Communication Theory

Basis of multimedia

- Based on two sciences
    1. Communication science
    2. Computer science

Definitions and roots of communication science

- Mostly derived from social sciences and humanities
- Communication and computer sciences: distinctions and similarities
    - Information transmission
    - Usage of electronic media
    - Information representation (information theory; minimum code required to represent information without loss)
    - Computer science concentrates on technical aspects of representation, manipulation, transmission, and reception of information while communication science concentrates on human aspects of the same
    - Computer science deals with representation of images in terms of pixels
    - Communication science deals with representation of content at a higher level, more from presentation point of view
    - Broadly, computer science deals with transmission of data; communication science deals with transmission of information/emotion/knowledge
    - Communication vs communications
        * Communication refers to human aspect
            · Human to human
            · Human to computer
            · Computer to human
        * Communications refers to technical aspect
            · Computer to computer
- History of modern communication science
    - Foundations in sociology, social psychology, and education
    - Mass communication vs interpersonal communication
    - Shaping the public opinion, and propaganda
    - Social psychology
        * Focused on persuasion, attitude change, group processes, and interpersonal communication
        * Education research
            1. Educational use of new technologies
            2. Research on communication skills
            3. Investigation of communication strategies and instructional outcomes
            4. Research on reading and listening
    - Commercial applications
        * Administrative research and effectiveness of advertising

    * Information about audience and target marketing
    * Group dynamics research

Models of communication

- Mathematical theory of communication
  - Developed by Claude Shannon at Bell Telephone Labs in 1948
  - Describe the amount of information in messages that are transmitted and received in a communications system such as telephony
    * No intent for modeling human communication
  - Linear model of communication
    * General model of human communication using Shannon's theory
    * Straight line order of factors and effects
  - Basic concepts in Shannon's model
    * Information
      · Not to be confused with *meaning*
      · Amount of information is defined to be logarithm (base 2) of the number of available choices of messages
      · Specified in terms of a value known as *entropy*
      · Entropy calculated from the number of different symbols used in the communications and their relative probability of occurrence
      · Most relevant for compression and error detection/correction
    * Message
      · Material to be transmitted by information source to the destination
      · Encompasses meaning
    * Information source
      · Entity responsible for selecting or formulating a particular, desired message out of a set of possible messages
      · Originates or creates a message
      · Because entropy of information is probabilistic, process of selection exercised by the information source is crucial to the statistical analyses included in the formal definition of Shannon's theory
    * Signal
      · Form in which message is physically sent to recipient
      · Sound waves, radio waves, variation in electrical current
    * Channel
      · Transmission medium
    * Transmitter
      · Converts/encodes the message to a format suitable for transmission
    * Noise source
      · Entity that introduces something to the signal not intended by the information source
    * Received signal
      · Combination of transmitted signal and noise
    * Receiver
      · Converts/decodes the received signal to message that can be understood
    * Destination
      · Recipient of the message

- Basic concepts applied to human communication and multimedia
  - Three levels of problem
    1. Level A – Technical problem
       - Concerns engineering issues involved in maintaining the accuracy of messages transmitted over channels to receivers
       - Original focus of Shannon's work
       - Concerns computer scientists and electrical engineers
    2. Level B – Semantic problem
       - Issue of meaning in communication
       - How well do symbols communicate the intended meaning?
       - Important issue in interpersonal communication research
       - Negotiated meaning – meaning not contained in words but in interpretation by participants
    3. Level C – Effectiveness problem
       - Concerned with whether the message has intended effect
       - Advertising effectiveness and political communication
- Information source
  - What is information source in multimedia CD-ROM?
  - Not the hardware itself, or the computer reading the data off the CD-ROM
  - Could be the creator of code on CD-ROM
  - Could be the user of the software as he provides feedback to the computer
  - Treat computer as a human, preprogrammed to provide human-like responses to the user
  - Importance of user interface
- Transmitter
  - Produces a signal to be transmitted over the channel
  - Encodes the information produced by information source in a format suitable for transmission
  - Human communication involves body language in addition to voice
    - Use of hands (kinesics)
    - Touch to demonstrate emotions/intimacy (haptics)
    - Distance between communicators for interpersonal factors (proximics)
  - Multimedia transmitters are speakers/monitor/modem
- Encoding/decoding
  - Conversion of format for storage, manipulation, and transmission
  - Natural language processing
  - Gesture recognition
  - "Turn off the light" vs "Turn off the light?"
  - Conversion of the command into a sequence of signals
  - Iconic symbols (logos and traffic)
  - Use of icons in user interface
- Noise
  - One of the important problems
  - Noise is introduced if the received signal does not perfectly match the transmitted signal
  - In multimedia, noise may be introduced by ambiguous interface metaphors, imprecise text, typographical errors, inappropriate feedback to user input, badly designed icons, lack of clear error messages, or poor sound/image quality
  - In some instances, it may be necessary to introduce noise deliberately for effect (infra-red simulation)
- Receiver

    - Generally the user
    - Multimedia developer must keep in mind the audience
    - Audience with limited hearing range, or possibly color blind
    - Language and cultural issues
  - Destination
    - Mind of the user
    - Negotiating meaning (interpretation vs what is contained in words)
      - Somebody using the word "marketing" in place of "shopping"

