Perception of Human Motions

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COS 598 B

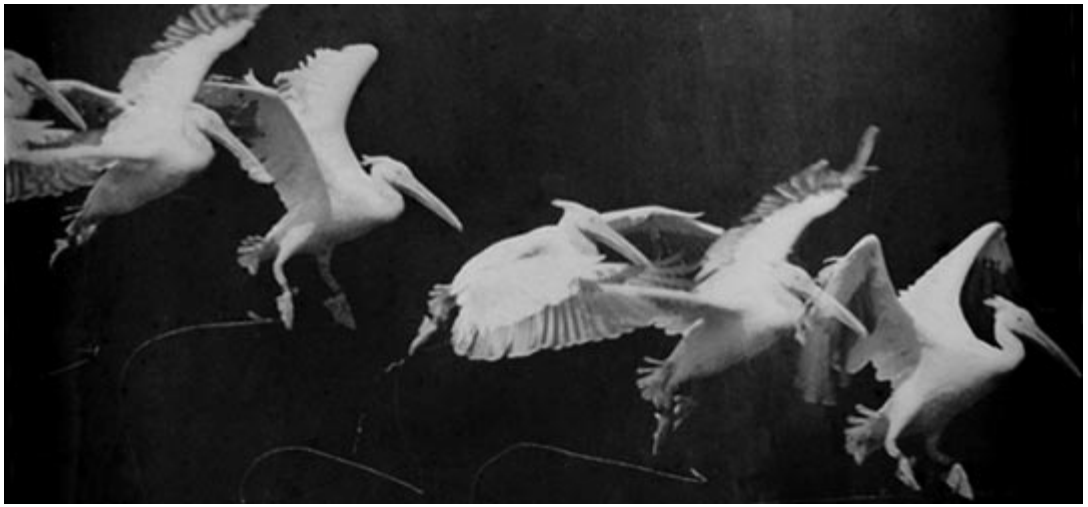
April 28 2008

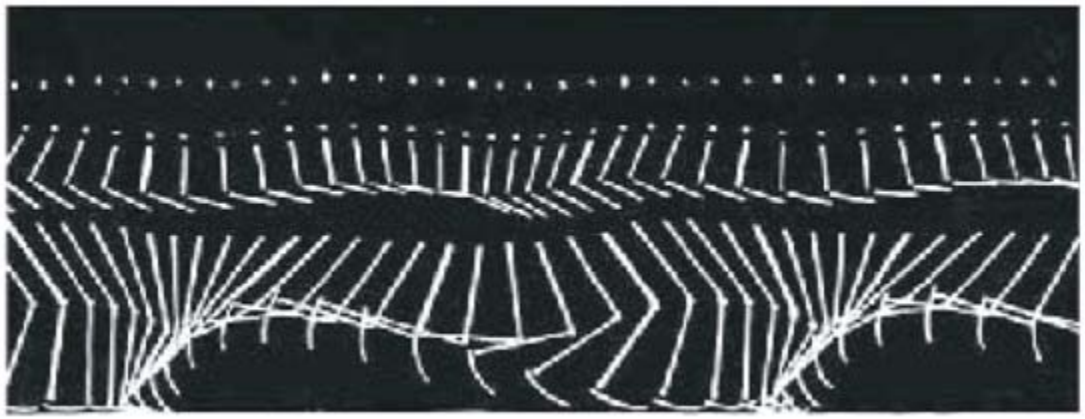
Kinematics

- How do you represent motion?
- Motion vs. appearance

Chronophotography

- Etienne-Jules Marey (1884)





PL animation

- Gunnar Johansson (1973)
- Individual frames have no “meaning”
- 10-12 dots

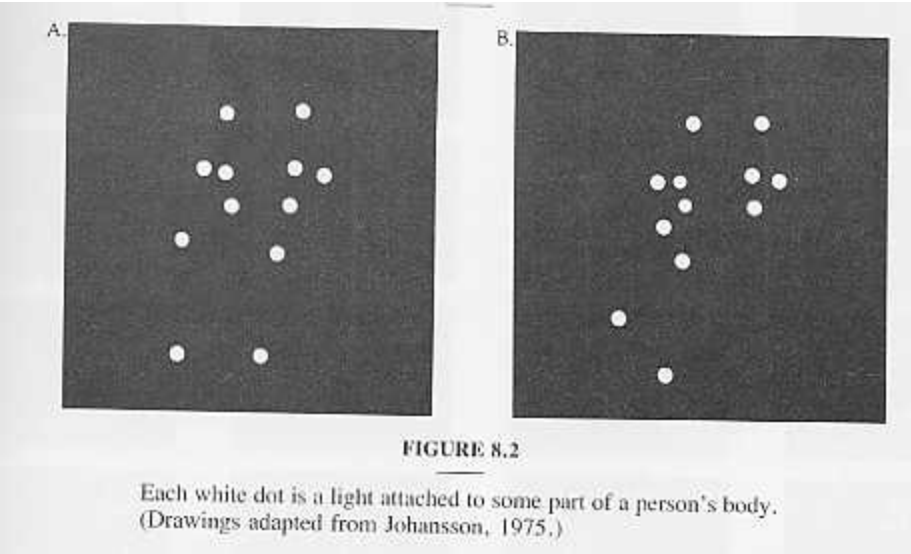
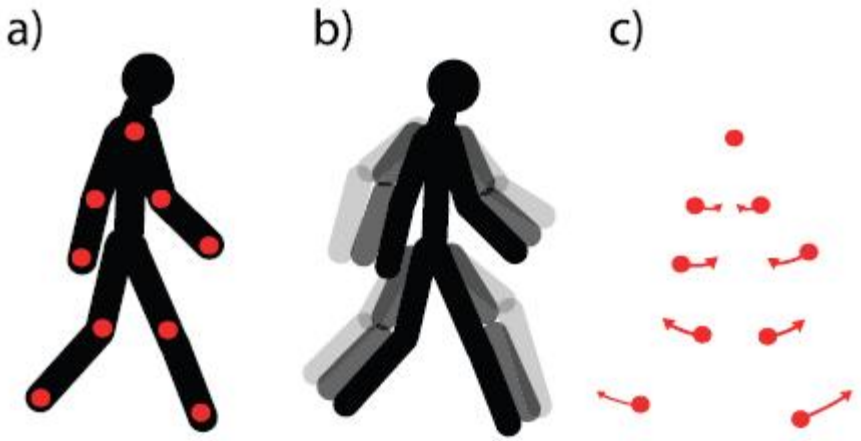


