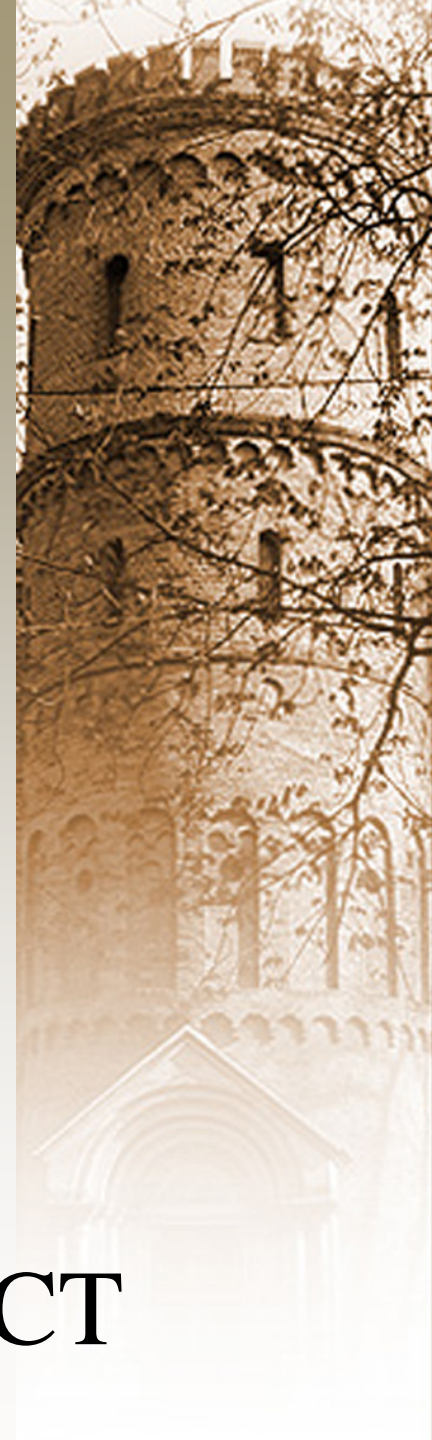


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Learning for understanding:
The interplay of cognition and ICT

From information to understanding

”Where is the wisdom we have
lost in knowledge?”

Where is the knowledge we have
lost in information?”

T. S. Eliot

What is the goal of education?

- Information
- Knowledge
- Understanding
- *Surface*
- *Depth*
- *Mastery*

So how can we create educational tools for reaching understanding?

Motivation

- **Outer** (e.g. grades)
- **Inner** (e.g. the joy of discovery)
- Understanding increases inner motivation
- "Overjustification effect": if you are rewarded for something you like anyway, it becomes less interesting

To understand is to see a pattern

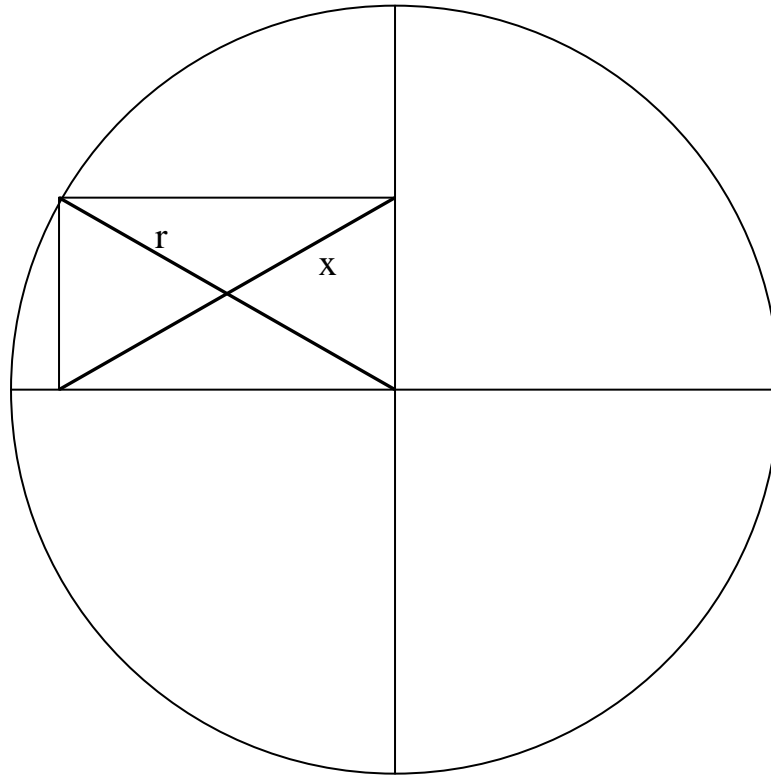
I don't
understand



What is this?



