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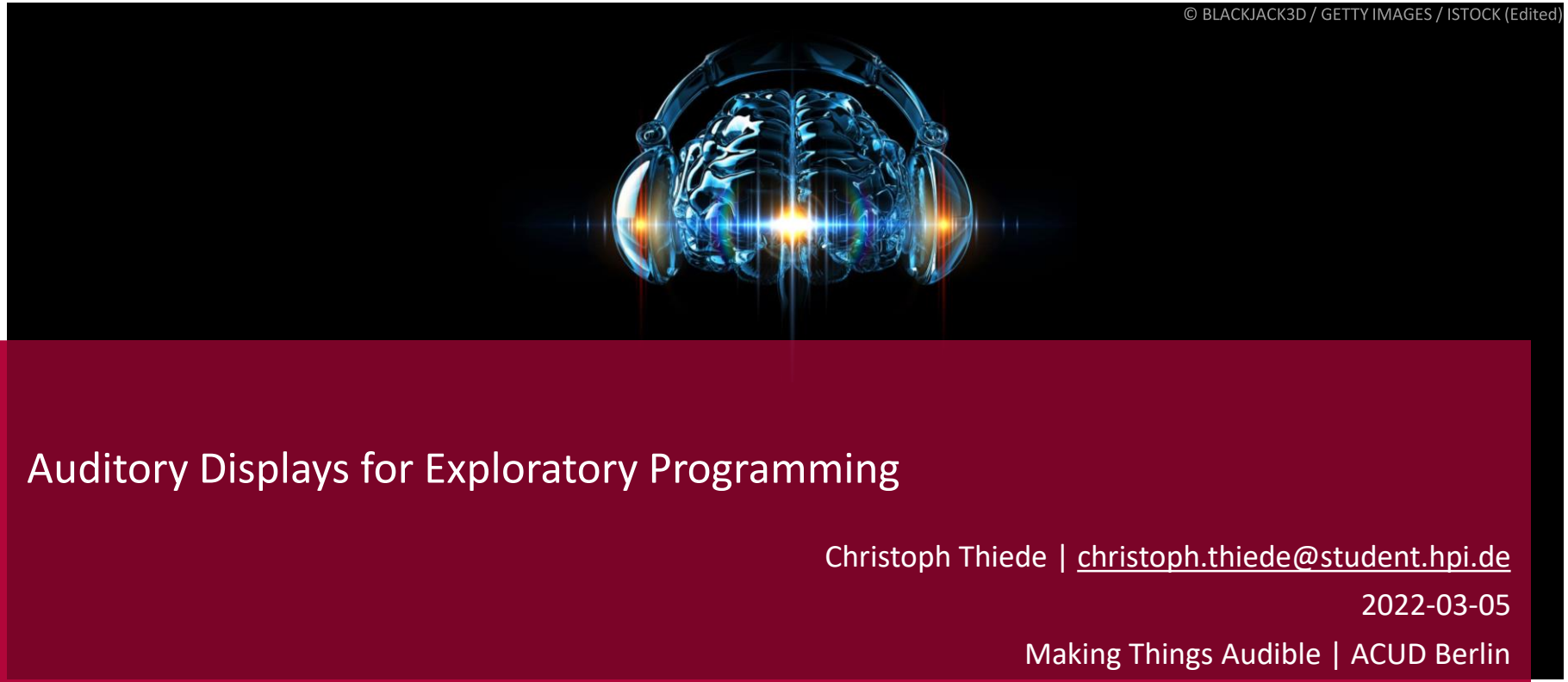

Auditory Displays for Exploratory Programming

Christoph Thiede | christoph.thiede@student.hpi.de

2022-03-05

Making Things Audible | ACUD Berlin

Hasso Plattner Institut

Software-Architekturen

Fachgebiet | Hasso-Plattner-Institut
Universität Potsdam

Squeak/ Smalltalk

Neurodesign

Forschungsgruppe | Hasso-Plattner-Institut
Universität Potsdam

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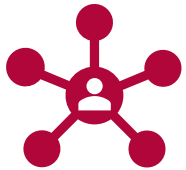
Motivation



save visual channel

background perception

attention

alternative perspectives

[Bingmann, 2013]

Related Work: Program auralization

Related Work: Sound techniques

- Learnings from prior work:
  - don't replace visuals but augment them [Hussein et al., 2009; Vickers et al., 2006]
  - avoid fatigue/discomfort in the listener [Vickers, 2004, 2011]
  - use sound for characterization, not for identification [Vickers, 2011]
  - often helpful: playback/variable speed [Berman et al., 2017]

speech to describe information using **natural language**

earcon: "**abstract, synthetic tones** that can be used in **structured combinations** to create sound messages to represent parts of an interface." [Brewster et al., 1993]

auditory icon: "**everyday sounds** that convey **information about events** in the computer or in remote environments by analogy" [Gaver, 1994; Gaver et al., 1995]

