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On Being Warm-Hearted:

Daily Diary Investigations of Self-Location and Social Functioning

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Abstract

When people are asked to locate the self within the body, they most frequently point to the head or upper torso, which contains the heart. The head and the heart also figure prominently in conceptual metaphors for the self, with the head linked to cold rationality and the heart linked to warm emotionality. Three studies involving four daily diary samples (total $N = 540$) focused on inter-relations between perceived locations for the self and daily interpersonal conduct. On days on which individuals perceived the self to be located primarily in the heart, they felt and behaved in a more prosocial manner, and these relationships remained significant when controlling for daily stressor frequencies. Variations in self-location did not predict antisocial behaviors, though hostile feelings were less intense when self-locations favored the heart. The results provide new evidence for the relevance of conceptual metaphors to self-representation and social functioning.

Keywords: Conceptual Metaphor, Head, Heart, Prosocial, Daily Diary

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The self should be located somewhere in the body, but where? This question has been of interest since the ancient Greek era (Swan, 2009), but different theorists favored different locations. Perhaps most prominently, Aristotle favored the heart as the location of the self and Plato favored the head (Niemeier, 2011). These two perceived loci have been confirmed in modern experimental research. Limanowski and Hecht (2011) found that people believed the self to be located in a particular bodily region. However, that location varied across individuals, with some participants placing spatial markers on the head region of a silhouette self and others placing the same markers over the heart region. Alsmith and Longo (2014) asked blindfolded participants to position a pointer such that it pointed directly at them. Some participants adjusted the pointer such that it pointed at the head and others adjusted the pointer such that it pointed to the upper torso, where the heart is located. More recently, Alsmith, Ferrè, and Longo (2017) developed a subtle misalignment paradigm that required participants to indicate whether a ball was located to the left or right of a human figure whose head was tilted sideways. In this paradigm, the same ball was judged to be left approximately 50% of the time, implicating a torso frame of reference, and right approximately 50% of the time, implicating a head-related frame of reference. In short, people perceive the self to be located in two prominent body regions – namely, the head region and/or the heart region.

Since ancient Greece, too, the head and the heart have acquired metonymic and metaphoric significance (Swan, 2009). Both the head and the heart are conceptualized as locations for important psychological activities (Afreh, 2015) and as processing systems whose

modes of operating are different (Niemeier, 2011). Plato described the head as the seat of rationality and the heart as the seat of the passions (Luo & Yu, 2015) and similar mappings exist to this day (Swan, 2009). For example, a person might be admonished to "use your head" as a way of avoiding faulty decision-making processes in his/her life. By contrast, a person might be encouraged to "follow your heart", which should result in life choices that are both authentic and emotionally satisfying (Swan, 2009). As recognized by Plato, the head and the heart can often be in conflict, such as when feelings of romantic interest are involved, and there are likely to be strengths and weaknesses to each mode of interacting with the world (Luo & Yu, 2015). Favoring one mode to the other should therefore result in systematically different consequences, depending on which mode of operating is currently favored. In an investment game, for example, Powell, Puustinen-Hopper, de Jode, Mavros, and Roberts (2018) found that head-related feedback increased investments and heart-related feedback resulted in behaviors that were more altruistic (also see Parzuchowski & Wojciszke, 2014; Van Lange, Finkenauer, Popma, & van Vugt, 2011).

Conceptual metaphor theory (Lakoff & Johnson, 1980, 1999) can be used to understand processes of the type described. According to this theory, human beings need to use metaphors – which typically liken something abstract or intangible to something concrete and perceptible (Landau, Robinson, & Meier, 2014) – to make sense of their experiences. Thoughts, feelings, and mental operations are not visible or directly sensed and we often use mental metaphors to better understand such occurrences (Lakoff & Johnson, 1999). Ascribing distinct operations to the head and the heart reinforces the distinction between different modes of processing and locates them in particular bodily regions, which are physical entities that can be perceived (Niemeier, 2011; Swan, 2009). Such distinct modes of processing follow a dual-process logic

(Luo & Yu, 2015) that can be understood in various overlapping ways, such as the distinction between systemizing (asocial, analytic) versus empathizing (social, intuitive: Baron-Cohen, 2002), agency (achievement-focused, tasks) versus communion (social connection: Bakan, 1966), or rational versus experiential processing (Epstein, 2003). From these perspectives, what the head is purported to do is systematic, agentic, and rational and what the heart is purported to do is empathetic, communal, and experiential (Niemeier, 2008, 2011).

Inspired by these ideas, Fetterman and Robinson (2013) created a self-location measure that asked individuals whether they were primarily located in their heads versus their hearts. Across multiple datasets, 50-50 splits were commonly observed (i.e., 50% choosing the head/brain and 50% choosing the heart). Consistent with expectations, head-locators described themselves as more logical than heart-locators did and they favored a rational processing style; by contrast, heart-locators described themselves as more emotional than head-locators did and they favored an experiential (feeling-based) processing style. More recently, Fetterman et al. (2020) found that heart-locators, relative to head-locators, believed in God to a greater extent, which is consistent with frameworks positing that religious beliefs follow from intuitive rather than reflective modes of thinking (e.g., Van Leeuwen, 2014). In summary, extant research on variations in self-location (head versus heart) has largely focused on the question of individual differences and their links to the logical/emotional (Fetterman & Robinson, 2013) or intuitive/reflective (Fetterman et al., 2020) distinctions.

Present Studies

A recent body of research has shown that personality-related tendencies, which are typically conceptualized in trait-like terms, in fact exhibit a great deal of malleability across measurement occasions (e.g., Church et al., 2013). In fact, Fleeson (2001, 2004) concluded that

the average person exhibits nearly all levels of a given Big 5 dimension (e.g., extraversion) across daily reports and differs from him/herself across time as much as he/she differs from others in mean trait standing. The processing modes linked to self-location are likely to be even more malleable, whether due to recent experiences (Capraro, Everett, & Earp, 2019), situational factors (Rauthmann et al., 2014), or a need to alternate among different processing priorities (Inzlicht, Schmeichel, & Macrae, 2014). The motivations linked to each processing mode would also be expected to wax and wane across time, as is true of motivations in general (McClelland, 1987).