FIGURE 8.2

Each white dot is a light attached to some part of a person's body. (Drawings adapted from Johansson, 1975.)

PL animation

- http://www.psy.vanderbilt.edu/faculty/blake/AR/AR06BM.html (main)
- http://astro.temple.edu/%7etshipley/mocap/dotMovie.html

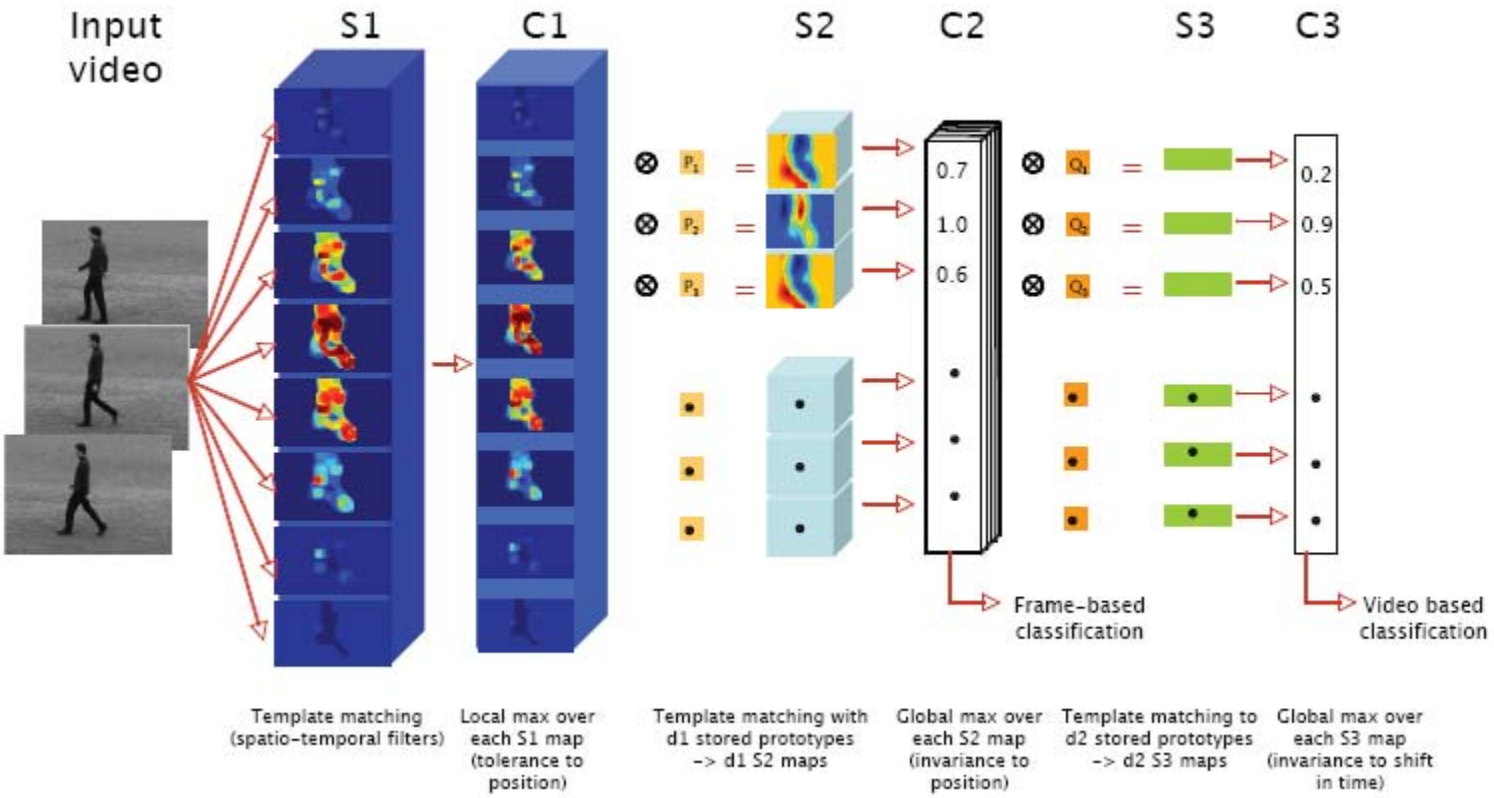


PL animation

- Modern applications
- Attach “appearance” to “motion”

Computational models

- Jhuang et al. (2007)



