

extent. Indeed, one might find that individuals low in purity concerns do not show the effect at all. It is difficult to overstate the explanatory value of such a pattern. First, it would establish moderator conditions for the phenomenon, which is an important next-generation question in embodiment research (Meier, Schnall, Schwarz, & Bargh, 2012), particularly given the heterogeneity in effect sizes documented by L&S. Second, it would provide critical evidence for mechanism: If purity concerns are involved, as is proposed, then individuals who have such concerns to a greater extent *should* display the phenomenon to a greater extent. If they do not, one might need to rethink the mechanism that links the manipulation to the dependent measure (Underwood, 1975).

As an example of this type, consider Study 2 of Fetterman, Bair, Werth, Landkammer, and Robinson (2016). Meier, Robinson, and Clore (2004) had shown that negative words were evaluated more quickly when in a black font color and positive words were evaluated more quickly when in a white font color. Meier et al. (2004) proposed that the relevant mechanism was metaphoric cognition because darker colors are metaphorically bad (e.g., “dark times”) and lighter colors are metaphorically good (e.g., “bright person”). If such effects are driven by metaphoric cognition, then people who use metaphors more often – in their everyday speech and thought – should be more susceptible to effects of this type. Fetterman et al. (2016) examined this hypothesis by creating a Metaphor Use Measure that asked individuals whether they would use literal (e.g., “I was very sad”) or metaphoric (“my heart was broken”) language to characterize a series of events and feelings. There were 30 of these pairs and individuals were consistent in their tendencies toward literal versus metaphoric conceptions. Of particular importance, Fetterman et al. (2016) found that assigning relatively neutral words to a lighter (vs. darker) font color resulted in more positive evaluations, but *only* among individuals who tend to think, speak, and write metaphorically. These findings, which are displayed in Figure 1, confirm the relevance of metaphoric thinking to the phenomena identified by Meier et al. (2004).

The cleansing literature, we suggest, would benefit from similar analyses because a number of mechanisms have been proposed, but definitive individual difference studies have not been consistently carried out. If the phenomena previously identified (e.g., Schnall, Haidt, Clore, & Jordan, 2008) co-opt the disgust system, the relevant effects should be more pronounced among disgust-sensitive individuals. If they involve embodiment or metaphor, they may be more pronounced among individuals who exhibit greater embodiment (Häfner, 2013) or who use metaphors more often (Fetterman et al., 2016). As described, the psychological causes of cleansing behavior seem to involve avoidance motivation and, if so, the relevant effects should interact with avoidance motivation rather than approach motivation (Carver, 2006). On the contrary, the consequences of cleansing may involve mechanisms (like psychological separation) that are more difficult to characterize and an individual difference approach could help in clarifying these processes. In general, then, we suggest that individual differences can play a key role in theorizing and mechanism evaluation within the cleansing literature specifically and embodied literature more broadly.

**Financial support.** This research received no specific grant from any funding agency, commercial, or not-for-profit sectors.

**Conflict of interest.** None.

## References

- Carver, C. S. (2006). Approach, avoidance, and the self-regulation of affect and action. *Motivation and Emotion*, *30*, 105–110.
- Fetterman, A. K. (2016). On god-belief and feeling clean: Feelings of cleanliness are associated with feelings and behavior in daily life, particularly for those high in god belief. *Social Psychology and Personality Science*, *7*, 552–559.
- Fetterman, A. K., Bair, J. L., & Robinson, M. D. (2015). Submissive, inhibited, avoidant, and prone to escape: The correlates and consequences of crossing one’s arms. *Motivation Science*, *1*, 37–46.
- Fetterman, A. K., Bair, J. L., Werth, M., Landkammer, F., & Robinson, M. D. (2016). The scope and consequences of metaphoric thinking: Using individual differences in metaphor usage to understand the utility of conceptual metaphors. *Journal of Personality and Social Psychology*, *110*, 458–476.
- Graham, J., Nosek, B. A., Haidt, J., Iyer, R., Koleva, S., & Ditto, P. H. (2011). Mapping the moral domain. *Journal of Personality and Social Psychology*, *101*(2), 366–385. <https://doi.org/10.1037/a0021847>.
- Häfner, M. (2013). When body and mind are talking: Interoception moderates embodied cognition. *Experimental Psychology*, *60*, 255–259.
- Herbert, B. M., & Pollatos, O. (2012). The body in the mind: On the relationship between interoception and embodiment. *Topics in Cognitive Science*, *4*, 692–704.
- Meier, B. P., Robinson, M. D., & Clore, G. L. (2004). Why good guys wear white: Automatic inferences about stimulus valence based on brightness. *Psychological Science*, *15*, 82–87.
- Meier, B. P., Schnall, S., Schwarz, N., & Bargh, J. A. (2012). Embodiment in social psychology. *Topics in Cognitive Science*, *4*, 705–716.
- Schnall, S., Haidt, J., Clore, G. L., & Jordan, A. H. (2008). Disgust as embodied moral judgment. *Personality and Social Psychology Bulletin*, *34*, 1096–1109.
- Underwood, B. J. (1975). Individual differences as a crucible in theory construction. *American Psychologist*, *30*, 128–134.