Along these lines, Gibbs (2019) has argued that the metaphors that we use are highly variable across time, such that people recruit metaphors (e.g., for the self) particularly when they seem suited to one's current experiences. Because one's current experiences – in addition to processing goals and orientations to the environment – will vary across time (Conner & Barrett, 2012), we might expect perceived locations for the self to migrate across occasions of measurement. Consistent with this point, Hanley, Lecy, and Hanley (2021) found that most people perceived some degree of self in both the head and heart regions of the body (also see Anglin, 2014). Further, there is evidence that self-locations can be primed (Fetterman & Robinson, 2013; Parzuchowski & Wojciszke, 2014) and doing so leads individuals to act in accordance with conceptual metaphors for the head versus the heart (e.g., by acting more altruistic when the heart location is primed: Powell et al., 2018). On the basis of such research, we hypothesized that perceived locations for the self would vary across days and that within-person changes in self-location would predict within-person changes in motivation, feeling, and behavior.

In addition to examining within person links between perceived locations for the self and daily motivation and behavior (which have yet to be examined), the present studies focused on the possibility that the heart-located self, relative to the head-located self, is more social and prosocial in its operations. At a broad level, the head-heart distinction seems to map, metaphorically, to the distinction between rationality and emotionality (Fetterman & Robinson, 2013; Luo & Yu, 2015). A more fine-grained analysis of metaphors for the heart, however, suggests that they are linked to prosocial states and inclinations. The prototypic emotion for the heart, for example, appears to be love, whether romantic or non-romantic (Niemeier, 2000). Beyond love, people use heart-related metaphors to conceptualize other prosocial, altruistic states like caring, compassion, empathy, and the like (Niemeier, 2000). Indeed, people place their hands over their hearts when they feel close connections with others (Farley, Akin, & Hedgecoth, 2021) and it is the abnormal heart – whether hard, cold, or small – that is prone to callousness or antisocial feelings (Niemeier, 1997). On the basis of this metaphoric analysis, we expected self-locations in the heart to be associated with prosocial sentiments and behaviors, consistent with prominent heart-related metaphors suggesting that it tends to be warm and big (i.e., prosocial) rather than cold and small (Afreh, 2015; Niemeier, 2008).

Stated another way, a close analysis of heart-related metaphors (Niemeier, 1997, 2000, 2008) suggests that they are linked to caring for others, perhaps as manifest in something like a communal orientation (Le, Impett, Kogan, Webster, & Cheng, 2012) or intimacy motivation (McAdams, 1980). On the basis of this theorizing, we hypothesized that participants would exhibit higher levels of prosocial behavior when perceiving the self to be located in the heart, relative to the head. Of additional importance, we hypothesized that such increases in prosocial behavior would be linked to motivations to help others (Study 1) and to prosocial feelings like

caring and friendliness (all studies). Studies 2 and 3 investigated the question of whether the heart-located self is prone to antisocial feelings (we viewed this unlikely) and Study 3 probed for temporal direction. Based on data supporting bidirectional links between metaphor-related variables and social cognition and behavior (He, Chen, & Li, 2018; Lee & Schwarz, 2012), bidirectional links between self-location and social functioning were expected.

Study 1

Method

Transparency and Openness

Datasets, code, and materials for this project can be found at OSF: https://osf.io/j8tuw/?view_only=7b01679208c143e99d480cc58f487d8b (Authors, 2022). Data were primarily analyzed using the PROC MIXED procedures of SAS. Designs and analyses were not pre-registered, but replication was sought.

Sample Size Planning

In all studies, we followed simulations as well as rules of thumb in planning sample size for multilevel studies. On the basis of their simulation results, Maas and Hox (2005) recommended at least 50 observations at the highest nested level and we sought sample sizes greater than 100. In addition, we sought at least 900 daily observations within each data set, following the recommendations of Scherbaum and Ferreter (2009). According to the simulation-related results of Scherbaum and Ferreter (2009) as well as Raudenbush and Liu (2000), all studies should be adequately powered to detect medium-sized within-subject relationships.

Participants and Procedures

Participants consisted of undergraduate students taking psychology classes at a Midwestern University in the United States. To complete a research involvement requirement or

to obtain extra credit, eligible students could enroll in a "Daily Diary Study" through the department's SONA-programmed participant registration website. Participants were told that we were interested in their daily perceptions and experiences and that they would receive 1 point of credit for each daily report that was completed. Participants who agreed to these terms completed a demographic survey and then began the daily diary portion of the protocol. For 14 days in a row, participants received an email, at 5 p.m., with subject number information and a link to a daily diary survey, which was programmed using SurveyMonkey software. Each daily survey remained open until 8 a.m. the next morning, following which it was unavailable.

For purposes of replication, the same study was run for two semesters in a row and these samples will be referred to as Studies 1a and 1b. Participants were included in the final datasets if they completed at least 9 of the 14 daily surveys, which was an a priori criterion given the focus on within-person slopes (West, Ryu, Kwok, & Cham, 2011). Fifteen individuals failed to meet this criterion in Study 1a and 10 failed to meet it in Study 1b, resulting in final sample sizes of 136 (68.38% female; 88.97% White; *M* age = 19.03) and 137 (48.91% female; 89.05% White; *M* age = 19.36). The latter individuals completed an average of 12.71 (*SD* = 1.33) and 12.38 (*SD* = 1.50) surveys, resulting in a dataset consisting of 1729 reports in Study 1a and 1696 reports in Study 1b.

Daily Diary Measures

Participants were asked to report on feelings, motivation, behaviors, and personality states designed to assess prosocial functioning within a daily context. In addition, participants were asked to indicate whether they perceived the self to be located in the head or the heart on a particular day. The self-location measure was placed toward the end of the survey, but is described first because it was the predictive variable of interest.

