Center for Human-Computer Interaction
University of Salzburg

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Augmented Reality for Industrial Robot Programmers:

Workload Analysis for Task-based, Augmented Reality-supported Robot Control

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Motivation

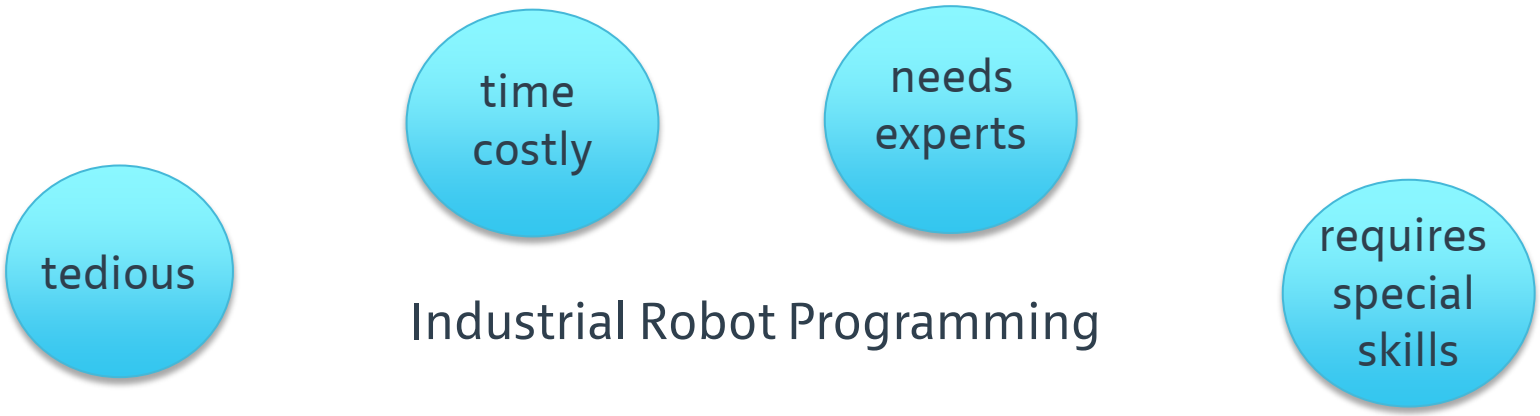
WHY?

