E. (1977). Differential emotions theory. In *Human emotions* (pp. 43-66). Springer. https://doi.org/10.1007/978-1-4899-2209-0_3

Kalawski, J. P. (2010). Is tenderness a basic emotion? *Motivation and emotion*, *34*(2), 158-167. https://doi.org/10.1007/s11031-010-9164-y

Kim, H.-Y. (2017). Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test. *Restorative dentistry & endodontics*, *42*(2), 152. https://doi.org/10.5395/rde.2017.42.2.152

Kosonogov, V., De Zorzi, L., Honore, J., Martínez-Velázquez, E. S., Nandrino, J.-L., Martinez-Selva, J. M., & Sequeira, H. (2017). Facial thermal variations: A new marker of emotional arousal. *PloS one*, *12*(9), e0183592. https://doi.org/10.1371/journal.pone.0183592

Levenson, R. W. (2014). The autonomic nervous system and emotion. *Emotion review*, *6*(2), 100-112. https://doi.org/10.1177/1754073913512455

Mason, R. E. (1959). Three studies relating internal sensory experiences and feeling reactions. *The Journal of General Psychology*, *60*(2), 211-228. https://doi.org/10.1080/00221309.1959.9710223

Molaeinezhad, M., Scheidt, C., Afshar, H., Jahanfar, S., Sohran, F., Salehi, M., & Goli, F. (2025). Bodily map of emotions in Iranian People. *Health Education and Health Promotion*, *9*(2), 153-164. https://hehp.modares.ac.ir/article_2231.html

Nieuwenhuyse, B., Offenberg, L., & Frijda, N. (1987). Subjective emotion and reported body experience. *Motivation and emotion*, *11*(2), 169-182. https://doi.org/10.1007/BF00992342

Nummenmaa, L., Glerean, E., Hari, R., & Hietanen, J. K. (2014). Bodily maps of emotions. *Proceedings of the National Academy of Sciences*, *111*(2), 646-651. https://doi.org/10.1073/pnas.1321664111

Pace-Schott, E. F., Amole, M. C., Aue, T., Balconi, M., Bylsma, L. M., Critchley, H., Demaree, H. A., Friedman, B. H., Gooding, A. E. K., & Gosseries, O. (2019). Physiological feelings. *Neuroscience & Biobehavioral Reviews*, *103*, 267-304. https://doi.org/10.1016/j.neubiorev.2019.05.002

Philippot, P., & Rimé, B. (1997). The perception of bodily sensations during emotion: A cross-cultural perspective. *Polish Psychological Bulletin*, *28*, 175-188. https://psycnet.apa.org/buy/PI

Rimé, B., & Giovannini, D. (1986). The physiological patterns of reported emotional states. https://www.researchgate.net/publication/232589505_The_physiological_patterns_of_reported_emotional_states

Shiota, M. N., Neufeld, S. L., Yeung, W. H., Moser, S. E., & Perea, E. F. (2011). Feeling good: autonomic nervous system responding in five positive emotions. *Emotion*, *11*(6), 1368. https://doi.org/10.1037/a0024278

Siegel, E. H., Sands, M. K., Van den Noortgate, W., Condon, P., Chang, Y., Dy, J., Quigley, K. S., & Barrett, L. F. (2018). Emotion fingerprints or emotion populations? A meta-analytic investigation of autonomic features of emotion categories. *Psychological bulletin*, *144*(4), 343. https://doi.org/10.1037/bul0000128

Stemmler, G. (2004). Physiological processes during emotion. In *The regulation of emotion* (pp. 48-85). Psychology Press. https://doi.org/10.4324/9781410610898-8

Stephens, C. L., Christie, I. C., & Friedman, B. H. (2010). Autonomic specificity of basic emotions: Evidence from pattern classification and cluster analysis. *Biological psychology*, *84*(3), 463-473. https://doi.org/10.1016/j.biopsycho.2010.03.014

Zupan, B., Dempsey, L., & Hartwell, K. (2023). Categorising emotion words: the influence of response options. *Language and Cognition*, *15*(1), 29-52. https://doi.org/10.1017/langcog.2022.24