Computational models

- Jhuang et al. (2007)
  - .avi file

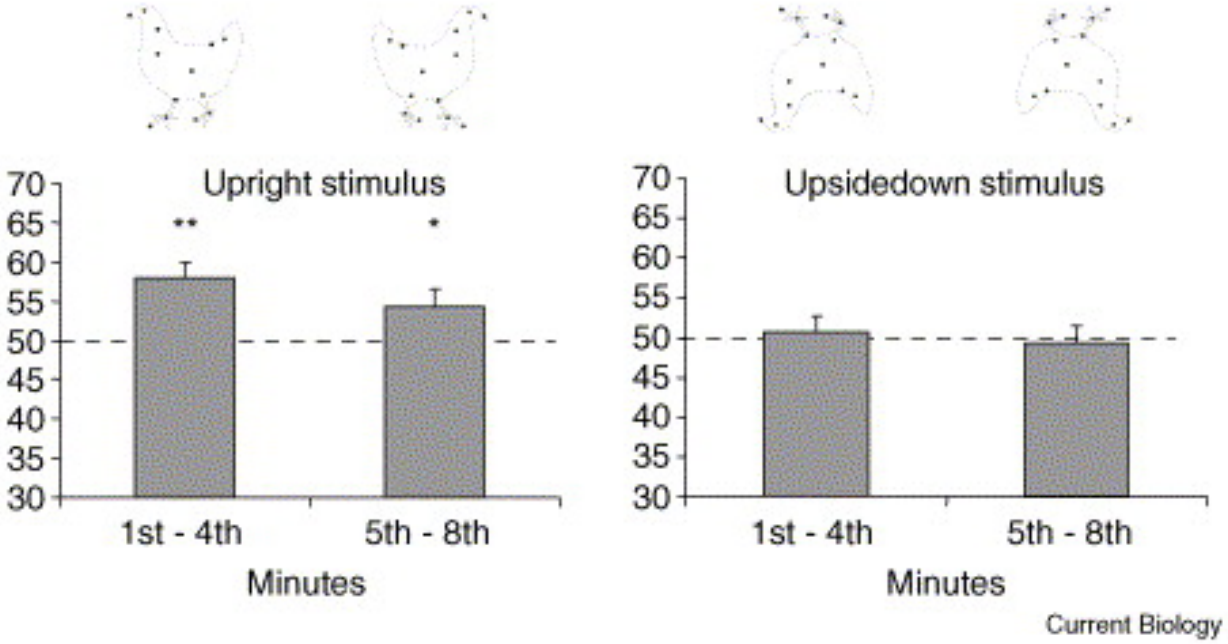
PL recognition

- Susceptible to inversion (Sumi 1984)
  - … just like static face perception (Valentine 1988)
- Warning observers of inversion *a priori* doesn't help (Pavlova & Sokolov 2000)

- Can infer properties of *objects* with which that PL actors interact (Bingham 1993, Stoffregen & Flynn 1994)
- Preferential baby-looking (Bertenthal 1993)
- People can identify PL animals (Mather & West 1993)
- Animals can recognize PL (Regolin et al. 2000)

Animal PL

- Regolin et al. (2000)



Social determinants from motion

- From motion, subjects can determine
  - Sex (Barclay et al. 1978)
  - Sexual orientation (Ambady et al. 1999)
  - Dancing ability (Brown et al. 2005)
  - Openness (Brownlow et al. 1997)
  - Social dominance (Montepare et al. 1998)
  - Intent to deceive (Gunns et al. 2002)
  - http://www.biomotionlab.ca/demos.php

Social determinants from motion

- Sexual orientation (Ambady et al. 1999)
  - Typical performance on 10s movies: 70%

Table 1
Sexual Orientation Judgment Accuracy (r) by Judge Gender, Judge Sexual Orientation, and Channel

	Channel			
Judge type	Stills	1-s clips	10-s clips	*M*
Heterosexual women	.10	.26	.55	.32
Lesbians	.23	.50	.51	.42
Heterosexual men	.08	.30	.51	.31
Gay men	.21	.31	.50	.35
M	.16	.35	.52	.35

Social determinants

- Detect emotions through PL door-knocking (Pollick et al. 2001b)
- Demo movie

PL recognition

How do we understand PL so well?

- Does PL support “Bottom-up” or “Top-down” models?
- Are high-level or low-level features more important?