The language of the self-location predictor was similar to previous studies (Fetterman & Robinson, 2013), except that a more continuous measurement approach was adopted. Participants were asked "Which body part did you more closely associate with your self today?" and responses were made along a four-point scale (1 = head; 4 = heart) that was reverse-scored for analysis purposes, such that higher numbers reflected increased heart-location. When forcing individuals to choose a bodily location, approximately 50% choose each (Fetterman & Robinson, 2013). Consistent with this prior research, the self-location that was chosen for the average day was approximately in the middle of the scale (*M*s = 2.42 and 2.39 in Studies 1a and 1b, respectively). The self's location was deemed to vary substantially across days, however (*SD*s = 1.07 and 1.08).

Prosocial motivation was assessed with a face valid item. In response to the statement "Today, I was motivated to HELP somebody", participants indicated their level of agreement (1 = not at all; 4 = very much). The average day was associated with moderate levels of prosocial motivation (Study 1a: $M = 2.52$; $SD = 0.93$; Study 1b: $M = 2.33$; $SD = 0.91$). Prosocial feeling was assessed with a daily prosocial affect scale (Meier, Robinson, & Wilkowski, 2006). Participants reported on the extent to which (1 = not at all; 4 = very much) two statements described their day (e.g., "Today, I felt caring") and a prosocial feeling score was computed by averaging across items (Study 1a: $M = 2.73$; $SD = 0.84$; Study 1b: $M = 2.58$; $SD = 0.82$).

Later in the survey, participants completed a prosocial behavior measure (Fetterman, Meier, & Robinson, 2017) that asked them how often (1 = never; 4 = very often), on a given day, they had helped someone, did a favor for someone, and expressed gratitude to someone. The prosocial behavior score was computed by averaging across items (Study 1a: $M = 1.49$; $SD = 0.74$; Study 1b: $M = 1.37$; $SD = 0.73$). In addition, participants completed a prosocial personality

scale, which could capture a wider variety of experiences and behaviors (Wiggins, Trapnell, & Phillips, 1988), that asked them how accurate it was (1 = very inaccurate; 4 = very accurate) to characterize their personalities as warm and caring (two items that were averaged) on particular days (Study 1a: $M = 3.54$; $SD = 0.88$; Study 1b: $M = 3.44$; $SD = 0.86$).

Whether one locates in the head or the heart on a given day could reasonably vary as a function of daily events such as stressors. To quantify this feature of days, we asked participants to complete a daily stress scale (Compton et al., 2008) modeled on the Inventory of College Students Recent Life Experiences (Kohn, Lafreniere, & Gurevich, 1990). Participants indicated whether (1 = not at all true today; 5 = very much true today) particular days were ones associated with deadlines, responsibilities, time pressures, and too many tasks to complete. The relevant 4 items were averaged to quantify daily stressor levels (Study 1a: $M = 2.16$; $SD = 0.90$; Study 1b: $M = 1.84$; $SD = 0.75$).

Results

How Malleable Are Self-Locations?

Intraclass correlation coefficients (ICCs) were computed for each daily diary measure to quantify percentages of variance that could be ascribed to persons versus days (West et al., 2011). For the critical self-location variable, these ICC estimates were .32 (Study 1a) and .28 (Study 1b). Hence, although individual differences in self-location were apparent, approximately 70% of the variance in self-locations varied within persons, which is an appreciable degree of malleability.

For comparison purposes, we also computed ICCs for the other daily diary measures. These ICCs tended to be larger for the prosocial motivation (Study 1a: .41; Study 1b: .32), feeling (Study 1a: .41; Study 1b: .38), behavior (Study 1a: .47; Study 1b: .43), and personality

(Study 1a: .39; Study 1b: .39) measures. The malleability of self-locations was comparable to that for stressful daily conditions (Study 1a: .31; Study 1b: .31), which are presumed to be malleable (Compton et al., 2008).

Do Changes in Self-Location Predict Changes in Prosociality?

A central interest was in whether changes in self-location, across days, predict changes in prosocial functioning. Given the multilevel structure of the data, we used the PROC MIXED procedures of SAS (Singer, 1998) to conduct these analyses, with self-location as a predictor of each outcome in each study. The predictor was person z-scored, which will remove between-person sources of variance (Enders & Tofighi, 2007), and intercepts were allowed to vary between-persons, in accordance with the ICC results. In one analysis, the prosocial outcome variables retained their original units. In another, outcome variables were z-scored, which produces a standardized slope that can be considered a measure of effect size (Lorah, 2018).

Table 1 reports results from these analyses. On days that participants perceived themselves to be more heart-located, they experienced higher levels of prosocial motivation and feeling, and these results replicated across studies. Increases in heart-location also predicted increases in prosocial behavior as well as personality states of a prosocial nature. Overall, these results provide considerable support for the idea that self-locations that favor the heart are dynamically linked to higher levels of prosocial feeling, motivation, and behavior.

Additional Analyses

With respect to day-varying processes, it was found that higher levels of daily stress were predictive of locating the self in the head to a greater extent than the heart, b = -.139 [-.190, -.087], t = -5.27, p < .001, standardized b = -.130 in Study 1a, and b = -.099 [-.155, -.043], t = -3.49, p < .001, standardized b = -.091 in Study 1b. When controlling for stress levels, however,

all links between day-varying tendencies toward heart location and the prosocial outcomes remained significant, *t*s > 2.40, *p*s < .020. Stressful circumstances therefore occasion greater head location, but heart locations are nonetheless predictive of prosocial functioning.

Discussion and Study 2

The perceived location of the self appears to migrate, sometimes favoring the head as a home base and sometimes favoring the heart. These migrations are associated with systematically different manners of relating with others, such that higher levels of heart location are linked to higher levels of prosocial motivation, feeling, behavior, and personality. Nonetheless, the self-location measure of Study 1 was not as direct as it could be and we therefore created a new self-location measure that required participants to indicate percentages of the self that seemed to be located in the head versus the heart on a given day. This measure is less ambiguous in what it is asking about.

