Perception and action – what are the connections?

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The seven basic ways

- Perceiving *is* acting
- We perceive *in order to* act
- *What* we perceive is first and foremost action possibilities (affordances)
- Perception often *leads directly* to action
- Perception often results in *implicit, procedural knowledge*
- We more or less continually *perceive our own actions* (in a very special way)
- We intermittently *perceive other people's actions* (in a very special way)

Perceiving is acting

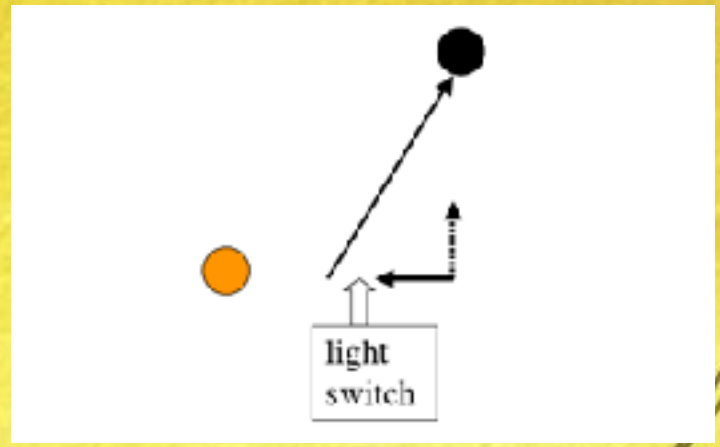
- ”See” *vs* ”look” (etcetera)
- ”Observation” – as result, but also as a process:
- We *move ourselves*
- We *move and adjust our sensory organs*
- We *use instruments*
- We *manipulate the object* (not only spatially)
- We *attend to selected objects and features*

Attending and acting – what are the connections?

- Active attention is under voluntary control
- When voluntary, it requires an effort
- Attention manifests itself in behaviour
- Attention is required for motor learning and "automatization"
- (Attending *is* learning!)

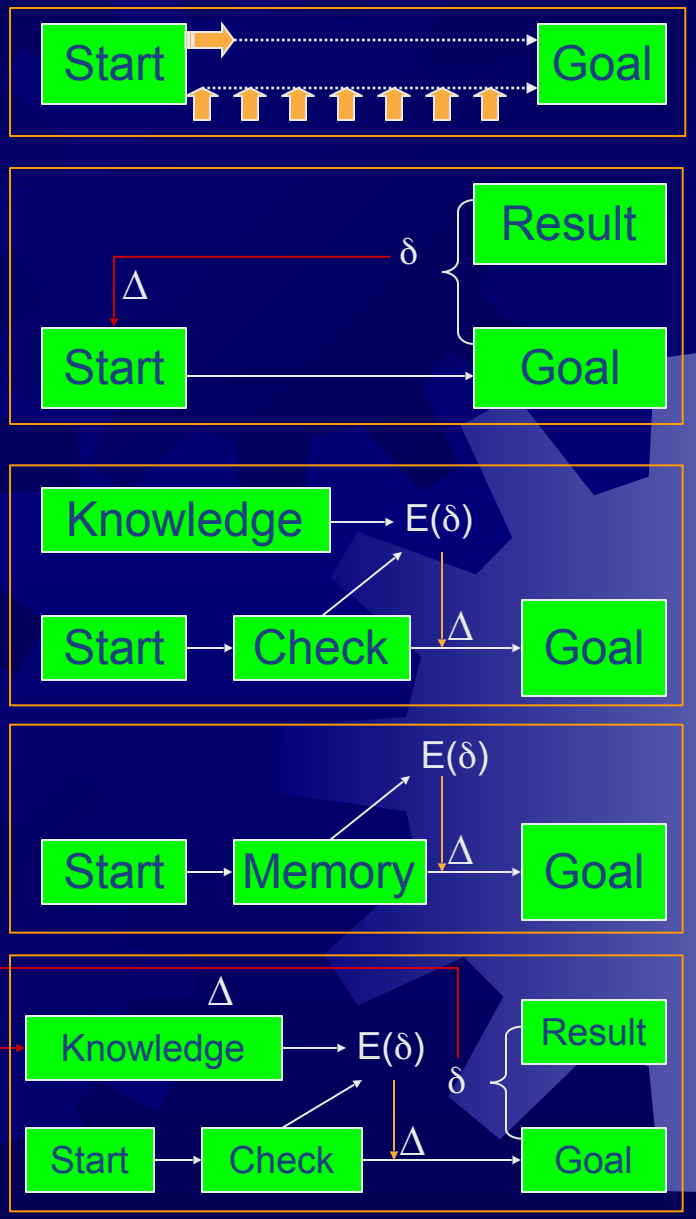
We perceive in order to act

- In order to identify the what/where of objects
- To continually monitor the results of our actions
- To steer our actions
- Evolutionary role...
- ...the reflex hierarchy...
- ... and conscious aims.
- (Blindsight)
- When the body is faster than the mind



