

Toward Studying Example-based Live Programming in CS/SE Education

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PAINT 2023 | Cascais, Portugal | Oct. 23



A (rectangular) cistern.

The height is 3,20, and a volume of 27,46,40 has been excavated.

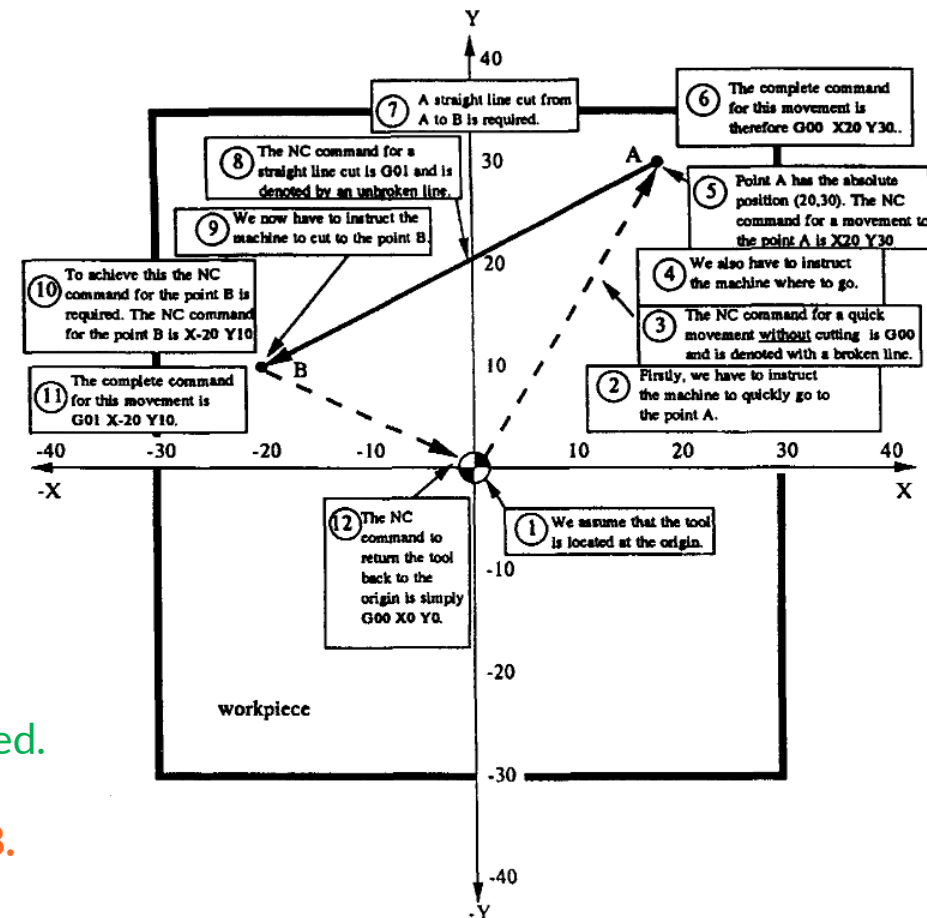
The length exceeds the width by 50.

You should take the reciprocal of the height, 3,20, obtaining 18.

Multiply this by the volume, 27,46,40, obtaining 8,20.

Take half of 50 and square it, obtaining 10, 25.

(Babylonia, 1800 B.C.)

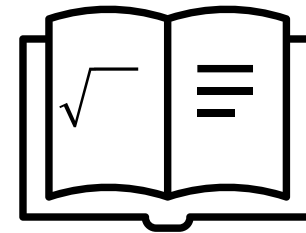


[*] Chandler and Sweller: *The Split-Attention Effect as a Factor in the Design of Instruction*, British Journal of Educational Psychology 62.2, 1992

