DEHUMANIZATION AND DISTINCT BODILY EMOTIONS TOWARDS EXTREME OUTGROUP MEMBERS

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Abstract

How groups are seen and perceived drives the way interactions occur. Some groups are perceived as dehumanized, and this could be observed through non-attribution of secondary emotions to them. We conducted two experiments, the first aimed to investigate how students perceive similar (other students) and homeless people regarding warmth and competence. Photos of students and homeless were evaluated in these two dimensions. As predicted by the Stereotype Content Model, lower scores of warmth and competence were attributed for the homeless. The pair of photos that best represented both groups was selected as a stimulus for the second study. The second experiment aimed to investigate how students map the primary and secondary emotions on representations of themselves, their ingroup (other students) or homeless people. Similarity matrices showed low similarities among primary and secondary emotions. Matrix correlations indicated consistent emotion similarity patterns across groups. Most primary emotions had independent BSMs for every group. However, for secondary emotions, while guilt, awe, gratitude, compassion, pride, and hope had distinct BSMs across groups, envy, shame, pity, contempt, and love lacked consistency. There's a clear distinction between self BSMs and outgroup BSMs, but not with ingroup BSMs. In outgroup conditions, all emotions were distinctly different from the self. Contrary to infrahumanization theory, people consistently attribute both primary and secondary emotions regardless of group. This underlines the complex interplay

between emotions, self-identity, and group affiliations, suggesting an overlap in self and in-group emotional perceptions, echoing prior cognitive research and social identity theories.

Keywords: homeless, infrahumanization, dehumanization, emotions, embodiment.

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In 2005, the United Nations reported that an alarming 100 million people globally were without homes, while over a billion faced inadequate housing conditions. Research from the Institute for Applied Economic Research (IPEA) reveals that in Brazil alone, over 101,000 individuals lack stable housing. Homelessness extends beyond the absence of a roof overhead; it frequently exposes individuals to both neglect and violence (No Safe Street, [s.d.]; Violence Against the Homeless Archives, [s.d.]).

Throughout history, acts of abandonment and violence against the homeless have been linked to various forms of dehumanization. Bar-Tal defines dehumanization as "categorizing a group as non-human, either by likening them to inferior races and animals or to negatively perceived superhuman entities like demons and monsters" (Bar-Tal, 1990). Expanding this definition, dehumanization can also manifest in perceptions where individuals are seen as lacking warmth and competence, as discussed by Fiske and colleagues, or are denied unique human emotions, as proposed by Leyens and colleagues (Fiske et al., 2002; Leyens et al., 2000).

Fiske et al. (2002) introduced the Stereotype Content Model (SCM), positing that stereotypes are framed by two primary dimensions: warmth (intentions towards help or harm) and competence (ability to act on those intentions). Within this model, homeless individuals are typically perceived as an extreme outgroup, characterized by hostility (low warmth) and incompetence (low competence; Harris & Fiske,2006). Harris & Fiske's (2006) study, which involved participants viewing photos of various social groups, found that images of homeless people or drug addicts—perceived to be both less competent and less warm—triggered diminished activity in areas of the brain linked to social cognition, like the medial prefrontal cortex. Conversely, these images intensified activation in the insula and amygdala, regions often tied to negative emotions like disgust. Further research by Harris & Fiske (2009) revealed that when participants described individuals with low warmth and competence in comparison to those with high warmth and competence, they employed fewer mental state-inferencing verbs, suggesting difficulty in empathizing or mentalizing about the former group. This evidence underscores the notion that such groups might be viewed as dehumanized. Supporting this attitudinally, Cuddy, Fiske, & Glick (2007) determined that stereotypes of low warmth and competence often lead to increased harm, neglect, and reduced support.

The SCM links perceptions of warmth and competence to specific emotions. When considering the extreme outgroup, the dominant emotion elicited is disgust, a primary emotion (Harris & Fiske, 2006). However, feelings of secondary emotions—thought to be uniquely human, such as gratitude, compassion, and hope—can vary based on the perceived ingroup or outgroup status of the subject of these emotions. In a sequence of studies, Leyens and his team (Leyens et al., 2000; Leyens et al., 2001; Paladino et al., 2002; Vaes, Paladino, Castelli, Leyens,

& Giovanazzi, 2003; Cortes, Demoulin, Rodriguez, Rodriguez & Leyens, 2005) demonstrated that participants tend to attribute primary emotions, but not secondary ones, to outgroup members. This omission in recognizing secondary emotions in others is a manifestation of dehumanization, termed by the authors infrahumanization. Consequently, individuals with homes might perceive the homeless as somewhat "less human," deficient in secondary emotions that characterize human uniqueness (Leyens et al., 2000; Leyens et al., 2001; Haslam 2006; Haslam, & Loughnan, 2014). Such perceptions can escalate to neglect or even aggression towards those deemed lacking in the full spectrum of human emotional experiences (Vaes et al., 2003).

Conversely, some argue that for violence against others to occur, the aggressors must believe that their actions cause genuine suffering in their victims (Bloom, 2017a, b). This implies that for such violence to manifest, the victims must be viewed as humans by the perpetrators. This view challenges the infrahumanization model, i.e. outgroups are not denied of uniquely human emotions. Supporting this perspective, Enock, Tipper, and Over (2021) found that outgroup members are recognized as having human emotions, however, there's an imbalanced distribution. Specifically, they are often attributed with fewer prosocial emotions and more antisocial ones. This suggests that what was once considered as "infrahumanization" (denying outgroups human qualities or emotions) might actually stem from favoritism towards the ingroup and derogation of the outgroup. Furthermore, investigating how people evaluate others emotions is a complex endeavor, with outcomes that can vary based on the methodology employed. Exploring new techniques to grasp how we perceive others' secondary emotions is essential to provide a more detailed understanding of phenomena that result in neglect and/or violence.

