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# Relevance of sensory and body-image to emotions in persons with alexithymia traits

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The purpose of this study is to investigate the effect of an individual trait (alexithymia) on the relevance of sensory and body-image to the 6 emotions (happiness, sadness, fear, anger, surprise, disgust) by using the modality differential (MD) method and the body-image location (BI-L) scale. Participants (153 university students) were asked the Toronto Alexithymia Scale (TAS-20) and to rate the relevance of 10 sensory modalities (warm, cold, olfactory, gustatory, tactile, pain, equilibrium, kinesthetic, visual, and auditory) and 7 body parts (forehead, throat, chest, stomach, lower abdomen, internal organs, and whole body) to each emotion, using a 7-point scale. The high TAS group (27 participants) and the low TAS group (21 participants) were divided based on TAS-20 scores. In the MD method, persons with the high TAS group had difficulty connecting subtle differences in sad emotions to proximal senses modalities. In the BI-L scale, the differences in level of relevance to body parts for specific emotions (sadness and anger) were observed depending on high and low alexithymia traits. There is a trend for the high TAS group to sense that body-image have stronger relevance of emotions compared to the low TAS group. These relevance patterns were discussed in relation to somatosensory amplification characteristics in alexithymia.

**Key words:** modality differential method, body-image location scale, emotion, alexithymia

In everyday life, under a variety of circumstances, various emotions arise as subjective experiences. We think that we ourselves really understand the emotions that well up. Emotions that are subjective experiences are cognitively processed and labeled as "awareness of vague and indistinct feelings." However, how do we identify and describe as emotions those feelings whose outlines are fuzzy? For example, "sadness that constricted one's chest" and "biting one's lips with sadness" are bundled together under "sadness." Anyone can sense through experience the subtle difference between these two kinds of sadness. Emotions are strongly connected to sensory modalities (warm, cold, pain, gustatory, etc.) and it is possible to infer that there is a close relationship between emotions and sensory and body-image. In English as well, emotions are described in reference to parts of the body-image. Here are some examples where subtle differences in emotion are linked to senses and body parts. "Fear" can be expressed as "one's heart was in one's mouth," and "sadness that cannot be described in words," can be expressed as "one felt a lump in one's throat."

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These are figurative ways of expressing emotions, but it is conceivable that emotions are inseparable from sensory and body-image. Emotions (including vague and indistinct feelings) that arise as subjective experiences have a strong association to sensory and body-image, and have subtly and minutely different characteristics.

Okada and Gyoba (2017) performed detailed empirical research into the association between emotions and sensory and body-image and invented an effective psychological scale to study it. There, using the modality differential (MD) method developed by Suzuki, Gyoba, Kawabata, Yamaguchi, and Komatsu (2006) and the newly devised body-image location (BI-L) scale, they measured the sensory and body-image relevance of the six basic emotions (happiness, sadness, fear, anger, surprise, and disgust).

The above-mentioned research of Okada and Gyoba (2017) demonstrated that there are sensory modalities that tend to relate to each emotion and that emotional specificity exists. Additionally, in terms of body-image association, among body parts, emotions had a particularly strong association with the chest. Looking at each of the emotions, sadness and disgust displayed particular associations compared to other emotions. Sadness was less likely to be associated with body parts other than the throat and chest. Furthermore, they reported that disgust is strongly associated with body parts relating to the chest and internal organs, such as the stomach and lower abdomen.

Meanwhile, the word alexithymia is often translated in Japanese as a loss of affect, described as the characteristic of being unable to describe or differentiate one's emotions. It is a personality trait identified by Sifneos (1973) and is said to be strongly associated with disorders such as psychosomatic illness and post-traumatic stress disorder (PTSD), and to involve difficulties in identifying and describing one's emotions. To understand alexithymia traits, a Japanese version of a questionnaire structured on a three-factor model comprised of 1) difficulty in identifying feelings (DIF), 2) difficulty in describing feelings (DDF), and 3) externally oriented thinking (EOT) was standardized by Komaki and Maeda (2015). Scores of 39–58 in the Japanese version of the Toronto Alexithymia Scale (TAS-20) were judged to characterize the healthy group, enabling judgment of alexithymia traits.

