



# Typical & Atypical Cognitive Development

Unit 5. Recap & Preparing for Exam  
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# RECAP & PREPARING FOR EXAM

- Today's assignment
  - Reflecting key messages of each of the previous units
  - Finding answers to corresponding key questions
- Exam next week
  - Form available at <https://seasense.github.io> on **20<sup>th</sup> April 2019**
  - Answers to be sent to [paul.seitlinger@tlu.ee](mailto:paul.seitlinger@tlu.ee) by **27<sup>th</sup> April 2019** the latest
- Final assessment
  - Announced at **10<sup>th</sup> May 2019**
  - Homework (60%)
    - 5 reflections:  $5 \cdot 3 = 15$
    - 3 (compulsory) reading assignments: 9 points
  - Exam: 16 points (40%)
  - Maximum: 40 points (plus 3 extra points for the fourth optional Unit 3-reading assignment)

# UNIT 0: INTRODUCTION TO BIOLOGICAL CONSTRAINTS OF COGNITIVE DEVELOPMENT

## – **Key messages**

- Much of neural development
  - is postponed until after birth.
  - consists in the development of efficient communication between neurons (within cell circuits) and increasingly specialized brain areas (of large-scale brain networks).
- Examples of biological mechanisms involved are synaptogenesis, myelination, and synaptic pruning.

## – **Key question**

- Why does the phenomenon of synaptic pruning indicate that fundamental learning mechanisms take place as an interaction of biological and environmental factors?

# UNIT 1: TRANSACTIONAL MODEL OF GENE-ENVIRONMENT INTERACTIONS

## – Key messages

- Cognitive development can be understood as an interplay of maturation and learning.
- Results of behavior genetics can be interpreted meaningfully, only if context variables, such as socio-economic status or age, are taken into account.

## – Key questions

- Maturation
  - Which processes mediate between genetically encoded information and protein synthesis?
  - What is *gene expressivity*?
- Learning
  - How can we describe classical conditioning in biological terms?
  - What is the learning rule of Hebb?
- Which logic (in research on behavior genetics) underlies the estimation of  $h^2$ ,  $c^2$ , and  $e^2$ ?
- Which conditions help an individual fulfill her or his genetic potential?

# UNIT 2: THEORIES OF COGNITIVE DEVELOPMENT

## – Key messages

- Piaget suggests that children progress through different stages of increasing intellectual sophistication: sensory-motor, preoperational, concrete-operational, and formal-operational.
- Contemporary approaches, such as Neo-Piagetian theories and the framework of Neuroconstructivism, aim to explain the mechanisms underlying this developmental progress.

## – Key questions

- Why does the controversy between empiricism and nativism continue in the context of Neo-Piagetian theories?
- Which levels of observation are taken into account by the neuroconstructivism and which sources of constraints on cognitive development are associated with these levels?

# UNIT 3: INDIVIDUAL DIFFERENCES IN COGNITIVE DEVELOPMENT

## – Key messages

- On a neuro-physiological level, executive functions (EF) are sub-served by a large-scale brain network spanning prefrontal and parietal regions.
- The strength of fronto-parietal connections increases from infancy to adulthood. The improvement of this “communication structure” goes hand in hand with EF improvements.
- Extensive engagement in cognitively demanding activities, such as learning to read, can increase a child’s performance in tasks on EF.

## – Key questions

- Which EF sub-functions are typically distinguished in the corresponding research literature and what are typical instruments to measure each of them?
- Which of these sub-functions contributes most to the prediction of a child’s reading comprehension skills?
- Which “sources of constraints” (as proposed within the framework of neuroconstructivism) help us understand the reciprocal relations between reading comprehension and EF?

# UNIT 4: NEUROPHYSIOLOGICAL CORRELATES & TRAINING OF EXECUTIVE FUNCTIONS

## – Key messages

- Positive EF training effects on a behavioral level (performance in EF tests) are reflected on a neurophysiological level in form of an increased fronto-parietal brain activation.
- Training programs that implement a certain set of empirically validated principles can improve EF.

## – Key questions

- Why does the neuroconstructivist concept of *interactive specialization* help us understand the neurophysiological effects of effective EF training programs?
- Which of the above mentioned principles are easily implementable by a computer-based cognitive training on the one hand and physical exercises (integrating mindfulness) on the other hand?

Thank you for your attention 😊