Lecture 10: HCI, advanced course, Perception and motor behaviour

To read: Chapters 2 and 3 in J.M. Carroll (Ed.), *HCI Models, Theories, and Frameworks*. San Francisco: Morgan Kaufmann
Outline

- Perception and HCI
- Motor behaviour and HCI
- Results
- Guidelines and examples
- General conclusions
Perception and HCI

- Perception theory well developed
- We should put an adequate amount of focus on perception in HCI
- Here we focus on visual perception, but sound and other senses are also relevant within HCI related theory
Stages in visual perception

• Stage one: early vision
• Stage two: pattern perception
• Stage three: Objects
Early vision

- guidelines about colour, motion, form etc.
- motion
- colour (mostly studied)
- texture
- 3D
- form
- preattentive processing theory, i.e. what draws attention to something
Attention

(a)

(b)
Attention

(a)

(b)
Attention

(a)

(b)
Guideline examples, level 1

• To draw attention to an object, use a unique attribute (colour, form, direction, movement)
• Movement is especially suitable when objects are not in immediate focus
• Make sure the contrast between objects (text) and background is big enough. Different colours might not be enough
Pattern perception

- Stage two in the perception process
- Related to Gestalt theory
- Supports problem solving by external representation, methods for visualising
Conflicts in Gestalt theory

Grouping conflict

Proximity is outweighed by region

Proximity is outweighed by connectedness
More conflicts

Symmetry emphasises structure

Continuity emphasises information flow
Guideline examples, level 2

• Place links, icons or functions/tools close to indicate that they are related
• Use frames if proximity is not enough to indicate relationship
• Be aware of conflicting signals and patterns that may appear unintentionally
Objects, level 3

- related to working memory
- relate an object’s attribute to form, colour, texture, where form is primary and colour and texture are secondary (cf. lowest level where colour is primary)
Some guidelines for level 3

- Humans can only remember a few objects at a time, objects could be combined to form few but more complex objects
- Use colour and texture to represent the attributes of the object
- When looking at simple objects, form is more important than colour and texture
Implications for design

- Theories on the lowest level of perception give us distinct guidelines for design.
- On higher levels, humans are more unpredictable and design decisions must involve other aspects.
Motor behaviour and HCI

- Predictive models
- Descriptive models

Questions to ask:
- What is done?
- How do we do things?
- How long does it take?
- How well does it work?
Models

• Simplify the reality
• For the purpose of
  – designing
  – evaluating
  – understanding
• Descriptive or
• Predictive
Predictive models

- Quantitative results
- Analysis based on the model, not on results of an experiment or studies
- Does not need a working systems
- Hick-Hyman law
- Fitts’ law
- Keystroke level model
Descriptive models

• Help describing and thinking about a situation or a problem
• Key-Action Model
  – Symbol keys
  – Executive keys
  – Modifier keys
• Buxton’s 3-state model
• Guiard’s 2-hands model
Buxton’s model

• Graphical input
• Three states:
  – out of range
  – tracking
  – dragging
• To explore pointing devices and what they afford
3-state model of graphical input

State 0
- Raise Mouse
- Lower Mouse
- Out of Range

State 1
- Button Up
- Tracking

State 2
- Button Down
- Dragging
Use of Buxton’s model

(a) Mouse

(b) lift-and-tap touchpad
Dimensions and degrees of freedom

- A model that clarifies the relation between dimensions and degrees of freedom
- Makes obvious that a mouse is not fully 2D
- Inspiration for alternative ways of input
Guiard’s model – two hand interaction

• Yves Guiard 1987
• Focus on the roles of the hands (cf. Buxton & Myers, 1986)
• Analysis of the location of keys in an ordinary keyboard related to the mouse for pointing
• Three unique keys to the left, 15 to the right
• Ordinary keyboards more suitable (less unsuitable) for left-handed people
101-style keyboard

Symbol keys
Executive keys
Modifier keys
People

Perception
• Colin Ware
• Anne Treisman
• David Marr (Vision)

Motor behaviour
• I. Scott MacKenzie
• William Buxton
• Yves Guiard
Summary

- Theories on the lowest level of perception give us distinct guidelines for design.
- Higher levels of perception involve interpretation.
- Predictive models for motor behaviour when design alternatives are compared and evaluated.
- Descriptive models help us understand interaction situations, think about design suggestions, and how to study them.