

## LET'S CALL IT PLECTICS

Murray Gell-Mann

A decade ago, when the Santa Fe Institute was being organized, I coined a word for our principal area of research, a broad transdisciplinary subject covering aspects of simplicity and complexity as well as the properties of complex adaptive systems, including composite complex adaptive systems consisting of many adaptive agents. Unfortunately, I became discouraged about using the term after it met with a lukewarm response from a few of my colleagues. I comforted myself with the thought that perhaps a special name was unnecessary.

Perhaps I should have been more forceful. A name seems to be inevitable. Various authors are now toying with such neologisms as "complexology," which has a Latin head and a Greek tail and does not refer to simplicity. In this note, I should like to try to make up for lost time and put forward what I have long considered to be the best name for our area of study, if it has to have one.

It is important, in my opinion, for the name to connect with both simplicity and complexity. What is most exciting about our work is that it illuminates the chain of connections between, on the one hand, the simple underlying laws that govern the behavior of all matter in

the universe and, on the other hand, the complex fabric that we see around us, exhibiting diversity, individuality, and evolution. The interplay between simplicity and complexity is the heart of our subject.

It is interesting to note, therefore, that the two words are related. The Indo-European root *\*plek-* gives rise to the Latin verb *plicare*, to fold, which yields *simplex*, literally once folded, from which our English word "simple" derives. But *\*plek-* likewise gives the Latin past participle *plexus*, braided or entwined, from which is derived *complexus*, literally braided together, responsible for the English word "complex." The Greek equivalent to *plexus* is *πλεκτος* (*plektos*), yielding the mathematical term "symplectic," which also has the literal meaning braided together, but comes to English from Greek rather than Latin.

The name that I propose for our subject is "plectics," derived, like mathematics, ethics, politics, economics, and so on, from the Greek. Since *plektos* with no prefix comes from *\*plek-*, but without any commitment to the notion of "once" as in "simple" or to the notion of "together" as in "complex," the derived word "plectics" can cover both simplicity and complexity.

It is appropriate that plectics refers to entanglement or the lack thereof, since entanglement is a key feature of the way complexity arises out of simplicity, making our subject worth studying. For example, all of us human beings and all the objects with which we

deal are essentially bundles of simple quarks and electrons. If each of those particles had to be in its own independent state, we could not exist and neither could the other objects. It is the entanglement of the states of the particles that is responsible for matter as we know it.

Likewise, if the parts of a complex system or the various aspects of a complex situation, all defined in advance, are studied carefully by experts on those parts or aspects and the results of their work are pooled, an adequate description of the whole system or situation does not usually emerge. The reason, of course, is that these parts or aspects are typically entangled with one another. We have to supplement the partial studies with a transdisciplinary "crude look at the whole," and practitioners of plectics often do just that.

I hope that it is not too late for the name "plectics" to catch on. We seem to need it.