UniversitätsKlinikum Heidelberg

Child Development
in the Age of Digital Media

Thomas Fuchs

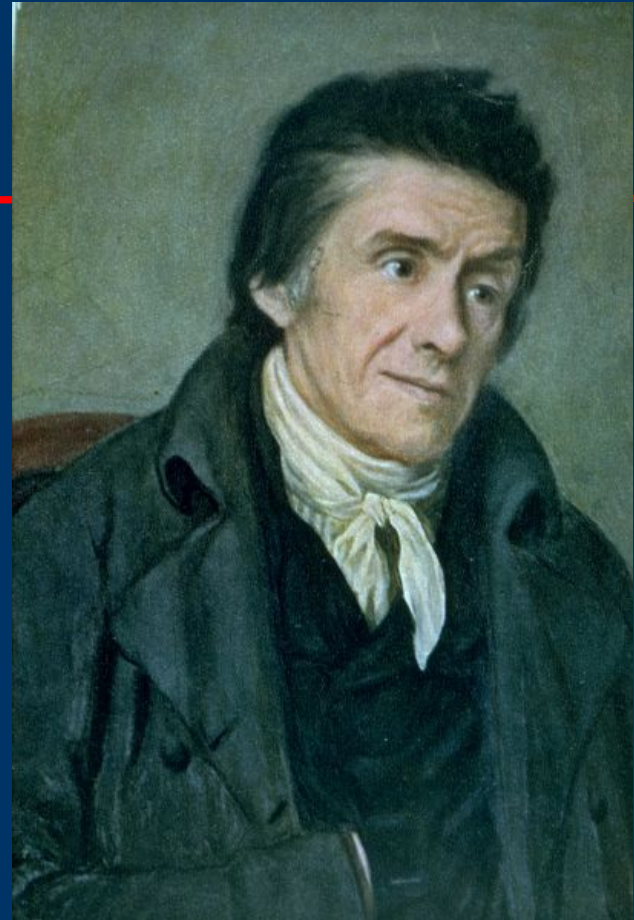Dept. of Psychiatry / Philosophy, University of Heidelberg

Introduction

Learning should proceed "with head, heart and hand."

Cognition, emotion and action always work as an integral unity:

→ *Embodied Cognition* or *Embodiment*

Heinrich Pestalozzi
(1746-1827)

Introduction

Learning and embodiment:

„Erfahrung" – from *„fahren"* = to move, to drive

„experience" – from „*experire"* = to gain knowledge and skills from moving through the world

This is also the way the brain is shaped in learning – embedded in, and adapting to *interaction.*

Overview

I. Embodied learning: Interacting with the world

II. Social learning: Interacting with others

III. Digital media

IV. Consequences

Overview

I. Embodied learning: Interacting with the world

Social learning: Interacting with others

Digital media

IV. Consequences

I. Embodied Learning: Interacting with the World

Embodied Cognitive Science

(Varela et al. 1991, Thompson 2007, Fuchs 2008/2017, etc.)

We experience the world through constantly interacting with it – in integrated sensorimotor loops.

