


HUMAN-COMPUTER INTERACTION THIRD EDITION

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chapter 10

universal design




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universal design principles

- NCSW


- equitable use
- flexibility in use
- simple and intuitive to use
- perceptible information
- tolerance for error
- low physical effort
- size and space for approach and use



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Multi-Sensory Systems

- More than one sensory channel in interaction
 - e.g. sounds, text, hypertext, animation, video, gestures, vision
- Used in a range of applications:
 - particularly good for users with special needs, and virtual reality
- Will cover
 - general terminology
 - speech
 - non-speech sounds
 - handwriting
- considering applications as well as principles



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Usable Senses

The 5 senses (sight, sound, touch, taste and smell) are used by us every day

- each is important on its own
- together, they provide a fuller interaction with the natural world

Computers rarely offer such a rich interaction

Can we use all the available senses?

- ideally, yes
- practically - no

We can use • sight • sound • touch (sometimes)

We cannot (yet) use • taste • smell

Multi-modal vs. Multi-media

- Multi-modal systems
 - use more than one sense (or mode) of interaction
 - e.g. visual and aural senses: a text processor may speak the words as well as echoing them to the screen
- Multi-media systems
 - use a number of different media to communicate information
 - e.g. a computer-based teaching system: may use video, animation, text and still images: different media all using the visual mode of interaction; may also use sounds, both speech and non-speech: two more media, now using a different mode

Speech

Human beings have a great and natural mastery of speech

- makes it difficult to appreciate the complexities
- but
- it's an easy medium for communication



Structure of Speech

- phonemes
- 40 of them
 - basic atomic units
 - sound slightly different depending on the context they are in, these larger units are ...
- allophones
- all the sounds in the language
 - between 120 and 130 of them
 - these are formed into ...
- morphemes
- smallest unit of language that has meaning.

Speech (cont'd)

Other terminology:

- prosody
 - alteration in tone and quality
 - variations in emphasis, stress, pauses and pitch
 - impart more meaning to sentences.
- co-articulation
 - the effect of context on the sound
 - transforms the phonemes into allophones
- syntax – structure of sentences
- semantics – meaning of sentences

Speech Recognition Problems

- Different people speak differently:
 - accent, intonation, stress, idiom, volume, etc.
 - The syntax of semantically similar sentences may vary.
 - Background noises can interfere.
 - People often “ummm.....” and “errr.....”
 - Words not enough - semantics needed as well
 - requires intelligence to understand a sentence
 - context of the utterance often has to be known
 - also information about the subject and speaker
- e.g. even if “Errr.... I, um, don’t like this” is recognised, it is a fairly useless piece of information on it’s own

Speech Recognition: useful?

- ☺ Single user or limited vocabulary systems
 - e.g. computer dictation
- ☺ Open use, limited vocabulary systems can work satisfactorily
 - e.g. some voice activated telephone systems
- ☹ general user, wide vocabulary systems ...
 - ... still a problem
- Great potential, however
 - when users hands are already occupied
 - e.g. driving, manufacturing
 - for users with physical disabilities
 - lightweight, mobile devices

Speech Synthesis

The generation of speech

Useful

- natural and familiar way of receiving information

Problems

- similar to recognition: prosody particularly

Additional problems

- intrusive - needs headphones, or creates noise in the workplace
- transient - harder to review and browse

Speech Synthesis: useful?

Successful in certain constrained applications when the user:

- is particularly motivated to overcome problems
- has few alternatives

Examples:

- screen readers
 - read the textual display to the user
 - utilised by visually impaired people
- warning signals
 - spoken information sometimes presented to pilots whose visual and haptic skills are already fully occupied