How long is x ?



Learning for understanding

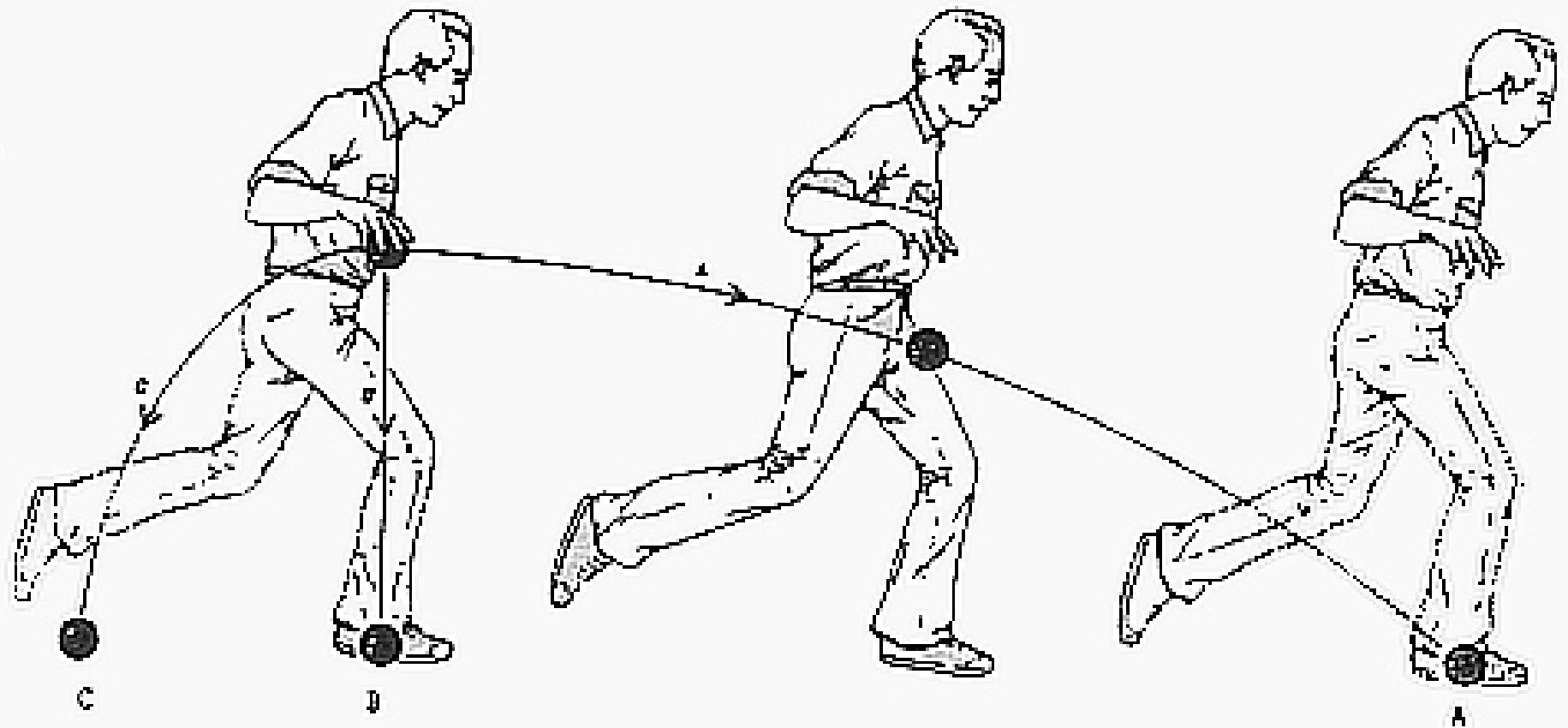
- Aha-experiences are motivating
- Not understanding is frustrating and leads to lack of motivation



What *more* do you know when you understand something?

- Seeing patterns makes it possible to *generalize*
- *Transfer* to new kinds of problems
- Abstract representations improves transfer
- Metacognition supports understanding

When theory is not understood ...



How is understanding achieved?

- Abstract theories about a subject can introduce patterns
- But the patterns must be grounded in experience to become *meaningful*

How does a student achieve relevant experience?

