# I. Claude E. Shannon

- **A. Born in Michigan**
  - 1. Father was a judge
  - 2. Mother was a high school principal
- **B. Studied at Michigan, MIT**
  - 1. Mathematics and engineering
  - 2. Earned MS, then PhD in 1940
- **C. Post-doctoral fellowship at Princeton**
- **D. Influenced by**
  - 1. Nobert Wiener
    - a) Some credit Wiener as co-discoverer of information theory
    - b) Wiener had recognised that communication of information was a statistical problem
  - 2. His own work on cryptography stimulated his information theory
    - a) Fits well into information theory
    - b) Encoding theoretically amounts to adding deceptive noise to original messages
    - c) Use of appropriate receiver can remove the noise from the disguised message

# II. Later years

- **A. At Bell Labs from 1941-1956**
  - 1. Joined wartime research effort
    - a) Cryptography, as a stimulant to information theory
    - b) Antiaircraft fire posed by Wiener
  - 2. Rather eccentric
    - a) Organisation culture at Bell Labs tolerated the brilliant individualist
    - b) Bell Labs, esp. its maths department, very permissive in allowing great freedom to its researchers to pursue their own research topics
- **B. Visiting professor at MIT (1956)**
- **C. Centre for Advanced Study in the Behavioural Sciences (1957-58)**
  - 1. Think tank, tied to Stanford but has own autonomy
- **D. MIT professor until his retirement**

# III. Origins/Development of Information Theory

- **A. Worked as research assistant on the differential analyzer to Vannevar Bush**
  - 1. DA a mechanical computer created by Bush
- **B. Master's thesis on relay switching (1938)**
  - 1. Applied Boolean logic to circuits

- 2. Had profound effects on design of telephone systems and other electronic circuits
- 3. Considered one of the most important master's theses ever completed
- **C. Began conceptualising information as part of a (technical) communication process**
  - 1. Thinking about information in statistical sense
  - 2. Expressed information (intelligence) in an equation
- **D. Continues working on the concept during post-doc and at Bell Labs**
- **E. Studying cryptography advances theory**
  - 1. See Influences in part I
- **F. Published articles in 1948, book in 1949**

## IV. Nature of Information

- **A. Unusual behaviour of information from other matter**
  - 1. Value typically increases when selectively shared
  - 2. Does not depreciate with use, although it may with time
- **B. Amount of surprise in a message as an index of information**
  - 1. A message containing information you already know contains no information
- **C. Information as matter-energy (can be moved and transformed) decreases uncertainty**
- **D. Inherent drive in people to reduce uncertainty**
- **E. Shannon proposes the binary digit or bit (0 or 1, a dichotomous expression) as fundamental unit of information**
  - 1. Reducing information into bits
- **F. Uncertainty is a function of the number of alternatives available**
  - 1. Mathematical expression of what uncertainty was and how to reduce it
- **G. Based on an equation for *entropy* in the Second Law of Thermodynamics**
  - 1. Entropy is degree of uncertainty or disorganisation of a system
- **H. Biggest uncertainty is when there is an equal chance of probability (equally possible alternatives)**

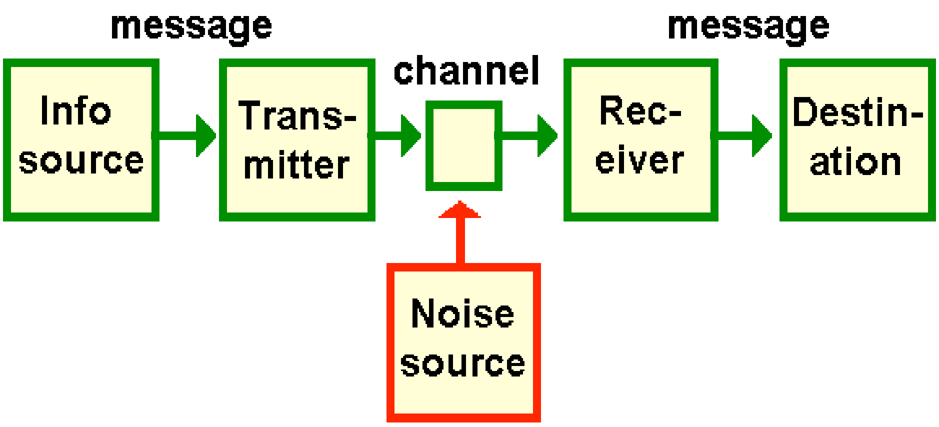
## V. Implications of Shannon's Information Theory