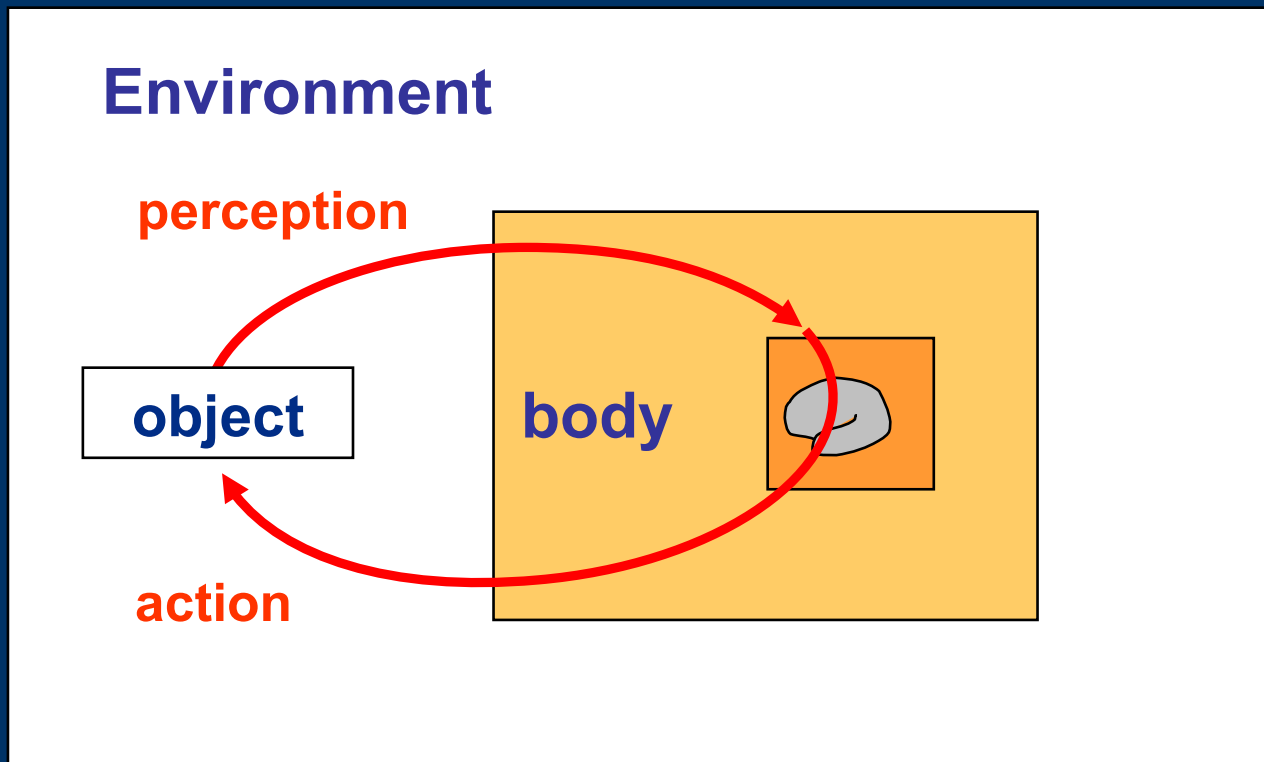Human cognition is inherently connected
– with bodily action
– with social interaction
– with emotional engagement

→ The brain is no hard drive or computer,
but a *relational organ* that is formed through interaction.

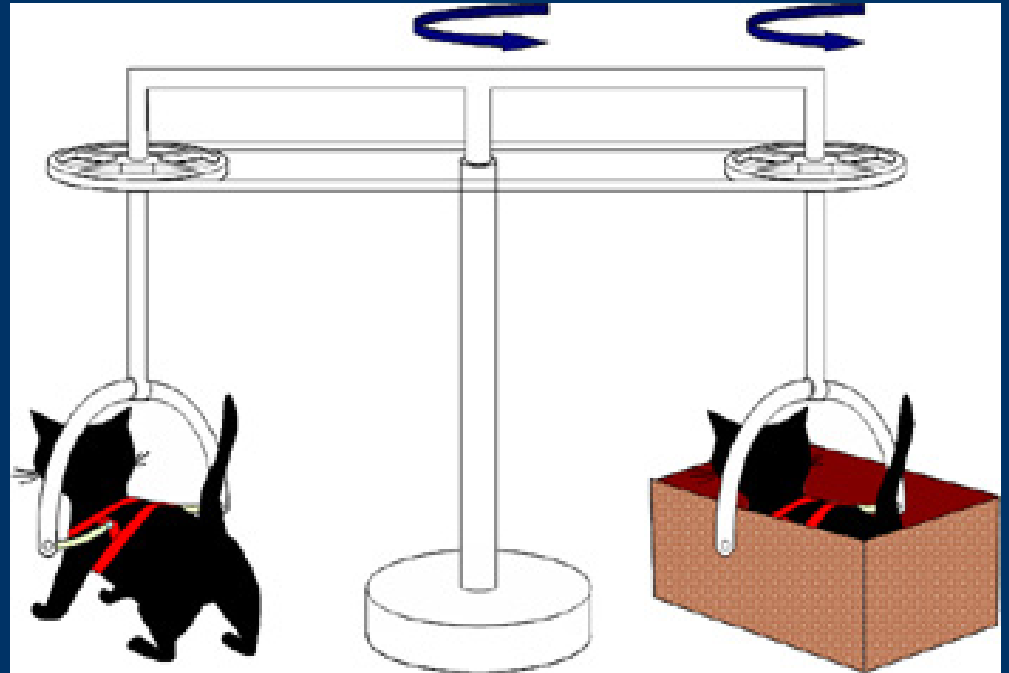# Ecology of the Brain: Sensorimotor Cycles

