I. Norbert Wiener and Cybernetics

II. Life

- **A. Born in Columbia Missouri**
- **B. Russian Jewish heritage**
  1. Did not know he was Jew until he was at Cornell University
     a) Parents have hid identity from him, mother spoke of Jews derogatorily
  2. Traumatised him
- **C. Father, Leo Wiener, was very influential**
  1. Taught at University of Missouri
  2. Prof. of Modern Languages
     a) Spoke 40 languages
  3. Self-educated (no PhD)
  4. Taught at Harvard
     a) Moved from Missouri when he was not appointed chair of Department of German
  5. Had to take other jobs to support family
- **D. Traumatic childhood education**
  1. Father had high expectations of Norbert
  2. Terrified Norbert when he fumbled in his studies

III. Young Norbert

- **A. A child prodigy**
- **B. Unconventional education**
  1. Father took him out of school at 7 and taught him algebra and classical languages
  2. Entered college at age 11
- **C. BA in Mathematics (1909)**
  1. Age 15
- **D. PhD in Philosophy (1913)**
  1. Age 18
- **E. Post-doc at Cambridge**
  1. Studied with Bertrand Russell
- **F. Served during WWI**

IV. The Academic Wiener

- **A. Joined faculty of MIT (1919)**
  1. Joined Department of Mathematics after military service
  2. Started in a 'dubious' manner: promotions came slowly at first

- 3. Eventually career took off and MIT treated him with great respect

- **B. Mathematics research and more**
  - 1. Found his life's niche in mathematics
- **C. Brilliant odd man**
  - 1. Talkative and open, but insecure
    - a) Due to traumatic childhood
    - b) Craved for his father's praise
    - c) Became even more insecure in middle age
      - (1) Worried that his academic productivity was falling off
        - i) "Tell me, am I slipping?"
  - 2. International scholarship
    - a) Frequently travelled to conferences or to lectures in Europe, esp. Germany
    - b) Corresponded with Margaret Mead and Gregory Bateson, amongst others
  - 3. Wiener-wegs
    - a) Wandered in random path through MIT, dropping unannounced into offices
    - b) Pondered deeply during walks, trailing forefinger to guide him to avoid collision
- **D. Intellectual interests range widely**
  - 1. Multidisciplinary in scholarly interests
    - a) Diversity of personal networks helped advanced cybernetic theory and its wide applications
- **E. Helped transform MIT**
  - 1. Mathematics took a back seat initially at MIT, serving technology
  - 2. But department grew with Wiener, becoming academic centre for advanbcing state of the art theoretical mathematics
- **F. Postwar (WW2) Rebellion**
  - 1. Declined any federal government research grants
    - a) Did not trust US government with atomic bombing of Hiroshima

V. "Yellow Peril" as origin of Cybernetics

- **A. Poor accuracy of antiaircraft guns versus high speed of planes led to "Yellow Peril" research**
  - 1. Book *Extrapolation, interpolation and smoothing of stationary time series with Engineering applications*
  - 2. What would become cybernetic theory to the antiaircraft gunfire problem
  - 3. Did not directly solved antiaircraft gunfire problem though
- **B. Firing control as communication problem**
  - 1. As a process of information transmission

- **C. Focus on the role of feedback**
  - 1. Degree which previous shell approached target treated as feedback to improve next shot
- **D. Intelligent machines and man-machine systems**
  - 1. Wiener began to think about the human operators of the AA guns, thus propelling Wiener towards transdisciplinary thinking
- **E. Transdisciplinary thinking**
  - 1. Study human neurophysiology, brain functioning, and
  - 2. to a lesser extent, intrapersonal and interpersonal communication process
- **F. Stimulated emergence of**
  - 1. Information theory (with key contributions by Claude E. Shannon)
  - 2. Cybernetic theory

VI. Cybernetic Theory

- **A. Feedback systems existed before Wiener's wartime (WW2) work**
  - 1. But Wiener came up with the mathematical theory of how feedback cntrolled a system
- **B. Cybernetics as the theory of self-regulating systems (and signal transmission?)**
  - 1. the control of future conduct of a system by information about its past performance
    - a) Feedback as the response by a receiver to the source's previous message, indicating its effects
    - b) Enables source to gradually self-correct the effectiveness of a series of messages, making them closer to what is needed to accomplish their intent
- **C. Concerned with how messages are exchanged between two or more units so that each influences the other**
  - 1. Could be man/machine
    - a) Similar to Shannon, 'unique' in including machines as possible components in a comm. system
- **D. Closely linked to Information Theory**
  - 1. (?)
- **E. Two key concepts**
  - 1. Feedback and its stabilizing properties
    - a) Negative vs. positive feedback
      - (1) e.g. Positive evaluation vs negative evaluation in social science
      - (2) To cybernetricians, negative feedback stabilise, positive feedback amplify deviations in consequences
  - 2. Information transmission makes parts whole
- **F. Circular causality (feedback loop)**
  - 1. A causes B, B causes C, C causes A, so that A causes itself
    - a) e.g.speaker modifying his presentation while monitoring audience reactions to it

- 2. To lead to a major change in basic conceptions of science, due to systems theory movement in 1960s

