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Locating the Embodied Sense of Self and Examining its Relationship with Psychological Well-Being

Adam Hanley

Natalie Lecy

Robert Hanley

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Adam Wesley Hanley
C-MIND, University of Utah
Salt Lake City, UT, USA

Natalie Lecy
C-MIND, University of Utah
Salt Lake City, UT, USA

Robert Hanley
CohnReznick
New York City, NY, USA

Westerners tend to localize their sense of self in the head, and, to a lesser degree, in the chest. However, single-point, localization studies of the self omit direct exploration of the size and shape of the embodied self. This study explored a) beliefs about the location and spatial distribution of the embodied sense of self, and b) whether individual differences in how the embodied self was represented were associated with psychological and subjective well-being. Results from a sample of 206 American adults confirm extant reports, indicating that the embodied sense of self is most often located in the head and chest. However, results from this study extend previous findings by suggesting that the majority of respondents (70%) located their embodied sense of self in multiple body regions, and individuals that reported a more widely distributed sense of self reported greater well-being. Specifically, a more widely distributed sense of self in the torso was most strongly associated with psychological well-being. No relationship emerged between the distribution of the sense of self in the head and psychological well-being. Results from this study indicate that the sense of self may be located throughout the body, and that locating the sense of self in the torso may have psychological benefit. As such, exploring methods of shifting the sense of self out of the head and into the body may have therapeutic value.

Keywords: ***self; self-location; well-being; self-report***

Philosophical and psychological inquiry has long examined the nature of the self. Unsurprisingly, diverse perspectives have emerged over time and across cultural context. Yet, despite this multifinality of perspective, a sense of self is believed to originate in each person in much the same way. The sense of self is thought to arise in tandem with critical developmental milestones such as the advent of object permanence, around 18–24 months, and theory of mind during the 4th or 5th years (Austin, 2006). A child's mental model of self emerges when biological states come to be distinguished from psychological states, which suggests to the child the "self" is something separate from the body (Johnson & Wellman, 1982). For most, this separation holds true into adulthood (Anglin, 2014; Stanovich, 1989), although many adults find it difficult to clearly articulate what their sense of self actually is (Bloom, 2007; Haidt, Bjorklund, & Murphy, 2010).

That the general public struggles to articulate the self with exactness is unsurprising given the varied ways in which the self has been conceptualized by modern scholars (e.g., Berkovich-Ohana & Glicksohn, 2014; Friedman, 1983; Gallagher, 2000; James, 2013; Varela, Rosch & Thompson, 1993). Some have emphasized the self's unifying capacity (e.g., Kant), characterizing it as "the epicenter of knowledge, cognition, experience and action"

(Varela, Rosch & Thompson, 1993, p.xvii). Others have emphasized the self's multiplicity, subdividing it into two distinct aspects (Gallagher, 2000; Pashko, 2013), three psychological dimensions (Berkovich-Ohana & Glicksohn, 2014), or a great many things (e.g., Linville, 1985). Others have proposed the self to be transpersonal, suggesting it extends beyond the individual's physical body to include wider spatial (e.g., the environment) and temporal (e.g., past and future) dimensions (Friedman, 1983; Mara, DeCicco & Stroink, 2010). Still others have claimed the sense of self is ultimately illusory (e.g., Hume; Gyamtso 1994; Macy, 1991). Clearly, the self can be construed in many ways, and a thorough review of all self construals is beyond this paper's scope (See Leary & Tangney, 2003 for more). Here, we confine ourselves to better understanding where the sense of self is localized within the physical body.

In contrast with how difficult it can be to conceptualize the self, locating the sense of self within the body appears to be relatively intuitive. Evidence from five, recent empirical studies using diverse methodologies converge to suggest that a) the self can be readily located within the body by both children and adults, b) the self is most commonly situated behind the eyes, but c) a subpopulation report the self is localized in the chest (Alsmith & Longo, 2014; Anglin, 2014; Bertossa, Besa, Ferrari, & Ferri, 2008; Limanowski & Hecht, 2011; Starmans & Bloom, 2012).

