Second Order Cybernetics: Expanding Science in Accord with the Correspondence Principle

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Introduction

- My intention in these brief remarks is to indicate where cybernetics has been and where it is today
- I shall also try to clear up an important confusion about the field
- Many people think that cybernetics is a synonym for computer science
Theoretical and philosophical cybernetics

• I think it is more helpful to think of cybernetics as having a technical branch – computer science, artificial intelligence, robotics, computer networks, etc.

• And a theoretical and philosophical branch – processes of control and communication in biological and social systems and some machines
Cybernetics and physics

• I think of cybernetics as offering a set of principles governing information and regulation just as physics offers a set of principles governing matter and energy.

• Just as physics helps to explain the physical world, cybernetics helps to explain the information world – processes of perception, cognition, learning, adaptation and autonomy.
The Macy Conferences

- Cybernetics grew out of 10 conferences held in the late 1940s and early 1950s in NYC chaired by Warren McCulloch.
- Other participants were Norbert Wiener, John von Neumann, Margaret Mead, Gregory Bateson, Kurt Lewin, Ross Ashby and Heinz von Foerster.
Title of the conferences

• The conferences were titled, “Circular Causal and Feedback Mechanisms in Biological and Social Systems”

• After Norbert Wiener’s book, *Cybernetics or Communication and Control in the Animal and the Machine* was published in 1948, the name was changed to the Macy Conferences on Cybernetics
Second order cybernetics

- Second order cybernetics is a term invented by Heinz von Foerster in 1974
- Cybernetics had become associated with computer technology
- Heinz wanted to refocus attention on finding basic principles, which could be investigated by studying biological and social systems
Warren McCulloch
Heinz von Foerster
Experimental epistemology

• McCulloch, von Foerster and others wanted to understand cognition

• Their strategy was to test available theories of knowledge from epistemology using neurophysiological experiments

• Rather than using philosophy to guide theory development, they used science to test philosophical assumptions
Including the observer

- What they found was that observations independent of the characteristics of the observer are not physically possible.
- Scientific observations require scientific observers who have personal histories.
- Scientific results are interpreted by other scientific observers.
A controversial conclusion

• In the 1970s this conclusion was controversial because it seemed to undermine the claim of objectivity.
• Cognitive science has since provided more and more examples of how the brain helps us in ways we are not aware of.
• Today the evidence for taking account of the observer is overwhelming and the idea is increasingly widely accepted.
A second conclusion

• In the social sciences theories often alter the phenomenon described

• In economics if people accept a theory and act upon it, for example theories by Adam Smith, Karl Marx, John Maynard Keynes or Milton Friedman, the social system behaves differently

• There is a dialogue between theories and society
The Correspondence Principle

• What is happening here can be described using the Correspondence Principle
• “Any new theory should reduce to the old theory to which it corresponds for those cases in which the old theory is known to hold”
• The CP was proposed by Niels Bohr when developing the quantum theory
• A new dimension is required
An Application of the Correspondence Principle
Why expand science?

• For many years social scientists have tried to imitate the physical sciences
• Much has been achieved, but we are encountering limits to this approach
• The Correspondence Principle can be applied not just to ideas within a field but also to the philosophy of science
How would science change?

• We need to recognize that inanimate objects and purposeful systems (individuals, organizations and some machines) are fundamentally different

• We need to develop new, participatory methods for dealing with purposeful systems

• We can view physics not as a guide for all of science but rather as a subset of an expanded conception of science
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