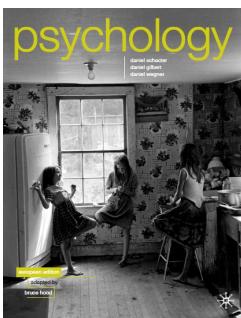


## Why Do You Need a Brain?



## Lecture 2 Sensation, Perception & Action



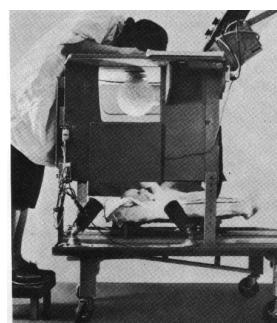
Sensory input is often ambiguous or incomplete



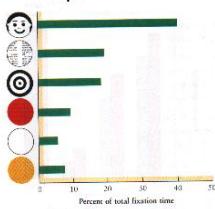
Perception organizes sensory input into representations that the brain can use



Early research simply measured how long infants would look at visual stimuli.



Using this simple technique, Fantz in the 1950s demonstrated that infants had visual preferences



Later research with newborns, revealed that infants could discriminate between stimuli using the habituation technique,



"the baby assailed by eyes, ears, nose, skin and entrails at once feels it all as one great blooming, buzzing confusion."

William James 1890

Empiricists (Aristotle, Locke) believe that little is built in and that organization emerges from experience

Nativists (Plato, Descartes) argue that the organization is built in to the system

As always, the truth lies somewhere between.

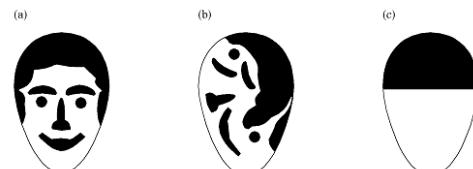
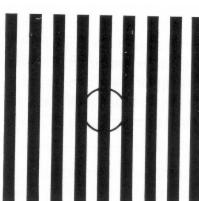
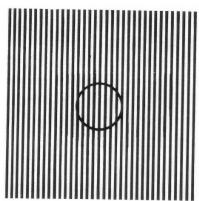


Figure 5.4 Face stimuli used by Fantz (1961): (a) facial arrangement, (b) jumbled facial features, (c) control stimulus with same overall brightness as the other two.



## What Can Newborns See?



Normal adult acuity = 30cyc/deg  
Newborns = 1cyc/deg



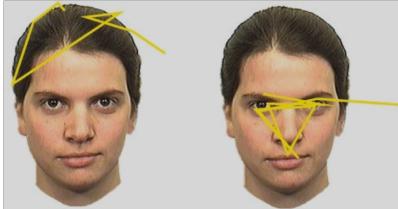
Adult Acuity



Newborn Acuity

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### Scanning Patterns at 1 & 3-months of Age

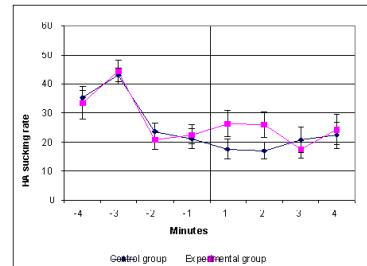


Face preference set-up



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## What Can Newborns Hear?



Data from 20 newborns discriminating Dutch from Japanese sentences

"Cat in the Hat" Evidence for prosody learning in fetus  
(DeCasper & Spence, 1986)

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## Making Sense of the World: Sensation

- Vision
  - Newborns are legally blind
- Audition
  - Hearing reaches adult levels at 5 to 8 years
- Taste and smell
  - Amniotic fluid can take on taste that influences later food preferences of infants
- Touch (baby massage – Field et al., 2004)

## What Can Newborns Taste & Smell?



Much less research done on other senses but:-

- preferences for sweetness (amniotic fluid study – Gandelman, 1992)
- learn taste preference from mothers (carrot juice study – Mennella et al., 2001)
- prefer smell of own mother (lactation study – Macfarlane, 1975)

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# Sorting Out the World: Perception

- Forming *mental representations*
- Newborns show perceptual constancies
  - Seem to understand that a moving object is the same thing as when it is still



## Perceptual Categorization

This requires the ability to extract general features such as the overall shape.