Alsmith and Longo (2014) used two different methods of locating the self among an adult sample: haptic and visual. For the haptic method, participants located their sense of self by manually manipulating a pointer to indicate the region of their body encapsulating their self while blindfolded. For the visual method, participants were not blindfolded and a researcher moved the pointer until the participant verbally indicated it was pointing to their self. Results of both methods indicate the self was most frequently located in the upper head or torso according to whether the pointer started pointing up or pointing down. Interestingly, participants were more likely to choose the body region closer to the starting point of the pointer, suggesting that environmental factors may influence conclusions about the self's location.

In an attempt to differentiate between mind, self, and soul, Anglin (2014) prompted participants to locate the three constructs on a human figure containing eight predefined regions. Participants were also asked to define the self, soul, and mind. The self was most frequently identified in the head, brain, or mind with a smaller subset locating self in the chest area. The soul was most frequently identified in the chest area and the mind was in the head or brain.

While attempting to find the "the seat of consciousness" (p. 325) Bertossa, Besa, Ferrari, & Ferri (2008) used a structured interview within a phenomenological "second-person" approach to solicit first-person reports from participants about the location of their self. Participants were adults, largely Westerners (n = 54), including eight participants who identified as blind from birth, and a small subsample of non-Westerners (n=5). During detailed thematic interviews, participants were asked to locate their "source of perception" (p.328) or the point zero for "I" by pointing to the location on their own body and by pointing to a spatial location on a frontal and lateral human profile. The majority of participants (83.0%)—including non-Western and blind participants identified the location of self in a precise point inside the head. Roughly ten percent indicated the "I" had no location. Considering the different lived experiences of the participants who were blind from birth and the different cultural experiences of the non-Westerners, it appears noteworthy that all three groups largely located the self in the same place.

Limanowski & Hecht (2011) used an online survey platform to investigate where adult participants (n=87) located their self. Participants were first assigned to one of two groups: 1) no education on the construct of self or 2) a short introduction to the phenomenal self. Then participants used mouse cursors to identify the location of self using a human silhouette. Despite group assignment, most participants indicated the location of self in the brain followed by the heart. A small group of participants indicated the location of self in the stomach or eyes. Due to the lack of statistical difference between groups (education on self vs. no education), findings from this study

appear to reinforce the intuitive nature around the conceptualization of self.

In an attempt to untangle the intuitive sense of self from culturally reinforced sentiments of self, Starmans & Bloom (2012) explored whether age influenced spatial locations of self by using mixed samples of preschool-aged children and adults. In three separate experiments using cartoon figures, participants were asked to identify when objects superimposed on various locations of the figure's body were closest to the figure's self. While small age-related differences were observed, the majority of children and adults indicated objects were closest to the figure's self as they moved closer to the eyes, suggesting that the perceived location of the self may remain static from early childhood into adulthood.

Results from these studies indicate the majority of participants; both children and adults overwhelmingly identify the embodied self—or physically represented self—in the head (primarily around the eyes) followed by the heart or broader chest area. While useful in establishing the embodied sense of self's point zero (Bertossa, Besa, Ferrari, & Ferri, 2008), the extant studies are limited in what they can suggest about the spatial dimensions of the embodied self. Given this diversity of perspectives on the nature of the embodied sense of self, only examining the point from which the self is believed to originate may provide a limited characterization of the embodied self. The extant single-point, localization studies omit direct exploration of the size and shape of the embodied sense of self. Indeed, Anglin (2014), expressly states that future research is needed to examine whether the self is believed to reside simultaneously in multiple regions of the body. Currently the spatial qualities of the embodied sense of self remain largely unknown.