The current study

There are many research methods and stimuli used to understand dehumanization such as face-morphing technique, psycholinguistic tools, neuroimaging, among others (for a detailed review, see Kteily and Landry, 2022). Also, most studies try to understand dehumanization by verbal judgment measures about others' emotions or by their neurophysiological correlates. In our research, we took a distinct approach. Using a topographical bodily sensation mapping tool, we prompted participants to identify how they perceived the bodily experience of diverse emotions within themselves, members of their group, or distinct outgroup members (the homeless). This Bodily Sensation Mapping (BSM) tool (Nummenmaa, Glerean, & Hietanen, 2014) has been proven effective in uncovering the bodily sensations tied to emotions felt personally and or related to social interactions (Novembre, Zanon, Morrison, & Ambron, 2019). This allowed us to pinpoint potential variances in how people perceive emotions in themselves as opposed to those in their group or outgroup members using a method that captures emotion through the lens of somatosensory and embodiment processes. Our focus is not merely to discern whether there is a lack of unique human emotions attribution to outgroups; rather, we are investigating how different these emotions are attributed between groups.

To accomplish this main goal, we conducted two distinct experiments. In the first experiment, our objectives were: 1. To evaluate if university students rate their peers (similar students) higher in terms of warmth and competence compared to the homeless; 2. To curate a collection of images that represent students and the homeless in relation to the Stereotype Content Model (SCM). This included images perceived by students to exemplify high warmth

and competence (photos of students) and those exemplifying low warmth and competence (photos of homeless individuals). The most representative images from each category were then chosen for the second experiment. Experiment 2 delved into understanding emotional representations within the body. Specifically, the objectives were: 1. To examine how primary emotions (like anger, fear, happiness, sadness, disgust, surprise) and secondary emotions (such as gratitude, pride, compassion, hope, awe, guilt, envy, contempt, love, pity) are represented differently in the body across all groups; 2. To determine if there's a congruence in how primary and secondary emotions are represented for the self compared to both in-group (student) and outgroup (homeless individuals) members. Grounded in the infrahumanization theory, our hypothesis was that while all groups would distinctly map each primary emotion in the body, only the self and in-group would distinctly represent each secondary emotion. Additionally, while the primary BSM of the outgroup and in-group would be similar to the self, the secondary BSM of the outgroup would be more distinct than the in-group when compared to the self's BSM.

Experiment 1 - Warmth and Competence

Methods

The sample size was estimated using the G*Power 3.1 software (Faul, Erdfelder, Lang, & Buchner, 2007). The statistical model for analyzing the primary outcomes (Competence and Warmth) was an t test (participants rating homeless or student photos). Based on the SCM (Fiske et al. 2002), we assumed a large f effect size (0.40) for participants' judgements of homeless versus students concerning competence and warmth in the calculations. The analysis suggested that a sample size of 42 subjects per group would be sufficient for an observed power of 0.95 at $\alpha < .05$. Participants were 81 self-reported healthy undergraduate students (68 females; mean age = 23.86 y/o and SD = 7.09) with no self-reported history of neurological and psychiatric disorders.

Experimental Design and Procedure

The studies were approved by the Research Ethics Committee of Mackenzie Presbyterian University (CAAE: 76803617.5.0000.0084). Participants were randomly allocated to one of the four conditions: color homeless/student or P&B homeless/student. All groups underwent the same evaluation task. They were asked to assess 15 photographs of either homeless individuals or students, based on their group assignment, rating competence and warmth using a 5-point Likert scale. Data were acquired using Google Forms, with links distributed to all participants.

To ensure consistency of photos with the homeless and students in terms of context and pose, we initially selected fifteen representative images of homeless individuals from Google Images. With these images as references, we then organized photoshoots for 15 undergraduate students in various city locations. These students were photographed in poses and contexts that mirrored those of the selected homeless images resulting in 15 matched pairs of photographs showcasing both homeless individuals and students, maintaining similarity in body posture and environmental context. Photographs were shot using a Nikon FX D610 camera equipped with a 50mm f1.4 lens. Although both color and black-and-white versions of the photos were produced, only the black-and-white variants were utilized for the study. We ensured that the luminance and temperature were consistent across each image pair.

Transparency and openness

We report how we determined our sample size, all manipulations, and all measures in the study. All data, analysis code, and research materials can be made available upon request for the correspondent authors. Data were analyzed using R version 4.1 (R Core Team, 2020). This study's design and its analysis were not pre-registered.

Results

Final sample was 81 participants (homeless condition = 42 and student condition = 39). First, factor analysis was performed for the two dimensions (warmth and competence) in all images. As the warmth dimension proved to be more restrictive, this criterion was chosen to

exclude the images. Images that presented less than 70% intragroup coherence were excluded (for more details see supplemental material). These analyses resulted in 12 image pairs in which we conducted the further analysis. For each subject, we created an index of warmth and competence by averaging their ratings on the twelve photos. Figure 1 shows the data for all subjects. Next, we performed t-test for warmth and competence considering group (student or homeless). With regard to warmth, we found a significant group differences for all images (all ps ≤ .003). The large efect size was present to image 9 ($t(79.93) = 6.91$; $p < .001$; $d = 1.53$). Competence presents similar results with significant group differences for all images (all ps ≤ .026) and large effect size for image 9 ($t(68.90) = 9.27$; $p < .001$; $d = 2.04$). Thus, we selected this particular photo as the most suitable representation of an ingroup (student) and extreme outgroup (homeless), aligning with SCM standards (for more details see supplemental material).