Furthermore, neuroimaging studies have pointed out the link between human emotional mechanisms and the processing of physical sensations. Moriguchi (2014) performed a detailed review of recent alexithymia research on the relationship between emotion perception and physical sensation, and stated that the findings that persons with alexithymia traits rely excessively on physical information processing while experiencing emotion, cannot successfully differentiate self and other, and do not transition into perceptual processes such as categorization and metaperception, have been clearly and repeatedly demonstrated.

The present study used the MD method to evaluate the strength of the association between emotions and sensory modalities (warm, cold, olfactory, gustatory, tactile, pain, equilibrium, kinesthetic, visual, and auditory). In addition, the study used the BI-L scale in a similar way to evaluate the association between emotions and body parts (forehead, throat, chest, stomach, lower abdomen, internal organs, and whole body). Thus, the purpose of

this study is to investigate the effect of an individual trait (alexithymia) on the relevance of sensory and body-image to emotions by comparing the MD data and BI-L data of high and low alexithymia groups as determined by TAS-20 scores.

## Method

### *Participants*

One hundred and fifty-three Aomori University of Health and Welfare students (22 men and 123 women, 8 unidentified: mean age = 18.8, *SD* = 1.08) participated.

### *Procedure and measurement*

The six basic emotions (happiness, sadness, fear, anger, surprise, disgust) were selected as target emotions, because they are easy to recognize.

**Modality differential method.** Using the MD method, we rated the relevance of 10 sensory modalities (warm, cold, olfactory, gustatory, tactile, pain, equilibrium, kinesthetic, visual, and auditory) to each emotion on a 7-point scale, with 0 being "irrelevant" and 6 being "highly relevant."

**Body-image location scale.** Similarly, using the BI-L scale, we rated the relevance of the seven body parts used by Okada and Gyoba (2017) (forehead, throat, chest, stomach, lower abdomen, internal organs, and whole body) to each emotion on a 7-point scale, the same as with the MD method. In our case however, to make it easier to judge the scales intuitively on the survey forms, we added a right triangle indicating the level of relevance to both of the scales (Figure 1). A total of four types of survey forms, which varied in presentation order

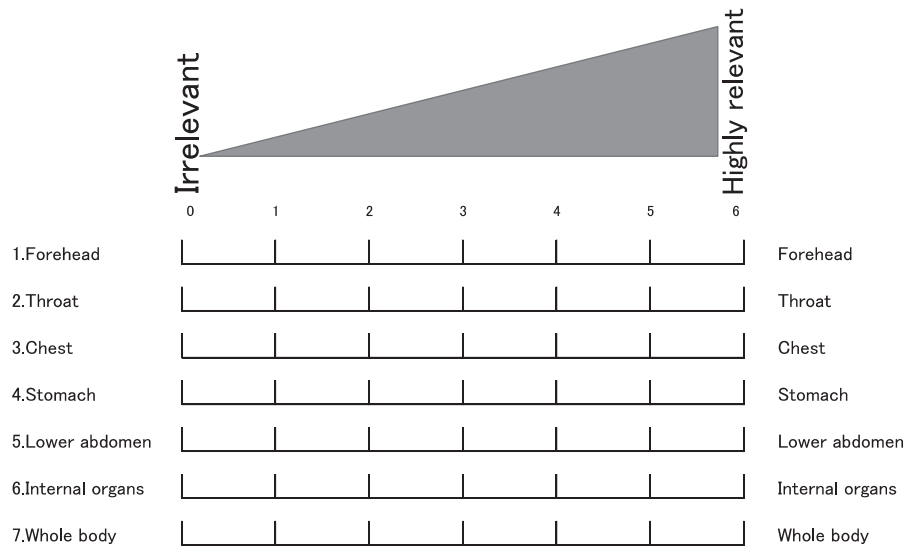


*Figure 1.* A sample of the body-image location (BI-L) form.

of the six emotions (2) by presentation order of sensory modalities and body parts (2), were randomly distributed to participants.