In addition, another purpose of Study 2 was to focus on antisocial as well as prosocial feelings, behaviors, and personality states, which can address several questions not examined in Study 1. If people are more "emotional" on heart-locating days, they should experience both prosocial and antisocial feelings, perhaps to a similar extent. If, on the other hand, the mode of interacting with others that is heart-located is empathetic and caring in particular terms (Afreh, 2015; Niemeier, 2000), then locating the self in the heart should not be positively linked to antisocial feelings, behaviors, or personality states. By including both prosocial and antisocial measures in the same protocol, we could differentiate these two possibilities.

Method

Participants and Procedures

Undergraduate students seeking course credit for their psychology classes were eligible to sign up for a "Daily Diary Study" using SONA software. After completing a demographic questionnaire and providing informed consent, potential participants received daily emails for 14 days in a row. Such emails included subject number information as well as a link to a Qualtrics-programmed daily survey. Emails were sent at 6 p.m. and participants were given until 2 a.m. (an 8-hour window) to complete each survey or it was considered missing.

Despite the fact that the study was run for an entire semester, data collection was slower than usual, and we retained participants who completed at least 8 of the 14 daily reports in order to meet sample size goals. Thirty-six individuals failed to meet this requirement and the final sample consisted of 124 (70.16% female; 83.87% White; *M* age = 20.65) participants who completed an average of 12.20 daily reports (*SD* = 2.60). The number of daily observations in this dataset was 1513.

Daily Diary Measures

The order of the measures (feeling before behavior before personality states) was similar to Study 1, except that the self-location measure was presented near the beginning of the survey, after entering subject number information. The self-location measure was also improved and it consisted of a slider rather than a Likert scale. Instructions stated that most of the time, we sense ourselves as being located primarily in the head or the heart. Participants were then asked to indicate which bodily region seemed to contain more of themselves on a given day, with options ranging from -100 (you were 100% in your head today) to +100 (you were 100% in your heart today). Participants needed to move the slider to an appropriate position and then click a button to record their answer. The slider position for the average day was almost perfectly centered (*M* = -3.30), but the standard deviation was substantial (*SD* = 54.50).

Daily motivations were not assessed. Instead, the daily protocol was expanded to include antisocial as well as prosocial feelings and behaviors. The prosocial feeling measure was similar to Study 1, except that statements were not used. Rather, individuals indicated the extent to which (1 = not at all; 5 = extremely) they felt "caring" and "friendly" on a given day (Meier et al., 2006) and these markers were averaged to quantify prosocial feeling (M = 3.47; SD = 0.96). Participants also indicated the extent to which they felt "angry" and "irritated" on a given day (Robinson, Boyd, & Persich, 2016) and ratings concerning these markers were averaged to quantify antisocial feeling (M = 1.67; SD = 0.76).

Relative to Study 1, the prosocial behavior scale (as well as an antisocial behavior scale) was more precise, in that it required participants to specify the number of times that they performed the indicated behaviors (1 = not a single time; 4 = more than 5 times). Prosocial behaviors consisted of "helped someone", "expressed affection to someone", and "did a favor for someone" (Robinson, Bair, Liu, Scott, & Penzel, 2017) and antisocial behaviors consisted of "criticized someone", "argued with someone", and "threatened someone" (Boyd & Robinson, 2015). Day-specific averages were computed to index these prosocial (M = 2.25; SD = 0.72) and antisocial (M = 1.24; SD = 0.38) behavioral outcomes.

We also sought to assess prosocial and antisocial behavioral tendencies using a checklist approach, which might be regarded as somewhat objective as well as inclusive (Irvin, Persich, & Robinson, 2021). Participants were asked to check each behavior that they engaged in and there were 15 items each for the prosocial (e.g., "helped someone in class", "comforted someone who was sad") and antisocial (e.g., "cursed at someone", "started an argument") behavioral checklists. Checklist-based scores for prosocial (M = 4.38; SD = 2.81) and antisocial (M = 0.76; SD = 1.13) behavior were computed by summing the number of boxes that were checked.

With respect to outcome measures, finally, we included global perceptions of personality, based on the interpersonal circumplex (Wiggins et al., 1988). Participants were asked to agree or disagree (1 = strongly disagree; 5 = strongly agree) with the statement "Today, I was friendly", capturing a prosocial personality state (M = 3.75; SD = 1.01). They also agreed or disagreed with the statement "Today, I was hostile", capturing an antisocial personality state (M = 1.44; SD = 0.79).

As in Study 1, it seemed plausible that daily stressors would shift self-locations toward the head. The stressor items (e.g., "had a deadline to worry about today") were identical to Study 1 (Compton et al., 2008), but participants were asked to indicate how frequently (1 = not a single time; 4 = more than 2 times) a particular stressor occurred. The daily stressor scale averaged across the relevant 4 items (M = 1.88; SD = 0.80).

Results

How Malleable Are Self-Locations?

Intraclass correlation coefficients (ICCs) were computed to quantify the percentage of variance for each measure that could be attributed to persons relative to days (West et al., 2011). The ICC estimate for the self-location variable was .20, indicating that there was considerable within-person malleability in the perceived location of the self across days. Prosocial tendencies were more stable across days (ICCs = .48, .54. 60, and .42 for the feeling, behavior, checklist, and personality measures, respectively) than antisocial tendencies were (ICCs = .27, .36, .50, and .44), but all such estimates were greater than .20. The daily stress measure yielded an ICC estimate of .50.

Did Changes in Self-Location Predict Changes in Prosociality?

Multilevel modeling procedures were used to examine whether within-person changes in self-location predicted within-person changes in prosociality, with analyses conducted in a manner parallel to Study 1. As indicated in Table 2, increasing levels of heart-location were again predictive of the prosocial outcomes. This relationship was apparent with respect to prosocial feelings, the prosocial personality measure, and both prosocial behavior measures, including one that adopted a checklist format. Further, on days on which participants were heart-located to a greater extent, they reported lower levels of antisocial feelings and lower levels of antisocial personality. The heart-location predictor was not linked to lower levels of antisocial behavior, but was not linked to higher levels either.