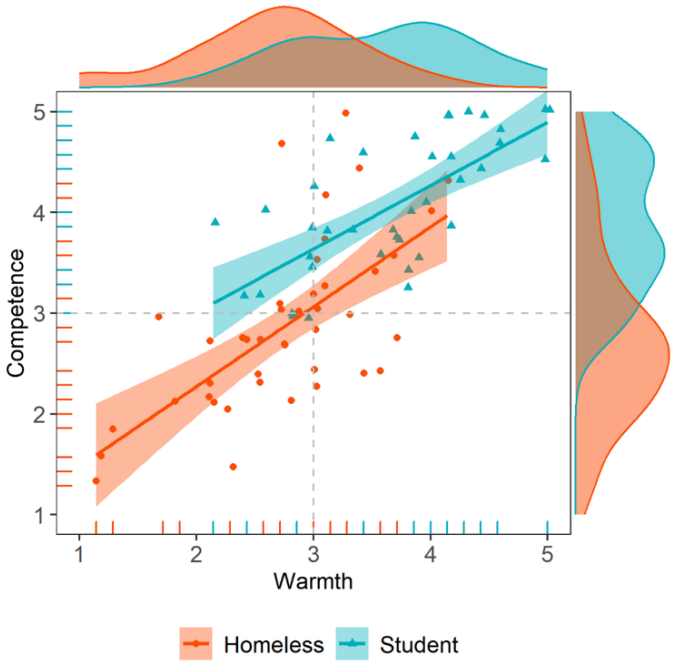

Figure 1. Competence and warmth evaluations for the homeless and students' images. Scatterplot presents average warmth and competence evaluations per participant (dots) and the LS regression line with 95% CI. Density plots show competence and warmth for ratings (1-5) for the two groups of images.

Discussion – Experiment 1

We observed a clear differentiation between perceptions about students and the homeless regarding warmth and competence. Our findings are in line with the SCM: participants attributed higher warmth and competence to the students and lower warmth and competence to the homeless people. Such observations can be positioned within the warmth-by-competence space proposed by previous research (Fiske et al.2002; REF). Notably, society often categorizes the homeless within the low warmth and low competence quadrant (Harris & Fiske 2009; Fiske 2015; Wagoner, Lomeli, & Sundby, 2023), a trend reaffirmed by our findings. Students were perceived as more competent. This accrods with previos literature that typically associates higher competence with higher-status groups (Harris & Fiske, 2006). The intertwined nature of warmth and competence perceptions in our data may reflect societal norms. It suggests that bias in one domain (be it warmth or competence) could influence perceptions in the other, highlighting the depth of these ingrained stereotypes (Fiske et al. 2002). Collectively, our findings spotlight the pivotal role of societal stereotypes in shaping perceptions.

Besides our findings being in agreement with previous research, the selected photos effectively convey the stereotypes commonly associated with students and homeless individuals,

as defined by the SCM (Fiske et al. 2002; Harris & Fiske, 2006) and therefore they are appropriate to be used in our second study. Taking into account that Study 2 aims to examine the attribution of primary and secondary emotions to in-group and out-group members based on infrahumanization theories, it was imperative to find in our sample that students consistently attribute warmth and competence in line with one of the facets of the dehumanization models.

Study 2 - bodily sensations maps

Methods

The sample size was determined to be at least 40 participants per group based on Nummenmaa et al. (2014), and no formal sample size calculation was conducted. Recruitment took place through standard e-mail and social network advertisements (e.g., Facebook and WhatsApp), and 153 participants were recruited (105 female; mean age of 20.99 $\pm$3.60 (SD)) with no self-reported history of neurological and psychiatric disorders.

Stimuli

For Study 2, we took a pair of photos (with a homeless person and a student) with maximal net difference in warmth and competence. Thus, we inspected the findings from Study 1 for each image pair and chose the one that better characterized the student in the quadrant of high-warmth and high-competence and the homeless in the quadrant of low-warmth and low-competence. Independent t-tests were performed to test if the student and homeless photos were significantly different from each other concerning warmth and competence. The selected pair fitted these criteria; differences in the ratings of warmth and competence between student and homeless photos were significant and showed high effect sizes (Warmth: Homeless ($M = 2.52$, $SD = 0.99$) and Student ($M = 4.03$, $SD = 0.97$); $t80 = -6.91$, $p < .001$, 95% CI [-1.93, -1.07], $d = 1.53$; Competence: Homeless ($M = 2.67$, $SD = 1.10$) and Student ($M = 4.53$, $SD = 0.68$); $t80 = -9.17$, $p < .001$, 95% CI [-2.26, -1.50], $d = 2.03$).

Figure 2. Selected pair of homeless-student photos.

Participants evaluated either their own bodily sensations maps (BSMs), the BSMs of an ingroup (student) or the BSMs of a outgroup (homeless) shown in the photos associated with six primary (anger, fear, disgust, happiness, sadness, and surprise) and eleven secondary emotions (love, contempt, pride, shame, awe, compassion, hope, gratitude, guilt, envy) as well as a neutral state. Each emotional word was presented once in random order. The participants' task was to evaluate which bodily regions typically became activated or deactivated when each emotion was felt by themselves (self), an ingroup (undergraduate student), or an outgroup (homeless). To ensure that all participants in the ingroup and outgroup made their judgments based on the same prototypes of a student (ingroup) or homeless person (outgroup), we presented the selected pair of photos (student and homeless) from Study 1 prior to emotion evaluation.

Experimental Design and Procedure

Participants were randomly assigned to one of the three experimental groups: (1) BSMs of themselves (n = 51; 33 female, mean age of 21.71$\pm$ 3.88 (SD)), (2) BSMs of an ingroup (n =

51; 37 female, mean age of 20.71± 4.24 (SD)), and (3) BSMs of an outgroup (n = 51; 35 female, mean age of 20.55 ± 2.39 (SD)). Data were acquired online with the emBODY instrument developed by Nummenmaa et al. (2014). Participants were shown two silhouettes of a human body and an emotional word between them. The first group of participants was instructed to colour the areas of the body typically activated (on the left silhouette) or deactivated (on the right silhouette) in response to each emotion when considering their own reactions (self-group). The tasks for groups 2 (ingroup) and 3 (outgroup) were similar, but they were asked to colour the bodily areas they believed would be typically activated or deactivated in an undergraduate or a homeless person, respectively, for each emotional response. The tool allowed for dynamic painting where consecutive strokes on an area enhanced the paint's opacity. The painting tool had a diameter of 12 pixels, and upon completion, the images were saved in matrices with paint intensity values ranging between 0 and 100. Both bodies were represented by 50,364 pixels. For more details, see Nummenmaa et al. (2014).