**Measurement of alexithymia traits.** At the same time, we asked each participant to complete the Japanese version of the TAS-20 (Komaki & Maeda, 2015) to assess their alexithymia traits. The TAS-20 scale has 20 questions, comprising three subscales, DIF, DDF, and EOT which are rated on a 5-point scale, whereby 1 is "strongly disagree" and 5 is "strongly agree." This was administered to the participants as a group. It is estimated that the time required to complete the entire survey was approximately 10 minutes.

### *Ethical considerations*

Informed consent was obtained from each participant prior to his or her participation. The ethics committee of Aomori University of Health and Welfare approved the study protocol.

## Results

Grouping by alexithymia traits using the TAS-20 was performed by arranging the total scores in ascending order, then assigning the 27 participants scoring in the top 20 points of the scale (including the participants with the same rank) to the high alexithymia group and the 21 participants scoring in the bottom 20 points of the scale (including the participants with the same rank) to the low alexithymia group. Table 1 shows the mean age in each group (*SD*) and mean TAS-20 score (*SD*).

Using the MD method in a similar way to Suzuki et al. (2006), we put the proximal (near) senses (warm, cold, olfactory, gustatory, tactile, and pain), the proprioceptive senses (equilibrium and kinesthetic), and the distal (far)-type senses (auditory and visual) into three categories and arranged them on the horizontal axis, and as the degree of relevance we arranged the average score of each subject on the vertical axis, thereby creating MD profiles and making it possible to compare the two groups for each of the emotions respectively.

Each of the emotions were compared between the two alexithymia groups (high TAS and low TAS groups) across 10 sensory modalities. There were no significant differences between the high and low groups for any emotion in the results of the two-way analysis of variance (ANOVA) of MD data.

*Table 1.* Characteristics of the high and low TAS groups who participated.

| | High TAS ($n$=27) | Low TAS ($n$=21) |
|---|---|---|
| Age-years (*SD*) | 18.38 (0.64) | 19.1 (1.41) |
| TAS score (*SD*) | 69.19 (3.66) | 40.86 (4.73) |

However, from the MD profiles we were able to discern characteristic patterns in the high and low TAS groups for proximal-type senses for each of the six emotions. For example, in contrast to happiness, fear, surprise, and disgust, where no clear differences between groups were observed in the proximal sensory modality, the MD profiles for sadness were noticeably different between the high and low TAS groups. Figure 2 shows a comparison of the MD profile for sadness between the high and low TAS groups, for proximal senses only, excluding proprioceptive and distal-type senses. To examine the relevance of alexithymia (high and low TAS groups) to sadness and proximal sensory modalities, we conducted a two-way ANOVA with sensory modality as the within-subject factor and alexithymia traits as the between-subject factor. There was a significant interaction ($F(5, 220) = 2.5$, $p < .05$). In the low TAS group, in the multiple comparison results, the simple main effect of the proximal sensory modality was significant ($F(5, 220) = 8.5$, $p < .001$), and the relevance was in the order of cold = pain > tactile = gustatory = warm = olfactory. By contrast, in the high TAS group, the simple main effect of the proximal sensory modality was not significant ($F(5, 220) = 1.4$, $p = .23$). In other words, regarding sadness, the persons with high alexithymia traits have the almost same evaluation for all proximal modalities. As a reference, Appendix I shows a chart listing MD scores for each emotion.