- Traditionally: as an apprentice
- In many school subjects it is difficult to provide relevant experiences
- Replace by "virtual" experience
- Interaction is important - "learning by doing"

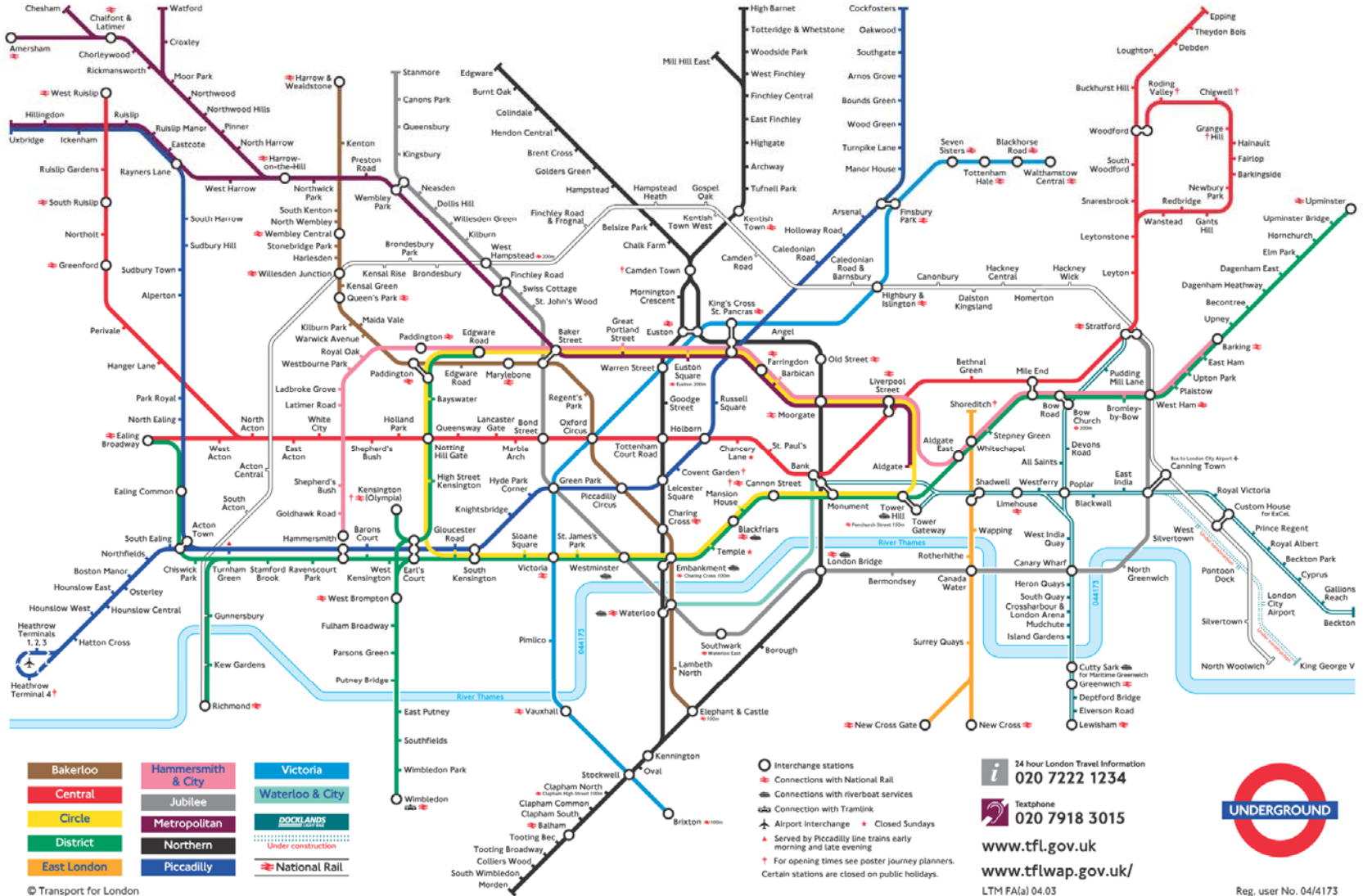
Efficient use of ICT in education

- Visualization
- Simulation
- Tutoring systems

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Information need not be true, only useful



Efficient use of ICT in education

- Visualization
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Simulations - learning by tinkering

- Flying
 - Driving
 - Patients
 - SimCity
 - SimLife
 - Sims
 - Dungeons and Dragons
- ... provide *virtual* experience