Statistical Analysis

Data were processed as described in Nummenmaa et al. (2014) to yield bidirectional activation-deactivation maps. Emotion activation/deactivation data for each group (self, ingroup and outgroup) were preprocessed into BSM maps for each emotion. To evaluate the difference in activation and deactivation between the BSM pixels, a t-test against zero was applied resulting in statistical t-maps where pixel intensities reflect statistically significant bodily sensations associated with each emotional state. The false discovery rate (FDR) correction was applied to the statistical maps as control for false positives due to multiple comparisons.

To assess the similarity of BSMs for a each emotion between groups, or for different emotions within a group, we averaged individual Spearman Correlation similarity matrices into between and within-group emotion similarity matrices (for more details see Nummenmaa et al. 2014). We applied Mantel's Permutation Test to each pair of group matrices to detect differences in emotions' similarities between groups (1000 permutations, mantel.test function in the ade4 R package).

To investigate whether ingroup and outgroup BSMs were represented with emotion sensations distinct from the self condition, we used statistical pattern recognition with linear discriminant analysis (LDA; self vs group model). Prior to the LDA pattern recognition, dimensionality of the data was reduced with a Principal Components Analysis (PCA) and as many components as necessary to explain 80% of data variance were retained (minimum = 88; maximum = 114). The classifier was trained to identify if a given BSM belonged to a given group (ingroup or outgroup) or to the self-condition. Training and testing were performed separately for each emotion. We used a stratified 10-fold cross-validation to estimate model performance.

The distinctiveness of emotion BSMs within each group was assessed with LDA models trained to classify a given emotion against all the others (one emotion vs all model), this was done for each emotion and each group separately. Otherwise, the pipeline was the same as the self vs group model, with the exception that a uniform prior was used to keep the chance level at 50%. All LDA analyses were repeated 1000 times with different stratifications of the data for cross-validation. The standard deviation of accuracy of the repeated models was obtained to assess model performance variability.

Transparency and openness

We report how we determined our sample size, all manipulations, and all measures in the study. All data, analysis code, and research materials can be made available upon request for the correspondent authors. Data were analyzed using MatLab R2018 and R version 4.0.0 (R Core Team, 2020). This study's design and its analysis were not pre-registered.

Results

BSMs for the attributed emotional activation and deactivation of body areas for Self, ingroup and outgroup are shown in Figures 3 (primary emotions) and 4 (secondary emotions). The similarity matrices among emotions in each group revealed low similarities among primary emotions (range: -0.01 to 0.49) and among secondary emotions (range: - 0.01 to 0.42; see Figure 5 for the complete matrices). Mantel's tests was used to assess the similarity of the bodily sensation map patterns (i.e. correlation matrices) between the groups. The analysis was run separately for primary and secondary emotions. Matrix correlations ranged from moderate to high (range: 0.67 - 0.83), indicating that the patterns of similarities among emotions were analogous regardless of the groups compared, for more details see Table 1.