Regarding the BI-L scale, using the results from Okada and Gyoba (2017) as a reference, we tabulated the seven body parts (forehead, throat, chest, stomach, lower abdomen, internal organs, and whole body) and arranged them on the horizontal axis, and made the degree of

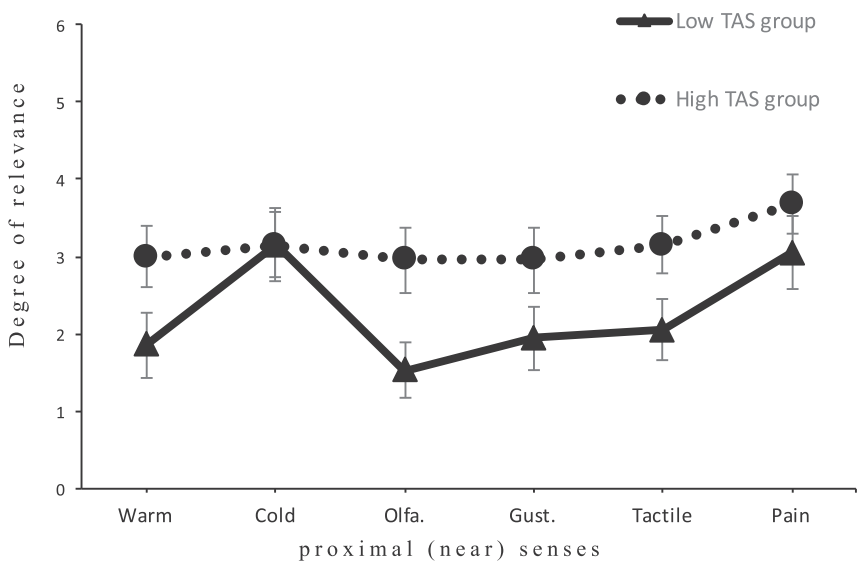


*Figure 2*. MD method proximal (near) senses data about sadness for the high and low TAS groups. Error bars represent standard errors.

Note. The symbols, "Olfa.", "Gust." signify olfactoy, gustatory.

relevance the vertical axis, creating a BI-L profile enabling a comparison of the two groups. For each of the six emotions, we studied the statistical differences by conducting a two-way ANOVA with alexithymia traits (high and low TAS groups) × 7 body parts. For sadness, the main effect of alexithymia traits was statistically significant ($F(1, 45) = 14.05$, $p < .01$), while the interaction effect was not significant ($F(6, 270) = 1.1$, $p = .36$). For anger, the main effect of alexithymia traits was also statistically significant ($F(1, 46) = 4.74$, $p <. 05$), while the interaction effect was not significant ($F(6, 276) = 0.8$, $p = .57$). Figure 3 shows the BI-L profile for sadness divided by group. Figure 4 shows the BI-L profile for anger. For the remaining four emotions (happiness, fear, surprise, and disgust), there were no significant main effects (happiness ($F(6, 46) = 1.7$, $p = .19$), fear ($F(1, 45) = 4.1$, $p = .05$), surprise ($F(1, 46) = 2.7$, $p = .11$), and disgust ($F(1, 44) = 0.4$, $p = .52$)), and no significant interaction effects (happiness ($F(6, 276) = 0.86$, $p = .52$), fear ($F(4.6, 207.3) = 1.9$, $p = .09$), surprise ($F(4.3, 199.9) = 0.7$, $p = .6$), and disgust ($F(4.1, 182.1) = 0.21$, $p = .93$)). Thus, we found that among the six emotions, the high TAS group scored higher in relevance to all body parts for sadness and anger than the low TAS group. As a reference, Appendix II shows a chart listing BI-L scale scores for each emotion.

