Haptic and locomotion Interfaces

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Premise of this talk:

To design better human-computer/machine interaction we need to understand natural human-environment interaction
Objects are the functional units (or, currency) of the mind

Our mind parses the environment into objects
Question 1

What are the senses that we have?

Vision
Hearing
Smell
Taste
Touch (Haptics)

**Proprioception**
The sense of the relative position of one's own parts of the body and strength of effort being employed in movement

**Vestibular sense**
The sensory system that provides the leading contribution to the sense of balance and spatial orientation for the purpose of coordinating movement with balance

**Interoception**
The sense of the internal state of the body
Question 2

Rank the following senses according to their importance

- olfaction (smell)
- gustation (taste)
- audition (hearing)
- vision (seeing)
- haptics (touch)
Question 2

Linguistic analyses across many languages show that references to sight predominate in spoken interaction


“Now see Mom, it’s like this – When you’re my age, you need a lot of extra money”
Question 3

What do you call someone who cannot feel touch?

**Anaphia**: a total or partial absence of the sense of touch

**Dysesthesia**: an unpleasant, abnormal sense of touch

Incapacitated with pain, despite no apparent damage to the skin or other tissue.

Patients suffering from dysesthesia also often suffer from psychological disorders
Of the senses, some consider the principal is touch. Each sense has its own element: sight, water; hearing, air; smell, fire; taste, earth.

[...] I will say (following common opinion) that touch corresponds to the dregs of the earth; [but] in its praise, that we believe that this [sense] alone is necessarily given for life. We see that the other senses are given us by nature to ornament our existence.

Equicola [1525]

Active touch = Haptics

Haptics = “Passive” touch + Proprioception + Motor Commands
Input = Haptics = output

Information to the “environment”

Information from the “environment”
Haptics for input
Hapticons are small programmed force patterns that can be used to communicate a basic notion in a similar manner as ordinary icons are used in graphical user interfaces.

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<th>Meaning</th>
<th>Hapticon</th>
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Some emoticons and proposed hapticons by Rovers and van Essen [2004].

Information display

- **Haptic icons**
- Notification
- Augmentation of GUIs
- Expressive control
- Communication of affect
- Mobile and handheld computing
- Guidance
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http://www.talk2myshirt.com/blog/archives/3971
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Fixed-base driving simulator

- Full instrumentation
- Monitors: 115° x 25°
- SCANeR™ Studio (OKTAL)
- Active steering system for **realistic force feedback**
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![Graph](image)
Haptics for output
Natural interface?
Virtual Reality

We now have near-photo realistic visual VR

http://www.igta5.com/screencaps
Immersive display

And we have hi-fidelity visual VR display options
Natural interface?

But we don’t have natural ways to interact with (visual) VR
Locomotion interfaces

A treadmill is a solution; it allows user to cover great distances in a confined space. But movement is constrained to one direction/dimension.

Natural unconstrained walking means going in any direction we please.
Design an interface that allows you to walk freely and naturally in all directions

Is the interface you designed...

- feasible?
- practical?
- affordable?
Locomotion interfaces

As advertised

https://www.youtube.com/watch?v=AZ9mA34Bzw0

As advertised?

https://www.youtube.com/watch?v=MPSqM-g7_r0
Locomotion interfaces

VirtuoSphere

Cybersphere

http://www.youtube.com/watch?v=NmpOQZgHUMo

https://www.researchgate.net/profile/Vinesh_Raja/publication/220425224_Cybersphere_The_fully_immersive_spherical_projection_system/links/02e7e5267d19844e85000000.pdf
Locomotion interfaces

CirculaFloor

Locomotion interfaces

Torus treadmill

http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4145210&isnumber=4145131
In short

• Designing for natural interaction requires understanding natural interaction
• Natural interaction starts with the body, not vision or audition
• Body includes haptics and locomotion

**Haptics**

• Touch is typically considered less important than vision|hearing; but in a way it is the most important
  While you can live relatively easily without vision and/or hearing, but you cannot live without touch
• Touch is extremely robust
  It’s extremely rare to not be able to feel touch
• We should consider designing interfaces that allow us to interact with virtual environments through haptics

**Locomotion**

• Walking one of the natural ways in which we engage with our environment
• We should consider designing interfaces that allow us to walk through virtual environments in a natural and unconstrained manner
  Easier said than done