## Developmental antecedents of cleansing effects: Evidence against domain-general

Emily Gerdin<sup>a</sup> , Shruthi Venkatesh<sup>b</sup>, Joshua Rottman<sup>c</sup> and Jasmine M. DeJesus<sup>b</sup>

<sup>a</sup>Department of Psychology, Yale University, New Haven, CT 06520-8205;

<sup>b</sup>Psychology Department, University of North Carolina at Greensboro (UNCG), Greensboro, NC 27412 and <sup>c</sup>Franklin & Marshall College, Lancaster, PA 17604-3003.

[emily.gerdin@yale.edu](mailto:emily.gerdin@yale.edu); [s\\_venkat@uncg.edu](mailto:s_venkat@uncg.edu); [jrottman@fandm.edu](mailto:jrottman@fandm.edu);

[jmdejes2@uncg.edu](mailto:jmdejes2@uncg.edu); [www.joshuarottman.com](http://www.joshuarottman.com);

<https://www.devculturehealth.com/>

doi:10.1017/S0140525X20000515, e7

### Abstract

Lee and Schwarz propose grounded procedures of separation as a domain-general mechanism underlying cleansing effects. One strong test of domain generality is to investigate the ontogenetic origins of a process. Here, we argue that the developmental evidence provides weak support for a domain-general grounded procedures account. Instead, it is likely that distinct separation procedures develop uniquely for different content domains.

Lee and Schwarz (L&S) propose grounded procedures of separation as a proximate mechanism for cleansing effects. This same mechanism is proposed to underlie other grounded procedures of separation (e.g., enclosing and avoiding contact), with a variety of psychological consequences (e.g., sympathetic magic and positive contagion). Thus, they claim that the mechanism producing cleansing effects is domain-general, and that only a grounded

procedures account can explain how cleansing effects occur in an array of contexts. In this commentary, we argue that this claim can be tested by investigating the ontogenetic origins of grounded procedures of separation. Overall, the developmental evidence casts doubt on the existence of the proposed domain-general mechanism.

The development of these “separation” (or, conversely, “connection”) procedures should include some key elements. First, children must form a mental representation of the act of separation (or act of connection). The idea of cleansing, for example, suggests that there is something that must be purified or removed from one’s person. In other words, children must come to understand that there are contaminants (visible and invisible) in their environments, and that such contaminants are threatening (i.e., they harbor disease or may result in other deleterious effects). Second, children must come to construe the procedures as acts of both physical separation (i.e., can remove a physically present contaminant such as dirt) and psychological separation (i.e., can remove an imagined contaminant such as bad luck). Finally, children must start behaviorally displaying the “separation” and “connection” effects. If grounded procedures of separation are the proximate mechanism behind all of these domains, then one may predict that children will display cleansing effects and other “separation effects” at similar developmental time points. Children should start cleansing themselves of dirt and germs at the same time they begin to separate themselves from social outgroup members (we suggest that this can be understood as a form of separation as one is avoiding contact with outgroup members because of negative views or expectations of the outgroup; see Table 2 in the target article). If the trajectory of development is constant across domains, then the developmental evidence supports the domain generality of grounded procedures of separation. However, if the different domains follow different trajectories, then this complicates L&S’s claim that all these phenomena involve the same mechanism.

In fact, although the domain-generality of grounded procedures of separation and connection has not been explicitly studied with developmental populations, the present literature suggests that such effects may *not* have consistent developmental trajectories. In some domains, the concepts of separation and connection and subsequent avoidance behaviors appear quite early in life, but in others they emerge much later. For example, infants in their second year of life have a concept of both connection (two foods touching connects them) and separation (removing the disliked food from the plate alleviates some concern) when it comes to foods. Eighteen-month-olds will refuse to eat a preferred food that has been “contaminated” by touching a disliked food on the same plate, and many even call for the disliked food to be entirely removed from the plate (Brown & Harris, 2012). However, when it comes to germs and illness, an understanding of contamination has a much more protracted development. Preschoolers do not differentiate between eating a clean versus germ-contaminated food (DeJesus, Shutts, & Kinzler, 2015) and do not avoid contact with someone who is “sick” (Blacker & LoBue, 2016). In fact, it is not until age 5 or 6 that these capacities reliably emerge (for a review, see Rottman, DeJesus, & Greenebaum, 2019). It is important to note that some conceptual causal knowledge of germ contagion is relatively early-emerging (Blacker & LoBue, 2016; Raman & Gelman, 2008). For example, 3-year-olds can accurately provide contamination-based explanations for illness when