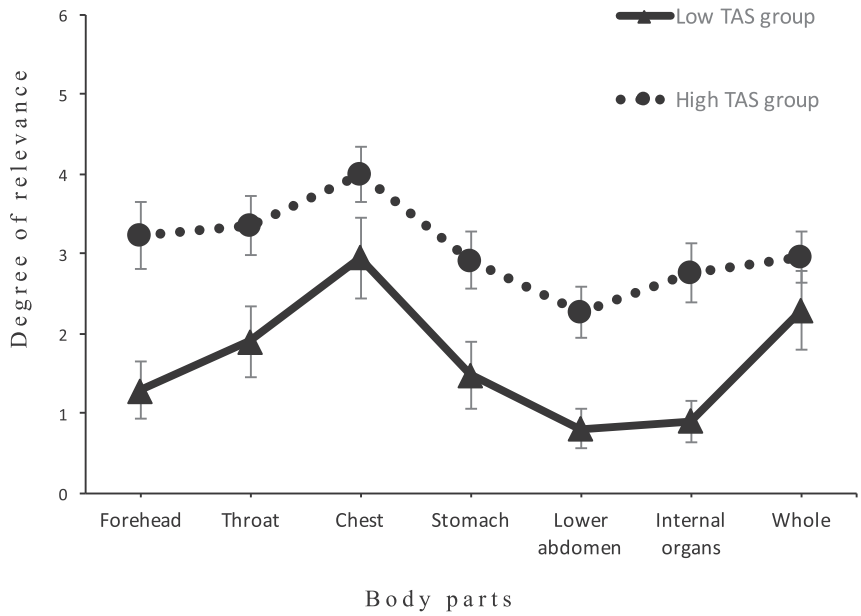


*Figure 3.* BI-L scale data about sadness for the high and low TAS groups. Error bars represent standard errors.

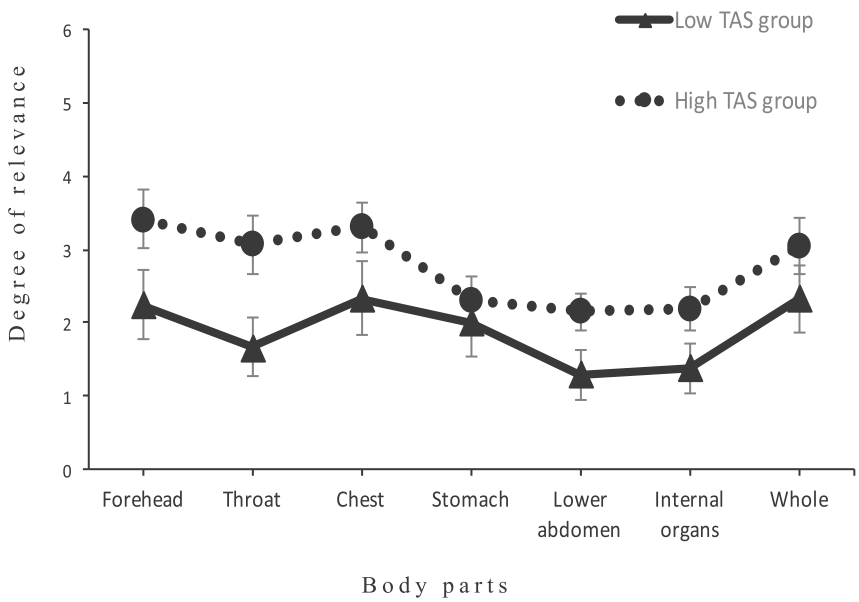


*Figure 4*. BI-L scale data about anger for the high and low TAS groups. Error bars represent standard errors.

## Discussion

From the results of the proximal senses MD profile for sadness shown in Figure 2, the low TAS group could evaluate emotional relevance highly to warm, cold, olfactory, gustatory, tactile, and pain modalities. However, we found that for the high TAS group, the proximal senses MD evaluation was flat. This indicates that persons with high alexithymia traits have difficulty connecting subtle differences in sad emotions to proximal senses modalities and feeling them, and may have difficulty expressing subtle differences in sad emotions. This is consistent with DIF and DDF, which are subscales of the TAS-20. However, this was a specific finding observed only for sadness in this study. The high TAS group distinguished the proximal senses modalities for the other five emotions in similar patterns as the low TAS group. The high TAS group only showed specific difficulty in sensing the sad emotion in relation to proximal senses modality.

In the BI-L profiles shown in Figure 3 and Figure 4, compared to the low TAS group, the high TAS group scored a strong relevance to all body parts for sadness and anger. In addition, for the other four emotions (happiness, fear, surprise, and disgust), no statistical difference was observed between the two groups, but we observed a trend for the high TAS group to show stronger relevance for the four emotions compared to the low TAS group.