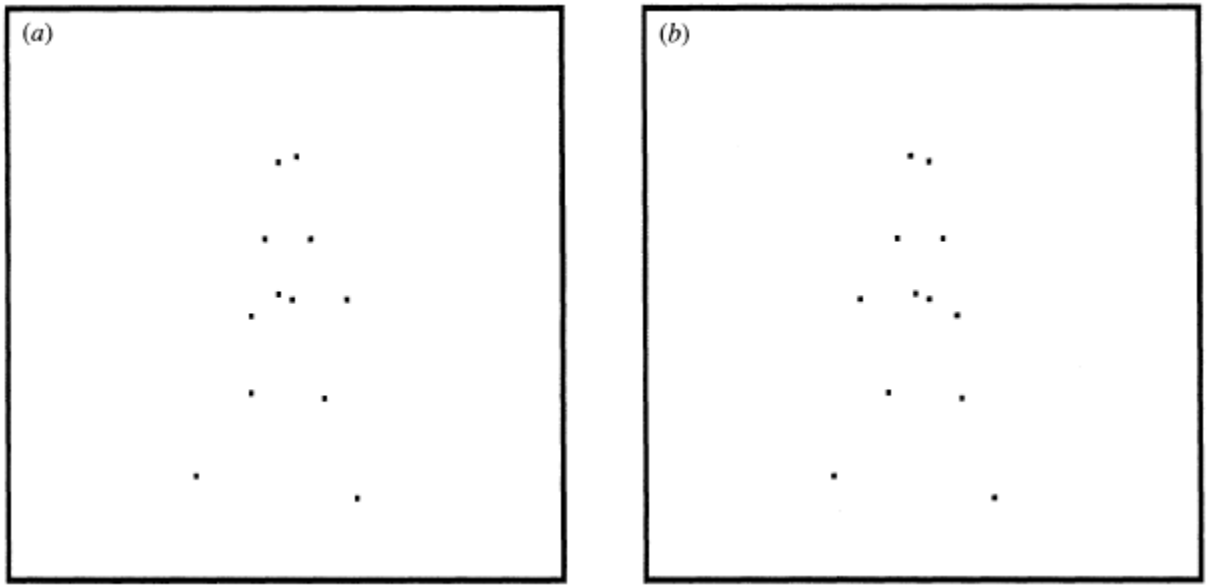
Low-level vs. High-level

- Johansson (1973): low-level visual processes, combined in “bottom-up” fashion

- Vector analysis of “parts” (pairs of dots)

Low-level vs. High-level

- Mather et al. (1992)
  - Insert empty frames, see what happens



Low-level vs. High-level

- Mather et al. (1992)

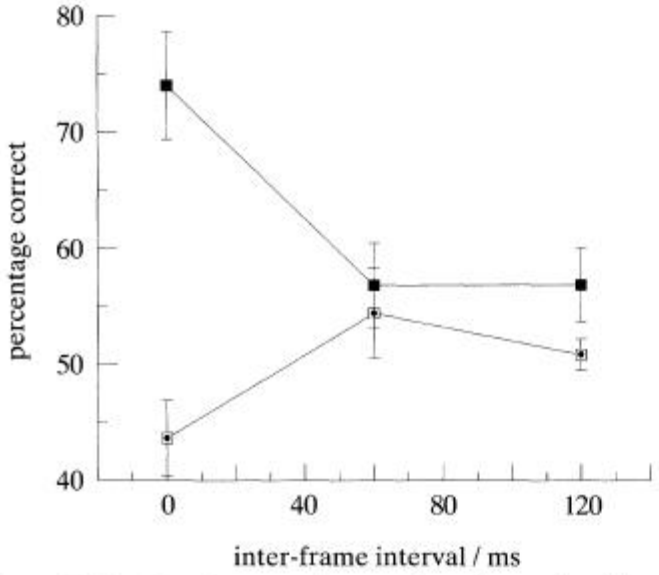


Figure 2. Results of an experiment to investigate the effect of inter-frame interval on perception of biological motion. Each data point is the mean percentage correct across five subjects, based on 40 trials per condition per subject. Vertical bars represent standard errors. Subjects discriminated coherent presentations (figure 1*a*) from incoherent presentations (figure 1*b*). Filled symbols represent results when frames were presented in the correct order, and open symbols represent results when frame order was randomized.

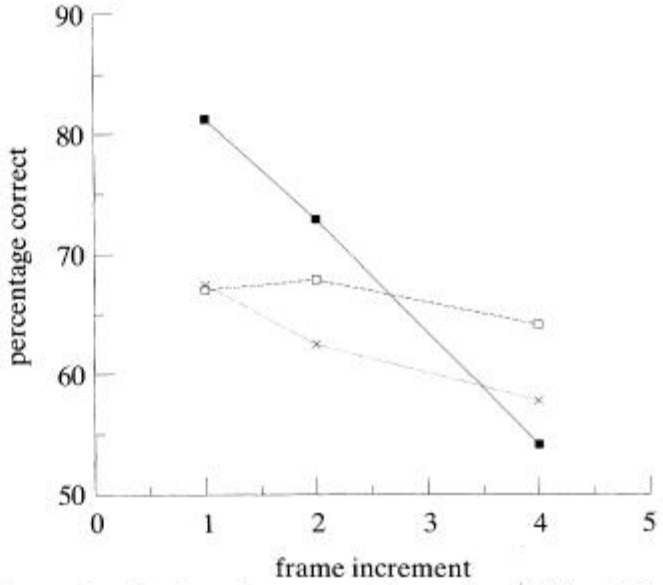


Figure 3. Results of an experiment in which subjects discriminated the direction the walking figure faced (left against right, all presentations were coherent), as a function of frame increment (abscissa) and inter-frame interval. Filled squares, inter-frame interval = 12 ms; open squares, inter-frame interval = 48 ms; crosses, inter-frame interval = 120 ms. Standard errors are omitted for clarity, but were similar to those plotted in figure 2.