prompted (Legare, Wellman, & Gelman, 2009). However, as explained above, it is not until kindergarten or later that children reliably display avoidance behaviors, whereas even 18-month-olds will avoid liked foods “contaminated” by disliked foods. Indeed, children who do not have knowledge of germ contagion will nevertheless engage in avoidance behaviors toward foods, animals, and core disgust elicitors (Stevenson, Oaten, Case, Repacholi, & Wagland, 2010).

Comparing the domains of food and illness suggests that perhaps children have a harder time understanding invisible contaminants such as germs, viewing them as more abstract than clearly visible foods. Indeed, this suggests that abstract forms of separation and cleansing (e.g., removing germs or an “essence”) may develop later than concrete forms (e.g., removing dirt or a disliked food). Yet, there are invisible elements of separation and connection that children seem to understand even earlier than germs and illness, such as the connection between people and their objects. As early as 4 years, children value authentic objects, rate objects owned by celebrities as worth more than others, and search for traces of ownership (Frazier & Gelman, 2009; Gelman, Frazier, Noles, Manczak, & Stilwell, 2015; Gelman, Manczak, Was, & Noles, 2016; Hood & Bloom, 2008). As discussed by L&S, these so-called “sympathetic magic” effects should be undergirded by grounded procedures of connection.

Moreover, although some procedures of separation (e.g., desiring foods to be separated) seem to mature spontaneously, it seems children must be socialized to perform some procedures of separation – in particular, cleansing procedures (Oaten, Stevenson, Wagland, Case, & Repacholi, 2014; Stevenson et al., 2010). Understanding the ontogenetic precursors to grounded procedures of separation will be a crucial complement to understanding the proximate mechanisms that produce these procedures in real time.

Taken together, children are precocious separators in some domains, but the prototypical act of separation – cleansing the body of contaminants – appears to be relatively late-developing and is not immediately understood as an act of separation. The current developmental evidence presents a complex but intriguing picture of how cleansing effects may emerge in childhood, and we challenge researchers to further investigate the ontogenetic roots of cleansing effects and grounded procedures of separation and connection more broadly.

**Financial support.** The writing of this commentary was supported by a National Science Foundation Graduate Research Fellowship to E.G.

**Conflict of interest.** None.

## References

- Blacker, K. A., & LoBue, V. (2016). Behavioral avoidance of contagion in childhood. *Journal of Experimental Child Psychology*, *143*, 162–170.
- Brown, S. D., & Harris, G. (2012). Disliked food acting as a contaminant during infancy. A disgust based motivation for rejection. *Appetite*, *58*(2), 535–538.
- DeJesus, J. M., Shutts, K., & Kinzler, K. D. (2015). Eww she sneezed! Contamination context affects children’s food preferences and consumption. *Appetite*, *87*, 303–309.
- Frazier, B. N., & Gelman, S. A. (2009). Developmental changes in judgments of authentic objects. *Cognitive Development*, *24*(3), 284–292.
- Gelman, S. A., Frazier, B. N., Noles, N. S., Manczak, E. M., & Stilwell, S. M. (2015). How much are Harry Potter’s glasses worth? Children’s monetary evaluation of authentic objects. *Journal of Cognition and Development*, *16*(1), 97–117.
- Gelman, S. A., Manczak, E. M., Was, A. M., & Noles, N. S. (2016). Children seek historical traces of owned objects. *Child Development*, *87*(1), 239–255.

- Hood, B. M., & Bloom, P. (2008). Children prefer certain individuals over perfect duplicates. *Cognition*, *106*(1), 455–462.
- Legare, C. H., Wellman, H. M., & Gelman, S. A. (2009). Evidence for an explanation advantage in naive biological reasoning. *Cognitive Psychology*, *58*(2), 177–194.
- Oaten, M., Stevenson, R. J., Wagland, P., Case, T. I., & Repacholi, B. M. (2014). Parent-child transmission of disgust and hand hygiene: The role of vocalizations, gestures and other parental responses. *The Psychological Record*, *64*(4), 803–811.
- Raman, L., & Gelman, S. A. (2008). Do children endorse psychosocial factors in the transmission of illness and disgust? *Developmental Psychology*, *44*(3), 801–813.
- Rottman, J., DeJesus, J. M., & Greenebaum, H. (2019). Developing disgust: Theory, measurement, and application. In V. LoBue, K. Pérez-Edgar & K. Buss (Eds.), *Handbook of emotional development* (pp. 283–309). New York: Springer.
- Stevenson, R. J., Oaten, M. J., Case, T. I., Repacholi, B. M., & Wagland, P. (2010). Children's response to adult disgust elicitors: Development and acquisition. *Developmental Psychology*, *46*(1), 165–177.