Cognitive Load

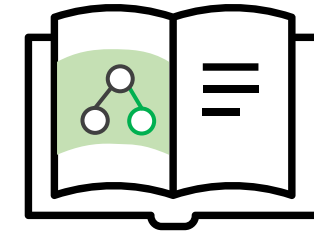
Worked-example Effect

Concrete applications relieve learners from “sensemaking effort”



abstract

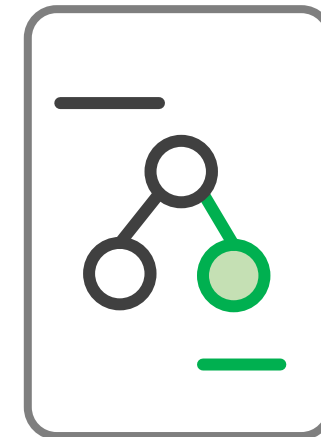
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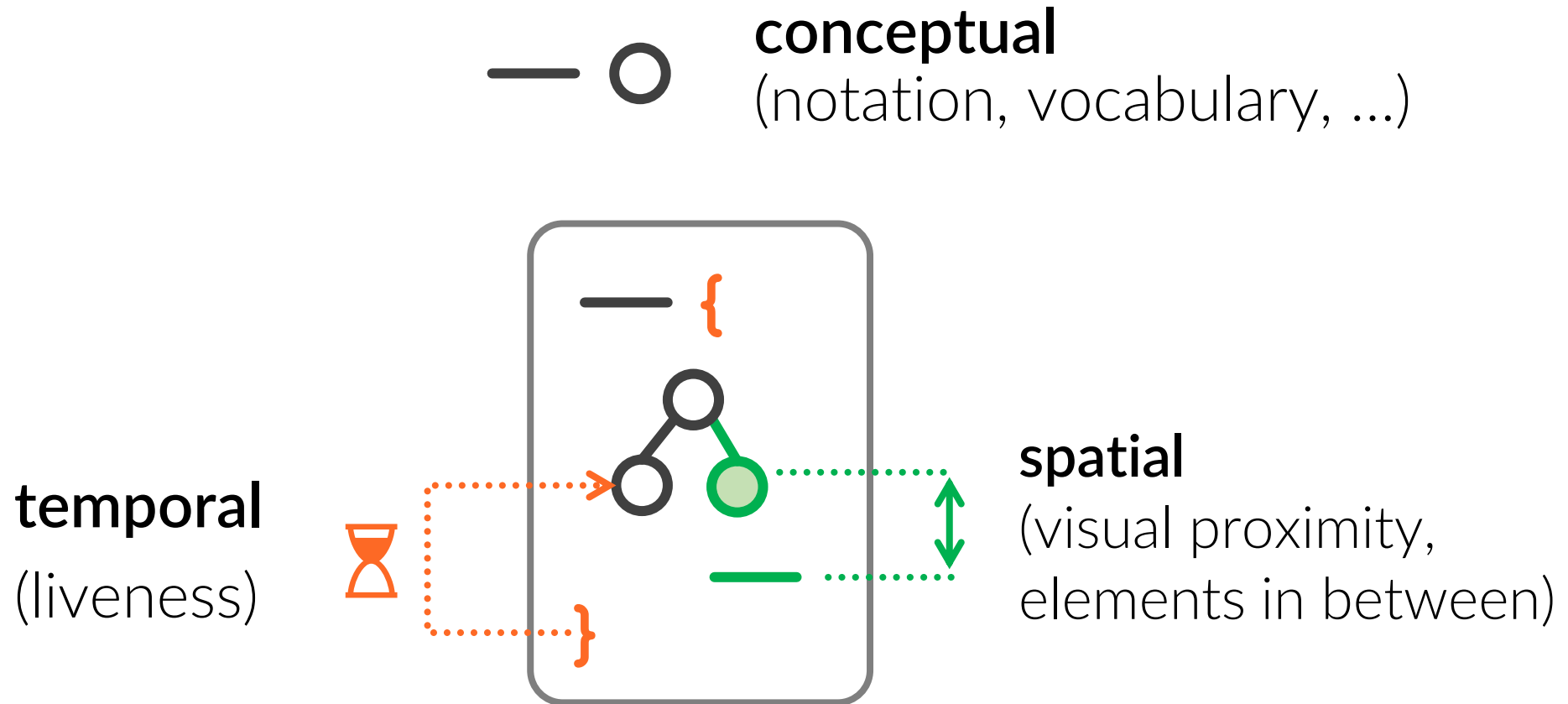
abstract + concrete

Split-attention Effect

Integrating abstract and concrete material relieves learners from “mapping effort”