Additional Analyses

When participants had stressors to worry about on particular days, they self-located in the head to a greater extent than the heart, b = -3.814 [-6.636, -1.192], t = -2.85, p = .004, standardized b = -.070. Nonetheless, all significant relationships displayed in Table 2 remained significant when controlling for daily stress levels, $|t\text{s}| > 2.70$, $p\text{s} < .010$. The prosocial signature of heart-locations cannot therefore be ascribed to having less busy and demanding lives on particular days.

To further pursue questions of this type, we note that in Study 2 (but not Study 1) we recorded whether particular days were weekdays or weekend days, given that weekdays are likely to be busier with task-related demands (Watson, 2000). In further analyses, we reran all of the Table 2 models after excluding weekend days and confirmed that all of the significant relationships reported in Table 2 remained significant when only weekdays were included in the analyses, $|t\text{s}| > 2.00$, $p\text{s} < .050$. Thus, lifestyle differences due to weekend effects were not sufficient in accounting for the relationships that were observed.

Discussion

In Study 2, we contrasted two perspectives of self-location. Individuals who find themselves to be more heart-located on a given day may simply be more "emotional", which would be linked to the increased experience of both prosocial and antisocial feelings. Alternatively, self-locations favoring the heart may be associated with an ethic of caring that would predispose individuals to prosocial feelings and behaviors, but not antisocial feelings and behaviors. The results of Study 2 support the second possibility in that heart locations were associated with increased prosocial feelings *and* decreased antisocial feelings. Although relations between heart locations and antisocial behaviors were not significant, there was no indication that self-locations favoring the heart supported antisocial tendencies of any type. These findings provide important evidence in favor of the prosocial nature of the mode of experiencing and acting in the world that is heart-located.

Study 3

Thus far, the unit of sampling has been the day, but there are also advantages to sampling feelings and behaviors, as well as personality states, more frequently (Shiffman, Stone, & Hufford, 2008). Study 3 instituted a design of this type by sampling outcomes twice a day (morning and afternoon) rather than once a day. This sampling frequency also allowed us to examine whether modes of being in the morning were predictive of modes of being in the afternoon. For example, we might expect self-locations in the morning to display some continuity with self-locations in the afternoon, which would be suggestive of an orientation (either more head-located or more heart-located) that has some degree of temporal stability to it. In addition to focusing on both prosocial and antisocial feelings and behaviors, which would permit replication, we also asked individuals how extraverted and agreeable they were during

particular time periods. Both extraversion and agreeableness relate to interpersonal warmth (DeYoung, Weisberg, Quilty, & Peterson, 2013) as well as empathy (Haas et al., 2015) and we therefore expected increases in heart location to be linked to both extraverted and agreeable personality states.

Method

Participants and Procedures

As in Studies 1 and 2, undergraduate students seeking course credit for their psychology classes were eligible to sign up for a "Daily Diary Study" using SONA software. The procedures of the study were different, however. Participants were given up to 19 days to complete 8 paired daily reports, with one completed in the early afternoon and one completed in the late afternoon/evening. Compliance with the protocol was closely monitored, such that participants completing 8 paired reports were graduated from the protocol, whereas others who had not met this criterion were given additional days to complete it. Morning emails were sent at 12 p.m. and targeted the entire morning time frame. Participants had 2 hours to complete this report or it was considered missing. Similarly, evening emails were sent at 6 p.m. and they targeted the 2 p.m. to 6 p.m. time frame. Participants were also given 2 hours to complete this report or it was considered missing. Both surveys were programmed with Qualtrics software.

To meet sample size goals (more than 100 individuals: Ohly, Sonnentag, Niessen, & Zapf, 2010), we ultimately needed to relax criteria for inclusion to some extent. Of the 143 individuals who completed at least 1 daily survey, 130 (63.08% female; 88.46% White; *M* age = 18.65) completed at least 7 unpaired reports, which was considered acceptable. With respect to this unpaired dataset, the average included participant completed 16.68 reports, resulting in 2169 rows of data. We also prepared a second "paired" dataset consisting of 117 participants who

completed at least 5 paired reports (morning and evening for the same day). The average participant within this second dataset completed 7.55 paired reports, resulting in 883 rows. According to Figure 1 of Scherbaum and Ferreter (2009), both datasets were adequately powered (.80) to examine within-subject slopes in the context of medium effect sizes.

Daily Diary Measures

As in Study 2, the self-location measure was presented toward the beginning of the survey, after entering subject number information. Instructions for the measure were identical to Study 2, except that the relevant time frame was either "this morning" in the case of early afternoon reports or "this afternoon" in the case of early evening reports. Participants moved the self-location slider to the appropriate position – from "100% of my self was in my head" to "100% of my self was in my heart" – and then clicked a button to record the answer. The average report, in the unpaired dataset, had a mean of -4.07 (ever so slightly head-located), but the standard deviation was substantial (SD = 61.39), as was the case in Study 2.

The self-location measure was nested within a number of other metaphor-related measures relevant to other projects. After completing this section of the survey, participants reported on the experience of prosocial (M = 3.30; SD = 1.02) and antisocial (M = 1.58; SD = 0.82) feelings using measures identical to Study 2, except that participants were reporting on their feelings within a given time frame (either waking to 12 p.m. or 2 p.m. to 6 p.m.). Prosocial (M = 1.85; SD = 0.67) and antisocial (M = 1.34; SD = 0.52) behavior measures were also very similar to Study 2, but consisted of 2 rather than 3 behaviors each (e.g., "helped someone" for prosocial behavior and "argued with someone" for antisocial behavior), given that these surveys needed to be brief because of the twice-daily reporting requirements.

We obtained three personality state ratings in Study 3. Participants were asked whether their personality could be described as hostile (1 rating) versus very friendly (5 rating) within a given time period (M = 3.73; SD = 0.97). We will refer to this measure as a prosocial personality measure given that it was scored in the prosocial direction. Participants were also asked to indicate their level of agreement (1 = strongly disagree; 5 = strongly disagree) with statements tapping the social dimensions of extraversion ("I was extraverted": M = 3.03; SD = 1.24) and agreeableness ("I was agreeable": M = 3.56; SD = 0.97) within a particular time period.