Study

As such, this study explored the location and distribution of the embodied self, using a computerized sensation manikin to capture the embodied sense of self's location and spatial distribution in a granular manner. Furthermore, just as variation in cognitive representations of the self has implications for well-being (e.g., Gyamtso, 1994; Ryan & Deci, 2000; Ryff & Keyes, 1995), variation in the spatial representation of the embodied sense of self may as well. Research examining outcomes related to whether people locate the self in their head or their heart, indicate associations exist between self-location and personality, self-concept, religiosity, performance, decision making, emotion, and charitable giving (Adam, Obodaru, & Galinsky, 2015; Fetterman & Robinson, 2013; Fetterman, Juhl, Meier, Abeyta, Routledge, & Robinson, 2020). Thus, associations between the spatial qualities of the embodied sense of self and well-being will also be explored in this study. The primary aim of the present study was not to identify the true location of the embodied self, but to a) gather information about present-day *beliefs* about the location and spatial distribution of the embodied sense of self, and b) determine whether psychological and subjective well-being are associated with individual differences in the representation of the embodied sense of self. We hypothesize that the spatial location of the embodied self is located primarily between the head and the torso (Alsmith & Longo, 2014; Anglin, 2014; Bertossa, Besa, Ferrari, & Ferri, 2008; Hartelius, 2007; Hartelius, 2015; Limanowski & Hecht, 2011; Starmans & Bloom, 2012); and with theory connecting too much self-centeredness with maladaptive psychological functioning (e.g., Dambrun & Ricard, 2011) we hypothesized a more widely distributed sense of self (e.g., extending beyond the head) will be associated with greater well-being.

Participants and Procedures

Participants ($N = 206$) were recruited from Mechanical Turk (MTurk), Amazon's online participant recruitment platform. To ensure data quality, only MTurk workers with a proven history of providing good data were invited to participate in this survey (i.e., successful completion of >500 previous tasks with a task approval rate of >95%). Respondents were provided 25 cents for completing the survey, which is consistent with standard MTurk compensation rates. Table 1 provides participant demographics.

All study procedures were completed in a single, online study session. After providing consent and demographic information, participants completed the computerized Sensation Manikin

(Hanley & Garland, 2019) and then the well-being survey. Participants were excluded (n=53) from the final analyses if they did not fully complete both the Sensation Manikin and the well-being surveys.

Measures

Embodied sense of self was measured with the Sensation Manikin (Hanley & Garland, 2019).

Table 1: Participant Demographics (*N* = 206)

Measure	M	SD
Age	38.24	12.31
	No.	%
Gender	133 F	65%
Race	No.	%
American Indian/Alaskan Native	5	2%
Asian or South Asian	19	9%
African American	21	10%
Caucasian	129	63%
Latino	20	10%
Multiracial	8	4%
Other	3	2%
Marital Status	No.	%
Single	96	47%
Married	90	44%
Divorced	18	9%
Widowed	2	1%
Family's Level of Education		
Less than High School	2	1%
High School or Equivalent	54	26%
Trade School Certificate	8	4%
Associate's Degree	34	17%
Bachelor's Degree	73	35%
Graduate Degree	35	17%
Family's Estimated Yearly Income		
Under $25,000	51	25%
$25,000 to $49,000	63	31%
$50,000 to $74,000	45	22%
$75,000 to $99,999	30	15%
$100,000 to $149,999	14	7%
Over $150,000	3	2%

The Sensation Manikin is a human figure silhouette overlaid with a grid of 469 "self pixels." To introduce the Sensation Manikin, the self was defined for participants as "the epicenter of knowledge, cognition, experience and action" (Varela, Rosch & Thompson, 1993, p. xvii). Participants were then asked to identify where they located their sense of self within their bodies by clicking on self pixels with the computer mouse. Clicking on a self pixel turned that pixel green. Participants were instructed to click as many self pixels as necessary to fully represent the location and distribution of their self within the body. Each selected pixel was assigned a value of 1. Five scores were calculated from participants' Sensation Manikin responses: 1) a total self-distribution score, reflecting the distribution of the embodied sense of self throughout the whole body, and regional self-distribution scores, reflecting the distribution of the embodied sense of self throughout four distinct body regions: 2) head, 3) torso, 4) arms, and 5) legs. A higher distribution score reflected a more widely distributed sense of embodied self.