Low-level vs. High-level

- Thornton et al. (1998)
  - Change only time resolution
  - Try longer videos

Low-level vs. High-level

- Thornton et al. (1998)

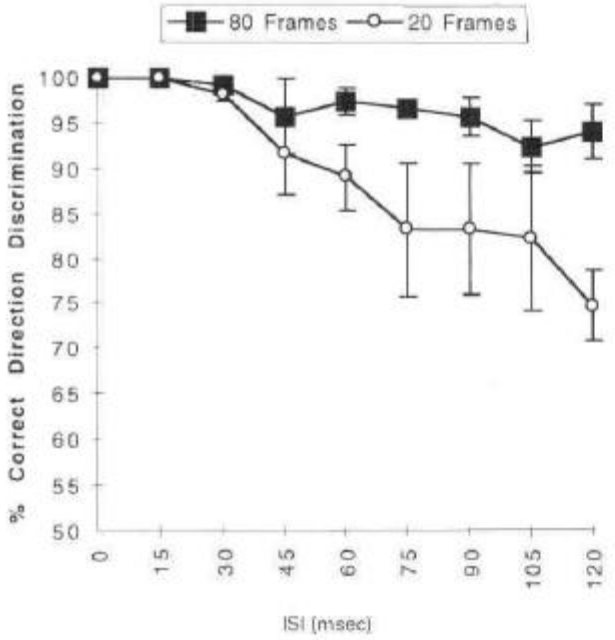


Fig. 3. The results of Experiment 1. The results are

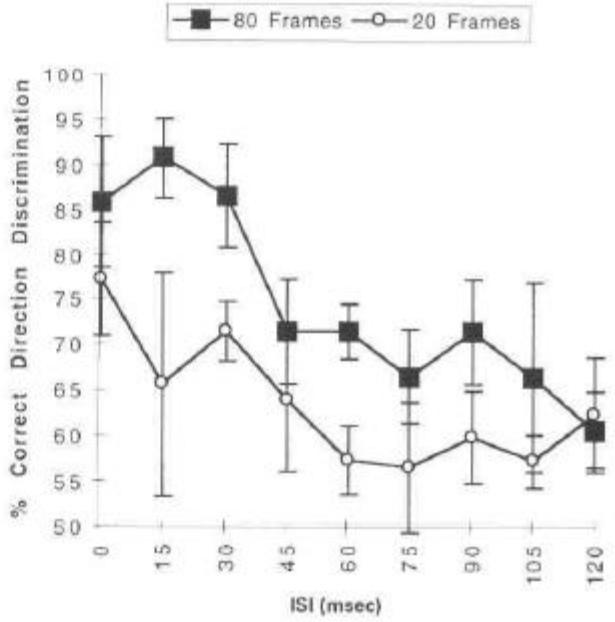


Fig. 4. The results of Experiment 2 collapsed across

Common coding principle

- Reed & Farah (1995)

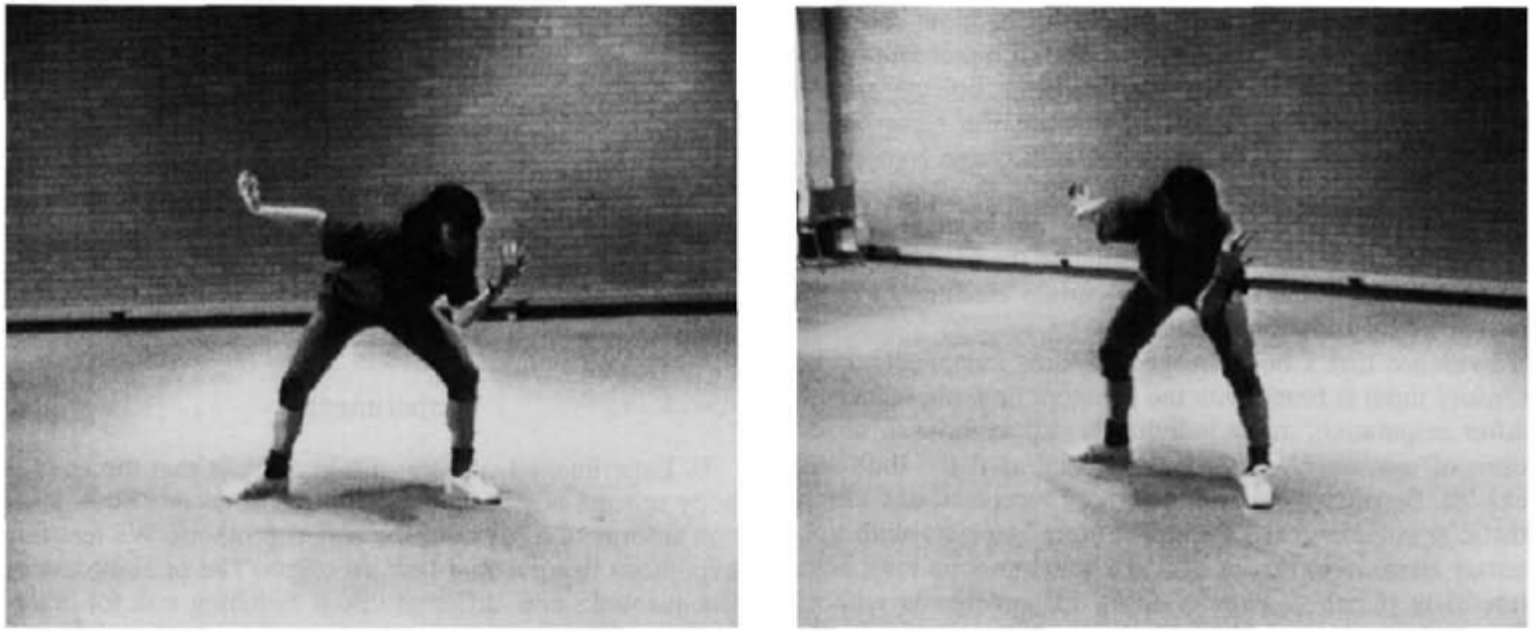
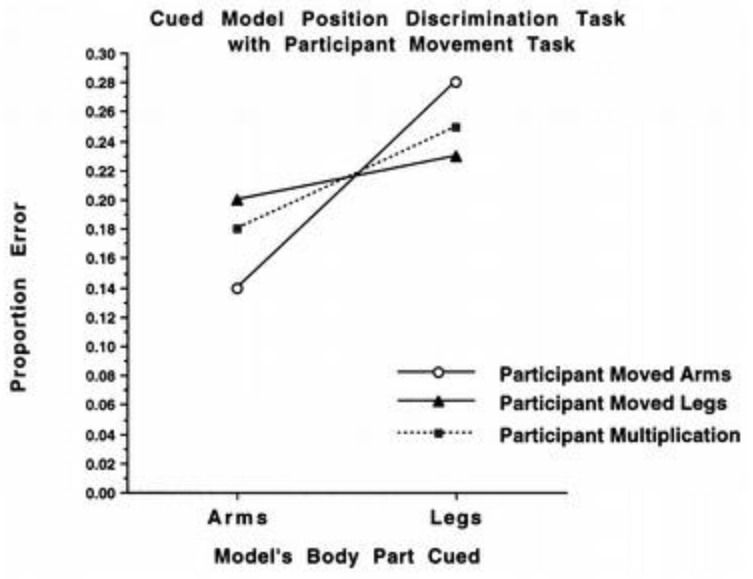
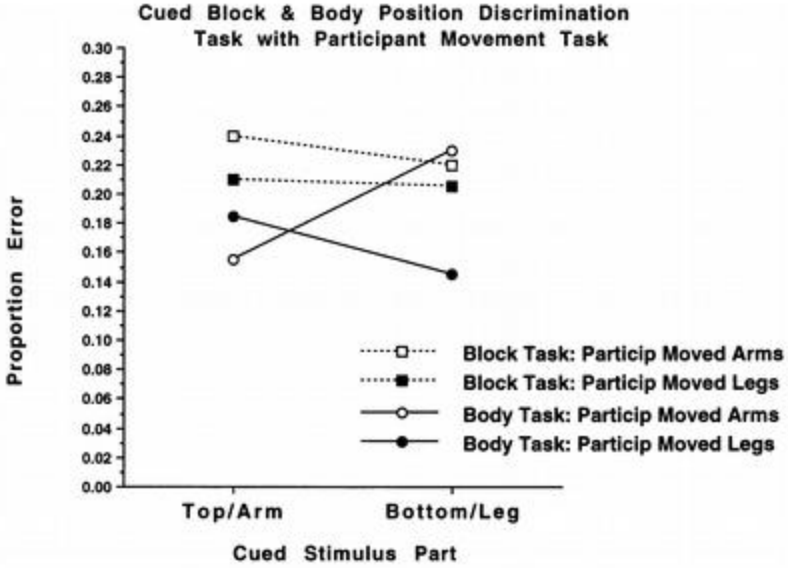


