

# Didactics of computer science

# Outline

- Didactics - what is it and why care about it?
- Behaviorism and constructivism
- Cognitive load and scaffolding

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# What is didactics

- What students should learn
- Why they should learn this
- How we can teach it

# Some attitudes you might have met with regards to learning

- Whatever goes:
  - It does not matter how you teach, because you can never say that one way of teaching is better than any other way.
- Give me the rules of thumb:
  - Provide me with a few bullet points on what is the best way to teach - before you can do that, I couldn't care less

# Now, how would that look in any other field? (e.g. *mining*)

- Whatever goes:
  - It does not matter how you dig a mine, because you can never say that one way of mining is better than any other way
- Give me the rules of thumb:
  - Provide me with a few bullet points on what is the best way to dig a mine - before you can do that, I couldn't care less

# Learning underlying principles of learning

- Use as basis for reflecting on practical day-to-day situations
- Provide some foundation for handling any unforeseen situation
- Serves as framework for organizing experiences (further learning)

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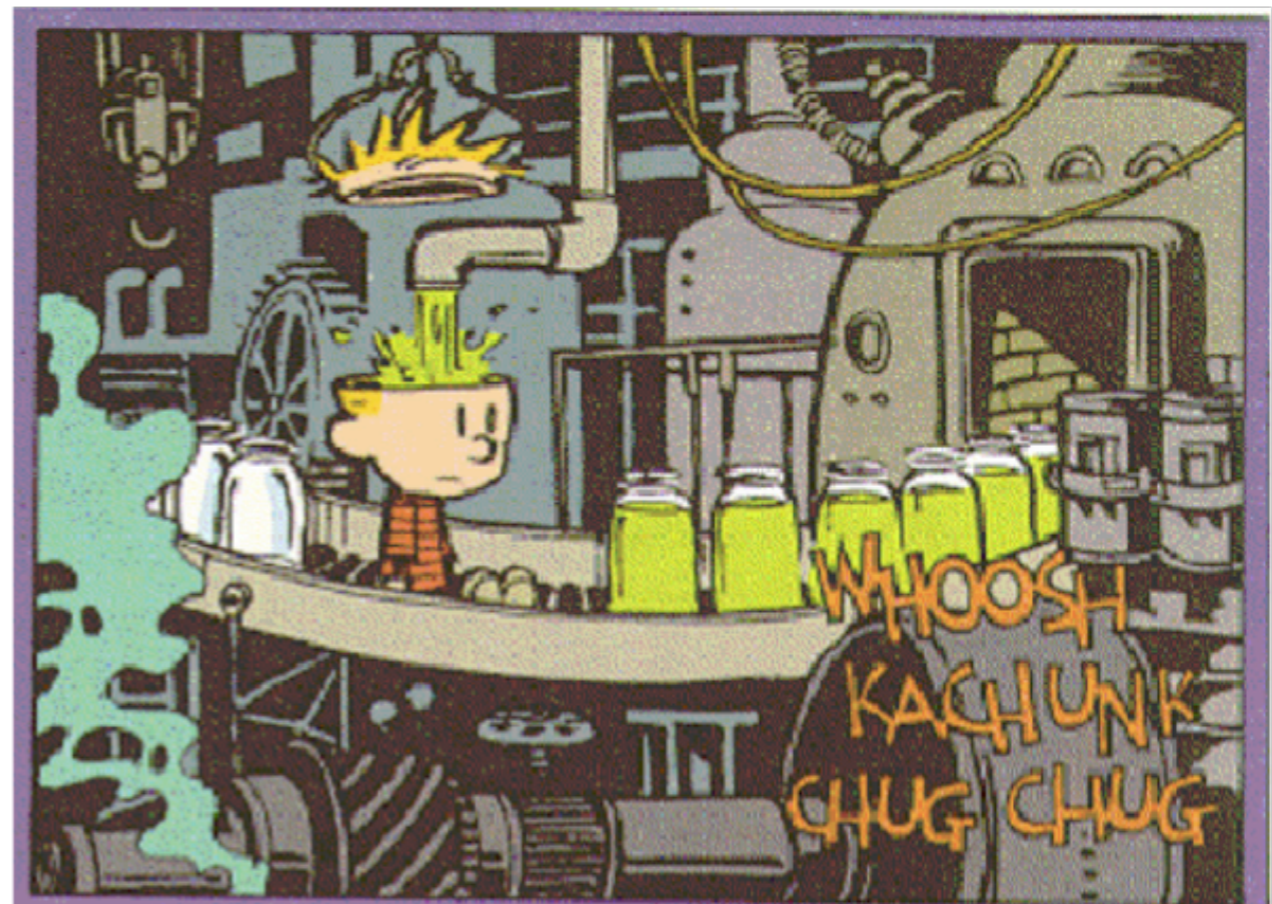


# Behaviourism

*We can't know what's inside peoples' heads  
- therefore must focus only on what goes in and out*

Consequence  
for learning:

*"The mind is a clean slate that  
can be filled with transmitted  
knowledge"*



# Constructivism

*Knowledge is not written into a free block of brain space  
- it is integrated with an existing knowledge structure*

*"Knowledge is actively  
constructed by the student,  
not passively absorbed from  
textbooks and lectures"*



*"Since the construction builds recursively on knowledge  
(facts, ideas and beliefs) that the student already has,  
each student will construct an idiosyncratic version of knowledge."*

# What this means in primary school

- Fifty years ago, parents were told it was important that children DID NOT learn to read before school
- Today, children are encouraged to learn letters or even reading before school (wrong technique not considered a big problem)
- "Individuell tilpasning"
  - Match the prerequisites and level so as to motivate each pupil
- Explain the same thing in different ways
  - Because of differing existing knowledge structures, different ways of explaining will work for different pupils

# What this means for a university course

- All prior knowledge each student has is something we should consider and cater for
- We should show alternative solutions to a problem, and support the solution path taken by each student (not force an alternative approach)
- We should help students build viable cognitive structures for learning (tbc.)

# Students and cognitive structures

- *Many* students has no effective model of a computer:
  - No cognitive structure that the student can use to **make viable constructions** of knowledge, **based upon experiences** such as reading, listening to lectures or working with a computer.
  - At most, the model is limited to the grossly anthropomorphic '**giant brain**', hardly a useful metaphor when studying computer science.
  - The idea that a '**hidden mind**' within the programming language has intelligence is referred to as the 'superbug'.

# How to approach students that have prior experience

- They will usually have an advantage through richer structures that new knowledge can be attached to
- But, they may also have problematic misconceptions
  - Misconceptions are part of the prior knowledge that forms the (shaky) basis for construction of new knowledge
  - Merely listing misconceptions is fruitless; a description of the underlying (faulty) model and a prescription for constructing a modified one must be given

# What this means for the teacher (you)

- You're not transmitting knowledge to passive students
  - You're supporting students' active knowledge construction

# What this means for the teacher (you)

- You can never do a perfect job
  - Teaching is notoriously challenging, and always a compromise
- You don't even have all the knowledge you would like
  - Not enough to only know a single solution - should ideally be able to relate constructively to all possible solutions..

*"The task of the teacher is significantly more difficult than in the classical paradigm, because the guidance must be based on the understanding of each student's currently existing cognitive structures"*



# Conclusions

- Students don't come with empty, one-size-fit-all brains
- Students actively construct knowledge based on what they know and believe beforehand
- The learning process is thus unique to every student
- Being a teacher is immensely challenging, but also very fascinating
- As a teacher, we try to support the diverse learning processes of every student
- Impossible to do perfect - but this only means that how we do it matters all the more