Psychological well-being was measured with the 18-item Scales of Psychological Well-Being (SPWB; Ryff & Keyes, 1995). The SPWB is a well-validated measure of well-being scored on a 7-point Likert scale (1 = "Strongly Agree", 7 = "Strongly Disagree") with higher scores reflecting greater psychological well-being. The SPWB demonstrated strong internal reliability in this study ($\alpha = .83$).

Subjective Well-Being was measured with the 5-item Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). The SWLS is a well-validated measure of well-being scored on a 5-point Likert scale (1 = "Very slightly or not at all", 5 = "Extremely") with higher scores reflecting greater subjective well-being. The SWLS demonstrated strong internal reliability in this study ($\alpha = .91$).

Statistical Approach and Analyses

Three analytic approaches were used in this study. First, the self distribution scores (e.g., the sum of the pixels from each sensation manikin) reflecting the distribution of the embodied sense of self throughout the body (as referenced in the Measures Section) were used to visually depict the embodied sense of self. Descriptive statistics

were used to investigate in which body regions respondents located their sense of self. Second, Pearson correlations were used to explore bivariate associations between the self distribution scores, psychological well-being, and subjective well-being. Third, one-way ANOVAs were used for sensitivity analyses exploring whether self distribution scores differed by sex or race. Due to the disproportionate number of Caucasian respondents in this sample, the racial analysis only compared Caucasian with non-Caucasian respondents.

Results

Descriptive results present frequencies of self-location in various bodily locations, summaries of results for four major body regions, and numbers of participants reporting multiple locations of self. Bivariate correlations report on correlations between self-location in the four major body regions and subjective or psychological well-being. A sensitivity analysis describes an examination of correlations between self-distribution and variables of race, sex, and age.

Descriptive Results

Figure 1 is the aggregated, embodied sense of self image, derived from the self-distribution scores. Color intensity reflects the frequency of self reports in a given sensation pixel, with darker coloring indicating more self reports in that pixel. Visual inscpection of this image indicated the embodied sense of self was most commonly located in the head and torso (predominately around the chest region). The self was found to occupy very little of the body as a whole. On average, only 8% of the body was reported to be self-relevant.

The regional self-distribution scores for each of the four body regions (head, torso, arms, legs) are reported in Table 2. These scores confirm visual inspection of the aggregated embodied sense of self image, indicating that, on average, a higher percentage of self pixels were selected in the head (26%) and torso (10%), than in the arms (3%) or legs (1%).

The majority of respondents reported their embodied sense of self was located in multiple body regions simultaneously (n=145, 70%). Most frequently the embodied sense of self was simultaneously located in two (n=105, 51%), three (n=24, 12%), or four (n=16, 8%) of the four body regions. Out of those who located the self in two body regions, the most common pairings were the head and torso (n=104, 99%); head, torso and arms (n=12, 50% of those locating the self in three body regions); and head, torso and legs (n=11, 46% of those locating the self in three body regions).

Bivariate Correlations

The total self-distribution score evidenced significant, positive associations with both psychological well-being and subjective well-being (Table 2). With respect to the four regional self-distribution scores, the torso also evidenced significant, positive associations with both psychological well-being and subjective well-being. The