Alexithymia has been described as "difficulty in identifying one's own emotions, and difficulty in discriminating between emotions and bodily sensations" (Komaki & Maeda, 2015). There appears to be a contradiction in the results of this study, in which the high TAS group evaluated higher relevance of sensory and body-image to emotions. However, this could be the

influence of somatosensory amplification in alexithymia. Barsky, Goodson, Lane, and Cleary (1988) defined somatosensory amplification as the tendency to perceive bodily sensations as intensely and noxiously disturbing. In Japan, Nakao, Kumano, Kuboki, and Barsky (2001) described it as an emotional and perceptual tendency to have heightened concern about unpleasant bodily sensations, a tendency to focus attention selectively on specific bodily sensations regardless of their frequency or degree, and to feel that the occurrence of sensations is pathological. The results of this study also demonstrate that for all emotions there is a trend for the high TAS group to sense that body parts have stronger relevance compared to the low TAS group. It can be inferred that due to the effect of somatosensory amplification, persons with alexithymia strongly sensed relevance of body-image to emotions.

In conclusion, the present study investigated the relevance of sensory and body-image to the six basic emotions using the MD method and the BI-L scale. A noteworthy finding was that among the six emotions, sadness was the emotion that demonstrated specific relevance, compared to the other five emotions. For sadness, the influence of alexithymia was remarkable. The specificity of the emotion of sadness was also demonstrated in Okada and Gyoba (2017). In this study, there was also a difference between the two groups for anger when the BI-L scale was used. The question of why sadness and anger have different sensory and body-image relevance from the other four emotions and whether sadness and anger are subjective experiences different from the other emotions will require further study, together with further empirical research that investigates sensory and body-image relevance to emotions focusing on the effect of somatosensory amplification in persons with alexithymia traits.

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***Appendix I*. Means and standard deviations of 10-sensory modalities for 6-emotions.**

| | | Proximal | | | | | | Proprioceptive | | Distal-type | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Warm | Cold | Olfa. | Gust. | Tactile | Pain | Equi. | Kine. | Visu. | Audi. |
| | | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) |
| Happiness | LowTAS(*n*=21) | 4.5(1.5) | 1.9(2.1) | 3.3(2.2) | 4.4(2.2) | 3.4(2.1) | 1.4(1.8) | 1.3(1.4) | 3.3(2.1) | 4.7(1.9) | 4.4(1.9) |
| | HighTAS(*n*=27) | 4(1.9) | 3.2(2.2) | 3.6(2.3) | 4.5(1.9) | 3.5(1.9) | 2.8(2.2) | 2.9(2.2) | 4(1.9) | 4.3(2.1) | 4(2.2) |
| Sadness | LowTAS(*n*=20) | 1.9(2.1) | 3.2(2.1) | 1.5(1.8) | 2(1.9) | 2.1(1.9) | 3.1(2.2) | 1.4(1.6) | 2.1(2) | 4.4(2) | 4(1.8) |
| | HighTAS(*n*=26) | 3(2) | 3.2(2.2) | 3(2.1) | 3(2.1) | 3.2(1.9) | 3.7(2) | 2.6(2.2) | 3(2) | 4(2.2) | 4.3(1.6) |
| Fear | LowTAS(*n*=20) | 2.2(2.1) | 4.6(1.8) | 2.5(2.3) | 1.7(2) | 4.1(1.9) | 4.2(2.2) | 2.8(2.1) | 2.4(2.1) | 4.9(1.6) | 5(1.5) |
| | HighTAS(*n*=26) | 2.8(2.3) | 3.9(1.9) | 2.8(2) | 2.1(2) | 3.8(1.9) | 4(1.8) | 3.4(2) | 3.4(2) | 4.6(2) | 4.5(1.6) |
| Anger | LowTAS(*n*=21) | 2.1(1.9) | 1.9(1.7) | 1.9(1.7) | 1.8(1.7) | 2.5(2) | 3.3(2.1) | 1.8(1.9) | 3(2.2) | 4.1(2) | 3.5(1.7) |
| | HighTAS(*n*=27) | 3.4(2.3) | 3.2(1.9) | 3.3(2.2) | 2.1(1.7) | 3.2(1.9) | 3.8(1.9) | 2.9(2.1) | 3.3(2) | 4.1(2) | 4.1(1.8) |
| Surprise | LowTAS(*n*=20) | 2.8(1.7) | 3.5(2) | 3.2(1.8) | 3.3(2) | 3.8(2) | 4.2(2.2) | 2.6(1.9) | 3.3(2.3) | 4.7(1.4) | 4.6(1.6) |
| | HighTAS(*n*=27) | 3.8(2.1) | 3.8(1.9) | 3.3(2.2) | 3(1.9) | 3.9(2) | 4(1.9) | 3.2(2) | 3.2(2) | 4.5(1.9) | 4.6(1.6) |
| Disgust | LowTAS(*n*=21) | 2.6(2.4) | 3.1(2.4) | 4.5(1.9) | 3.7(2.3) | 3.5(2.2) | 4.4(2) | 2.5(2.5) | 3.1(2.3) | 4.7(1.8) | 4(2.2) |
| | HighTAS(*n*=27) | 2.7(2.2) | 3.4(2.1) | 4.3(2.1) | 3.5(2.1) | 3.3(2.2) | 4.4(1.8) | 3.2(2) | 3.6(2) | 4.2(2) | 4.3(1.8) |

