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

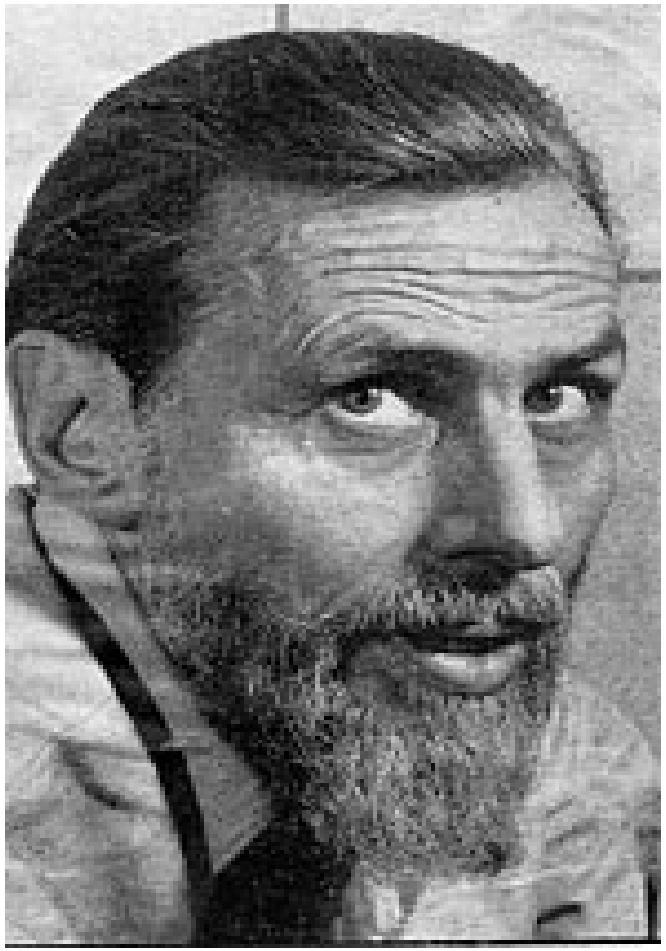
Title of the conferences

- 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

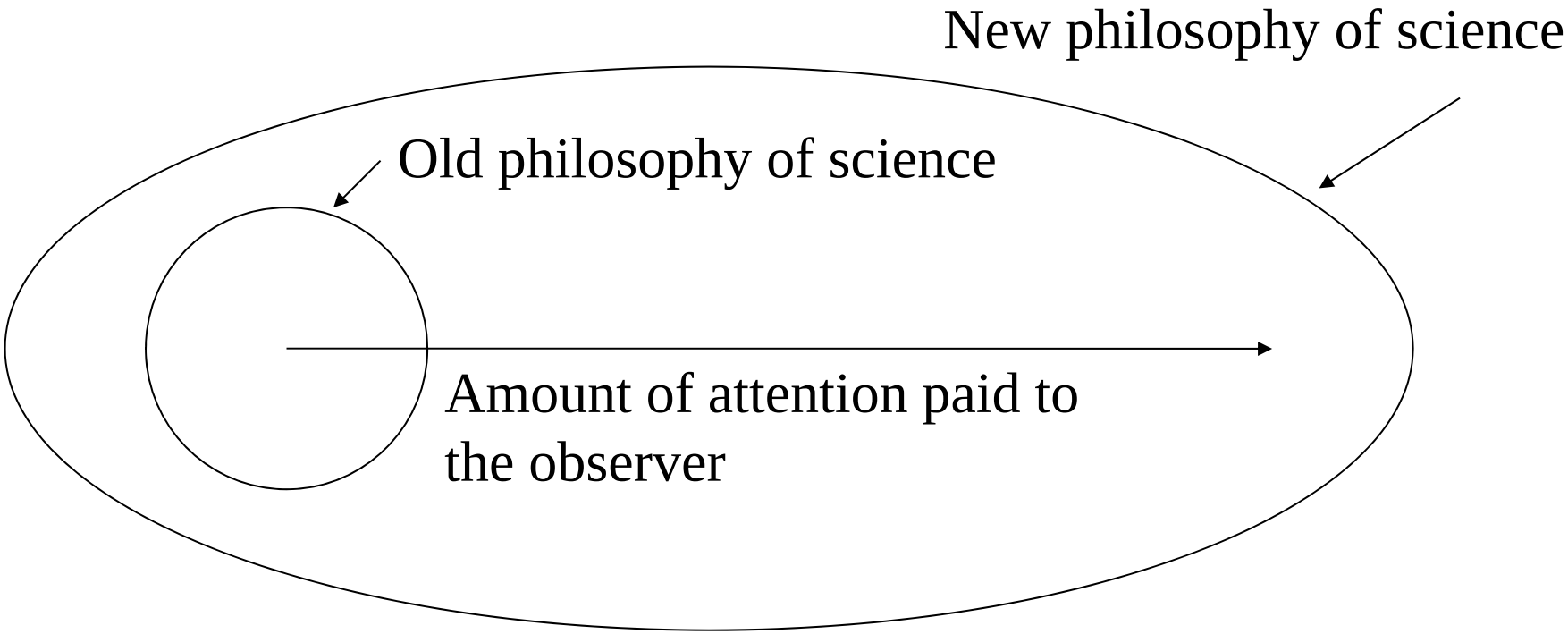
- In the 1970s this conclusion was controversial because it seemed to undermine the claim of objectivity
- Cognitive science has since provided more and more examples of how the brain helps us in ways we are not aware of
- Today the evidence for taking account of the observer is overwhelming and the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

Contact information

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