Symbolic Cognition Symposium
Gerald Goldin

For some time I’ve been especially interested in mathematical problem solving and its relation to students’ mathematical learning and development. A key construct has been the notion of a system of representation, whose configurations are structurally related to each other, and semantically related to configurations in other representational systems. It is important and useful to distinguish external representational configurations and systems from internal ones (cf. Goldin and Kaput, 1996, in Steffe, Nesher et al., Theories of Mathematical Learning, Erlbaum).

The interests I would like to highlight for the Symbolic Cognition Symposium are two:

1. Affect as a system of representation, and the particular role of the affective system in relation to mathematical cognition

One main idea here is the symbolic function of emotional feelings. Among the meanings encoded by emotions may be information pertaining to the mathematical problem being solved or the mathematical concept being learned. Most often, these are matters pertaining to the relation of aspects of the problem solver himself or herself to the mathematics. I think this is especially important to undergraduate mathematics teaching.

Examples include: frustration encoding successive trials (of special cases, or strategic approaches) without success, or time elapsed without apparent progress; anticipatory joy encoding the possibility of new understandings, or likelihood of experiencing a challenging problem and succeeding in solving it; elation encoding sudden insight, the “aha” experience; anxiety encoding failure possibilities, or satisfaction encoding the fact of learning and/or insight having occurred during problem solving or study.

Of special interest are recurring sequences of emotional feelings, or affective pathways that may occur during problem solving. These may lead to or contribute to the construction of global affect – affective structures such as mathematical integrity, mathematical self-identity, and the capacity for mathematical intimacy.

The significations of emotional feelings are highly ambiguous and context-dependent. In particular, meta-affect (i.e., affect about affect, affect about cognition about affect, affective monitoring of cognition and affect) may profoundly transform emotional feelings in relation to mathematics.

2. The role of ambiguity in mathematical cognition

This refers both to ambiguity within a representational system (e.g., in the construction of representational configurations from primitive signs, or in their structural relation to each other), and ambiguity in the representing relationships that may exist between or across systems. How in practice is a symbol-configuration interpreted, how are ambiguities of structure or meaning resolved, with reference to the representational system itself and with reference to contextual information outside the system to which the symbol belongs?

The kinds of ambiguity that may occur include ambiguity of mathematical signs and symbols, ambiguity of spoken mathematics or written mathematics, and ambiguity of
affect in relation to mathematics. “Mathematical ability” sometimes translates into skill in resolving ambiguities from contexts, or skill in interpreting the tacit assumptions of teachers, textbook authors, examination writers, or the “school mathematics culture.”