Industrial Robot Programming

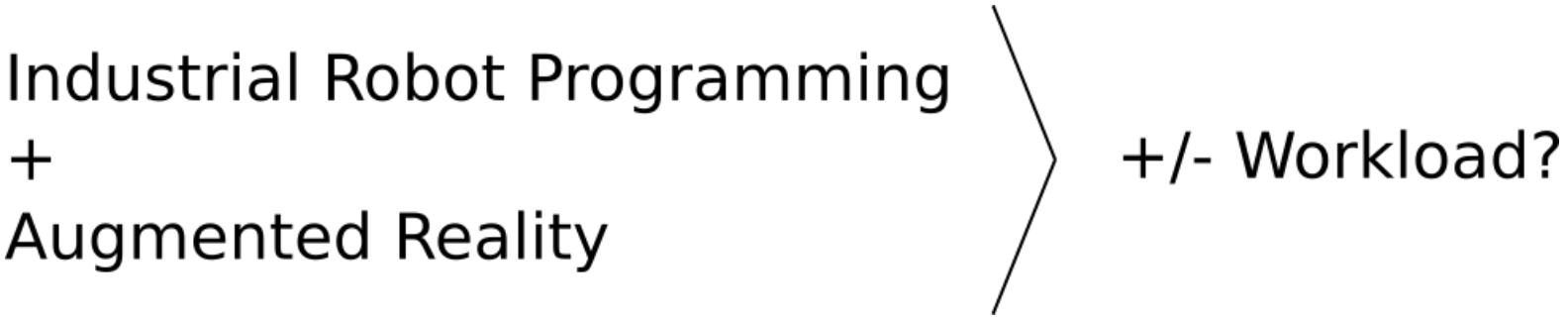
+

Augmented Reality

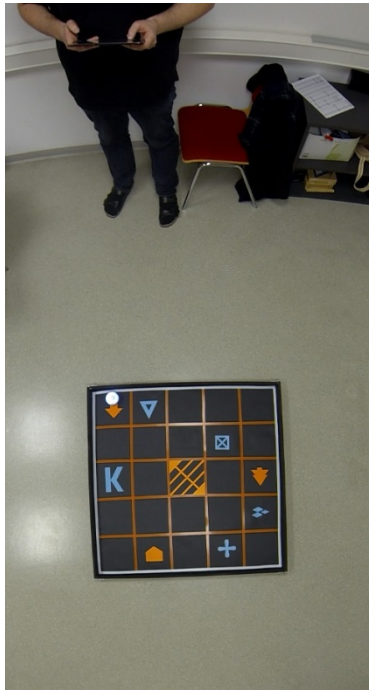
Motivation

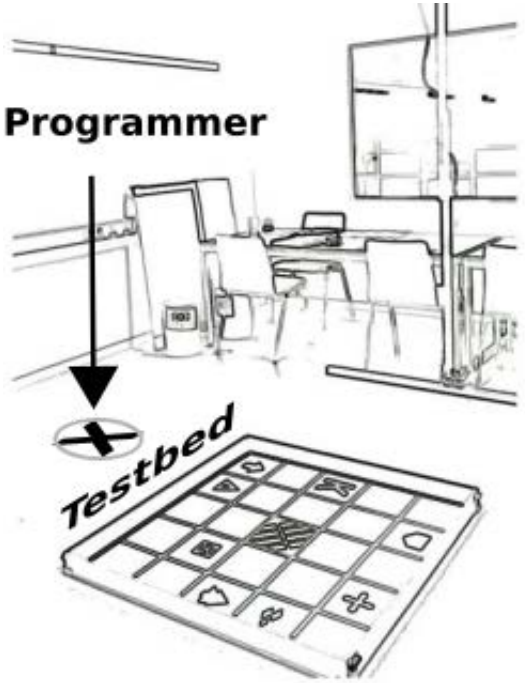

time costly
needs experts
tedious
requires special skills
Industrial Robot Programming
+
Augmented Reality
(Augmented Reality is the superimposition of reality with computer-generated content)