- **A. Information can be quantified**
  - 1. Viewing information as discrete than continuous
- **B. Fundamental unit widely applicable**
  - 1. Beginning of digital revolution
- **C. Information Theory optimises coding**
  - 1. Reduces number of bits to optimise transmission
  - 2. Allows for error-correction
    - a) Richard Hamming's error-correcting codes (1950)

- (1) Preserve integrity of information
- **D. Transmission capacity can be assessed**
  - 1. Electrical signals can be disrupted by other electrical signals, magnets etc.
- **E. Identifies impact of noise, redundancy**
  - 1. Engineering issue: Signal-to-noise ratio (either increase signal or reduce noise)
  - 2. Redundancy (i.e. repetition) makes it more likely that signals go through
- **F. But his mathematical propositions on channel capacity attracted little attention of communication scholars**
  - 1. Most of them lack mathematical ability to do so
  - 2. Unlike Shannon, they do not assume communication is constrained by limited channel capacity
    - a) Rather, an abundance of capacity seem more reasonable
  - 3. And are predominantly interested in communication effects

## VI. Shannon-Weaver Model of Communication

- **A. Goal of transmission optimization**
  - 1. Improve transmission of information over a telegraph or telephone line affected by electrical interference, or noise
  - 2. Bell Labs concerned about increasing channel capacity
    - a) Which is not the focus of communication researchers
- **B. Communication defined as "the process through which one mind influences another"**
  - 1. Thus viewed as intentional
- **C. Model originally applied to machines (telephone)**
  - 1. Hence engineering term such as 'receiver'
- **D. Created a linear model of signal transmission**
- **E. Model similar to Lasswell's Five Questions Model**
  - 1. But *noise* differentiates Shannon's model from Lasswell's
  - 2. Who, says what, to whom, in what channel, with what effects?
- **F. Six (?) elements**
  - 1. Source: May or may not be human
  - 2. Message
  - 3. Transmitter: Encoding device, Shannon's work was related to telephone
  - 4. Signal
  - 5. Noise: Usually influences channel
  - 6. Received signal
  - 7. Receiver: Decoding device
  - 8. Destination

- 9. 


- **G. Communication scholars use Shannon's model to focus on effects of communication**
  - 1. But Shannon's intention is to explain channel capacity to carry messages
  - 2. Use of model have led scholars away from emphasising the subjective meanings created through information exchanged between individuals
- **H. Immensely useful in explaining the essential components of a communication act**
  - 1. Source, channel, message, receiver, noise, and feedback (SMCR)
- **I. Weaver "translated" Shannon's theory, applied it to human communication**
  - 1. Many scholars could not understand information theory, written in a highly mathematical language
  - 2. Schramm published Weaver's translation and Shannon's original articles while at Illinois

## • VII. Interpretation of Transmission Model

- **A. Shannon and Weaver disagreed about how the model should be applied**
  - 1. Shannon limited the applicability of his information theory to engineering or technical communication
    - a) Claimed that it did not apply to human communication from the beginning
      - (1) Human meanings and interpretations were soft data that couldn't be reduce to precise formulae
  - 2. Weaver invited wide application of Shannon's information theory to all types of ***intentional*** communication
- **B. Three levels of communication problems**
  - 1. Accuracy in transmission (technical problem)
  - 2. Precision in conveying meaning (semantic problem)
  - 3. Effectiveness in bringing about desired effect (behavioural problem)
- **C. Shannon limit model to technical level**
- **D. Weaver apply model to all levels**

## • VIII. Application of the model

- **A. Model "served as the paradigm for communication study"**
  - 1. Provide useful guidelines for future generations of scholars
    - a) Decreasing uncertainty about what topics to study,
    - b) How to study them, and

