CSC 428F/2514F

HUMAN-COMPUTER INTERACTION

Lecture 7

HUMAN PERCEPTION IN RELATION TO COMPUTERS

presented by
Ben Barkow

Ronald Baecker
Professor of Computer Science
University of Toronto

1. Purposes for learning about perception

    1. The Ames Window: it's all a mental construct

    2. Introduction: everything the computer does to the person is perceptual interaction; everything the person does to the computer is motor interaction (or, more generically, human-performance interaction); the mental activity in-between is cognition; in short, the distinctions are fuzzy

       The next three lectures deal with exo-computer (read "human") processes in any great bionic loop which includes computing.

       We need to understand psychology in order to develop displays (and reaction systems) which create the desired perceptions (and natural reactions) in users. These good perceptions are intended to support those cognitions which lead to easy human performances which, in turn, fulfills the purposes of the loop.

       Because…

       Hey folks, there's nothing the least bit real about a CRT-borne picture. There's nothing moving when you move a cursor! It's *all* perceptual illusion.

       Moreover, there's nothing homuncular about perception… it's all a computed illusion.

       Finally, there's nothing direct about motor inputs to a computer… just more illusion.

2. What is perception?

   1. A brief depiction of perception… a active process barely
      distinguishable from cognition and performance.

   > HELPS
   > PROVIDING SUPPORT FOR INNOVATIVE
   >   MAKE
   > WAYS TO ADVANCE THE FIELD OF HCI
   >   DREAMS
   > AND THE COMMUNICATION OF
   >   A REALITY
   > INFORMATION WITHIN SIGCHI
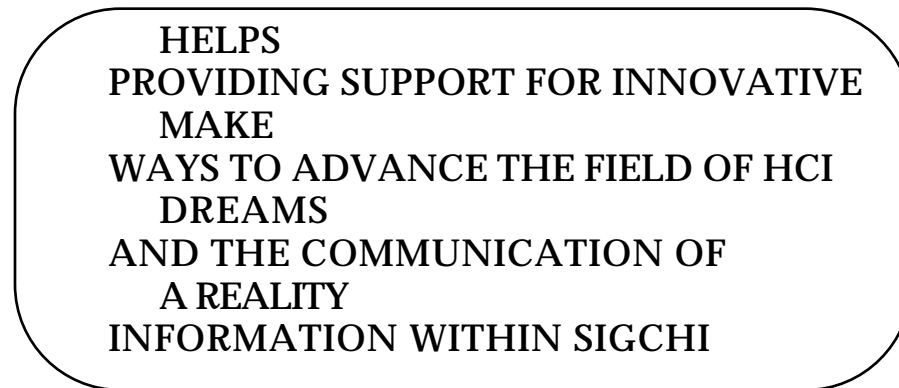
   Fig. 1. See page 5 for the slightly less challenging original.

   2. Concepts:
         1. stimulus or cue (the originating physical entity or element),
         2. perception or phenomenological experience (the picture
            you hold),
         3. illusion (lack of correspondence between the stimulus and
            the perception),
         4. veridicality (no lack of correspondence),
         5. peripheral and central mechanisms (in the eye; in the
            brain), and
         6. feedback, equivalent cues, conflict of cues, coherence,
            and/or plausibility testing (making sense of cues).

   3. What are the senses? It is somewhat arbitrary to define but
      significant for VR. Phenomenological experience is all in the
      nerve pipelines.

   4. The metrics or the vocabulary of perception:
         1. sensitivity or detectability,
         2. JNDs, discriminability, and signal/noise detection,
         3. ratios and range, and
         4. qualitative tags.

3. Mechanisms of Perception (all modalities)

1. All perceptions are constructed, Helmholtz' "unconscious hypothesis"; no stimulus what so ever is unambiguous; human sensory systems create meaningful percepts from the available cues.

2. "Gestalt" principles — figure-ground, good continuity, common motion, etc. — represent the way the brain strives for coherence but people do not always produce veridical perceptions. When this is blatant, it is wrongly called an "illusion" or at the top of a flight of stairs, an "accident."

3. Stimuli are processed in adaptive ways, for example, to minimize mental effort (all Euphasians look alike to me, so do most pages at a website). Conceptual elements can take on the qualities of a physical stimulus and physical and conceptual elements can be processed as distinct channels.

4. Humans respond (almost exclusively) to change and "adapt out" to constancy (in E.E. this is called "A.C. coupled"); therefore, in all senses *adaptation levels* are established which are the cousin of *negative after-images* and that static stimuli disappear (except pain, and pain is rarely used as an intentional stimulus in an interface).

You may find it interesting to learn how vision, hearing, and other senses work; if so, please have a peek at 'most any introductory psychology textbook.

4. Vision

All stimuli are pre-processed peripherally to a lesser or larger degree which is worth knowing only because this dumber processing sometimes leads to anomalies like Moiré patterns or Mach bands.

The HCI specialist attacks interaction challenges through a knowledge of vision at different levels…

    1. Engineering Psychology Level
        1. basic acuity and visibility
        2. legibility of fonts, UC v LC, and descenders
        3. visibility vis à vis colours and contours, disappearing blues

    2. Perceptual Level
        1. layouts, dotted leaders
        2. principals of perception

from *SIGCHI Bulletin*, **July, 1997**

    3. Cognito-Perceptual Level
        1. occasional non-stupid icons and pictograms
        2. saliency
           3. smart use of language

5. Hearing

Demonstration of the Shepherd Tones (also J-C Risset's version)

Levels

1. Human Factors Level

    1. basic audibility of sound: pitch, loudness
    2. signaling (reaction time) properties

2. Perceptual Level

    1. spatial localization
    2. identification and distinctiveness of "voices"
    3. speed of speech (really important to understand)

3. Cognito-Perceptual Level

    1. spatial and "meaningful" channels
    2. spoken information as a serial process

6. Applying principles of perception to interface design

    1. The Psychology of displays indicating what is effective for various purposes (and we definitely do not mean the Art displays): lots of detailed information

    2. Saliency… a thousand and one tricks you can use

    3. In VR, only a handful of cues are modeled and therefore conflicts of cues are inevitable

    4. Don't be fooled when you come to design: the Gottschalk Fallacy (What do you expect from an Artist!)