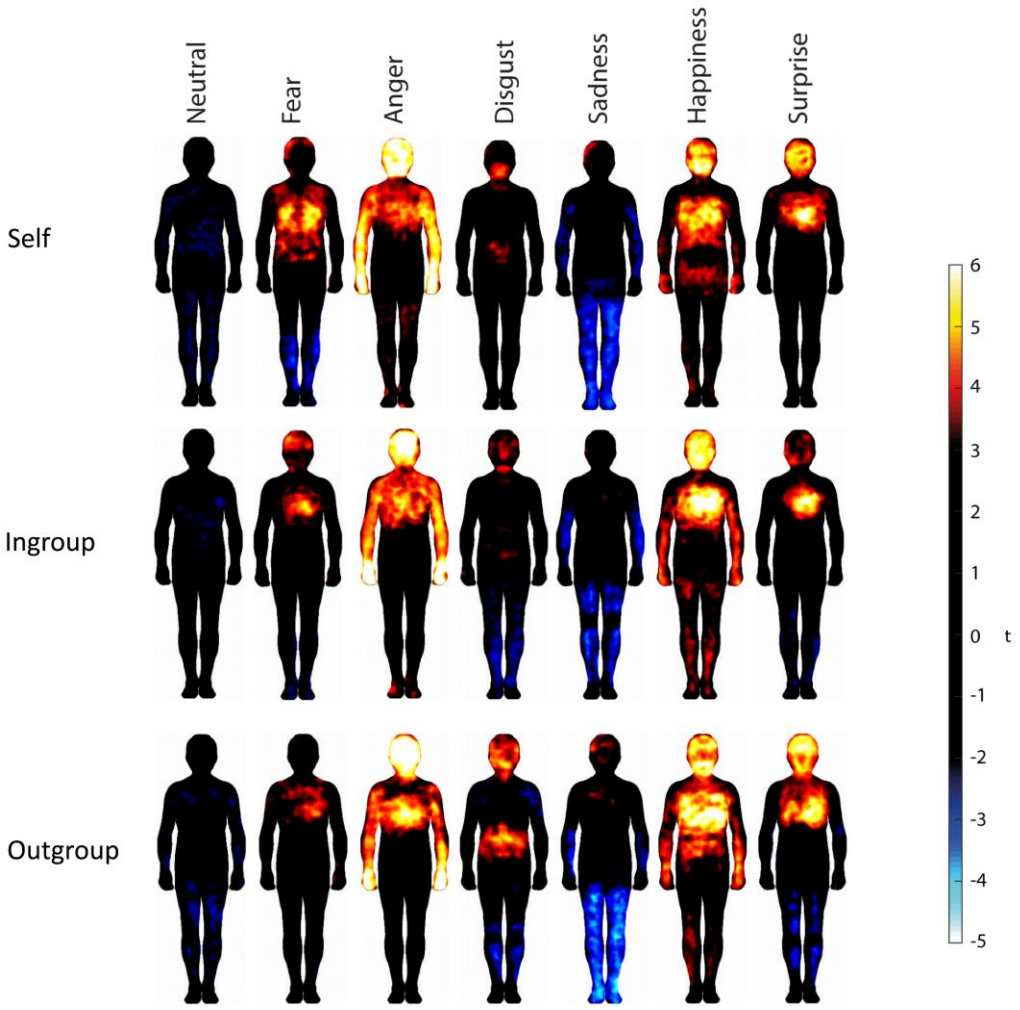

Figure 3. Bodily maps of six primary emotions and a neutral emotional state. The maps show regions whose activation increased (warm colors) or decreased (coold colors) when feeling each emotion ($P < 0.05$ FDR corrected; $t > 1.94$). The colorbar indicates the t-statistic range.

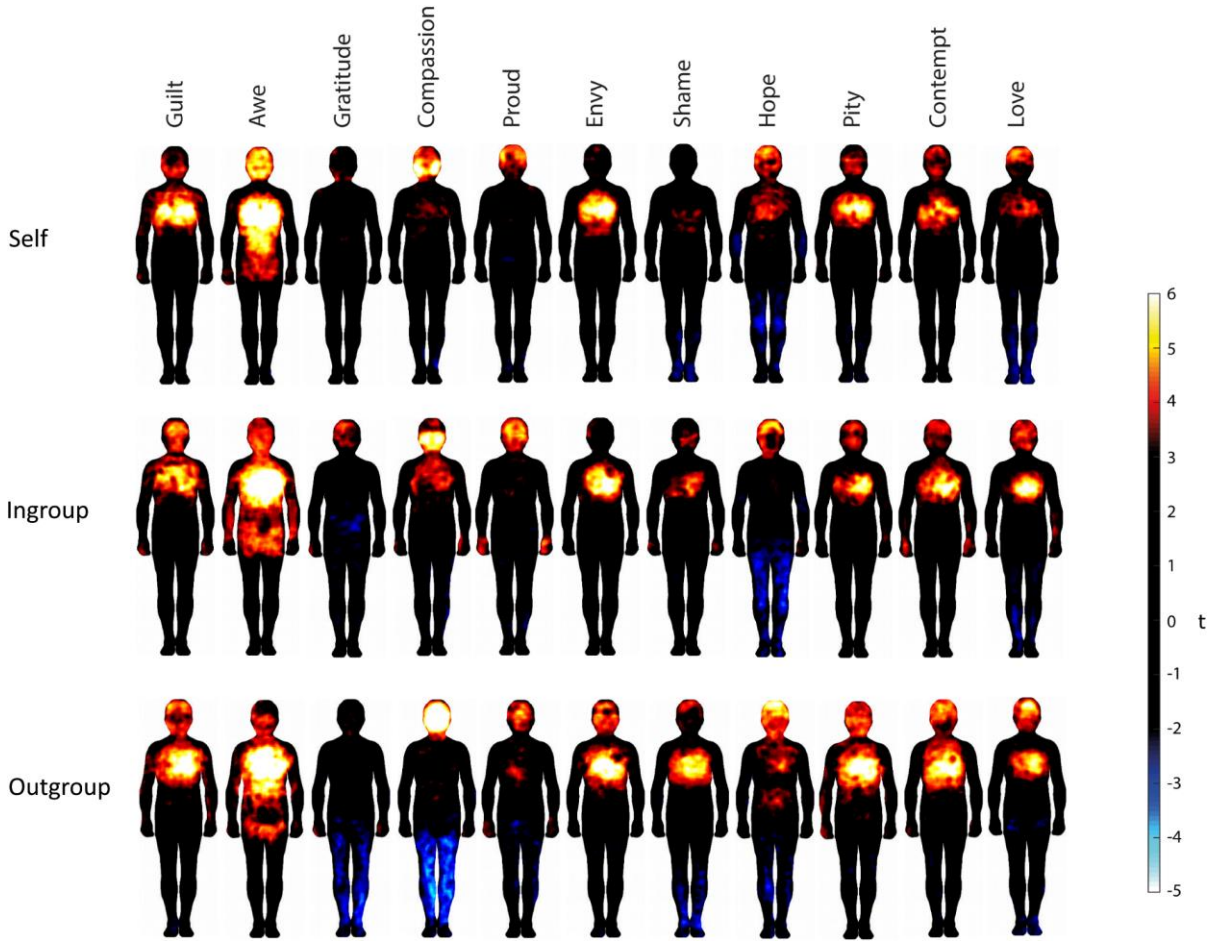

Figure 4. Bodily maps of eleven secondary emotions. The maps show regions whose activation increased (warm colors) or decreased (cool colors) when feeling each emotion ($P < 0.05$ FDR corrected; $t > 1.94$). The colorbar indicates the t-statistic range.