Brain Development through Interaction

Held & Hain (1963):
Spatial perception in
newborn kittens

a) active group
b) passive group

→ Space and depth perception depend on the active,
 moving body.

→ Merely visual (two-dimensional) stimuli do not
 constitute the *world.*

Brain Development through Interaction

Sur et al. (2000): „Rewiring" of optic nerve to auditory brain center in newborn ferrets

→ Through repeated visuomotor stimulation, the *auditory* brain center turned into a *visual* center.
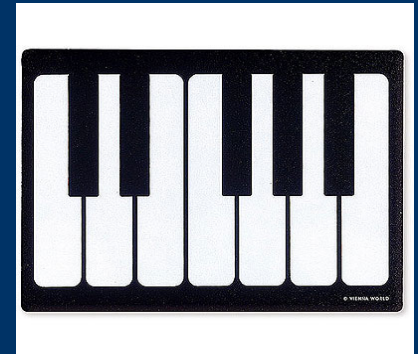

„Form follows function":

The function, through its embodied execution, creates its suitable cerebral organ.

Interaction with the environment creates the neural conditions of experiencing it.

Brain Development through Interaction

Establishing sensorimotor links in the brain: training to play a melody on the piano

Results after some training sessions:

−merely listening to the melody → subliminal activation of motor brain centers and finger muscles

−playing the keys on a silent piano → activation of auditory centers, „inner listening" to the melody

→ in-depth learning, enhanced memorizing

II. Social Learning:
Interacting with Others

Learning in Early Childhood

Dyadic engagement:

face-to-face interactions, proto-conversation, sharing emotions

Learning in Early Childhood

Imitation
soon after birth

(Meltzoff & Moore 1989)

Learning in Early Childhood

Activation of social resonance and mirror systems for linking perception and action in the brain

→ Acquiring affectiv-interactive patterns,
  „schemes of being-with" (Daniel Stern)

→ Affect attunement and basic empathy

However:

Both „matching" and „mismatching" states are important!
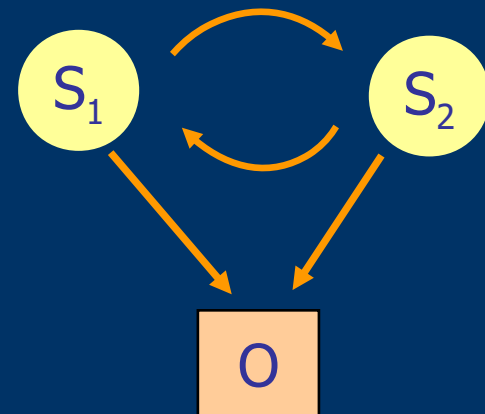
Learning in Early Childhood

8th-9th month:

dyadic → triadic engagement:

„joint attention"

Pointing and gaze following → shared relation to objects

→ Triadic interaction as
crucial human way of learning
(Tomasello 2005)

S_1 S_2

O

Learning in Early Childhood

„Natural pedagogy"
(Csibra & Gergely 2009)

–   Innate dispositions for social learning

–   Ostensive cues (gaze, raised eye brows, motherese): „This is important"

–   Human-specific form of communication: learning generalizable knowledge through interactive dialogue

