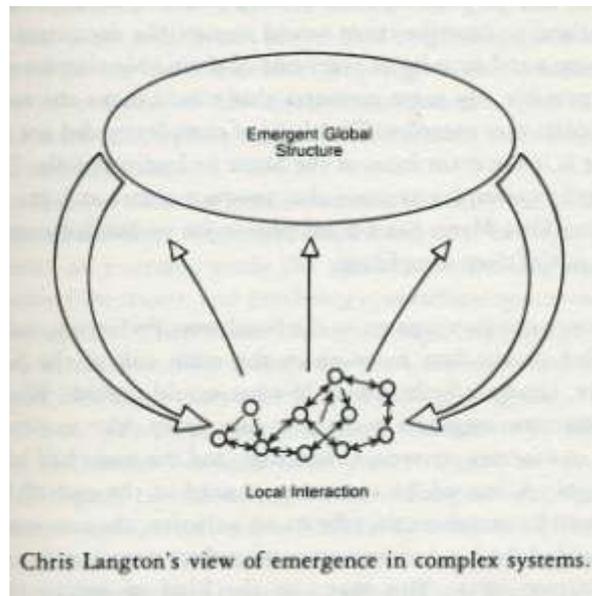


Dr. Christopher Langton did his undergraduate work at the University of Arizona, graduating with a double major in Anthropology and Philosophy. He received his PhD in Computer Science from the University of Michigan. Research interests include artificial life, complex adaptive systems, the origin and evolution of life, distributed dynamical systems, simulation in science and technology, and the role of information in physics. He was previously a Resident Research Professor at the Santa Fe Institute, where he was the Director of the Artificial Life Program and the Swarm Project.

Chris Langton's description of **emergence**, from 'Complexity, Life on the Edge of Chaos' by Roger Lewin -



“Classical physicists regarded complex systems as exactly that: systems that when powerful enough analytical tools were eventually at hand, would require complex descriptions. The central discovery in non linear dynamical systems is that this assumption is incorrect. Such systems may indeed appear complex on the surface, but they may be generated by a relatively simple set of sub processes.

Interactions in a dynamical system give you an emergent global order, with a whole set of fascinating properties. Chris is at the board again, rapidly sketching a cluster of small circles, joined by double headed arrows. These are the components of your system, interacting locally.

Above then appears what looks like a cloud and a volley large arrows shooting up from below. He then added two arrows, one emerging from each side of the cloud, sweeping down towards the cluster. From the interaction of the individual components *down here* emerges some kind of global property *up here*, something you couldn't have predicted from what you know of the component parts. And the global property, this emergent behaviour, feeds back to influence the behaviour of the individuals *down here* that produced it.

Order arises out of a complex dynamical system, global properties flowing from aggregate behaviour of individuals.

In industrial societies, the aggregate behaviour of companies, consumers and financial markets produces an economy 'as if guided by an invisible hand' as Adam Smith said. And for the brain, billions of neurones interact to yield complex behaviour patterns. Including consciousness? If the theory of complex systems is not some kind of seductive illusion; and if the brain can be described as a complex adaptive system; then yes, consciousness can be explained in principle.”