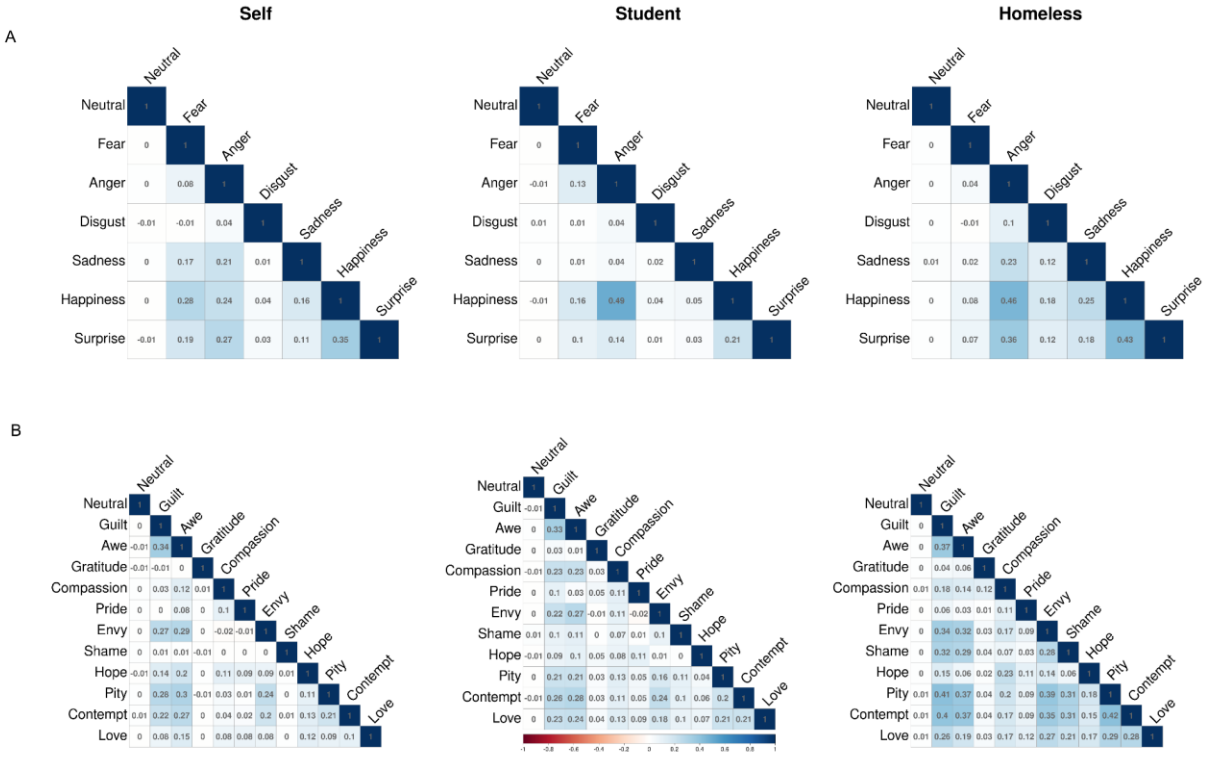

Figure 5. Similarity matrices between emotions. Top row shows the similarity between primary emotions (scores are similarly > 0.60) and bottom row the similarity between the secondary emotions (scores are similarly > 0.60).

TABLE 1. Mantel´s test

		z-value	*r*	*p*
Primary	Self vs. Ingroup	0.33	0.67	0.01
	Self vs. Outgroup	0.52	0.74	0.03
	Ingroup vs. Outgroup	0.44	0.73	0.01
Secondary	Self vs. Ingroup	0.90	0.78	< 0.01
	Self vs. Outgroup	1.32	0.72	< 0.01
	Ingroup vs. Outgroup	1.64	0.83	< 0.01

Note. Similarity structure between emotion through groups

The independence of the BSMs for all emotions was validated by LDA models in the three groups. As shown in Table 2, we found independent BSMs for all primary emotions, except for fear. Fear displayed the least discriminability overall across the groups, failing to surpass chance level in terms of classification accuracy for both ingroup and outgroup conditions. Conversely, anger emerged as the primary emotion that exhibited the highest discriminability overall across the groups.

TABLE 2. Emotion Classification Accuracy for Primary Emotions models

	Self	Ingroup	Outgroup
Neutral	0.78 ± 0.01	0.76 ± 0.01	0.75 ± 0.01
Fear	0.62 ± 0.01	0.50 ± 0.02	0.50 ± 0.02

TABLE 2. Emotion Classification Accuracy for Primary Emotions models

	Self	Ingroup	Outgroup
Neutral	0.78 ± 0.01	0.76 ± 0.01	0.75 ± 0.01
Anger	0.74 ± 0.01	0.69 ± 0.01	0.72 ± 0.02
Disgust	0.65 ± 0.01	0.64 ± 0.02	0.67 ± 0.01
Sadness	0.61 ± 0.02	0.63 ± 0.02	0.57 ± 0.02
Happiness	0.65 ± 0.02	0.65 ± 0.02	0.64 ± 0.02
Surprise	0.54 ± 0.02	0.60 ± 0.02	0.57 ± 0.02

Note. Analysis has a chance level of .50. Values are described by mean ± SD

Distinct bodily topographies associated with secondary emotions across the three conditions are depicted in Figure 3 and detailed in Table 3. LDA for individual emotions underscored the distinctiveness of BSMs for emotions like guilt, awe, gratitude, compassion, pride, and hope across all groups, with accuracy rates consistently at or above 0.50 (chance level). However, not all emotions maintained this consistency. While envy demonstrated accurate classifications for self and ingroup conditions, its accuracy was below the chance level for the outgroup. Both shame and pity underperformed in the ingroup and outgroup conditions, while contempt underperformed in the self and ingroup conditions. Finally, love was below the chance level in both the self and outgroup conditions. In essence, while many emotions surpassed the chance-level accuracy, a few like envy, shame, pity, contempt, and love did not for

some comparisons. Specifically, they underperformed in 2 out of 11 emotions for self, 3 out of 11 for the ingroup, and 4 out of 11 for the outgroup.