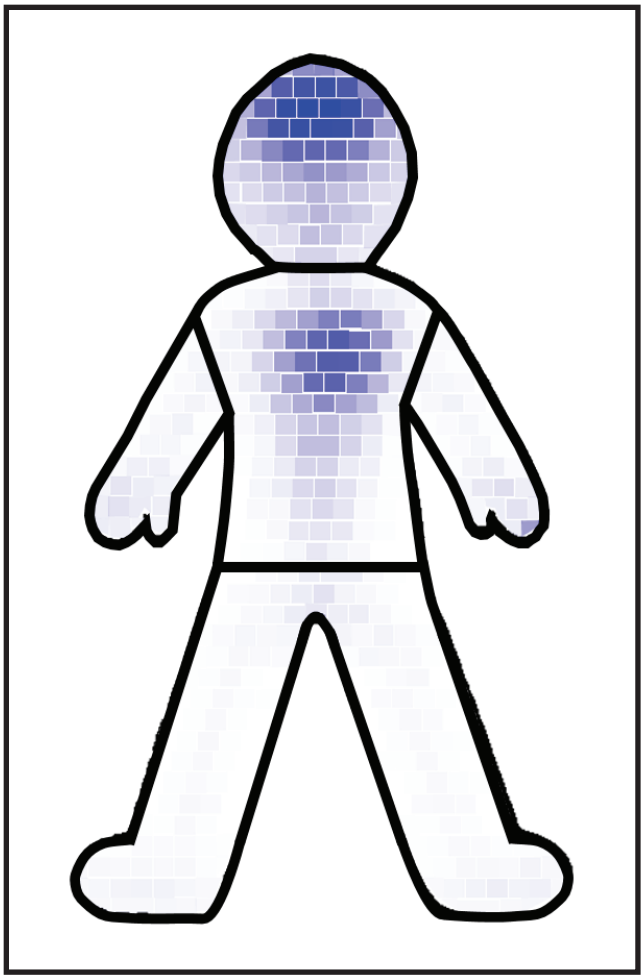

Figure 1. ***Aggregated Embodied Sense of Self Image***. Color intensity reflects frequency of self report in a given self pixel. Darker coloring represents more frequent self reports in that pixel. Thick lines represent segmentation of the Sensation Manikin into the four body regions examined: head, torso, arms, legs.

leg's regional self-distribution score was significantly associated with psychological well-being. The arm's regional self-distribution score was significantly associated with subjective well-being and a trend was observed between the arm's regional self-distribution score and psychological well-being (p=.058). The head's regional distribution score was not associated with either form of well-being.

Sensitivity Analyses

Total self-distribution scores did not differ by sex ($F_{1,195}$=0.79, p=.37) or race ($F_{1,195}$=3.21, p=.08), and the total self-distribution score was uncorrelated with age (r=-.04, p=.55). Only one regional self-distribution score differed by sex: women ($\bar{x}$=15.31, SD= 13.44) reported a more widely distributed sense of self in the torso region than men ($\bar{x}$=10.68, SD= 16.34), $F_{1,195}$=4.77, p=.03. Regional self-distribution scores did not differ by race, and age was not correlated with any regional self-distribution score.

Discussion

This study suggests that there is value in extending the examination of the embodied sense of self beyond single point localization procedures. Exploring the spatial qualities of the embodied sense of self appears to allow for a more complete depiction of the self's location in the body. Specifically, results from this study indicate most people locate their sense of self in multiple body regions, most often in both the head and chest, which is consistent with the most common self locations reported in previous single point investigations (Alsmith & Longo, 2014; Anglin, 2014; Bertossa, Besa, Ferrari, & Ferri, 2008; Limanowski & Hecht, 2011; Starmans & Bloom, 2012). Furthermore, a more widely distributed sense of self was associated with greater well-being, consistent with theoretical links suggesting individual differences in self-representation are related to well-being (e.g., Dambrun & Ricard, 2011; Friedman, 1983; Gyamtso, 1994; Ryan & Deci, 2000; Hartelius et al., 2022; Ryff & Keyes, 1995).