- c) How to interpret research findings
- **B. By identifying key variables in communication process**
  - 1. Providing easily understandable specification of these variables
  - 2. The SMCR components, used by communication researchers, such as Hovland's MLA
- **C. Also introduced new concepts**
  - 1. Physical noise vs. semantic noise
    - a) Physical/technical noise
      - (1) e.g. microphone feedback
    - b) Semantic noise
      - (1) e.g. speaking in different languages or in codes etc.
      - (2) Importance of shared meanings
  - 2. Redundancy (Cloze test of readability)
    - a) Take out every 5th, 6th or 7th word and try to fill in the blank.
      - (1) If it is high on readability, should be able to fill in the blank because of redundancy
- **D. Strengths of the model:**
  - 1. Simplicity, generality, quantifiability
- **E. Used in numerous engineering applications**

## IX. Conceptual Models

- **A. Models as simplified descriptions**
  - 1. Simplicity is the source of attractiveness to scholars
- **B. Purpose of model**
  - 1. Purpose 1:
    - a) Simplify concepts; of no use if they completely represented concept in its fullness
    - b) Still, do not do phenomena justice if they over-simplify
  - 2. Purpose 2:
    - a) Represent key elements and their relationships (e.g. SMCR)
  - 3. Purpose 3:
    - a) To build upon?
    - b) e.g. Berlo's incorporation of feedback , with Wiener's cybernetics, sought to coceptualise communication as a process than an act
- **C. Functions of Models**
  - 1. Organising
    - a) through arranging elements in a systematic way
  - 2. Explaining
    - a) phenomena, more than describing, how things work in tandem with another

- 3. Predicting (considered most valuable function)
  - a) the likely outcome
  - b) e.g. how people are going to change their attitudes after hearing a persuasive message
- **D. Understanding limitations is key**

## X. Limitations of transmission model

- **A. Linear transmission model of the communication act**
- **B. Shannon and Weaver debated the extent to which the model could be applied**
  - 1. See Interpretation of the Transmission Model
  - 2. Shannon does not think the model can deal with issue of semantics
- **C. Limited what was considered communication**
  - 1. Explicit,
  - 2. Logical material,
  - 3. Deliberate,
  - 4. Formal encoding process,
  - 5. Leading to mutual understanding
- **D. Technical vs. human communication**
  - 1. Failed to include entire range of interactions between people
    - a) Communication scholars adopted the technique without considering the difference between human and machines: emotions, etc.
      - (1) e.g. nonverbal communication

## XI. Critique of the Model

- **A. Model is an oversimplification, and a misleading metaphor**
  - 1. Led communication toward a one-way conceptualisation of communication behaviour and focus on determining communication effects
- **B. A paradigm can be an intellectual trap, trapping scholars who follow it in a web of assumptions that they may not fully recognise**
- **C. Main problems**
  - 1. Communication is a process, not an act
  - 2. Communication is not always linear
    - a) Interruptions, etc.
  - 3. Communication is often unintentional
- **D. Model does not address:**
  - 1. Intentions
    - a) Which influence meaning

- (1) e.g. Mesages with persuasive intent treated very differently from messages for entertainment/ information only
- 2. Meaning (Semantics)
  - a) Main reason why Shannon did not think model was suitable for human communication
  - b) Which depends on shared understanding or meaning extensively
- 3. Context
  - a) e.g. Formal/informal, familiar/unfamiliar
- 4. History (relationships)
  - a) i.e. Shared experiences
  - b) Ongoing relationships are fundamental in communication
    - (1) e.g. communication btw old friends not fully understood despite without historical appreciation
- 5. Non-verbal communication

## XII. Closing thoughts on the Model

- **A. Model served as a powerful heuristic**
  - 1. Heuristic: mental shortcut, cues
  - 2. Value in raising questions that can point to other important things to study
  - 3. Like Lasswell's model
  - 4. For those working within the framework
    - a) e.g. the SMCR Model (Berlo, 1960) (?)
      - (1) Problem: source/transmitter, receiver/destination not easily distinguished
      - (2) These components fit better into technical communication, but still linear (Berlo, 1960)
  - 5. For those working outside the framework
    - a) e.g., constructivist models by cultural & critical scholars
      - (1) Constructivist: Understanding is shaped by social interactions (shared understandings with others, outshoot of symbolic interactionism)
      - (2) Motivated to understand communication in terms of its historical antecedence, cultural significance, what context factors meant and what meaning meant
      - (3) Thus will not be a linear model like Shannon-Weaver
- **B. Model as a source of great debate**
- **C. Information theory had greater impact on engineering than social science**
  - 1. But even then, his ideas were more relevant 50 years after his death
  - 2. His works largely unknown to public at large at time of his death