

Computer Science Reconsidered: The Invocation Model of Process Expression

by Karl M. Fant
(Wiley-Interscience, 2007)

Review by Ross Gagliano

Karl Fant has written a very compelling book that should be read by both academicians and practitioners alike. Here I speak from experience, having assumed a role in both in prior incarnations. Fant's rejection of commonly held mathematical foundations should pique the curiosity of those in the theoretical computer science community. On the other hand, those in the "real world" of circuits, architecture, compilers, programming, operating systems, and applications need to be aware of Fant's proposed clockless systems design.

In a prior book [***Logically Determined Design: Clockless System Design with NULL Convention Logic***], Fant presented his fully expressive logical system for designing and implementing clockless digital electronic circuits. In fact, in this current book, he illustrates NULL logic implementation with a number of classical examples, including the half-adder, full-adder, pipeline ring, linear feedback shift register, and Roman Numeral arithmetic system.

His consulting firm, Theseus Research, specializes in real-time image processing systems, plus he is the co-inventor of Computer Generated Synthesized Imagery, a system that generates real-time photo-realistic scenes from a variety of photographic images. Having worked in this vineyard for many years, it makes sense that Fant claims nearly thirty patents in these areas, and more information can be found at several web sites; e.g.: <http://www.theseusresearch.com/NCLPaper01.htm>.

Nonetheless, along with several colleagues, Fant has a significant research investment into computer theory as well. He contests the algorithmic formulations for computer science based on that of well-recognized luminaries such as Leibniz, Boole, Frege, Hilbert, and Godel. His basic argument is that mathematicians consider process independent of expression; whereas, computer scientists are primarily interested in expression, independent of process.

I tend to agree with this argument which resonates from a position espoused over 25 years ago by many, including simulation colleague G. Arthur Mihram, that mathematics (at least from a linguistic point of view) exclusively employs the declarative (third-person) style that is distinctly different from programming languages built upon the imperative (second-person) form of expression.

Further, Fant argues that 'sequentiality' was preferred (demanded?) in earliest (first?) computer systems as it overcame issues of concurrency; i.e., conflicts, races, hazards, etc. Thus, the clock became the ultimate 'controller' where his 'clockless system design' based on his NULL Convention Logic stunningly eliminates the need for a clock! Moreover, his Invocation Model unifies forms of expression from (wet to dry?) cell metabolism to neural networks to clockless computers. Lastly, none other than the 'father of computer graphics himself,' I. E. Sutherland, also advocated such systems in an August 2002 *Scientific American* article.

Laying waste to Knuth and clock-speed in one fell swoop is quite a trip. But even my aging brain can almost absorb it, and there are scads of references to investigate both more thoroughly. Interesting book!

Ross Gagliano is a retired professor and co-founder of the Computer Science Department at Georgia State University. Previously, he was a senior researcher at the Georgia Tech Research Institute.

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