Example Integration



Example-Centric Programming

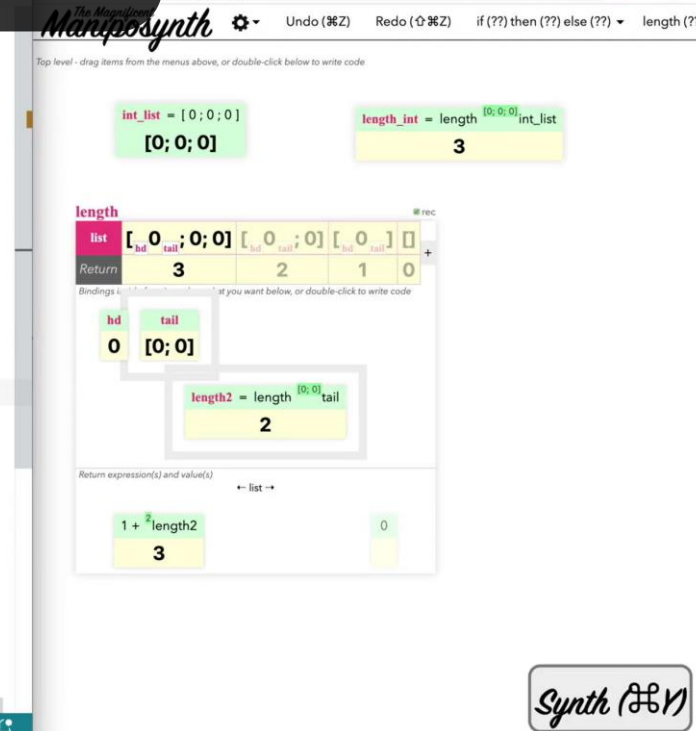
Edwards 2004

```

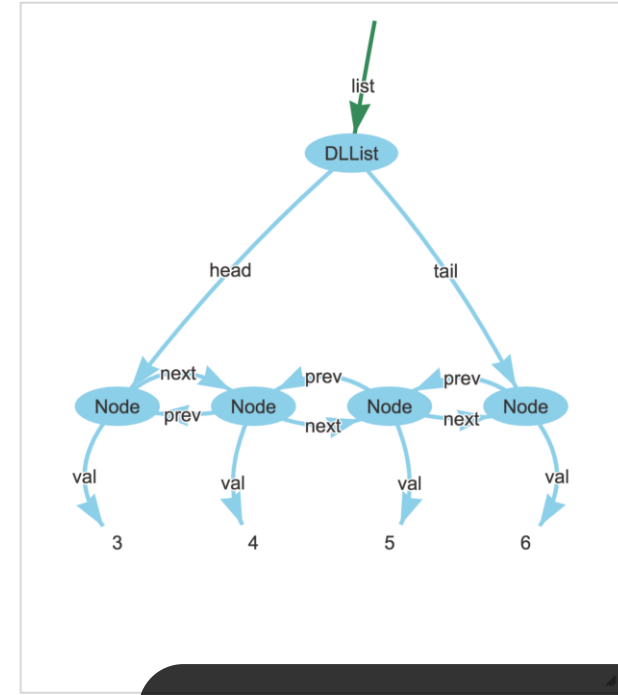
1 let int_list = [ 0; 0; 0 ] @@pos 77, 53]
2
3 'a list -> int
4 let rec length list =
5   match list with
6   | hd :: tail ->
7     let length2 = length tail @@pos 110, 99 in
8     1 + length2
9   | [] -> 0
10  @@pos 27, 176]
11
12 int
13 let length_int = length int_list @@pos 375, 58]

```

Maniposynth
Hempel & Chugh 2022

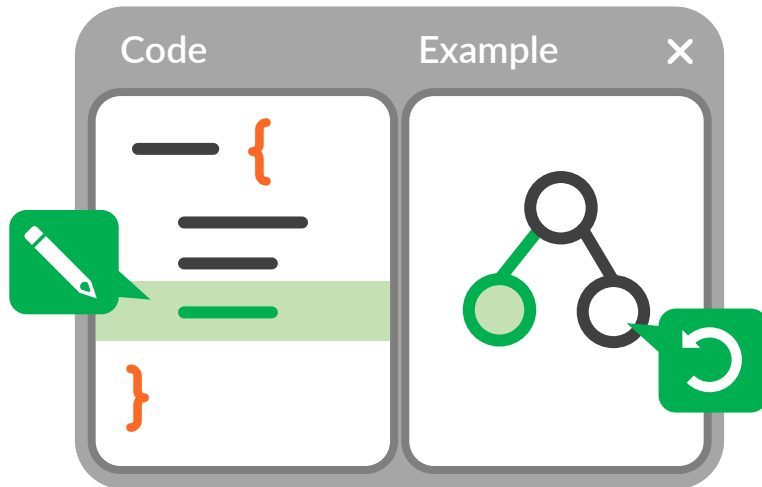


Synth (ÆV)