***Appendix II*. Means and standard deviations of 7-body locations for 6-emotions.**

| | | Forehead | Throat | Chest | Stomach | Lower abdomen | Internal organs | Whole |
|---|---|---|---|---|---|---|---|---|
| | | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) |
| Happiness | LowTAS(*n*=21) | 2.1(1.9) | 2.1(2) | 3.3(2.1) | 1.7(2) | 1.2(1.5) | 1.2(1.3) | 3.3(2.1) |
| | HighTAS(*n*=27) | 2.3(2) | 2.6(2.2) | 3.7(2.1) | 2.8(1.9) | 1.7(1.5) | 2.2(1.8) | 3.3(1.9) |
| Sadness | LowTAS(*n*=21) | 1.3(1.6) | 1.9(2) | 3(2.3) | 1.5(1.9) | 0.8(1.1) | 0.9(1.1) | 2.3(2.2) |
| | HighTAS(*n*=26) | 3.2(2.2) | 3.4(1.9) | 4(1.8) | 2.9(1.8) | 2.3(1.6) | 2.8(1.9) | 3(1.7) |
| Fear | LowTAS(*n*=21) | 1.7(2) | 1.8(2) | 3.1(2.1) | 1.6(2) | 1.2(1.6) | 1.7(1.9) | 3(2.2) |
| | HighTAS(*n*=26) | 3.2(2.1) | 2.7(2) | 3.2(1.9) | 2.5(2) | 2.3(1.8) | 3(1.8) | 3.1(2) |
| Anger | LowTAS(*n*=21) | 2.2(2.2) | 1.7(1.9) | 2.3(2.3) | 2(2.2) | 1.3(1.6) | 1.4(1.5) | 2.3(2.1) |
| | HighTAS(*n*=27) | 3.4(2) | 3.1(2.1) | 3.3(1.8) | 2.3(1.7) | 2.2(1.4) | 2.2(1.6) | 3(2) |
| Surprise | LowTAS(*n*=21) | 2.1(2.2) | 1.7(1.9) | 2.7(2.1) | 1.7(1.8) | 1.4(1.7) | 1.8(1.9) | 2.7(2.1) |
| | HighTAS(*n*=27) | 3.3(2) | 2.7(1.9) | 3.2(2.2) | 2.5(1.8) | 2.1(1.7) | 2.3(1.8) | 3(1.8) |
| Disgust | LowTAS(*n*=20) | 2.5(2.3) | 2.2(2.2) | 3.3(2.2) | 2.9(2.1) | 2.3(2.3) | 2.1(2.2) | 2.9(2.2) |
| | HighTAS(*n*=26) | 2.9(2.1) | 2.8(2) | 3.5(1.8) | 3.2(1.9) | 2.5(1.7) | 2.3(1.8) | 2.9(1.8) |