To keep the Study 3 survey short, we administered a single stressor item. Participants were asked to indicate how many times (1 = not a single time; 4 = more than two times), during a given time period, that they "had too many things to do at once" (M = 1.86; SD = 1.00). We consider this item to assess a core component of daily stress (Compton et al., 2008).

Results

How Malleable Are Self-Locations?

Intraclass correlation coefficients (ICCs) were computed to partition variance components for each of the daily measures (West et al., 2011). The ICC estimate for self-location indicated a high degree of variability across days (ICC = .18). This degree of malleability appeared to be more pronounced than with respect to the other measures (prosocial feelings = .46; antisocial feelings = .30; prosocial behavior = .30; antisocial behavior = .36; prosocial personality = .25; extraversion = .24; agreeableness = .30; stress = .32). Hence, self-location varies considerably within individuals and across time.

Did Changes in Self-Location Predict Changes in Prosociality?

We used the unpaired dataset and multilevel modeling procedures to examine whether changes in self-location predicted changes in prosocial and social functioning. As displayed in

Table 3, the results replicate and extend the prior studies. During time windows in which individuals were more heart-located, they experienced stronger prosocial feelings and weaker antisocial feelings. They also engaged in prosocial behaviors to a greater extent. Finally, they described their personalities as prosocial, extraverted, and agreeable. As in Study 2, the self-location measure did not predict the frequency with which antisocial behaviors were enacted.

Additional Analyses Involving the Unpaired Dataset

As in prior studies, when participants had stressors to worry about, they tended to self-locate in the head to a greater extent than the heart, b = -3.280 [-6.117, -0.443], t = -2.27, p = .024, standardized b = -.053. When controlling for stressors, however, all of the significant heart/outcome relationships reported in Table 3 remained significant, $|ts| > 6.00$, $ps < .001$. Accordingly, the occurrence of stressors cannot account for the phenomena of primary interest.

As in Study 2, we then deleted weekend reports and reran within-person analyses. All of the Table 3 results that were significant remained significant when deleting reports that occurred during a weekend, $|ts| > 3.50$, $ps < .001$. Thus, within-subject relations between self-location and the social and prosocial outcomes cannot be attributed to lifestyle differences pertaining to weekdays versus weekends (Watson, 2000).

Analyses Involving the Paired Dataset

In the unpaired dataset, time of day (a.m. = -1; p.m. = +1) did not influence the nature of self-locations, b = 1.283 [-1.078, 3.643], t = 1.07, p = .287, standardized b = .021. In the paired dataset, nonetheless, it was found that self-locations tended to be consistent within a day, such that self-locations in the morning predicted self-locations in the evening, b = 10.055 [5.669, 14.440], t = 4.50, $p < .001$, standardized b = .160. That is, entire days had characteristic self-locations.

We then used the paired dataset to explore directions of temporal relation. In one set of analyses, the morning self-location variable was entered as a predictor of an afternoon outcome variable (e.g., afternoon prosocial feelings), controlling for the morning version of the same outcome variable (e.g., morning prosocial feelings). In these multilevel models, morning self-location was a significant predictor of afternoon tendencies toward agreeableness, $b = .060$ [.004, .117], $t = 2.08$, $p = .037$, standardized $b = .064$, but not the other outcome variables, $|t\text{s}| < 2.00$, $p\text{s} > .100$.

In a second set of analyses, a morning outcome (e.g., morning prosocial feelings) was treated as a predictor of afternoon self-location, controlling for morning self-location. Prosocial behaviors in the morning, $b = 4.737$ [.835, 8.638], $t = 2.38$, $p = .017$, standardized $b = .076$, prosocial personality states in the morning, $b = 4.496$ [.536, 8.456], $t = 2.23$, $p = .026$, standardized $b = .072$, and extraversion in the morning, $b = 6.022$ [1.936, 10.109], $t = 2.89$, $p = .004$, standardized $b = .096$, predicted self-locations favoring the heart in the afternoon, but the other four models did not result in significant findings, $|t\text{s}| < 2.00$, $p\text{s} > .050$. Overall, the results suggest some degree of bidirectionality, but they also suggest that the most robust relationships link self-locations to concurrent rather than future variations in social and prosocial functioning.

Discussion

The design of Study 3 had some advantages in reducing retrospective bias and in examining cross-temporal relationships. Self-location did not vary by time of day, but individuals displayed consistent self-locations across time, such that days that were heart-located (versus head-located) in the morning also tended to be heart-located in the afternoon. When controlling for morning reports, though, relatively few lagged effects were evident and the effects that were evident suggested some degree of bidirectionality, with morning self-location

predicting one afternoon outcome and three morning variables predicting changes in self-location across time. Self-locations may therefore both predict and follow from prosocial orientations to the interpersonal environment.

General Discussion

In their influential book titled *Metaphors We Live By*, Lakoff and Johnson (1980) made the case that metaphors represent far more than linguistic phrases that are sometimes uttered. Rather, metaphors pervade the conceptual system that is responsible for understanding, in effect constituting the language of the mind (Lakoff, 1993). To understand oneself, one's emotions, and one's relationships, the theory contends, people frequently (and perhaps must) use mental metaphors to represent the less tangible aspects of their existence, such as their feelings (Crawford, 2009; Gibbs, 1994). A number of studies have used experimental approaches to examine predictions derived from this theory, but manipulations are foisted on individuals in ways that may or may not capture the manner in which metaphor is used in daily life (Gibbs, 2019) and replication concerns have occurred when using such methods (Lakens, 2014).