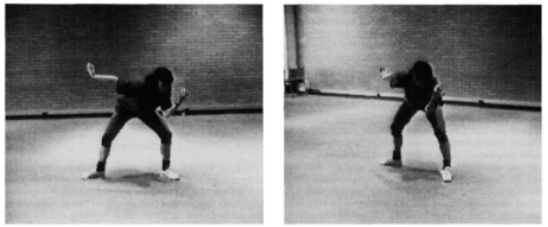
Figure 1. Examples of body position stimuli. The first pose (left) is photographed from a position directly in front of the model. The second pose (right) is photographed from a position 45° to the right of the model. Note that the two poses are identical.

Common coding principle

- Reed & Farah (1995)







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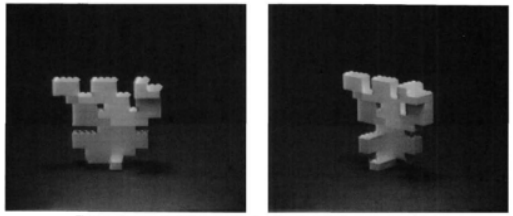
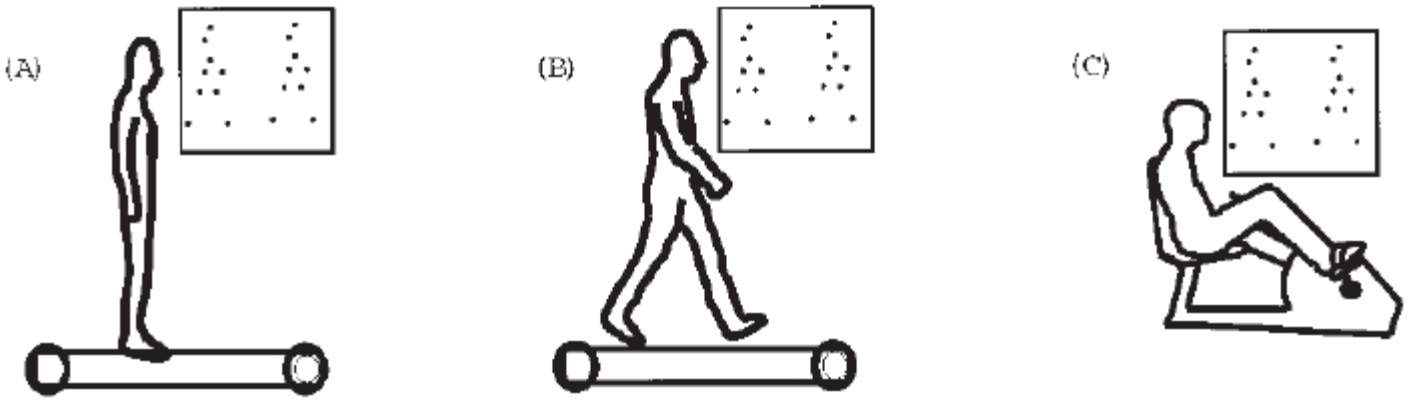


Figure 5. Examples of a "different" trial block position stimuli. The first configuration (left) is photographed from a position directly in front of the model. The second configuration (right) is photographed from a position 45° to the right of the model.