TABLE 3. Emotion classification accuracy for Secondary Emotions models

	Self	Ingroup	Outgroup
Neutral	0.77 ± 0.01	0.77 ± 0.01	0.78 ± 0.01
Guilt	0.52 ± 0.02	0.53 ± 0.02	0.55 ± 0.02
Awe	0.7 ± 0.01	0.72 ± 0.01	0.65 ± 0.02
Gratitude	0.63 ± 0.02	0.6 ± 0.01	0.59 ± 0.02
Compassion	0.64 ± 0.01	0.64 ± 0.01	0.71 ± 0.01
Pride	0.53 ± 0.02	0.55 ± 0.02	0.57 ± 0.02
Envy	0.58 ± 0.02	0.59 ± 0.02	0.49 ± 0.02
Shame	0.53 ± 0.02	0.49 ± 0.02	0.5 ± 0.02
Hope	0.55 ± 0.02	0.62 ± 0.02	0.56 ± 0.02
Pity	0.53 ± 0.02	0.48 ± 0.02	0.5 ± 0.02
Contempt	0.49 ± 0.02	0.48 ± 0.02	0.55 ± 0.02
Love	0.5 ± 0.02	0.56 ± 0.02	0.48 ± 0.02

Note. Analysis has a chance level of .50. Values are described by mean ± SD.

Finally, we investigated, for each emotion, whether it was possible to classify ingroup and outgroup BSMs against self BSMs. For all emotions, LDA models showed that self BSMs could be more easily distinguished from outgroup BSMs than ingroup BSMs (Figure 6). All

emotion accuracies for the classification of outgroup BSMs were above chance level (average accuracy = 0.65 ± 0.06), while the ingroup classifications show only 6 out of 17 above the chance level (average accuracy = 0.5 ± 0.05). For the ingroup BSMs, only two primary emotions (anger and happiness) and four secondary emotions (envy, awe, shame, love) were distinguishable from Self BSMs (accuracies above chance).

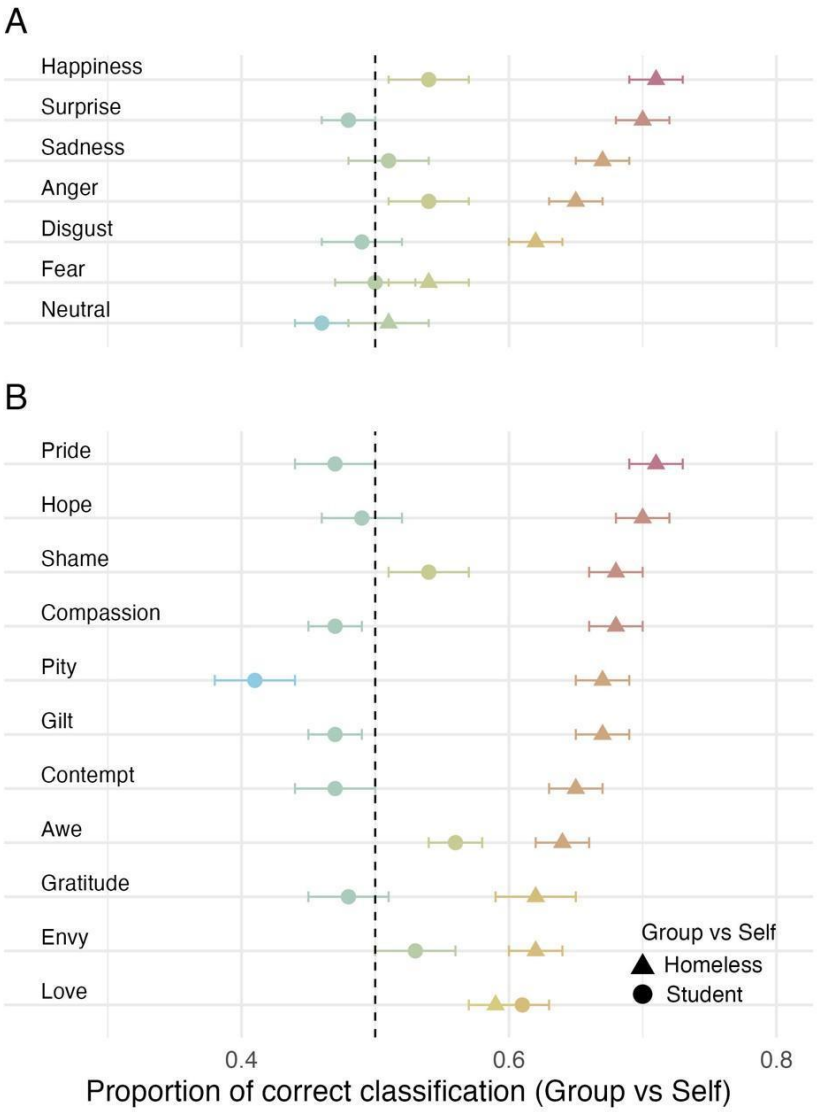

Figure 6. Distinctness between groups (ingroup and outgroup) BSMs and the self BSMs.

Discussion - Study 2

Our findings delineate clear patterns in the recognition and differentiation of emotions based on their bodily representations for self as well as ingroup and outgroup members. Notably, similarity matrices revealed low similarities among both primary and secondary emotions. Also, matrix correlations, when examining emotion similarity indices across groups, were moderate to high, suggesting analogous patterns of similarities among emotions regardless of the groups compared. The validation of the independence of BSMs for various emotions highlighted differential discriminability across the groups. While most primary emotions displayed independent BSMs for all groups, fear emerged as an exception, showing lower discriminability for both ingroup and outgroup members. Secondary emotions yielded more variable results. Emotions such as guilt, awe, gratitude, compassion, pride, and hope exhibited distinct BSMs with accuracy rates that were consistently at or above chance level across all groups. However, some emotions, namely envy, shame, pity, contempt, and love, did not have such a consistency across different conditions. Further exploration on the differentiation of ingroup and outgroup BSMs from self BSMs revealed a distinct pattern. Self BSMs were more easily distinguishable from outgroup BSMs than from ingroup BSMs. For the outgroup condition, all emotions were correctly distinguished from the self.

