What’s Happening in Haptics?

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Overview

• What is Haptics?
• Haptic technology
• Haptics research at Glasgow
• Hands On Demonstration

Haptics and Touch

Haptic (hap’tik) :
  – adj.[Gr. haptein, to touch + ic]
  – of, or having to do with, the sense of touch.
  – Webster’s New World Dictionary

• Computer haptics is complex and difficult to describe – it is better experienced
  – Hands on demo shortly

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The Sense of Touch

- Haptic channel is duplex / bidirectional
  - You can both transmit and receive information simultaneously

- Touch is a complex modality consisting of several distinct sensory channels
  - Skin, muscles, balance, orientation, pressure, temperature, pain....

- Complexity leads to misunderstandings

The Sense of Touch in Computing

- Relatively unused in mainstream computing
  - Implicitly – keyboards keys, casing of mouse....
  - Explicitly – programmable touch

- Beginning to change - devices are emerging
  - History – teleoperation devices
  - New devices – cheaper, smaller, better...

- Haptics is a complex modality
  - Better understanding required through research
  - Confusing terminology clouds matters

Terminology

- Haptic
  - Relating to the sense of touch.

- Kinaesthetic
  - Meaning the feeling of motion. Relating to sensations originating in muscles, tendons and joints.

- Tactile
  - Pertaining to the cutaneous sense - the sensation of pressure

- Force Feedback
  - Relating to the mechanical production of information sensed by the human kinesthetic system.
Tactile Technologies

- Tactile information produced by perturbing the skin
  - Pressure
  - Pain
  - Temperature
  - vibration

- Pins
  - as in devices for Braille display

- Air jets
  - blow to produce a disturbance

- Cushions of air
  - inflated/deflated to vary pressure on skin

- Electrical stimulation
  - low levels of current provide a localised tingling sensation

- Typically used in gloves, or suits for larger body areas

- These technologies can lack realism
Force-feedback Technologies 1

- Kinaesthetic information is produced by exerting mechanical forces
- Technologies are easier to produce than tactile and are now reaching the home
- Consoles - Dual Shock, Rumble Pack - cost ~ £10
- PCs - 2 degree of freedom force-feedback joysticks cost ~ £80
- Force-feedback mice - 3 degree of freedom mice are now available costing ~ £100

Force-feedback Technologies 2

- The PHANToM is a typical research device
- Provides 6 dof in, 3 dof out
- Produces rich feedback
  - suitable for many applications
- Point contact model of touch
- Costs £10,000!

Potential Uses for Haptics in Computing 1

- To increase the realism of an object
  - Games
- To increase presence or immersion
  - VR
- To give an object subjective/aesthetic properties
  - E-commerce
- To constrain the user to an object
  - Haptic desktop – scroll bar
- To guide the user over/through/to an object
  - Guided exploration
Potential Uses for Haptics in Computing 2

- To add social context
  - CSCW, sex industry?
- To train a user in a haptic related task
  - Critical procedure training
- To overcome limitations in other modalities
  - Interfaces for the visually impaired
- To produce richer interaction or visualization
  - Haptic visualization
- To convey information about an object
  - What it is, where it is, how rough it is…..

Haptics Research at Glasgow University

Research Projects - MultiVis

- An ongoing research project concerned with computerised presentation of information to the visually impaired

  - Haptic graphs and Multimodal tables
    - Haptics good for guidance
    - Non-speech audio good for discerning trends
    - Speech cues good for exact values

  - Current research questions:
    - Is direct translation of graphical data really the best presentation
Research Projects - Vet Training

- Training vet students
  - Maintenance of animals
  - Ratio of students to patients
  - Can create symptoms on demand
  - Risk posed by unskilled practitioners to animals

- Haptics can provide virtual training methods to alleviate these problems
- Working with Glasgow Vet school to construct and test models of virtual horse/cow ovaries
- Evaluation shows little difference to regular training

Other Research Projects

- Desktop Haptics
  - Visual overload
  - Haptically enhanced widgets to aid targeting
  - Significant decreases in errors produced, but not in time taken.

- CSCW
  - Heightened sense of presence and interaction
  - Pushing, Pulling (gesturing), Locating, Proximity

Conclusions

- Haptics could provide benefits to many domains
  - Physical training
  - Collaboration
  - Visualisation
  - Targeting (e.g. desktop interaction)

- Little is known about how best to use haptic technology and haptic sense during human computer interaction

- Further Haptic research is required
Questions / Comments?

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Hands On Demo