Common coding principle

- Jacobs & Shiffrar (2005)



Common coding principle

- Jacobs & Shiffrar (2005)

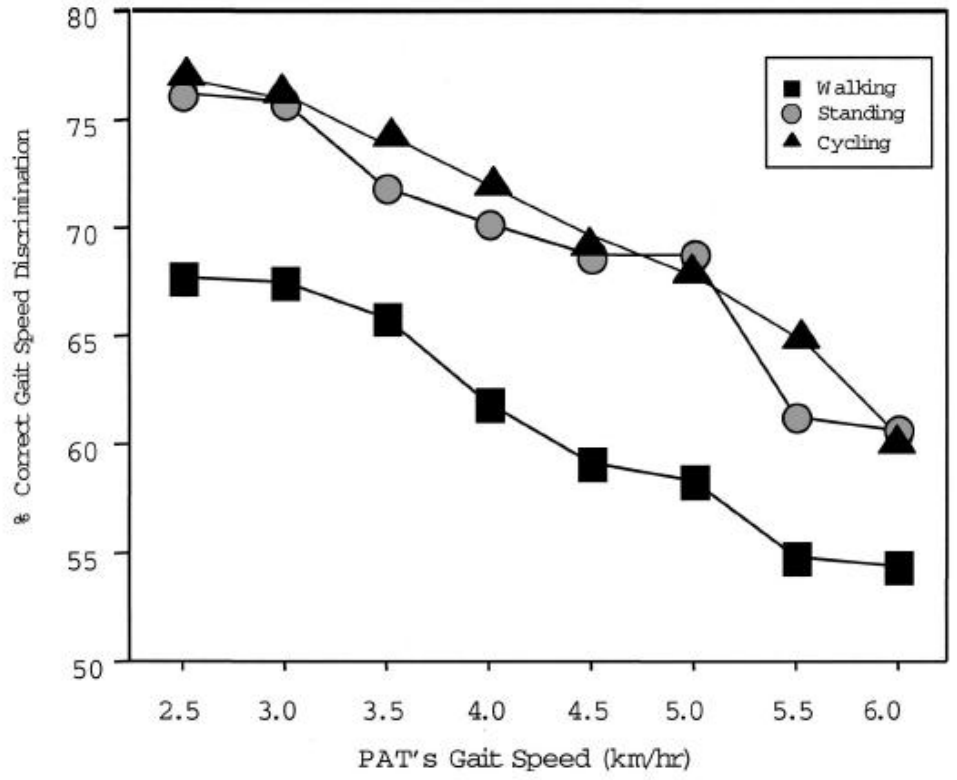
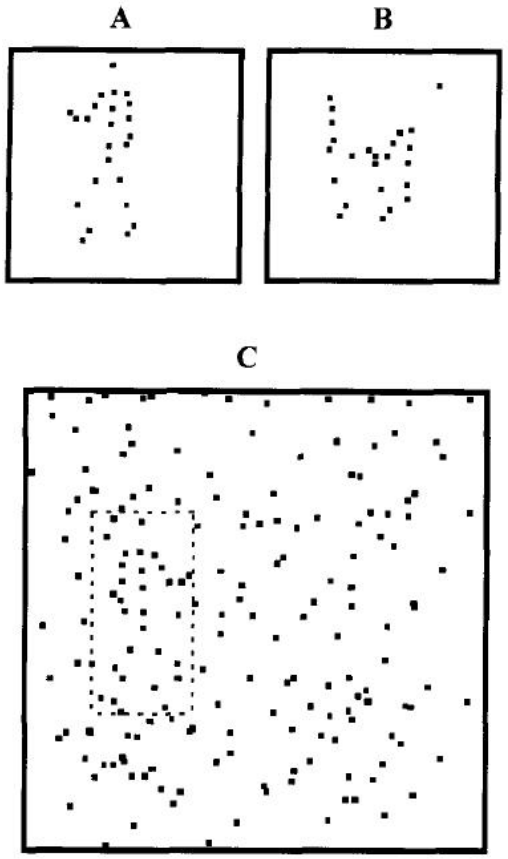


Figure 2. Mean discrimination accuracy in Experiment 1 as a function of condition and gait speed. PAT = the point-light walker presented on the right side of the computer screen.