VII. Application of Cybernetics

- **A. Wiener saw wide applications**
- **B. Any self-correcting system**
- **C. Cybernetic theory applied to**
  - 1. Servomechanisms
    - a) any device used to provide control of a desired operation through the use of feedback
  - 2. Human-machine systems
  - 3. Human nervous system
    - a) Particularly interested in biology, due perhaps to unsuccessful study of zoology
  - 4. Prostheses
    - a) Wiener concluded that an individual's pattern-recognition ability was often lost
      - (1) e.g. amputees had to learn the notion of roundness through non-tactile means
    - b) Inspired "Boston arm"
  - 5. Language and interaction
  - 6. Social organizations

VIII. Development of Cybernetics

- **A. The Philosophy of Science Club**
  - 1. Studied with Dr. Arturo Rosenblueth of Harvard
  - 2. Helped advanced cybernetics into study of human brain and nervous system as a cybernetic system
- **B. Macy Foundation Conferences (1940-1960)**
  - 1. Funded because member of Macy family been paralysed and helped by a group of scientists who met at an interdisciplinary meeting
  - 2. Cybernetics forums (1946-1953)
  - 3. Many distinguished participants
    - a) Lazarsfeld, Lewin, Bateson, Mead, John von Neumann (who worked on complex calculations for implosion detonation device for first atomic bomb; broke ties with Wiener post WW2)
  - 4. Fortunate name change
    - a) Feedback Mechanisms and Circular Causal Systems in Biology and Social Sciences -> Cybernetics
- **C. Multidisciplinarity of cybernetics**
  - 1. Margaret Mead (anthropologist) and Greogory Bateson (Palo Alto School) humanising influence on Macy conferences
    - a) Focusing the discussions so that social science applications of cybernetics did not get overlooked
    - b) Bringing the talk back to plain English when it threatened to go off into technical jargon

IX. Interdisciplinary and Multidisciplinary

- **A. Interdisciplinary**
  - 1. type of scholarly activity falling between more than one discipline
- **B. Multidiscipline**
  - 1. type of scholarly activity involving scholars from more than one discipline to come together to share their perspectives on a topic
- **C. Macy Foundation conferences provided fertile ground for communication study**
  - 1. Allowed Wiener and his cybernetics theory to infect social sciences, mathematics and neurophysiology with muidisciplinary perspective

X. Contributions to Communication Study

- **A. Cybernetics as a communication theory, though the field of communication not much influenced by it, because:**
  - 1. Certain degree of *mathematical ability* needed to understand or conduct research
    - a) Communication scholars lack the skill
  - 2. Competed for attention with *Shannon's information theory*
    - a) Appeared approximately at the same time
    - b) Fitted more easily with predominant interest in studying communication effects
  - 3. Wiener generally *opposed extension* of cybernetic theory to social science problems
    - a) Thought human relationships are more complex than machine-machine/human-machine relationships
    - b) Instead, focused on human brain functioning, biological and medical problems with Arturo Rosenblueth
  - 4. *Marked departure from convention thinking* in behavioural sciences (?)
    - a) Implications strongly resisted when applied to many fields
    - b) * Behavioural sciences essentially investigates the decision processes and communication strategies within and between organisms in a social system
    - c) * In contrast, Social sciences study the structural-level processes of a social system and its impact on social processes and social organization.
- **B. Uniqueness of Cybernetics as communication theory**
  - 1. *Importance of feedback* as a type of communication message flow
    - a) Information conveyed describe system's performance at a previous point in time
  - 2. *Implies a dynamic, processual view of behaviour* over time
    - a) As opposed to discrete events
  - *3. Reflexive, self-learning system*
    - a) Assumed control of system lies mainly within system itself; system learns from itself
- **C. Wide applications**
  - 1. Television ratings and programming

- 2. Public opinion polling
- 3. Organizational communication

XI. Systems Theory

- **A. Influenced by Cybernetic theory**
- **B. Holistic: stresses interrelationships among the parts of a whole**
  - 1. Systems consist of sets of component related to each other interdependently that work toward the overall objective of the whole
  - 2. Concerned with problems of relationships and interdependence of parts of the structure
  - 3. Rejects atomistic research analysing communication behaviour of individuals, but looks instead at:
    - a) Networks and relationships of individual with others
- **C. Not a theory stricly,but a broad paradigm, a reaction to growing scientific specialisation**
  - 1. Needed to look more broadly at context, and in an interdisciplinary and multidisciplinary way
- **D. As a reaction against reductionist approach of classical physics**
  - 1. Which had provided the ideal for scientific research
    - a) Testing discrete relationships among variables
  - 2. By investigating smaller and smaller pieces or components of a phenomenon
  - 3. Thus removing context of the behaviour of study and
  - 4. Eliminate interaction among various parts
- **E. Reductionist approach adopted from physics to biological and social sciences, which study living systems**
  - 1. Distorted reality of these system
- **F. Ludwig von Bertalanffy's General Systems Theory**
- **G. In vogue in 1960s and 70s, then faded**
  - 1. Because it offered an alternative to the previous scientific procedures of linear causality
    - a) Hypothesis-testing approaches OK for understanding discrete relationships among variables, such as those in physics
      - (1) Scientists looked at smaller and smaller elements to advance knowledge
    - b) Unsatisfactory for living systems
      - (1) Because interactions among the components mean that each relationship depends on the other relationships in the system
      - (2) Open to environment, exchanging information across boundary
        - i) Thus final state can be approached in a variety of way, without the same initial conditions
      - (3) e.g. homeostatis, maintenance of balance of system = cybernetics
- **H. Many still interested, but not in communication**

XII. Beyond Cybernetics

- **A. Second-order cybernetics (?)**
  - 1. Examining cybernetic models
  - 2. The observer as part of the system
- **B. Social Cybernetics (?)**