Efficient use of ICT in education

- Visualization
- Simulation
- Tutoring systems

Tutoring systems

- Domain knowledge
(e.g. a simulation model)
- Model of the student
(e.g. the student's cognitive profile)
- Model of the educational situation
(e.g. common errors)

Feedback from virtual social agents

- Highly important with corrective, explaining and supporting feedback in digital learning environments
- Human beings are 'made' for assimilating feedback from *social actors*



Feedback from virtual social actors

Students reach deeper understanding when (adequate) pedagogical agents (designed as social actors) are involved and communicate with them than in corresponding learning multimedia without pedagogical agents



Pedagogical agents, RITL

Catch up when students get stuck

Interventions by social characters turn out to be more efficient than interventions via voice or text only

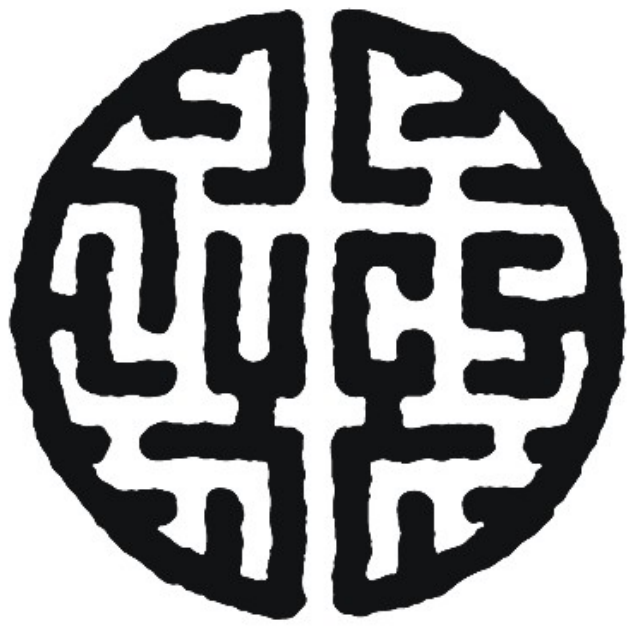
Agneta Gulz:

”I just have no math ability ... ”

Virtual agents to improve students’ self-efficacy

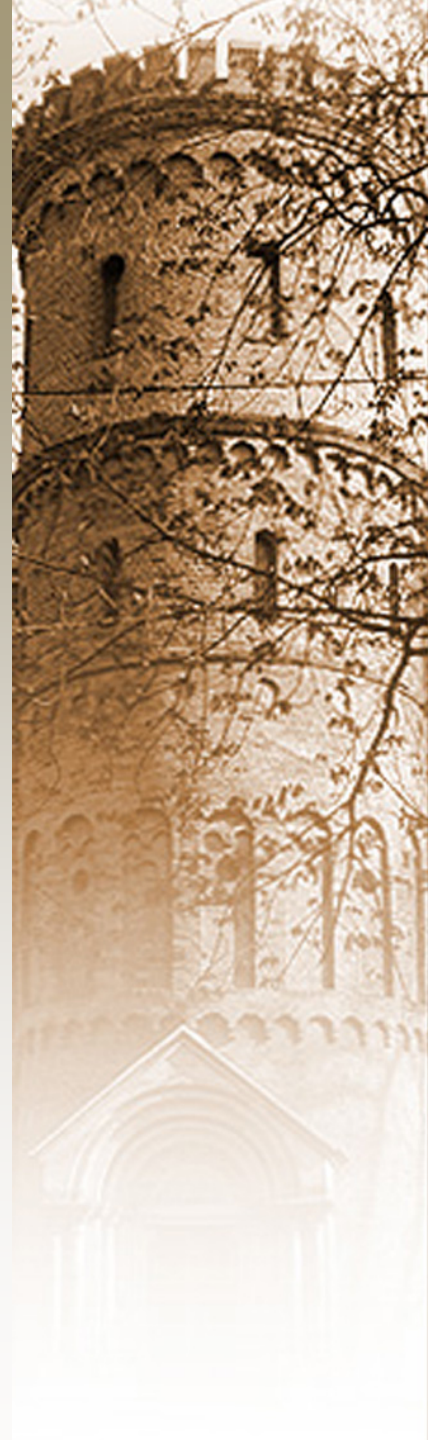


Pedagogical role play character, e-Circus, FearNot



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... the joy of understanding