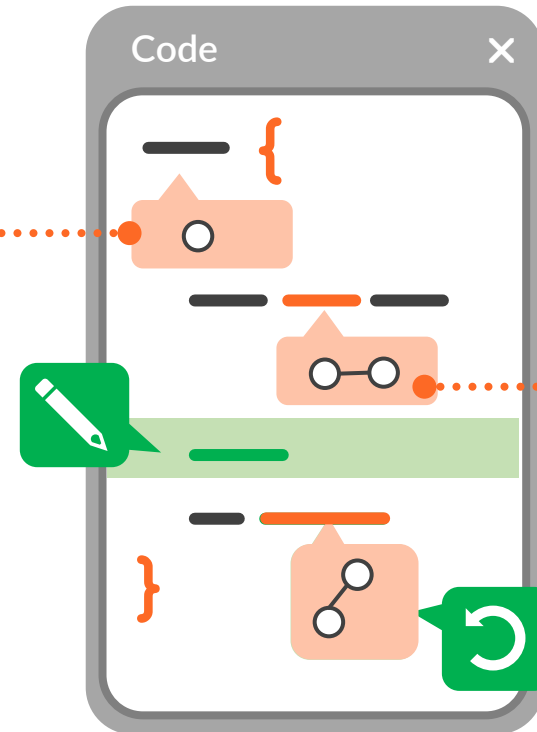


Kanon
Oka, Masuhara, Aotani 2018

“Bimodal” Examples



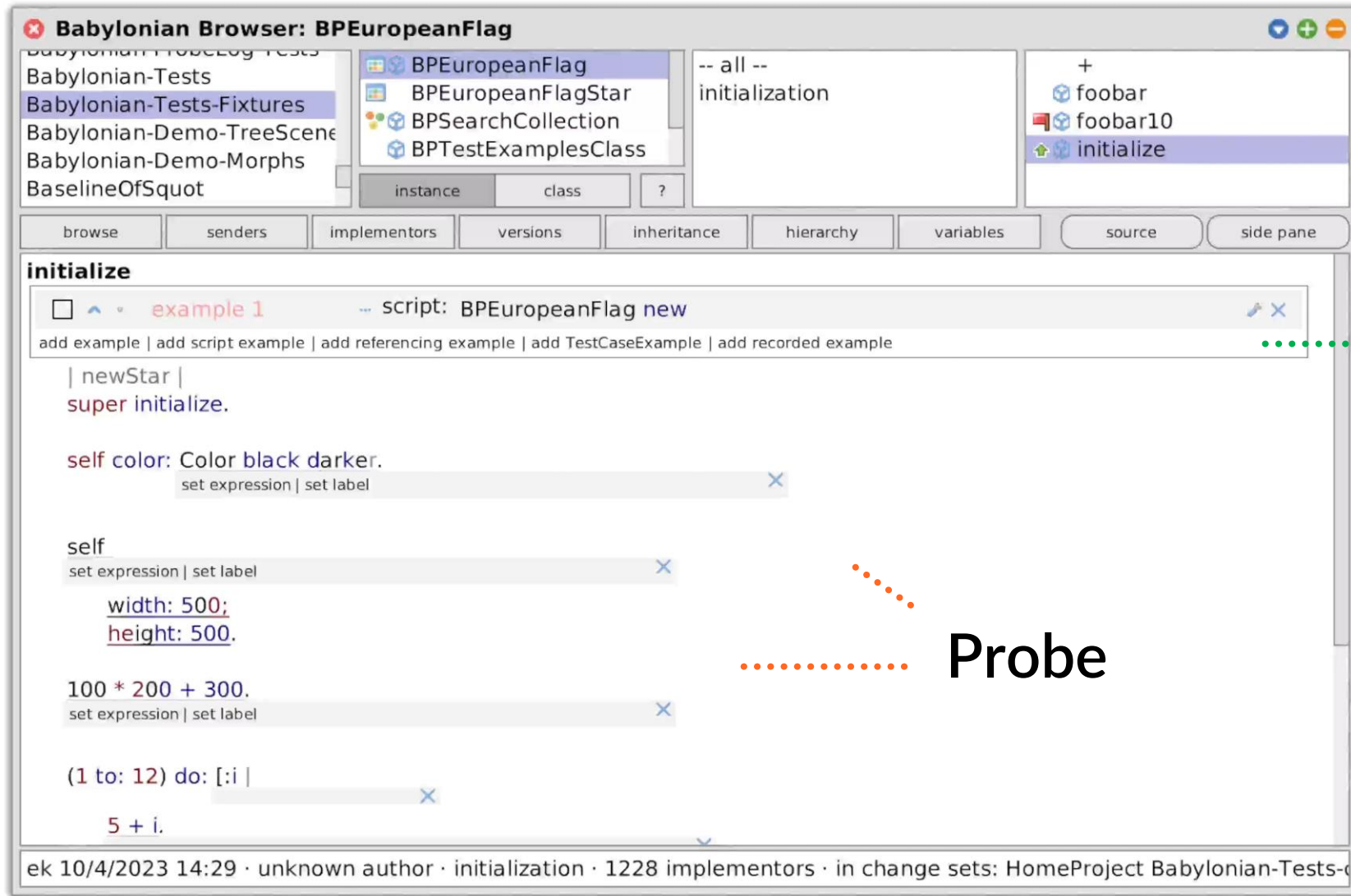
Example



Probe

Babylonian Programming

Babylonian Programming: Babylonian/S



Example

Probe

Opportunities in Babylonian Programming

Exemplification of environment by teacher:
Improved awareness of functionality & APIs

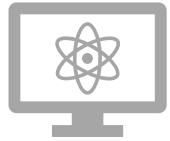
Probes over printf:
Augmenting mental simulation and experimentation

Probes deep in the control flow:
Exploring non-localized behavior



DALL·E 3

What we Need to Learn



1. Which **domains** benefit from Babylonian Programming?



2. Which **situations** motivate the use (of which **features**) of Babylonian Programming?



3. How do participants **find or create** examples?

Observation

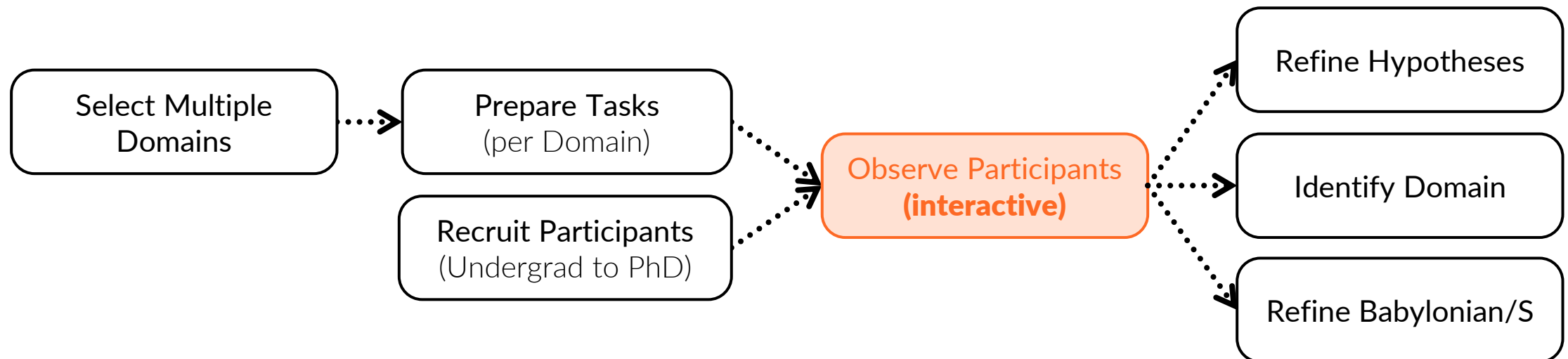
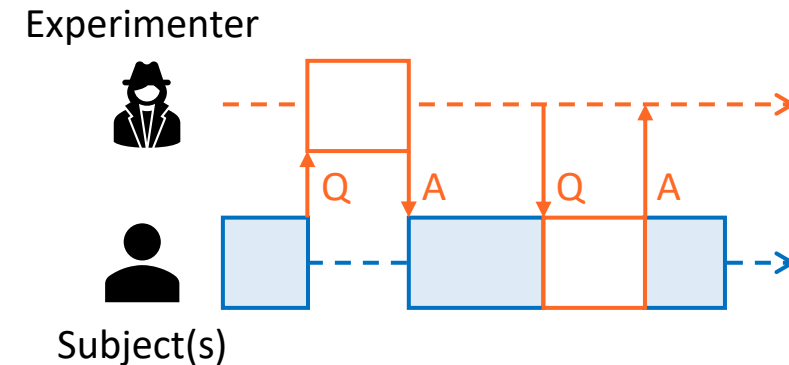
4. Does Babylonian/S improve **correctness, time to completion, engagement, frustration or confidence** over a baseline live-programming environment (Smalltalk)?

