Computer Models of Musical Creativity. David Cope. Cambridge, MA: The MIT Press; 2005: 462 pp. $45.00 (ISBN: 0-262-3338-0)

Can computer programs effectively model creativity? And can computer programs themselves create? If so, can they create musical works of art? David Cope (University of California, Santa Cruz) asks just such questions in *Computer Models of Musical Creativity*. He has years of research in musical creativity and computer composition to support his efforts (1991, 1996, 2000, 2001a, 200b), and has been praised by such luminaries as Douglas Hofstadter (1996, 1999) and Raymond Kurzweil (2000). I will briefly outline the structure of Cope's text, and then dig deeper.

Cope begins by surveying research in creativity and musical creativity, and then goes on to describe a number of possible models for computationally modeling the effects of human creativity. The text is divided into 12 chapters, each of which begins with a proposed principle of creativity. Through this winding path, Cope discusses relevant topics in creativity research, and introduces terms such as recombinance (combining existing structures in creative ways to create something new) and pattern-matching, allusions, learning, inference, analogy, musical hierarchy, and influence. He readily admits that the various models he describes only solve problems associated with selective aspects of creativity. What is needed is an integrated model (utilizing an inductive association computational process) in order for computers to effectively model musical creativity.

According to Cope, when it comes to musical creativity, meaning is out (music is "ineffable"), and so are other concepts traditionally associated with creativity such as originality, novelty, and invention; musical creativity is a process of connection (and

highly algorithmic in nature). As Cope defines it, creativity is "the initialization of connections between two or more multifaceted things, ideas, or phenomena hitherto not otherwise considered actively connected" (p. 11). He distinguishes musical creativity from creativity associated with other arts by emphasizing music's "ineffability" (meaninglessness), unlike Hofstadter, who personally "hear[s] meaning all over the place in music" (as cited in Cope, 2001, p. 322). A highly problematic position to say the least, it might have been more advantageous for Cope to argue not that music is meaningless, but that music *transcends* our attempts to determine its meaning. Nonetheless, in this way Cope keeps semantics out of the computational process.

After clarifying his definition of musical creativity, he presents a series of experimental models that demonstrate what he considers to be its most important (and most computable and empirically definable) constituents: recombinance, allusions, learning, hierarchy, and influence. Cope then argues that such creativity is the result of what he terms "inductive association" and that computers can in fact model such creative processes. In addition, Cope insists that those who claim otherwise are simply not defining creativity properly.

Inductive association turns out to be a computer version of human-based free association: a form of undirected and non-linear thought. A computer is using inductive association when a program "chooses" from a number of possible results (when "reasonable substitutes" are coded into its programming logic). While it is highly problematic (and anthropomorphic) to suggest that computers somehow "think" and "choose" when computing program code, Cope focuses on *processe*s and provides examples of his "inductive association" with language and word association. But he

qualifies his examples by reminding us again that unlike language, music is meaningless: “Language has clear semantic meanings as categorized in dictionaries, while music does not have meaning” (p. 297).

What is clear is Cope’s conclusion (that computers can model musical creativity); the question is just how convincing is it all? Cope’s strategy is to rethink creativity as a *process* as opposed to a *result*. Once the reader accepts the definition, the conclusion follows: Computers model musical creativity by the *process* of inductive association. Cope spends the rest of the book attempting to convince us why he thinks he’s right. And a creative effort it is.

But the emphasis on process leaves more than a few dangling interrogatives. If computers can successfully “model” the process of musical creativity and if it is indistinguishable from human musical creativity, would not creative *results* by necessity have to follow? And if the results indeed turn out to be uncreative, then what good is the model? Cope may be avoiding the muddy waters of relativism here -- and who could blame him? It is common knowledge that Mozart was buried in an unmarked grave. History tells us the creative artist is to a large extent determined not by the process of his or her creativity, but rather by unreliable human value judgments contextually bound in space and time. And these creative determinations are subject to change. How can we hope to define, let alone model, such a relative concept as creativity if we acknowledge such historical whims?

Even if we do accept the lessons of history, this does not exclude the possibility of *simulating the results* of musical creativity, as opposed to modeling the *processes* of musical creativity. After all, it is only through the results of creative processes that we

can determine (or interpret) if anything creative has taken place at all. We may thrash the strings or bang the keys all we like, but it is only the *response* to the results of such processes that will determine if the act has in fact been creative. This might lead one to believe that Cope is arguing up a tree; it is not rational arguments that determine what is or is not creative, at least according to history. Better yet, I am simply suggesting that what Cope is actually doing here is himself *creating* a simulation of musical creativity. Granting that computers can model musical creativity (however one defines it), the machines, concepts, logic, and code must be created in order to make that modeling possible. And to completely remove the human creative element, the computer model (and its creative musical results) would have to "pull itself into existence by its own bootstraps," as Nietzsche might phrase it.

Given Music Example A (created by a human) and Music Example B (created by a computer), and given that their level of creativity were indistinguishable, would humans consider Example B to be as "creative" as Example A? Cope admits that the answer to the question is determined not by computer creativity, but by human judgment. Critical theorist Walter Benjamin, in his essay "The Work of Art in the Age of Mechanical Reproduction" (1968), suggested that it is the *aura* of original (as opposed to mechanically reproduced) works of art that determines their value. Benjamin predicted that reproductions (or simulations) would fail to capture the imagination, fascination, and spirit of the originals, even if they were otherwise indistinguishable. If Benjamin continues to be right, humans may have the upper hand over computers when it comes to creativity: They may simply fail to be impressed.

The challenge then is for computers to create musical works of art so creative that they overcome these judgments. As history has shown, it is not rational argument, but great works of art themselves that determine (or redefine) standards of creativity.

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