

Gesture, Metaphor and Embodiment in Mathematics

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One perspective on mathematics as a form of human cognition is that its roots lie in common human experience, both social and biological. In particular, our experiences as embodied, conscious beings provide the "raw material" needed to construct mathematical concepts. From the perspective of embodied mathematics (Lakoff & Nunez, 2000), both mathematical objects and processes can be analyzed in terms of more basic conceptual structures such as image schemata and conceptual mappings (Fauconnier, 1997). A common type of mapping is the conceptual metaphor, in which the logical and inferential structure of a source domain is utilized in making sense of a target domain (an example would be the embodied understanding of how objects can contain each other which underlies, unconsciously, the mathematical notion of set inclusion).

A complementary perspective on cognition and communication utilizes the analysis of gestures to help reveal how people think about mathematics. Coming out of the work of David McNeill and other psychologists and linguists (McNeill, 1992, 2000), this perspective views gesture as an integral part of language, not simply an embellishment. In advance of the session, readings on embodied mathematics as well as the analysis of gesture generally and in mathematics teaching and learning (e.g., Goldin-Meadow et al. 1999) will be made available via a website. During the session, videotaped data will be analyzed interactively in terms of embodiment, as expressed in both metaphorical language and gesture. Through the discussion group, we hope to continue building a common vocabulary, theoretical perspective, and methodology for understanding mathematics as an embodied phenomenon.

Fauconnier, G. (1997). *Mappings in thought and language*, NY: Cambridge Univ.

Lakoff, G. & R. Nunez (2000). *Where mathematics comes from*. NJ: Basic Books.

McNeill, D. (1992) *Hand and mind: what gestures reveal about thought*. Chicago: Chicago University Press.

McNeill, D. (ed.) (2000). *Language and gesture*. NY: Cambridge Univ. Press.

Goldin-Meadow, S., Kim, S. & Singer, M. (1999). What the teacher's hands tell the student's mind about math. *Journal of Educational Psychology*, 91(4).720-730.