Innovating Perspectives

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Innovations Emerge (A love story)

By Bruce Beihoff

This is a short story. A love story. It starts with a classification of systems and ends with recognizing the process of innovation and invention as a type of system—an emergent one.

Classifying things has been a perennial method used for over 5,000 years to understand both the diversity and complexity of our environments, ourselves, and also to define sameness and difference. Classifying depends on a common understanding of what a system is. Russell L. Ackoff first published in his 1971 article *Towards a System of System Concepts* what many use as a basic working definition: "A system is a set of interrelated elements. Thus, a system is an entity composed of at least two elements and a relation that holds between each of its elements and at least one other element in the set. Each of a system's elements is connected to every other element, directly or indirectly. No subset of elements is unrelated to any other subset."

Ackoff went on to classify systems as "abstract" and/or "concrete," linking thereby the worlds of operations research and engineering science. His definition has held up over the years as a simple and coherent description of fundamental precepts necessary for a common language and understanding of perhaps the broadest paradigm in human thought—systems.

He went on to note that the interactions within and between system elements define a range of dynamic activities that in total have an effect on the overall behavior of a system. Classifying these interactions has become a key to understanding and developing systems. Systems dynamics has become a potent toolbox in our quests for understanding, and in our ability to invent and innovate. Models (visual, logical and mathematic representations of the system elements and their interactions) help us use the tools in the toolbox of systems dynamics.

Five types or classes of systems, based upon their over-all dynamic behaviors, can be described as deterministic, stochastic, mixed mode, chaotic, and emergent.

Deterministic: systems in which the output can be predicted with 100 percent certainty.

Stochastic: systems in which the output can be predicted within a known set of probability distribution(s).

Mixed Mode: systems in which the output can be predicted with a high degree of certainty in some states and within a known set of probability distributions in other states.

Chaotic: systems in which the output may be predicted within a known set of probability distributions for some period of time but cannot be predicted beyond that time because of two factors: (1) the sensitivity of the system's dynamic responses to even small changes in initial conditions, and (2) the ability of the system to change its topology (to change

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That's Just the Half of It!

By Lanny Vincent

What you know is only half of innovating. The other half is the new knowledge you can and must create.

After years of helping others generate ideas, I am now humbly aware that idea generation is less likely innovation's critical path, despite what many assume. Ideas—particularly ones that deserve serious attention—are more likely outcomes, not the input, driving successful innovations. Peter Drucker alluded to this over 25 years ago when he declared in *Innovation and Entrepreneurship* that the bright idea is the least reliable source of innovation.

Innovation's more likely critical path is knowledge-creation—what most of us call learning. Strong ideas come from knowledge-creation. Weak ones eventually reveal some form of knowledge omission or commission, especially about what is

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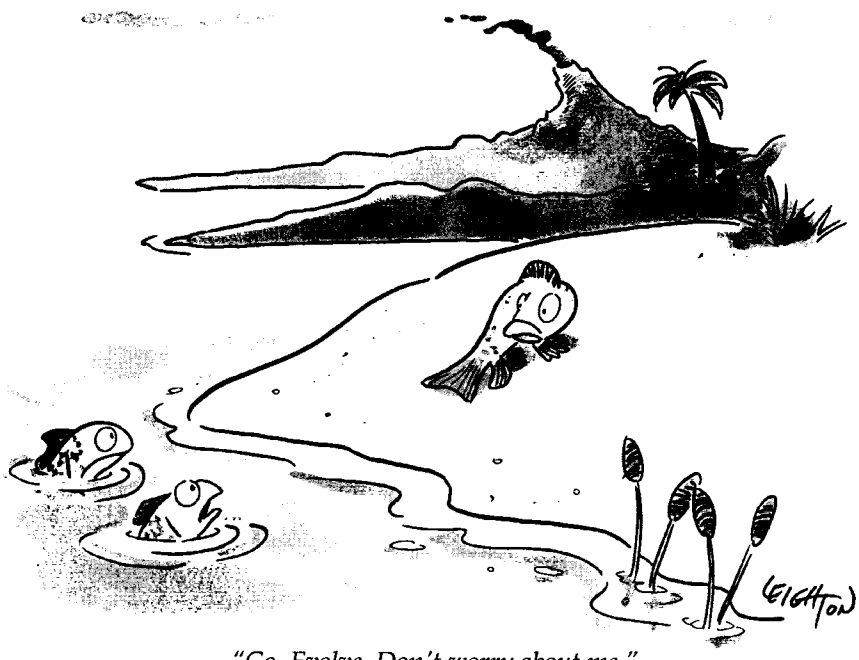
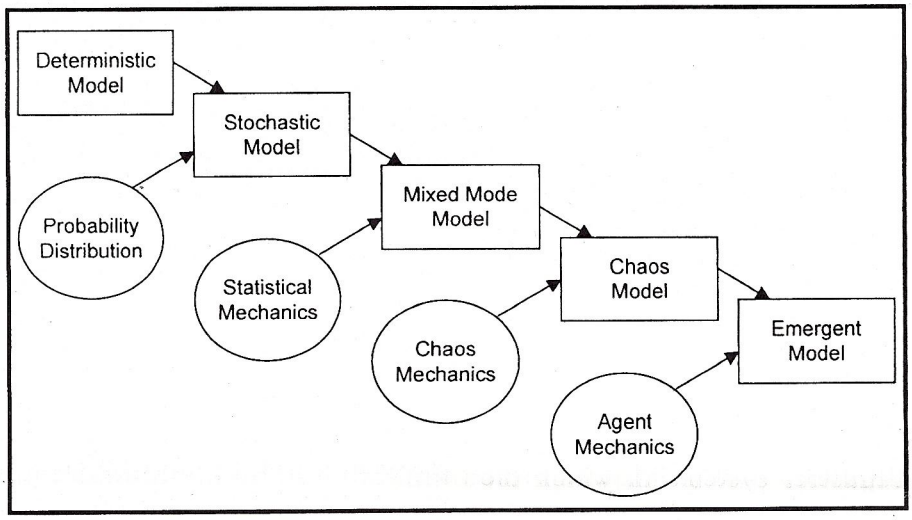