## Grounded separation: can the sensorimotor be grounded in the symbolic?

Michael Gilead<sup>a</sup>, Yaacov Trope<sup>b</sup> and Nira Liberman<sup>c</sup>

<sup>a</sup>Department of Psychology, Ben-Gurion University, Beer-Sheva, 8410501, Israel;

<sup>b</sup>Department of Psychology, New York University, New York, NY 10003 and

<sup>c</sup>Department of Psychology, Tel Aviv University, Tel Aviv 6997801, Israel.

[yaacov.trope@nyu.edu](mailto:yaacov.trope@nyu.edu)

doi:10.1017/S0140525X2000062X, e8

### Abstract

According to Lee and Schwarz, the sensorimotor experience of cleansing involves separating one physical entity from another and grounds mental separation of one psychological entity from another. We propose that cleansing effects may result from symbolic cognition. Instead of viewing abstract meanings as emerging from concrete physical acts of cleansing, this physical act may be appended with pre-existing, symbolic meaning.

The ubiquity of cleansing behaviors and their importance in human life cannot be overstated. Thus, the development of well-specified accounts – such as the one laid out in the comprehensive target article – is a laudable task.

Lee and Schwartz (L&S) theory is predicated on the idea that: “mental processes do not reside in a layer of amodal symbols abstracted and detached from sensorimotor capacities for perception and action.” This variant of embodiment theory (Barsalou, 1999) has been widely accepted in cognitive science. However, scrutiny of the evidence, as well as classic Kantian arguments, leads us to endorse an alternative view (Gilead, Trope, & Liberman, 2020a).

### The diverse representational substrates of the mind

Guided by this reasoning, we have explicated a *pluralistic, constructivist* account of mental representation, in which sensorimotor and amodal representations co-exist (Gilead, Trope, & Liberman, 2020b). Our model is *pluralistic* because it suggests

representations form a hierarchy from the concrete to the abstract that can be parsed into concrete modality-specific or *iconic* representations; multimodal or *indexical* representations; and abstract categorical or *symbolic* representations. The model is *constructivist* because it suggests that the act of forming novel representations – that is, abstraction – designates distinct, multidimensional entities as functionally identical; as such, abstraction forces us to *choose* a dimension along which stimuli are deemed similar (Medin, Goldstone, & Gentner, 1993).

We proposed that the dimensions we choose from when forming abstractions take their place in our mind via three routes: they can be *innate*, giving rise to what we termed *iconic* abstractions; they can be discovered based on *statistical learning*, giving rise to *indexical* abstractions; or can be passed on by social interaction, giving rise to *symbolic* abstractions.

### What links the acts of separation?

Our model can be used to analyze L&S's theory. They argue that “sensorimotor experience of cleansing involves separating one physical entity from another. This experiential basis can ground mental separation of one psychological entity from another.” Thus, in their view, a mental *linkage* is created between the concrete act of handwashing, and more abstract acts of separating ideas.

The suggestion that such a linkage exists is an interesting and plausible hypothesis. However, there is room for further analysis of the possible ontogeny of this purported linkage. Different conclusions of this discussion suggest different mechanistic explanations.

### Indexical underpinning

The linkage may be an *indexical* relation, namely, the result of repeated associations between experiences of physical and non-physical separation.

However, as suggested by the constructivist perspective, events can be interpreted in numerous ways, by focusing on different dimensions of the experience. Modern associationist models of learning have begun to acknowledge that in order to learn that event A (e.g., red light) and B (e.g., shock) co-occur, these events need to be consistently construed as such (i.e., as “red light” rather than “light” or “heat”), a process termed “situation recognition” (e.g., Redish, Jensen, Johnson, & Kurth-Nelson, 2007).

Is it indeed the case that acts of handwashing correlate with an experience consistently construed as “mental separation”? Does this interpretation indeed exist “out there” in the world, patiently waiting to be discovered by a statistician-child? We think that it is important to keep in mind that “a separation act” is a potentially idiosyncratic choice of how to construe cleansing (which can be viewed in innumerable other ways; e.g., as the annihilation of dirt, dilution, transformation, and so on).

### Iconic underpinning

The linkage may be a necessity borne out of the fundamental, potentially *innate* dimensional structure of the mind (i.e., that this is a manifestation of an *iconic* relation). Specifically, it is possible that the world of a newborn child is comprised of such