The present studies, instead, are among the few that have embedded metaphor-related measures into daily diary surveys and the results of these efforts provide hitherto unavailable evidence for the idea that metaphor-related mappings matter. At least with respect to locations for the self, which are rich with metaphor-related connotations (Afreh, 2015; Niemeier, 2011; Swan, 2009), where the self is perceived to be has extensive implications for how one will feel, behave, and view their personality states within daily life. Daily diary protocols can be recommended both because they are thought to capture the experiencing self (Conner & Barrett, 2012) in its natural habitat (Shiffman et al., 2008) and because they possess high levels of power in examining within-person relationships (Ohly et al., 2010) and personality processes (Heller,

Komar, & Lee, 2007). Such designs were also informative, in the present context, concerning the malleability of self-locations and the results are consistent with recent theorizing concerning the contextual and dynamic manners in which metaphors are used (Gibbs, 2019).

The results also point to a significant source of dualism in people's lives. When the self is perceived to be located in the heart to a greater extent, people adopt a prosocial mode of relating with others, caring about their well-being and helping them to the extent possible. This mode of being is experiential (Epstein, 2003) and communal (Bakan, 1966) and it displays continuity over long stretches of the day, as inferred from the fact that self-locations in the morning predicted self-locations in the afternoon (Study 3). When the self is perceived to be located in the head to a greater extent, one is likely to be more concerned with tasks to be accomplished, which we infer from the fact that there was a significant negative correlation between task-related stressors and self-locations across all datasets. Although it is likely that these modes of processing – one more social and one more task-oriented (Jack et al., 2013) – respond to the responsibilities of the day, there was some evidence, in Study 3, for the idea that locating the self in the heart during a morning can predict changes in agreeableness later in the day.

There was also evidence for the reversed direction of influence, however, such that prosocial behavior in the morning predicted changes in self-location later in the day. Thus, self-locations appear to both predict and respond to ways of relating with others that are prosocial, suggestive of bidirectional relationships. With respect to this point, although initial thinking concerning conceptual metaphor favored asymmetric influences (from embodied metaphor to social psychological states: Landau, Meier, & Keefer, 2010), more recent thinking emphasizes bidirectionality (Gibbs, 2019). As a case in point, He, Chen, Zhang, and Li (2015) found that power-related words (e.g., president, general) were inferred to be larger and larger words were

inferred to represent more powerful entities. Similarly, it is likely that self-locations both follow from and reinforce certain ways of relating to the world, though experimental work (e.g., along the lines of Parzuchowski & Wojciszke, 2014) would be valuable in speaking to directionality in a more convincing manner. For now, we suggest that self-locations can be linked to somewhat stable modes of relating that matter with respect to motivations, feelings, and behaviors that are more (heart location) versus less (head location) other-oriented and interpersonal.

Additional Analysis, Questions, and Future Directions

In their studies of head-heart metaphor, Fetterman and Robinson (2013) generally pursued the idea that the head is rational and the heart is emotional. However, the corpus-based analysis of Niemeier (2008) links the heart to positive emotions, particularly of a prosocial type, rather than to negative emotions. It is likely that there are two metaphor-related mappings here. In one, the head is the salient location. Because the head is rational, the heart needs to be emotional or intuitive to satisfy dual-process logic (Niemeier, 2008). The other mapping, however, starts with the heart. Because the heart is the source of authentic feelings (Niemeier, 2000), and because those feelings are generally perceived to be positive and prosocial (Hicks, Schlegel, & Newman, 2019), the head, by contrast, must be somewhat asocial (Baron-Cohen, 2002). These mappings may co-exist with each other, even if they are not entirely coherent (Niemeier, 2008), as metaphors often work in this manner. For example, higher levels of verticality are linked to both dominance and positive affect (Cian, 2017), despite the fact that dominance is not a primary source of positive affect (Locke, 2015). Even so, the current findings suggest that heart/prosocial mappings may be stronger than heart/emotional mappings, at least within the context of a daily diary protocol.

Previous research has also indicated that heart-locating persons are more agreeable than head-locating persons are (Fetterman & Robinson, 2013). Because agreeableness is a positive predictor of functioning within close relationships, including romantic ones (Jensen-Campbell, Knack, & Gomez, 2010), it seems likely that the average person would benefit from dating or being married to a heart-located person rather than a head-located person. Even so, the present data indicate that perceived locations for the self vary considerably across time. Such variations are linked to prosocial functioning, but they may also be linked to functioning in close relationships. The processes that support intimacy, for example, could be more effective when partners locate themselves in the heart relative to the head. Daily diary designs focused on such processes (e.g., Laurenceau, Barrett, & Rovine, 2005) might therefore benefit from a consideration of daily perceptions of self-location.

The present data clearly establish the point that self-locations are variable across days, but this degree of variability is likely to be more pronounced among some individuals than others (Fleeson, 2001). If the capacities and motivations linked to the head and the heart are both functional, as should be the case (Epstein, 2003), individuals who display greater variability across time in their self-locations may be advantaged. Relatedly, it has been shown that the flexibility of the self is valued in some cultures to a greater extent than others (Kashima et al., 2004) and self-location variability might be expected to be greater in countries like Japan than in the United States. Irrespective of cultural differences, some theoretical perspectives contend that context-appropriate variability may be a key to successful psychological adaptation and health (Kashdan & Rottenberg, 2010). Such considerations encourage a focus on individual differences in self-location variability, particularly of a context-appropriate type, in future research.

We have treated self-location as a predictor of social functioning, but self-locations also appear to change in response to the events and experiences of the day. On this point, all studies showed that having too many things to do at once, as well as other task-related stressors, appears to shift self-locations in a head-favoring direction, presumably because it is the head and not the heart that is perceived to be useful in solving cognitive problems (Alter, Oppenheimer, Epley, & Eyre, 2007). By contrast, Study 3 found that prosocial behaviors and personality states in the morning shifted self-locations in a heart-favoring direction in the afternoon. Further studies of this type, particularly when paired with the experimental method, could provide further insights concerning the factors that govern perceived movements of the self throughout its body. Pursuing leads of this type, we recently found that asking participants to think about relationship-oriented activities (e.g., cuddling with a partner, calling a friend), relative to neutral activities, shifted the perceived location of the self in a downward direction, toward the heart. Further studies of this type would be valuable.