- Schramm's model of communication
  - Model for mass communication
  - Based on Shannon and Weaver's mathematical model of communication
  - Additional details added include *feedback loops*, *fields of experience*, and *role exchangeability*
  - Encoding and decoding functions
    - Performed by both sender and receiver
    - Sender as well as receiver decodes/interprets/encodes messages
    - If the sign has been learned previously, the possible set of responses are known
    - Sign interpreted using prior experience and context
      - I could understand that "marketing" means "shopping" due to experience and context
  - The degree to which two communicators overlap in their field of experience determines the degree to which they share common meanings for words
    - *Mommy* vs *mummy*
  - Selection of symbols by multimedia developer
    - Iconic symbols
    - Numerals
    - Progressing from left to right or right to left, depending on the native language of the audience
    - Culture neutral (?) information for larger audience
  - Feedback
    - Return process in which transmitter acts as receiver
    - Feedback could be in the form of nonverbal cues in real life
      - Audience yawning
      - People leaving in disgust (*Honey I Shrunk the Kids*)
    - Feedback can be used to modify presentation (the game `xbill`)

- Berlo's model of communication
  - Expands on the models by Shannon and Weaver, and Shramm
  - Emphasis on additional aspects of communication
  - Communication as a process, concept of fidelity, success of communication
  - Communication as a process
    - Opposite to sequence of discrete events
    - Continuous operation that shows change over time
      - A person can never step in the same river twice as both the person and river have changed
    - Communication as a dynamic and continuous process
      - No start or end time
      - Any description of communication contains only a slice of the whole

    - Unique communication of theater
        - Not captured by ingredients such as script, actors, director, scenery, stage, audience, lighting, acoustics
        - A blend and continuous flow of all of the above, and more
    - Same argument for multimedia production
- Channel
    - Particularly relevant to multimedia production
    - Three different meanings to the word "channel"
        1. **Vehicle-carrier**: Material that physically carries the message; air, copper wire, cable
            - Wires within computer, CD-ROM drive, peripheral devices to carry signals internally
            - Air around the system to carry sound to the listener
            - Space to carry light from monitor
        2. **Message vehicle**: Form of energy that carries the message; sound waves, electricity, light waves, radio waves
            - Electrical impulses
            - Sound waves
            - Light waves
        3. **Modes**: Mechanism for encoding and decoding messages; vocal chords, listener sensory systems
            - I/O devices (keyboard, scanner)
            - User's senses
- Choice of channel
    - Selection of material presented in spoken form or written form
    - Effectiveness of sounds in various situations (music only when needed)
    - Efficiency and effectiveness of images – still and motion, or drawings – for different purposes
    - Choice based on experience because of a lack of formal model
    - Possible to use multiple channels to enhance the communication value of the presentation, point of multimedia
- Fidelity
    - Degree to which a communication is effective in achieving the purpose of the sender
    - High fidelity encoder adds minimum distortion or noise
    - Low fidelity encoder may present somewhat inaccurate/altered message to the recipient
    - Overall measure of success of communication
    - Four factors that affect fidelity (in-person vs multimedia)
        1. Communication skills
        2. Attitudes
        3. Knowledge level
        4. Position within a sociocultural system
    - Improves with proper use of code
        - Code could be any group of symbols meaningful to the person
        - Here, I had to specify the semantics of the word *code* because computer scientists use a different semantics for this word

- Communication as transmission vs Communication as ritual
    - In transmission model, messages are transmitted and distributed in space
    - Dominant model in western culture
    - Alternative view is the ritual model

    * Groups united by sharing faiths, principles, and ceremonies through shared rituals
    * Communication could be in art form – hieroglyphs – and not targeted at a specific audience

Interpersonal vs Mass Communication

- Is multimedia a form of interpersonal communication, with computer acting as one person, or is it a form of mass communication
- Interpersonal communication
    - Face-to-face, within a small group
    - Intimate, private, peculiar, plastic, malleable, and highly interactive
    - Involves at least two communicators
    - Intentionality
        * Event must be a purposeful act to be classified as communication
        * Without intentionality, communication is subsumed in every act such as walking, eating, and driving
        * "You cannot not communicate"
    - Transaction and empathy
        * Sender and receiver interchange roles during communication
        * Empathy is the ability of a participant to take the perspective of the other
    - Impersonal vs interpersonal communication, depends on a number of factors
        * Number of communicators
            · More communicators less interpersonalness
            · Public speaking is more impersonal than interpersonal
            · Deal with group rather than individual
        * Channel
            · Face-to-face allows for more interpersonal communication due to body language and gestures, plus engaging all senses
            · Interpersonal communication can occur to a lesser extent using new communication technologies such as telephone, videophone, and computer
        * Knowledge of communication partner
            · Course prerequisites
            · Sociocultural factors
            · Story in a magazine I read long ago

                "A man and his son were traveling by car. The car was in an accident. The man died. The son was badly injured and removed to hospital, and needed immediate surgery. The surgeon saw the boy and said: "I can't operate on him. He is my son." What is the relationship between the surgeon and the boy if his father is already dead?"
        * Formal vs informal relationships
            · More formal relationship implies more impersonal communication
- Mass communication
    - **Mass** – *A large, diverse, and heterogeneous, anonymous, geographically dispersed, and socially distant audience*
    - Sender sends messages to *mass* with little or no feedback