For example, do infants perceive these figures as shapes or separate lines?

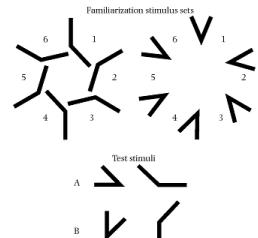


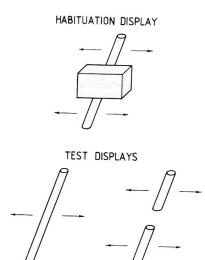
Figure 5.1 Figures used by Slater et al. (1991). During familiarization trials infants see either the set of obtuse or the set of acute angles, with stimulus orientation varied across presentation, so that the only constant feature is the angular relationship. They are then tested for a novelty preference between acute and obtuse figures.



## Filling in the Missing Information

Coherent motion is usually a reliable cue for conjoining disparate images (Kellman & Spelke, 1983).

The ability to fill in the missing section is present at 6 weeks if the rods move, but this ability has not been observed in newborns



## Testing for Perceptual Constancy



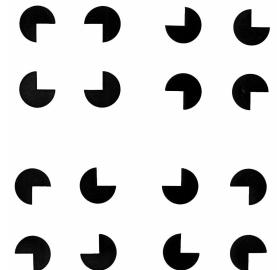
Size constancy: Slater et al. (1990) familiarized newborns to either a large or a small cube, which, over trials, was presented at different distances from the eyes.



## Subjective Contours

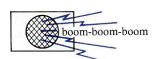
Only infants familiarized to the Kaniza arrangement in the top left show a significant preference away from squares (Ghim, 1990). Hence they must perceive a subjective square.

May not be present in newborns



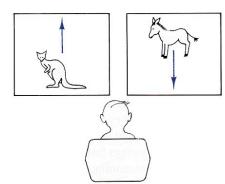
## Cross-Modal Link Between Sight & Sound

Orienting to sound is present from birth- implies that there is something to be seen



### Cross-Modal Matching

Studies using soundtracks de-synchronized from the image reveal a sensitivity to audiovisual correspondence from at least 4 mths (Spelke, 1976).



# Acting on the World: Motor Development

- Reflexes
  - Rooting and sucking (many reflexes disappear?)
- Stereopsis
  - Perceiving depth by combining images from both eyes (cortical function – Held et al., 1980)
- Visual cliff

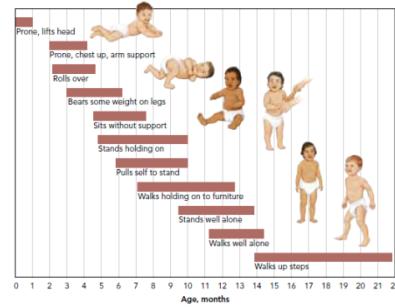


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# Acting on the World: Motor Development



Emerge in an orderly sequence but not a strict timetable  
(can be enhanced with interaction)

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## Perception & Action Come Together in Exploration



The ‘Visual Cliff’ (Gibson & Walk 1960)



Campos & colleagues (1970) demonstrated:

- 1) Early crawlers avoided heights earlier
- 2) Precrawlers given walkers avoided heights as well
- 3) Infants who wore casts were delayed in fear of heights
- 4) Early crawler and precrawlers given walkers performed significantly better on spatial search tasks.



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## Learning Points

- Perception organizes sensory input into representations
- Nativism and Empiricism differ in their account of perception
- Sensory abilities are limited but functional in the newborn
- Perceptual constancy is essential & is present early
- Infants are pre-adapted with many early preferences & learning
- Motor development enhances perceptual development