Learning in Early Childhood

M. Tomasello: „Why We Cooperate"(2009)

–   12-15 months: collaborative engagement
     (sharing action plans, distributing roles)

–   Human-specific altruistic motivation:
     sharing emotions, intentions, goals, and actions

     = best condition for establishing lasting neural
     networks   (Merzenich 1998, Bao et al. 2001)

Learning in Early Childhood

–   Learning <u>language</u> in triadic situations:
      interaction with objects, connected with pointing und naming

–   Each verb that we speak or listen to already activates the networks in the premotor cortex necessary for performing the activity

(Pulvermüller et al. 2005, Jirak et al. 2010)

What is good school education?

John Hattie (2008, 2011)

800 meta-analyses, 50.000 studies

Results:

– The teacher as a person is the most important factor.

– Individual learning (e.g. with digital media) is not effective.

– The teacher should not be a mere "coach" or "facilitator", but an "activator" – leading, structuring (ostensive cues!), and "tangible" as a person.

– Taking the student's perspective, asking for feedback

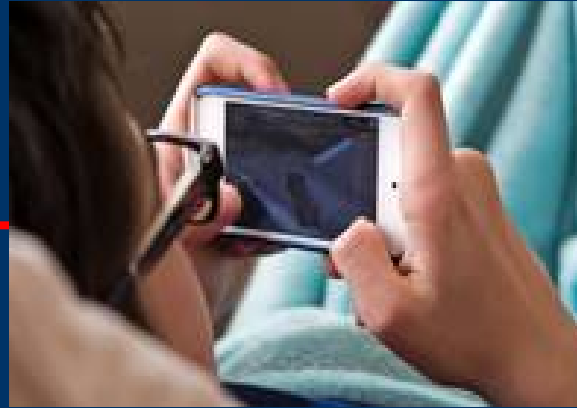– Warm, respectful attitude
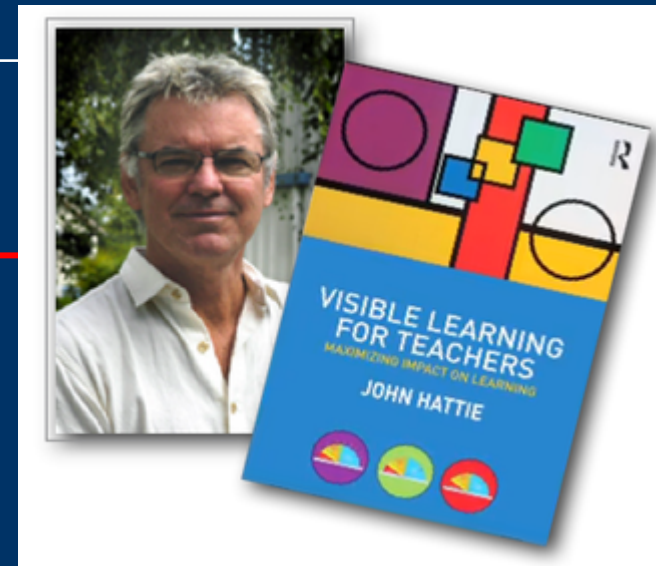
III. Child Development and Digital Media

1. Sensorimotor Structure of Digital Media

- Two-dimensional surface, no depth

- Rapid change of stimuli, pictures, and situations (training of distraction!)

- Disembodiment:

  - minimal bodily activity and intermodality

  - fixation of eye direction and focus

  - experience lacks resistance and weight

1. Sensorimotor Structure of Digital Media

In contrast: learning through interaction

– Keeping balance, coordination of trunk and arm movements

– Experience of agency, resistance and efficacy

– Intermodal sensorimotor experience

– Basis for later abstractions (e.g. laws of falling bodies): All logical and abstract operations are based on sensori-motor experience (Piaget 1953).

1. Sensorimotor Structure of Digital Media

Granted, children will always learn to move upright and to climb stairs.

However, the fine motor skills necessary to use tools and to explore the world are only learnt through interaction.

Impaired motor skills have a negative impact on cognitive and social learning.