"Go. Evolve. Don't worry about me."

Innovations Emerge (A love Story)



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the interactions between its elements).

Emergent: systems in which the output can be predicted only within broad probability distributions and during short observation periods due primarily to three predominant factors: (1) the system involves agents with choice (and in some cases, purpose), (2) the rules governing the actual dynamics of the system evolve much faster than the our ability to model them, and (3) the interactions between the elements are complex and have the ability to change their topology.

These system classifications are additive, from deterministic to emergent (see figure). The process of innovating or creating improved solutions involves all of these factors but is driven primarily by human agents who choose, often with deliberate purpose. As a result, the best system type for understanding innovation and invention is an emergent one. Innovation and invention are inherently emergent systems. When approached as deterministic, stochastic or chaotic, misunderstandings proliferate too easily and innovating efforts fall short too often.

What does all this mean to the stewards of innovation: managers, mentors, sponsors, midwives, inventors, intrapreneurs and innovators? Here are a few thoughts to consider:

- Significant advantages accrue to those who use the lens of emergent systems in the practice and management of innovation and invention. Most of the important solutions needed by our increasingly complex and dynamic world need to be understood as more complex and dynamic systems—emergent ones—in order to better perceive, imagine, invent and innovate.

- Managing the practice of innovation purely as a simplistic deterministic process or a completely black box statistical distribution has equally sub-optimal outcomes.

- Being aware of innovation as an emergent system can prove to be a constant reminder of the central role of the agent's (e.g., customer's) choice and purpose.

- Be not afraid. All of this non-linearity is what makes innovating and inventing ever-renewing and ever-improving. In fact, much of this non-linearity is the terrain from which the more significant and substantive innovations needed for our future will emerge. It is also the renewable source of our ability to improve our understanding of what is needed, valuable and possible, every day.

Why is this a love story? The answer is simple, really. I am a systems modeler, an inventor and innovator. For me, and others like me, working on innovation as an emergent system is the most exciting systems problem in the world. What's not to love? ❑

Bruce Beihoff is a close associate of Vincent & Associates, Ltd. He recently retired from Whirlpool Corporation, where he was the Global Leader Advanced Systems; Senior Principal Technologist, and Director of Innovation and Technology–Systems and Process Research. Previously he was the Principal Engineer and Group Manager in the Advanced Development Group at Rockwell Automation and Rockwell International. He can be contacted at bbeihoff@sbcglobal.net.

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valuable to the customer. When R&D-based innovations break through an otherwise "me-too" crowd of look-alike products, it is not because someone made a lucky guess. It is because some new learning occurred, some new observation was made, some knowledge was created, and correspondingly, something new and valuable was conceived.

What most see in successful innovation are outcomes. However, the paths leading up to these outcomes are filled with:

- experience and experiments (physical, virtual, mathematical) that create data,

- interpretations of data that create information, and

- applications of the information, successful or not, that create understanding of what works and what doesn't, and why... and that, in turn, develops knowledge.

These knowledge-creation paths twist and turn and cycle back, far from the mythical straight line hindsight suggests—more like a "Slinky" than a taught string.

R&D organizations are filled with knowledgeable experts—those who understand not only what works, but why. However, it is not simply what experts know that creates value. It's what experts do with what they know that leads to value creation—the critical path for innovating.

The irony of the expert's knowledge is that it can be the very thing that blocks learning, especially about the customers' value ecosystem. It has often been said, "all value is derived from context." If true, then to create new knowledge the expert must interpret the context (the ecosystem) in which the customer lives. That is where new value emerges and where innovation is nourished.

Identifying where gaps are in our knowledge, especially of what's meaningful and valuable to customers, may be where the critical path begins for the knowledge creators in R&D. Selecting and describing gaps in our knowledge may be one of the more reliable ways of targeting where we should focus our efforts. Successful innovations always seem to emerge from that kind of knowledge-creation.

What you know is only half of it. ❑