Approach

- **a general-purpose toolkit to explore software systems through sonification**
- empower developers to **rapidly listen** to **aspects of interest**
  - code artifacts (packages, interfaces, methods, …)
  - domain entities
  - conditionals
- define **custom parametrized sound mappings**
- further possible features:
  - sound aggregation
  - activation scope of triggers, debugger integration
  - sound watcher window (supports explorability)
  - scripted sound mappings
- advanced feature: sonify dynamic software metrics (EOC/IOC, LCOM, …; Chhabra, 2010)

No goals:

- complete/musical coverage (scalability)
- educational tool for beginners
- replace visual representations/build an accessibility product

USPs:

- liveness (no precompilation/prerecording)
- reusable general-purpose solution
- trace individual entities
- configurability

Sonyx

Sound-based t**O**ols for u**N**derstanding of software s**Y**stems through e**X**ploration

- a **general-purpose toolkit** to **explore software systems** through **sonification**
- empower developers to **rapidly listen** to **aspects of interest**
- define **custom parametrized sound mappings**

save visual channel

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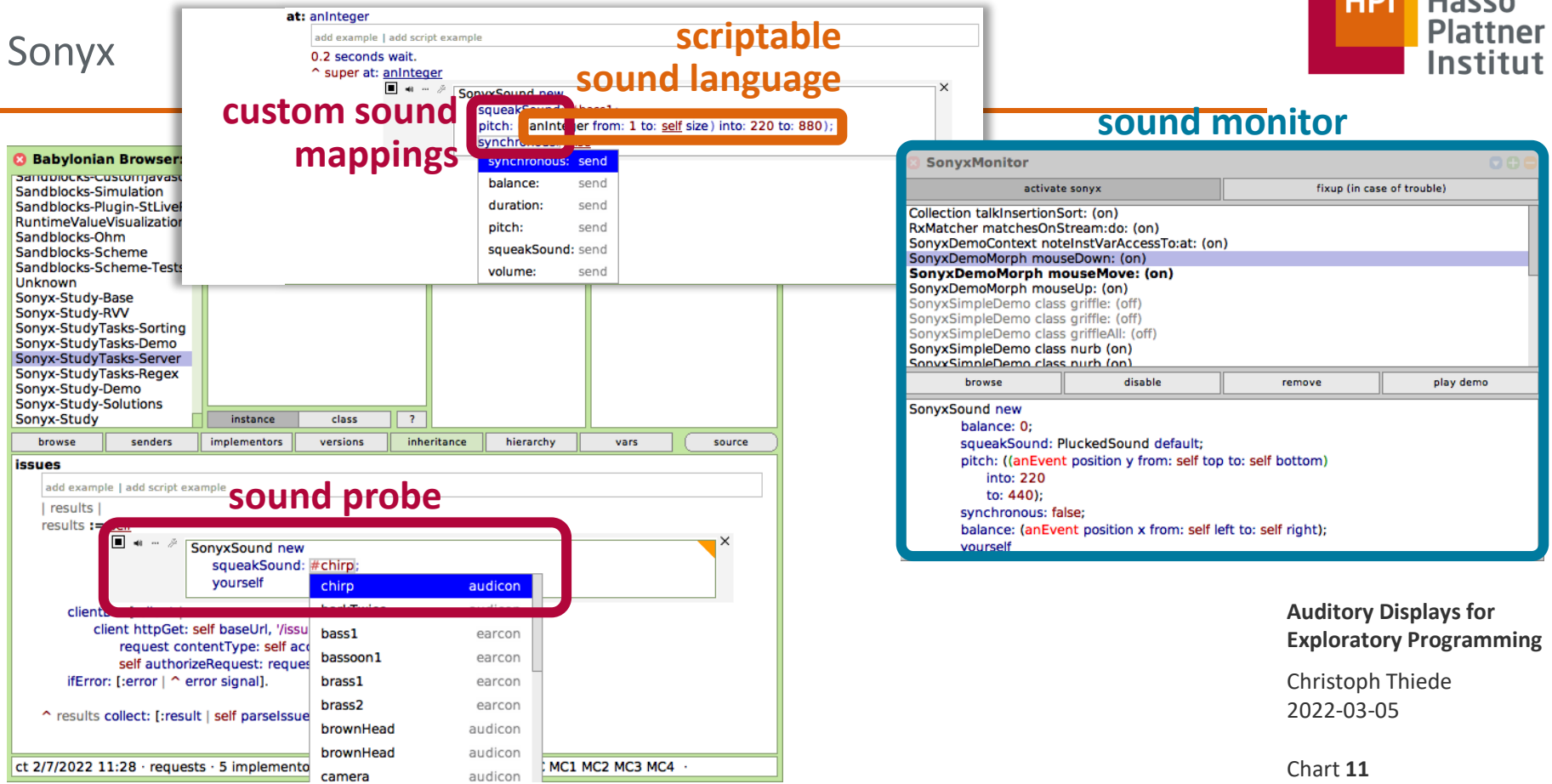
<Demo>