Example: Developmental Coordination Disorder leads to impaired school performance, peer relations and social functioning (Leonard 2016)

2. Cognitive Structure of Digital Games

– Digital games emphasize process, speed and mechanism over content and meaning

– Attention to distracting stimuli → training of Attention Deficit Disorder

– Total absorption in the here and now, blinding out of past and future = underfunctioning of prefrontal cortex

– Overstimulation of dopaminergic reward systems → possible addiction; analogic games get dull

3. Social Structure of Digital Media

Lack of body resonance, eye contact, interaffectivity (cf. natural pedagogy!)

Social networks: emphasis on self-presentation instead of spontaneous bodily interaction

No triadic interaction, joint attention or collaboration

Multiplication of contacts instead of deepening relations

Frequent fear of social exclusion (getting „offline")

3. Social Structure of Digital Media

Ekeocha & Brennan 2008 :

After face-to-face discussion on a movie in groups of 3 persons, their individual memory of the event is significantly better than after digital exchange.

Studies on Effects of Extensive Media Use

−   Impairment of language acquisition, attention disorders (Zimmerman et al. 2007)

−   Impaired reading and writing abilities, behavioral problems at school (Weis & Cerankosky 2010)

−   Impaired empathy for parents and friends (Richards et al. 2010)

−   Reduced performance at school, less satisfaction, increased depressiveness (Sanders et al. 2000, Lepp et al. 2014)

−   Increase of Attention Deficit Disorders (Zheng et al. 2014)

−   Increased obesity (Hancox et al. 2004)

Studies on Effects of Extensive Media Use

BLIKK media study

(German goverment 2017, > 5500 children, 2-13 ys.)

–Children below 6 ys. with extensive media use (> 30 min.) show significant deficits in concentration and language acquisition, hyperactivity, and inability to play for longer times

–8-13 year-olds, > 1 h media use: similar results + overweight

Decline of Empathy

Konrath et al. (2011): cross-temporal meta-analysis of 72 studies on empathy conducted between 1979 and 2009:

Empathic capacities in American college students showed a decline of over 40%,
with the major drop (> 25%) occurring in the samples after 2000.

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Conclusion

Holistic learning means learning through understanding, feeling and acting. All three capacities are engaged *as a unity* in a child's embodied interaction with the environment.

These manifold sensual and bodily experiences may neither be replaced by media nor by a computer. Grasping is the basis all comprehending.

Excessive usage of digital media may have severe consequences for children's cognitive, emotional and social development.

Consequences

– "Renaturalization of childhood": jointly playing outdoors

– Age-related restriction of media use without demonization (for example, no digital media before 6 ys., restriction from 6-15 ys.)

– Offering attractive alternatives, for example interactive play

– Promotion of holistic methods of education: multisensory, interactive, explorative, and based on the teacher as a person

Echnaton, Nofretete, and their children (1345 v. Chr.)
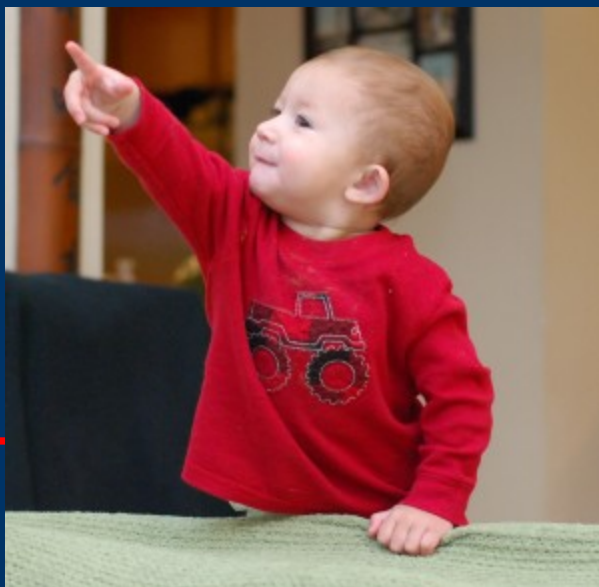
Thank you very much
for your attention!