We think that metaphor-related processes underlie the present results, but it may be useful to consider where these metaphors come from. The heart is a salient bodily organ and Aristotle thought that it was the center of the self or soul (Anglin, 2014). Further, there are sources of data suggesting that the heart beats faster when one is reunited with a romantic partner (Wascher, 2021), perhaps giving rise to metaphors linking the heart to love (Niemeier, 2000). More generally, Yu and Hao (in press) provided some evidence for the point that heart rate increases can occur in the context of contemplating prosocial actions, though findings of this type were particularly apparent among individuals who experienced some degree of stress during the tasks. But relationships between heart rate and prosocial behavior are complicated and Eisenberg (2000) has contended that prosocial behavior is often associated with moderate, rather

than low or high, levels of physiological arousal. It may also be germane to note that not everyone has interoceptive access to heart beat information (Herbert & Pollatos, 2012) and subjective experiences of arousal appear to function differently as a function of such skills (Dunn et al., 2010). Nonetheless, sympathetic and parasympathetic influences on heart rate clearly play some role in prosocial feelings and behaviors (Di Bello et al., 2020; Terasawa, Moriguchi, Tochizawa, & Umeda, 2014) and linking these models to findings of the present type may have merit.

As mentioned in the introduction, people primarily locate the self in the head and/or the heart (Alsmith & Longo, 2014; Limanowski & Hecht, 2011), providing a basis for the present self-location questions. However, individuals do occasionally perceive some components of self to be located in other bodily regions, such as one's fists (Schubert & Koole, 2009) or genitals (Fetterman, Kruger, & Robinson, 2015). Because this is the case, it would be interesting and valuable to create unipolar sliders (of the Study 2 type) that ask individuals how much self they perceive to be located in various bodily parts and regions, beyond those examined in the present studies. We deem it likely that self-locations of this type would vary across days and display meaningful relationships with motivations, experiences, and behaviors linked to the relevant body part. For example, Schubert and Koole (2009) found that clenching one's fists led men to perceive themselves to be more capable as well as assertive and similar findings might occur in a daily diary protocol. Findings of this type would extend our understanding of embodied components of motivation (Price & Harmon-Jones, 2015) as well as the folk theories that link perceptions of the self to variations in social conduct.

As a final point, head-heart metaphors are similar in a number of cultures (Afreh, 2015), but different in others (Niemeier, 2011). In Thai society, metaphors related to the heart abound

and the heart is perceived to be a gentle, caring entity (Berendt & Tanita, 2011). Findings of the present type might therefore be particularly strong among Thai participants. In China, as well as Korea and Japan, the heart appears to be the perceived center of the self and it is believed to be involved in both intellectual and feeling-oriented activities (Yu, 2003). Whether the present findings would be replicated in such heart-centered cultures is not known, but cross-cultural research of this type would be particularly valuable in exploring questions related to generalizability as well as the nature and nurture of embodied metaphor (Gilead, Gal, Polak, & Cholow, 2015).

Conclusions

When asked where the self is located, people tend to point to either the head region or the upper torso, presumably because these regions house the brain and heart organs (Alsmith & Longo, 2014; Limanowski & Hecht, 2011). These regions also figure prominently in conceptual metaphor, which links cold rationality to the head and warm emotionality to the heart (Fetterman & Robinson, 2013; Niemeier, 2011). In the present research, we have linked these lines of scholarship by showing that perceived self-locations vary in a day-to-day manner, which in turn predict metaphor-consistent experiences and behaviors. The findings provide novel insights into the mechanisms that link bodily representations to the self and its tendencies.

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Table 1

Self-Location as a Within-Subject Predictor of Daily Outcomes, Study 1

Measure and Study	*b* [95% CI]	*t*	*p*	standardized *b*
Prosocial Motivation				
Study 1a	.088 [.044, .133]	3.88	<.001	.095
Study 1b	.062 [.012, .112]	2.44	.015	.068
Prosocial Feeling				
Study 1a	.115 [.071, .160]	5.13	<.001	.138
Study 1b	.072 [.032, .113]	3.52	<.001	.089
Prosocial Behavior				
Study 1a	.067 [.034, .101]	3.95	<.001	.091
Study 1b	.056 [.022, .091]	3.24	.001	.078
Prosocial Personality				
Study 1a	.123 [.075, .172]	5.01	<.001	.141
Study 1b	.107 [.064, .149]	4.92	<.001	.124

Table 2

Self-Location as a Within-Subject Predictor of Daily Outcomes, Study 2

Measure Type and Outcome	*b* [95% CI]	*t*	*p*	standardized *b*
Feelings				
Prosocial	.143 [.100, .186]	6.50	<.001	.149
Antisocial	-.102 [-.147, -.056]	-4.40	<.001	-.133
Behavior				
Prosocial	.067 [.038, .095]	4.60	<.001	.093
Antisocial	-.007 [-.023, .009]	-0.86	.389	-.019
Checklist (Behavior)				
Prosocial	.151 [.042, .259]	2.72	.007	.053
Antisocial	.018 [-.024, .061]	0.84	.399	.016
Personality				
Prosocial	.125 [.079, .172]	5.26	<.001	.123
Antisocial	-.067 [-.108, -.027]	-3.27	.001	-.086

Table 3

Self-Location as a Within-Subject Predictor of Daily Outcomes, Study 3

Measure Type and Outcome	*b* [95% CI]	*t*	*p*	standardized *b*
Feelings				
Prosocial	.185 [.147, .223]	9.47	<.001	.182
Antisocial	-.136 [-.174, -.099]	-7.08	<.001	-.166
Behavior				
Prosocial	.085 [.060, .110]	6.73	<.001	.126
Antisocial	-.002 [-025, .020]	-0.21	.836	-.005
Personality				
Prosocial	.155 [.110, .200]	6.74	<.001	.160
Extraverted	.160 [.106, .213]	5.89	<.001	.142
Agreeable	.126 [.086, .166]	6.18	<.001	.131