Neural mechanisms

- Schenk & Zihl (1997)
- Lateral occipital gyrus == (MT/V5) of macaque monkey



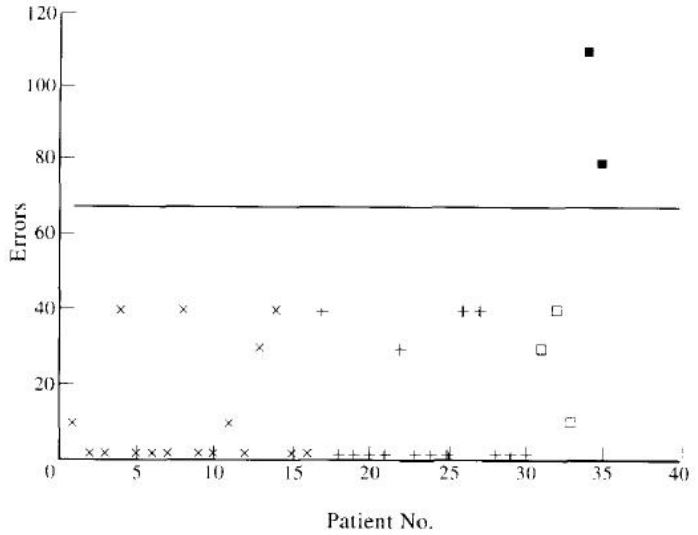
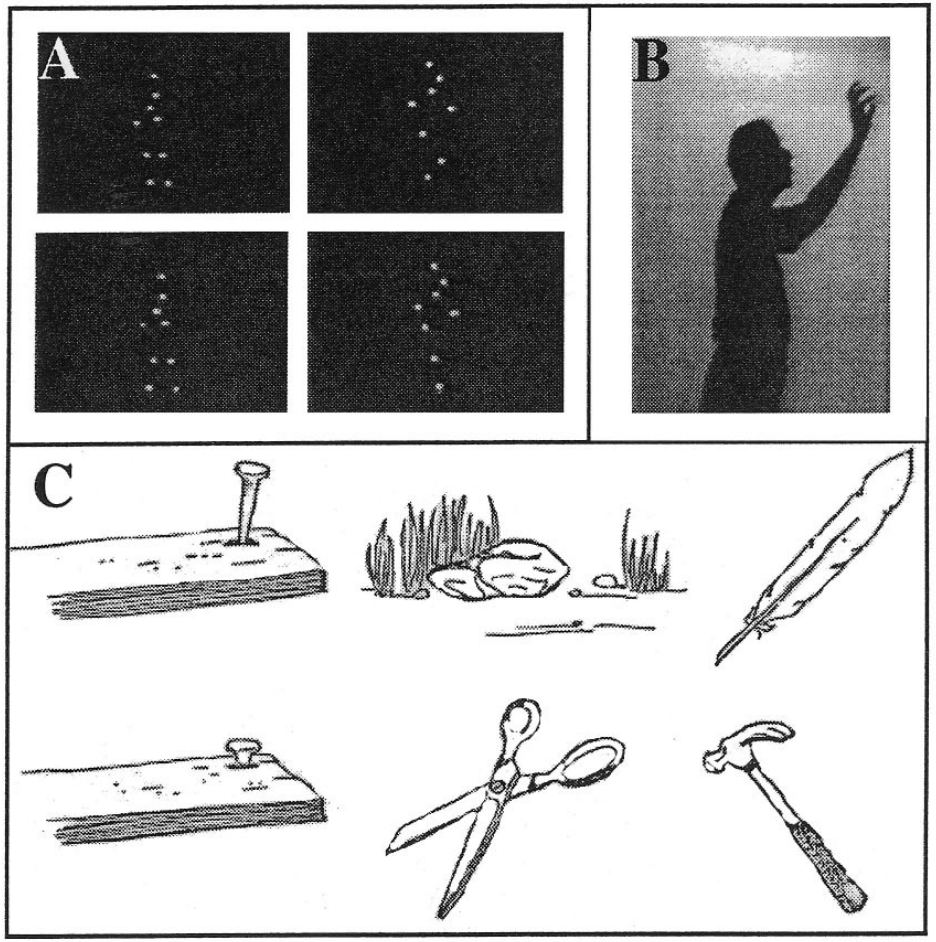


Fig. 2. Results of the identification task of Experiment 1B (figure on static random-dot pattern). The different symbols indicate different lesion groups. The symbol 'x' represents right-hemisphere patients; crosses (+) represent left-hemisphere patients; open boxes (□) stand for patients with bilateral lesions in subcortical, frontal or temporal regions; the dark boxes (■) represent the two patients with biparietal lesions (FM1 and FM2). The horizontal line in this figure shows the upper limit of the 95% confidence interval of the patient sample.

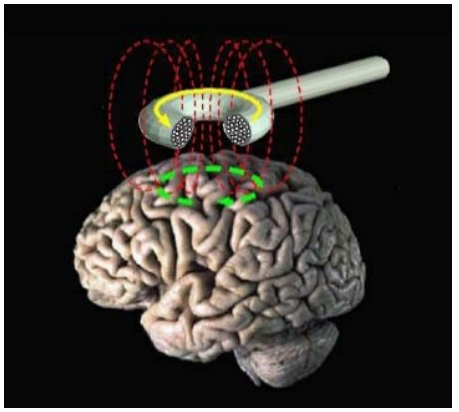
Neural mechanisms

- Cowey & Vaina (2000)
- Subject AL could not recognize people *when they moved*
- Cannot recognize PL actions
- Can recognize motions represented by static images (see box C)



Neural mechanisms

- Heberlein et al (2004)
  - Some patients impaired in judging emotion and personality (PL)
- Grossman et al. (2005)
  - Human motion perception (PL) disrupted by artificially-induced “lesions” by transcranial magnetic stimulation (TMS) of superior temporal sulcus (STS)



Neural mechanisms

- Mirror neurons
- Activate when an animal performs a visually guided activity, ie grasping

Discussion

- How is motor/social learning related to motion perception?
- Is human motion perception different from that of animal motion perception?