Locating the embodied sense of self in the head and chest, has empirical (Alsmith & Longo, 2014; Anglin, 2014; Bertossa, Besa, Ferrari, & Ferri, 2008; Limanowski & Hecht, 2011; Starmans & Bloom, 2012) and historical precedent. For instance, Descartes proposed that the self was located within the pineal gland (Descartes, 1989); William James concluded that the self "is found to consist mainly of . . . peculiar motions in the head between the head and throat" (James, 2013); and Aristotle suggested that the self is located in the heart (Lennox, 2001). The consistency with which modern empirical examinations find the self to be located in the head and chest provides empirical support for William James' assertion that "certain parts of the body are more intimately ours than the rest" (James, 2013). Indeed, the arms and legs appear to represent a second-tier of self-relevant body regions, regions where the sense of self was infrequently found in this study. More holistically, it is interesting to consider that the sense of self was largely absent from the majority of the body. On average, participants only reported their sense of self to inhabit only 8% of entire body. Thus, despite the central role the sense of self often plays in the human experience (e.g.,

Table 2. Descriptive Statistics for the Embodied Self- and Regional-Distribution Scores along with Associations with Psychological Well-Being

Variable	Whole Body	Head	Torso	Arms	Legs		
Total Possible Pixels	469	75	139	68	187		
Average # of Pixels Reported (Standard Deviation)	38.13 (33.71)	19.66 (18.43)	13.67 (14.66)	2.08 (6.64)	2.72 (11.02)		
Average % of Pixels Reported	8.13%	26.21%	9.83%	3.05%	1.45%		
Psychological Well-Being	.24**	.08	.25***	.13	.17*	87.84 (15.60)	.83
Subjective Well-Being	.14*	-.05	.24**	.16*	.10	21.33 (7.72)	.91
*p < .05 **p < .01 ***p < .001							

Klein, 2012; Wayment & Bauer, 2008), it occupies very little space.

Considering both of the primary embodied self regions—the head and the chest—as epicenters of "life" may provide some insight into their privileged positions with respect to self-location. The pronouncement of death has historically depended on the cessation of heartbeats, and more recently, on the cessation of neural activity (Sarbey, 2016). Similarly, Alsmith and Longo (2014) suggest that the self-salience of the head and chest may be the result of both regions serving critically important functions in a healthy body. With respect to the head, and in particular the upper half of the head, the eyes, ears and brain serve to create cognitive maps of the internal milieu and external landscape that allow for goal-directed behavior (Austin, 2000; Christoff, Cosmelli, Legrand, & Thompson, 2011; Klatzky, 1998; Legrand & Ruby, 2009). With respect to the chest, Alsmith and Longo (2014) suggest that the torso is the body's physical center, the core around which the appendages are arranged. As such, the torso physically gathers and stabilizes the body. Interpreting the self as an evolutionary adaptation may provide an additional explanation for the predominance of these two locations. Lodging the self in bodily regions of great physiological value may have aided survival. Protecting the self involves protecting of critically vital body parts, and vice versa.

Correlational results suggest that individuals reporting a more widely distributed sense of self were also more likely to report greater well-being, although the strength of this relationship was quite small. The positive relationship between a more distributed sense of self and well-being appears to be principally driven by more psychologically well individuals being more likely to locate their sense of self in their torso, and to a lesser degree their legs and arms. Interestingly, locating the sense of self in the head, the most common region of self-location in this sample, was not associated with either form of well-being. Taken together, these results suggest that differences in how individuals locate their sense of self in the body may have implications for well-being. Curiously, these results are also consistent with recent evidence suggesting that individuals with an allocentric frame of reference (Austin, 2006), characterized by feeling as if the sense of self is distributed throughout the surrounding environment, also report greater well-being (Hanley & Garland, 2019). Thus, regardless of whether the sense of self is more widely distributed internally or externally, a more distributed sense of self appears to be psychologically advantageous.