Research Question



Experimental Description





Tablet with AR interface

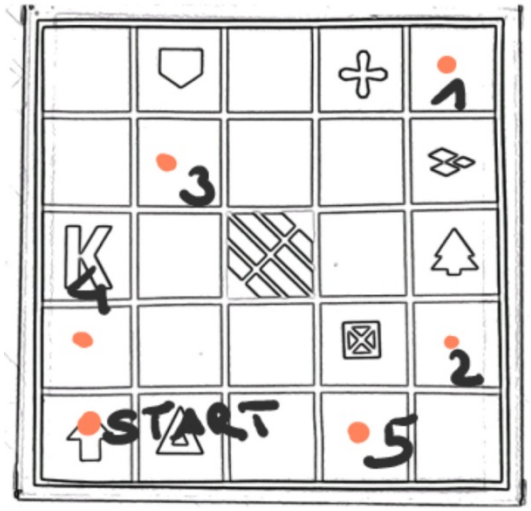
Sphero 2.0 robot ball

Experimental Description

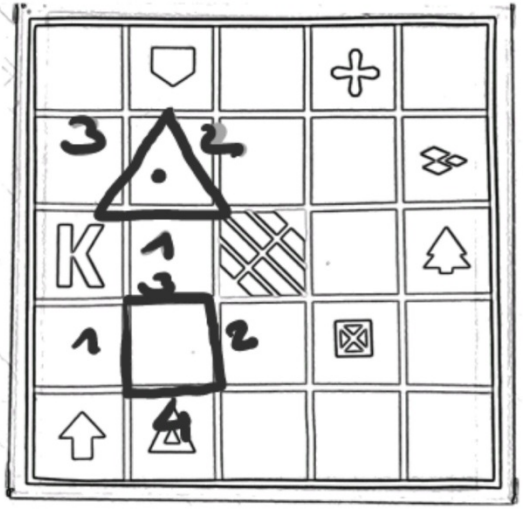
- industrial link:
  - participants: 19 male (M=33.53)
    - professional industrial robot programmers,
    - operators/maintainers,
    - software engineers,
    - managers
  - three highly repetitive industrial online teaching tasks
    - abstracted for study

Tasks

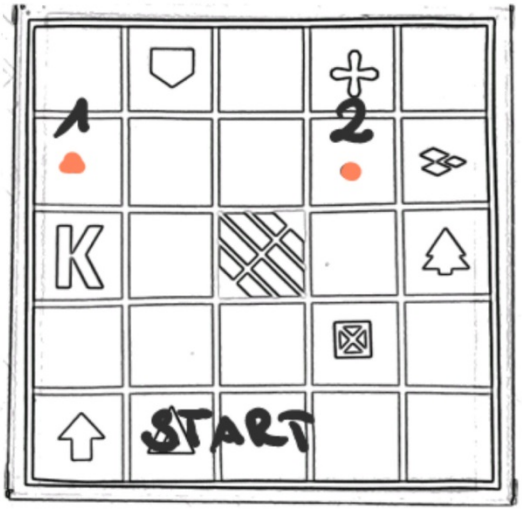
Trajectory

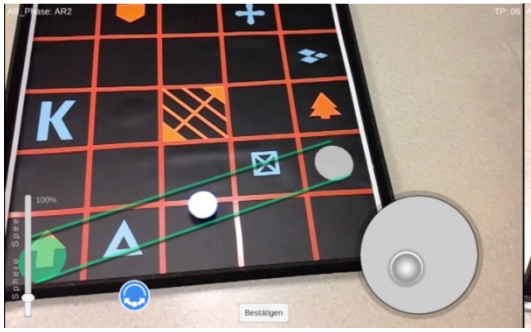


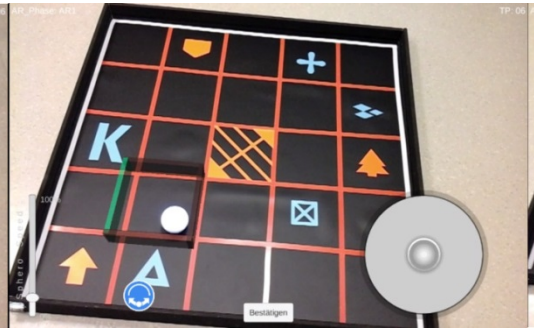
Tool Center Point

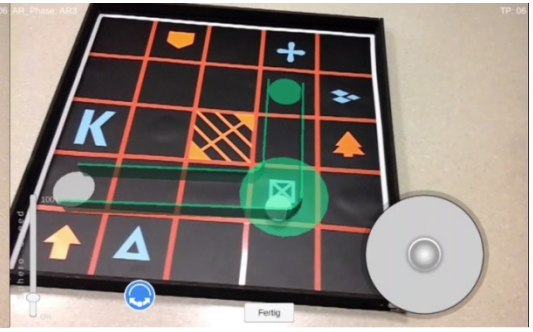


Overlap









Results

- robot control supported by task-based AR reduces mental workload
  - explanation: split attention effect
  - explanation: support of spatial ability
- experts and novices need different AR interfaces
  - explanation: expertise reversal effect
- prior knowledge of AR reduces workload throughout programming with AR
  - implication: AR training is beneficial

Challenges & Future Work

- refine content/information to visualize
  - speed/accuracy motivation
  - expert/novice
  - spatial ability e.g. mental rotation
- investigation of several interaction modalities with AR elements
- study with an industrial robot