Controlled Experiment

Initial Observational Study (I)

Goal:

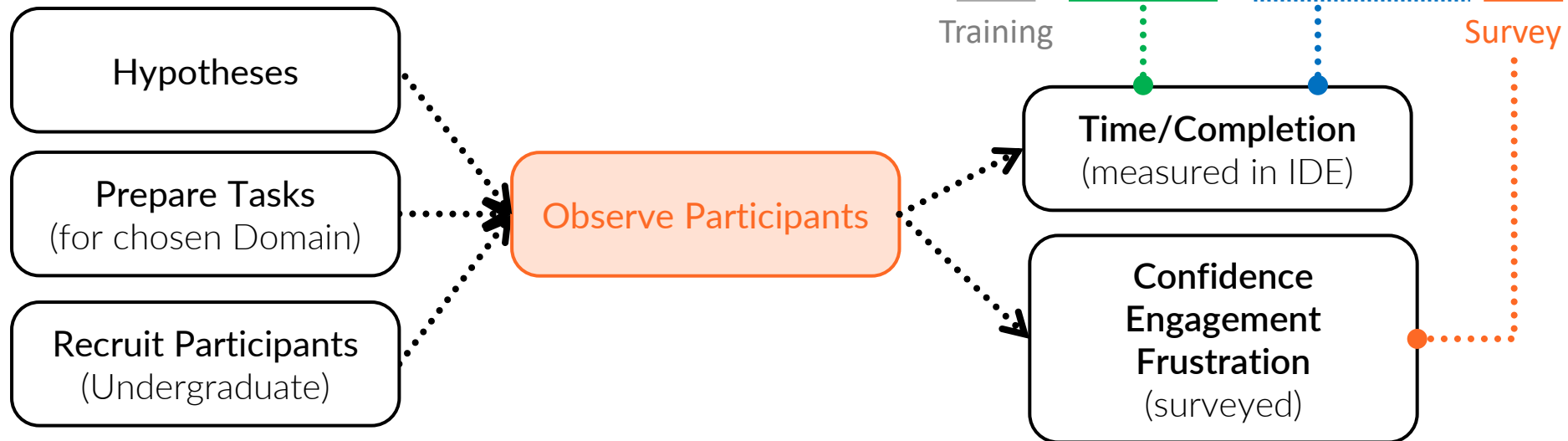
Understand how Babylonian Programming is used in different Domains



Controlled Study (II)

Goal:

Examine impact of Babylonian Programming on Educational Tasks of chosen Domain



Conclusions & Outlook



- **Educational promise:** Babylonian Programming allows worked examples directly at code level with minimally split attention and invites experimentation
- **Study proposals:**
 1. Observe when, how, and how successful its features are used
 2. Measure impact on educational tasks via controlled experiment

What we Need to Learn

- 1. Which **domains** benefit from Babylonian Programming?
- 2. Which **situations** motivate the use (of which **features**) of Babylonian Programming?
- 3. How do participants **find or create** examples?
- 4. Does Babylonian/S improve **correctness, time to completion, engagement, frustration or confidence** over a baseline live-programming environment (Smalltalk)?

Observation

Controlled Experiment

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Initial Observational Study (I)

Goal:
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Controlled Study (II)

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