

## Perception



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## ... and Action



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## Perception and Action

### *Old...*

involves established disciplines like  
psychology and neuroscience

### *New...*

thinking about old ideas in new ways and  
applying them to HCI

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## Why study this?

1. People create mental models of the world.
2. We want people to perceive our interface the way we expect them to.
3. To do that, we need to understand how people create mental models of the world around them.

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## What is perception?

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## What is action?

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## Motivation

1. Knowledge about user's capacity.
2. Knowledge about user's expectations.
3. Points out the nature and causes of problems users may encounter.
4. Provides models and methods for creation of easy-to-use interfaces.

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## Further Motivation



## Leaving bread crumbs

- Information is context-dependent.
- The ergonomics and structure influences how people will handle information.
- The way we design something impacts peoples' mental representation of the system.

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## Leaving bread crumbs

One important implication for HCI is the need to provide rich cues for information pickup and landmarks for navigation rather than assuming the user has the "complete mental map".

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## Attention!

1. Attention is a very limited mental resource.
2. Attention plays a crucial role deciding what information is attended to.
3. The limited capacity of attention is the root cause of the limitations to visual and auditory tasks.

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## Attention is limited



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## Attention is limited



## Schedule

1. Introduction (done!)
2. Structure of the visual system (Peter)
3. Experiments in the Imager lab (Everyone)
4. Discussion of experiments back in class (Everyone)
5. Perceptual bandwidth (Pinar)
6. Application of theories to web interfaces (Eric)

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## Objectives

- ☞ By the end of this presentation, you will be able to relate topics on perception to HCI and appreciate their importance to the field!
- ☞ You will then be able to use these ideas to:
  1. provide advice multimedia designers.
  2. apply the theory to create better perceptual interfaces.

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The *Goodale Paper* can motivate us to think differently about perception & action...

**Q:** What is the purpose of vision?

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## What is the purpose of vision?

*Weimer (1977)*

1. Passively receive information.
2. Developed from common-sense, everyday experience.
3. General-purpose!

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## What is the purpose of vision?

*Goodale (1992)*

1. Creation of an internal model of the world, used for recognition of objects and understanding the relations between objects.
2. Guiding our actions with respect the world by transforming visual inputs into motor outputs.

☞ **Duplex** approach to visual systems.

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## Evidence

Visual control, such as reaching out and grasping objects, appears to depend on mechanisms that are functionally separate from those mediating the perception of that object.

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## Evolutionary Argument

- ⌞ Vision evolved in animals to guide their movements through the world, not to "see" the world.
- ⌞ The visual system of most animals appears to consist of a set of relatively independent visuomotor modules, rather than a general-purpose vision network.
- ⌞ *Vision may have nothing to do with "seeing"!!!*

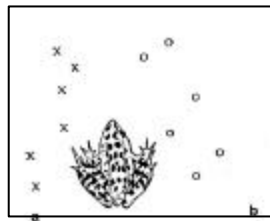
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## Evidence

Ingle Experiment (1973) from Goodale Article

1. *Optic tectum* "rewired".
2. Mirror-image feeding.
3. Mirror-image predator avoidance.

*But...*



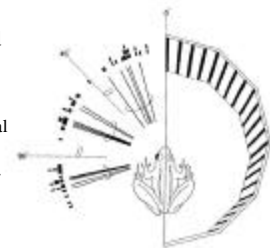
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## Evidence

Ingle Experiment (1973) from Goodale Article

... normal visually-guided barrier avoidance!

- ⌞ *Optic tectum* plays a critical role in visual control.
- ⌞ *Preteetum* still intact. Later studies showed that it plays a role in barrier avoidance.



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## Evidence

Ingle Experiment (1973) from Goodale Article

- ⌞ Frog has several visuomotor modules. (Perhaps as many as five!)
- ⌞ Against view of a general-purpose vision.

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## Goodale and Milner (1992)

from Goodale Article

- ⌞ *Ventral stream* constructs a perceptual representation of the world and objects within it.
- ⌞ *Dorsal stream* mediates the visual control of actions directed at those objects.
- ⌞ Example: donut.
- ⌞ Inputted information is the same but the processing is functionally different.

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## More Evidence: DF

(Milner 1991, Humphrey 1994 and 1996, Servos 1993) *from Goodale Article*

- ☞ Has a visual form of agnosia.
- ☞ Unable to recognize faces, shapes and contours.
- ☞ She can see colour and surface features.
- ☞ Evidence points toward damage in high-level processing.

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## More Evidence: DF

(Milner 1991, Humphrey 1994 and 1996, Servos 1993) *from Goodale Article*

- ☞ Consistent with Goodale's proposition that there are separate neural pathways for dealing with visual information.

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## Back to HCI

How does all of this affect how we think about perception and action in relation to HCI?

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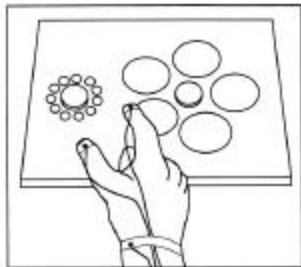
## Back to HCI

1. Our **Internal Model** of the world may be very inaccurate. Only relative position, orientation and size is of concern to perception.
2. **Visual Memory:** Once a movement is made the visuomotor coordinates used to guide that movement are lost.
3. **Visual field:** Perception depends on distance from centre of focus, but grasp continues to be well-calibrated for objects in the periphery.

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## Back to HCI

Ebbinghaus illusion *from Goodale Article*



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## Conclusion

- ☞ The visual perception and action systems are complementary but distinct.
- ☞ *What applies to perception may not apply to action!*

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