Towards Adaptive Hour of Code

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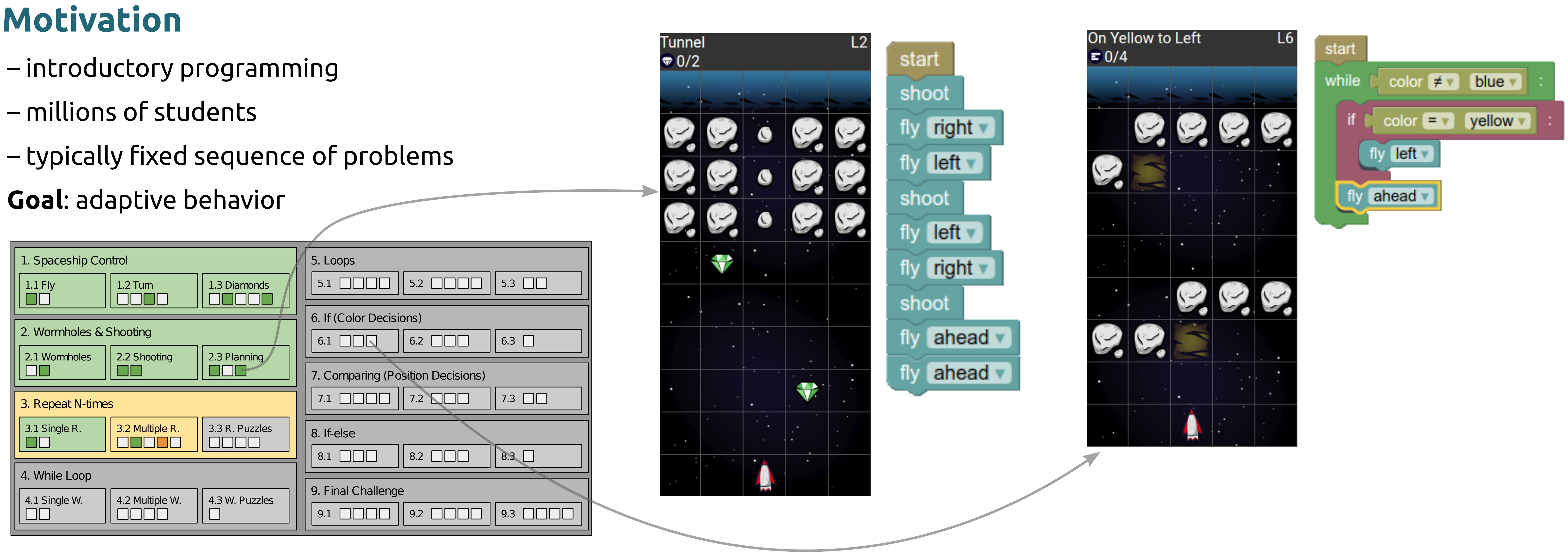
Motivation

– introductory programming

– millions of students

– typically fixed sequence of problems

Goal: adaptive behavior



1. Spaceship Control: 1.1 Fly 🟩□; 1.2 Turn □□🟩□; 1.3 Diamonds □🟩□□🟩

2. Wormholes & Shooting: 2.1 Wormholes □🟩; 2.2 Shooting 🟩🟩; 2.3 Planning 🟩□🟩

3. Repeat N-times: 3.1 Single R. 🟩□; 3.2 Multiple R. □🟩□🟧□; 3.3 R. Puzzles □□□□

4. While Loop: 4.1 Single W. □□; 4.2 Multiple W. □□□□; 4.3 W. Puzzles □

5. Loops: 5.1 □□□□; 5.2 □□□□; 5.3 □□

6. If (Color Decisions): 6.1 □□□; 6.2 □□□; 6.3 □

7. Comparing (Position Decisions): 7.1 □□□□; 7.2 □□□; 7.3 □□

8. If-else: 8.1 □□□; 8.2 □□□; 8.3 □

9. Final Challenge: 9.1 □□□□; 9.2 □□□□; 9.3 □□□□

Tunnel L2
0/2

```
start
shoot
fly right
fly left
shoot
fly left
fly right
shoot
fly ahead
fly ahead
```

On Yellow to Left L6
0/4

```
start
while color ≠ blue :
    if color = yellow :
        fly left
    fly ahead
```

Research Questions

1. How to organize tasks for a personalized Hour of Code?
2. How to measure performance on programming problems?
3. How to predict future performance?
4. How to recommend the next problem to solve?

Theoretical Framework

Proxy goal: optimal challenge *(zone of proximal development)*

Adaptivity: design loop, outer loop

– domain model

– performance measure

– student model

– tutor model

Methods

Exploratory analysis:

– problem difficulties, students' performance, concepts

– proxy evaluation of models

Online experiments:

– comparing tutor models

– proxy for learning: performance on *control tasks*

Simulated experiments:

– exploring methodological issues

– e.g., ordering bias and attrition bias

Data

Multiple programming exercises and interfaces:

Exercise	Interface	Problems	Students	Attempts
RoboMission	blocks	85	3,800	62,500
Turtle Blockly	blocks	77	11,000	63,600
Turtle Python	text	51	2,400	11,900
Python	text	73	2,000	10,700

Expected Contribution

– recommendations on modeling approaches and evaluation methods in the context of introductory programming

– replicability of previous results on a broader set of exercises and problems

Adaptive Learning

Research group, Masaryk university Brno

www.fi.muni.cz/adaptivelearning/