The differentiation observed among primary and secondary emotions in our study aligns with the distinction found in response patterns to different categories of stimuli from previous

studies (Nummenmaa, Glerean, Hari, & Hietane, 2014). The low similarities among primary and secondary emotions we identified suggest unique bodily representations for varied emotional states, pointing to specific physiological responses to these states. The uniformity in emotion similarity indices across groups observed mirrors the consistent response patterns observed across diverse stimuli Nummenmaa's study.

The moderate to high matrix correlations among groups for both primary and secondary emotions underscore a shared somatic representation for emotional experiences irrespective of the group of reference. These findings challenge traditional infrahumanization theory (Leyens 2001; Haslam & Loughnan, 2014), which posits that individuals often attribute uniquely human emotions more readily to their in-group members than to out-group members, subtly distinguishing between "us" and "them" on an emotional level. Historical discussions on dehumanization, such as the ones presented by Kelman (1976) and Staub (1989), often addressed the denial of identity and community to out-groups. But our data suggests a more general emotional recognition, with mostly emotions being represented by discrete maps for the three conditions (self, in-group, or out-group). This might indicate that the more extreme views on dehumanization, rooted in intense conflict and violence, may not entirely capture the nuances of everyday emotional attributions and intergroup relations.

Despite similar patterns among BSMs on all conditions, there's a more pronounced distinction between self BSMs and out-group BSMs compared to self vs in-group . This suggests a closer alignment or similarity between one's own emotional body states and those of individuals within their identified in-group. Interestingly, in the out-group condition, there was a stark contrast: every emotion was aptly differentiated from the self. This underscores the idea

that individuals might have a propensity to recognize and closely associate their emotional experiences with those of their in-group, whereas they distinctly separate or dissociate their emotional states from those of the out-group. Such findings shed light on the intricate dynamics of self- and group-identity and how they interface with our emotional perceptions. Rather than suggesting infrahumanization, our findings resonate with established theories like social identity theory and social categorization theory (Tajfel, 1974; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). According to these theories, the identification with group characteristics is essential to the constitution of individuals' self-image. Furthermore, group characteristics are employed as social categorization criteria which, in turn, guides interpersonal behavior. The attribution of BSMs arise as another task affected by such categorization processes.

The identification with a given group is built on an overlap of the mental representations for the self and the in-group members. Smith et al. (1999) highlighted an overlap between the mental representations of the self and in-groups, mirroring the findings in our own study. Even though our research mainly focused on emotional sensations and Smith et al.'s research delved into trait dimensions, there's a consistent pattern suggesting that the mental overlap of the self and in-groups extends across both emotional and cognitive dimensions. This alignment in findings is supported by the self-anchoring model introduced by Cadinu & Rothbart (1996) and further advanced by Otten and colleagues in 2002 and 2014. This model posits that the mental overlap between an individual's self-perception and their in-groups stems from inferences made from the self towards the group.

In social neuroscience, there is a growing body of literature that corroborates this perspective. Mitchell et al. (2005) championed the idea that many of our inferences about others,

especially those perceived as ourselves, are based on our self-referential processes. This was exemplified by a subsequent study by Mitchell et al. (2006), which demonstrated that when individuals pondered the thoughts of someone sharing their political beliefs, there was an activation in the ventral medial prefrontal cortex that was analogous to the activity seen when reflecting on their own beliefs. Taken together, these studies underscore the idea that individuals often use their own emotions and thoughts as a reference (self-anchoring/ mentalizing), particularly when they perceive others as being similar to themselves.

In a similar vein, previous findings (Hooker et al., 2008) suggest that our capacity to anticipate others' emotional responses is grounded in our own internal affective representations. Moreover, the higher our affective representations, the greater our capacity for empathy towards others. In our study, we did not assess the empathy levels of our participants concerning ingroups and outgroups. Future research might delve into whether the manner in which we embody emotions influences our empathic responses to different groups. Such investigations could shed light on models of dehumanization, social cognition, and other facets of interpersonal understanding.

Conclusion

Our study's findings underscore the profound influence of societal stereotypes on perceptions of warmth and competence about students and the homeless. We observed higher warmth and competence values to students as evaluated by their peers, while marginalizing the homeless by placing them in the low warmth and low competence quadrant. These judgments bring to light the depth of ingrained stereotypes, highlighting the need for society to recognize and possibly correct these skewed perceptions. Our data also revealed discernible patterns in how emotions are recognized and differentiated based on their bodily representations across reference groups. Employing bodily sensations as an implicit measure for dehumanization has demonstrated potential for future research. By representing emotions nonverbally and in embodied format, we were able to illuminate nuanced facets of how others are perceived. The data suggests that, contrary to traditional infrahumanization theory, individuals have a fairly consistent attribution to primary and secondary emotional states, regardless of the group being considered. This challenges the historically entrenched idea of not attributing uniquely human emotions to outgroups and instead proposes that the spectrum of emotional recognition and attribution might be more complex than previously thought. Our findings also highlight the nuanced relationships between one's emotional experiences, self-identity, and group affiliations. The similarity between how one perceives their emotional states and those of their in-group members stands in contrast to the clear distinction seen with out-group members, suggesting a potential overlap between self and in-group perceptions. This overlap resonates with prior research in cognitive dimensions, aligns with social identity theories and expands upon them by incorporating emotional perspectives. In conclusion, this research sheds light on the relationship between group identity and emotional perceptions, serving as a bridge between seminal

intergroup theories and modern interpretations of embodied emotions and paving the way for future investigations that explore the interplay between emotional embodiment, empathy, and intergroup relations.

Conflict of interest

There were no affiliations with or involvement in any organization or entity with a direct financial interest in the subject matter or materials discussed in the manuscript. All authors contributed to manuscript writing and approved the final version of the manuscript for submission.

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