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The evolution of technology and the mathematics of change and variation: using human perceptions and emotions to make sense of powerful ideas.

Hegedus, Stephen J. (ed.) et al., The SimCalc vision and contributions. Democratizing access to important mathematics. Dordrecht: Springer (ISBN 978-94-007-5695-3/hbk; 978-94-007-5696-0/ebook). Advances in Mathematics Education, 449-461 (2013).

Summary: This chapter reflects on the evolution of the mathematics of change and variation as technology affords the possibility of conceptualizing and communicating ideas for a wider range of learners than the few who traditionally study the higher levels of calculus. It considers the overall program of development conceived by Jim Kaput, instantiated in the SimCalc software as part of a full range of development using technology for "expressing, communicating, reasoning, computing, abstracting, generalizing, and formalizing" mathematical ideas [*J. J. Kaput* and *J. Roschelle*, ibid., 13–26 (2013; ME 2013c.00051)]. The development begins with interactive representations of dynamic real-world situations and extends the perceptual ideas of continuity and linearity through the operational symbolism of calculus and on to the formalizing power of mathematical analysis. It reveals that the Kaput program has the distinction that its overall framework contains the essence for continuing the complementary evolution of technology and the conceptions of mathematical change and variation. Furthermore, it envisages changes that we have, as yet, not implemented, such is the speed of technological change. In particular, new technology enables us not only to build more powerful ways of performing numerical and symbolic algorithms that may be represented visually and dynamically, it also provides new forms of input and gesture to offer an embodied, kinesthetic, and emotionally powerful experience of engaging with mathematics. This can be shared widely through fundamental human perception and action, and can develop in the longer term through symbolism and human reason to the mathematical literacy required of today's citizens, the theoretical applications of mathematics essential for today's society, and on to the boundaries of mathematical research that takes us into the future.

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