Steering and control of behaviour

- *Ballistic* and *pre-programmed* movements: no feedback
- Simple feedback control*:* error signal *after* the action
- Feedback afterwards is often too slow (you are already dead)...
- Knowledge about the system's dynamics enables estimation of the error in advance, and hence control through *antecipatory feedback*
- With complete knowledge, external feedback becomes redundant. You may use a *copy of the command* instead. If you don't preprogramm...
- All forward control mechanisms can in turn be controlled by feedback after the event – *learned control*



Watching our own performance

- *External* perception (including tactile)
- *Internal* perception: *proprioception* (joints, muscles) (overrated?)
- No feedback but a copy of the command: *corollary discharge*, *efference copy*
- *Fast* and *learnable*!

Uses (and abuses?) of the efference copy

- "Correction" of sensory signals affected by the movement (Helmholz)
- Forward control of the movement itself?
- Underlies our sense of agency?
- Constitutes most of the body schema (in adults)?
- Defective functioning in schizophrenia???

Perceiving the actions of others

- Epistemology vs. psychology

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Joint action: bodies and minds moving together

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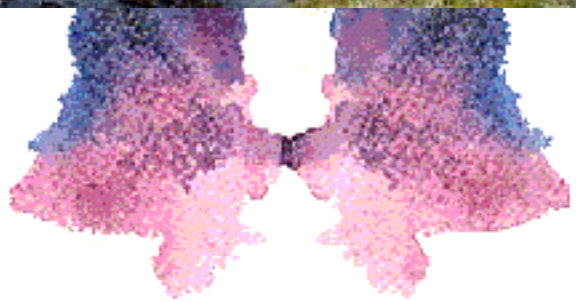
- Imitation vs. joint action: cooperation & competition

Seeing movement – even in still pictures

- Johansson's lights
- Seeing a movement as human depends only on its gross features (M. Schiffrer)

- Global features determine "movement responses" in the Rorschach test
- Rorschach also noted a latent imitation in this connection
- Two ways of perceiving movement: from the outside, and from the inside
- Physiognomic perception



The arch-empiricist states…

...I believe whoever will look narrowly into his own thoughts, and examine what he means by saying he sees this or that thing at a distance, will agree with me, that what he sees only suggests to his understanding that, after having passed at a certain distance, to be measured by the motion of his body, which is perceivable by touch, he shall come to perceive such and such tangible ideas, which have been usually connected with such and such visible ideas.

(Berkeley, G., *An Essay towards a New Theory of Vision*)

Or, in the language of practical perception:

Space is but a system of spatial affordances, organized through the body schema

Time and the body schema

- Husserl's idea of time perception: impression, retention, and antecipation of next impression
- But: Our perception of time is to a large extent a practical perception of the proper timing of actions
- It is not only important to strike *where* the ball is, but also *when* it is there. (The "when" system?)
- Complete practical knowledge about the required timing entails an ability to pre-program the action
- And that is what perceptual learning is for...

Overarching issues

■ REVIEW

Active Vision in Parietal and Extrastriate Cortex

ELISHA P. MERRIAM and CAROL L. COLBY
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Vision is an active process. We do not see the world directly; rather, we construct a representation of it from sensory inputs in combination with internal, nonvisual signals. In the case of spatial perception, our representation of the visual scene must take into account our own movements. This allows us to perceive the world as stationary despite the constant eye movements that produce new images on the retina. How is this perceptual stability achieved? Our central hypothesis is that a corollary discharge of the eye movement command updates, or remaps, an internal representation when the eyes move. In support of this hypothesis, the authors review evidence that parietal cortex and extrastriate visual areas in both monkeys and humans participate in spatial updating. These findings shed new light on the neural circuitry involved in producing a stable and coherent perception of visual space. NEUROSCIENTIST 11(5):484–493, 2005. DOI: 10.1177/1073858405276871

So, things may not be so simple after all...