Yet, given the novelty of these results, future studies are needed to replicate and extend them. For example, alternative methods of measuring the embodied self's location, such Schafer, Wentura, Pauly and Frings' (2019) self location task, could be used in conjunction with the Sensation Manikin to provide more accurate localization. Relatedly, connecting Sensation Manikin reports with physiological indices, such as EEG, or brain imagining techniques, such as fMRI, would help to further elucidate the nature of the embodied self (e.g., Hartelius, Likova & Tyler, 2022; Tyler, 2021). It would also be beneficial to further explore why locating a sense of self in the head is not associated with greater well-being. Could there be moderators such as anxiety or stress which contribute to experience of feeling disconnected from a sense of self below the neck? Furthermore, given the observed associations between well-being and the distribution of the self in the torso, future experimental studies are needed to examine whether therapeutic techniques can be developed to drop the sense of self out of the head and into the torso. Mindfulness meditation may be a promising behavioral approach, as mindfulness practices have been found to alter the practitioner's sense of self (Ataria, Dor-Ziderman, & Berkovich-Ohana, 2015; Dambrun, 2016; Dambrun et al., 2019; Dor-Ziderman, Ataria, Fulder, Goldstein, & Berkovich-Ohana, 2016; Dor-Ziderman, Berkovich-Ohana, Glicksohn, & Goldstein, 2013; Garland et al., 2019; Hanley, Nakamura, & Garland, 2018; Hudak, Hanley, Marchand, Nakamura, Yabko & Garland, 2021; Josipovic, 2014). Moreover, as brief mindfulness training was found to encourage more allocentric frames of reference (Hanley, Dambrun & Garland, 2019; Hanley, Deringer, Sneed, Bettmann, Gonzalez-Pons, 2021; Hanley, Dorjee & Garland, 2020), mindfulness training might also have the potential to encourage a more widely distributed embodied sense of self.

Despite the novelty of these descriptive and inferential results, limitations should also be addressed. First, results from this online sample recruited through Mechanical Turk may not be generalizable to other samples. While evidence suggests that Mechanical Turk respondents provide valid and useful data (Buhrmester, Kwang, & Gosling, 2011; Mason & Suri, 2012), future studies should explore whether the observed self-locations and correlations can be replicated in other samples. Second, the use of small boxes (i.e., self pixels) to capture self-locations arbitrarily fixed respondents' minimal level of resolution within the body and artificially bound body locations. While the size of each self pixel was chosen to maximize the degree of detail with which respondents were able to represent their embodied selves, the repeated clicking necessary to locate the self broadly in the body may have constrained participant responses. More technologically advanced methods of capturing participants' responses on a sensation manikin, potentially using a stylus or the mouse to draw salient body areas, should be pursued in future research. Finally, the four body regions examined in this study were designated by the researchers in a posthoc fashion, and were constrained by the grid that was prospectively overlaid on the Sensation Manikin. Participants may have interpreted the Sensation Manikin body regions idiosyncratically, and would disagree with the interpretations reported here. Future studies using the Sensation Manikin to map the embodied sense of self should also have respondents qualitatively report in which body regions they experience their embodied self to increase interpretative accuracy.

Conclusion

This study provides a more intricate description of the embodied sense of self than prior studies. Findings suggest that capturing more detailed beliefs about the embodied sense of self provides useful information about individual differences in psychological and subjective well-being. A more distributed sense of self, particularly when the embodied self is located in the chest and extremities, is associated with greater well-being. Continued research is needed to determine whether altering the embodied sense of self, perhaps through mindfulness training, results in greater well-being.-

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About the Authors

Adam Wesley Hanley, PhD, is a Licensed Psychologist and an Assistant Professor at the Center on Mindfulness and Integrative Health Intervention Development (C-MIIND) in the University of Utah's College of Social Work. The goal of his research program is to develop and refine both brief and intensive mindfulness-based interventions that can be embedded in medical settings to treat pain and addiction as well as improve quality of life.

Natalie Lecy, LCSW, is a Licensed Clinical Social Worker and Research Associate at the Center on Mindfulness and Integrative Health Intervention Development (C-MIIND) in the University of Utah's College of Social Work. Her research focuses on mindfulness-based interventions and increasing inclusivity in higher education for first-generation and marginalized students through student-centered approaches.

Robert Hanley holds a degree in Sociology from Southwestern University and is currently a Senior Consultant for CohnReznick's Emergency Management group in Austin, Texas. His research focuses on community resilience and well-being.

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