Sonyx



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Evaluation: User Study Design

typical programming tasks

operationalization

within-subjects randomization

participants (N = 6)

study script

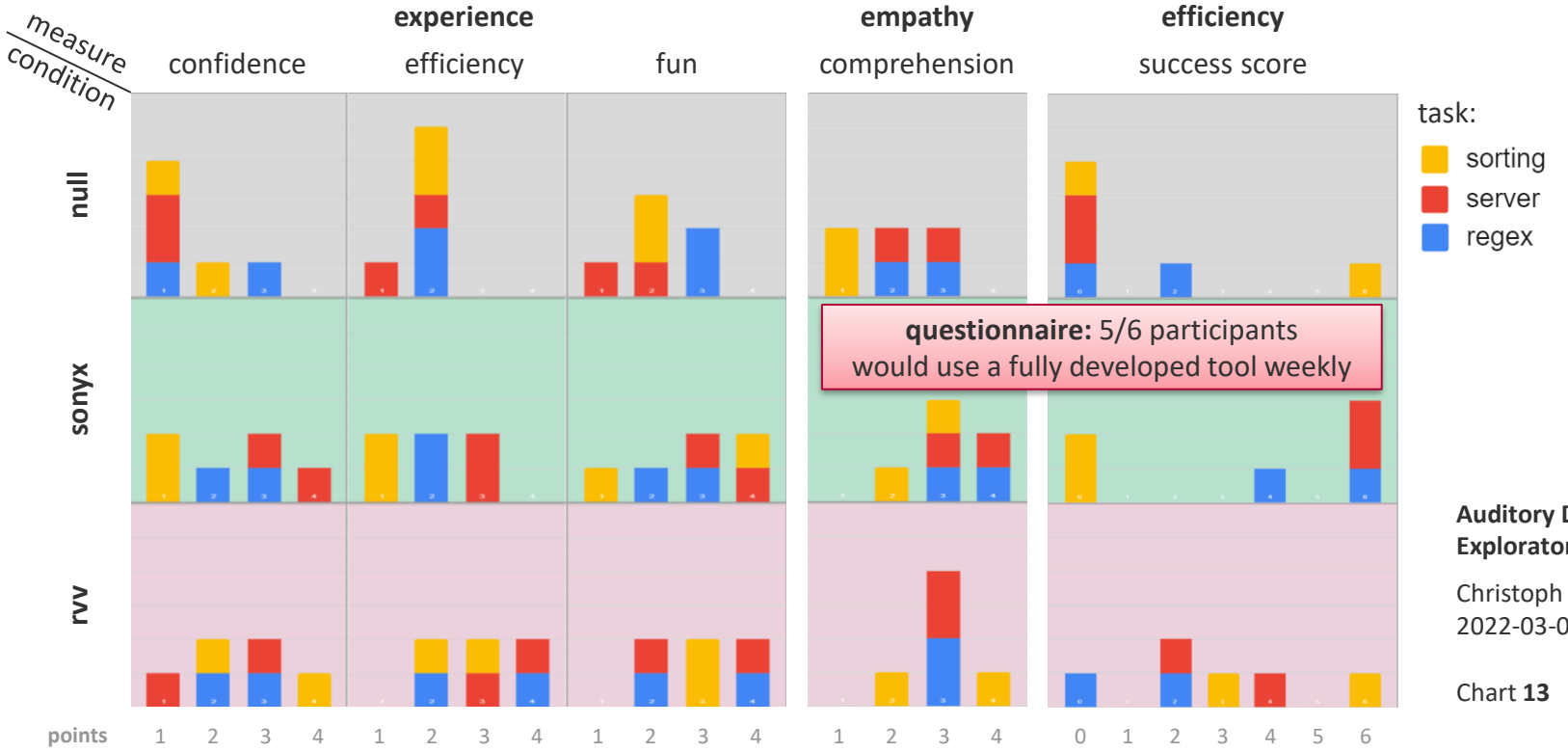
control conditions

one-to-one sessions

recruitment

Zoom screen share

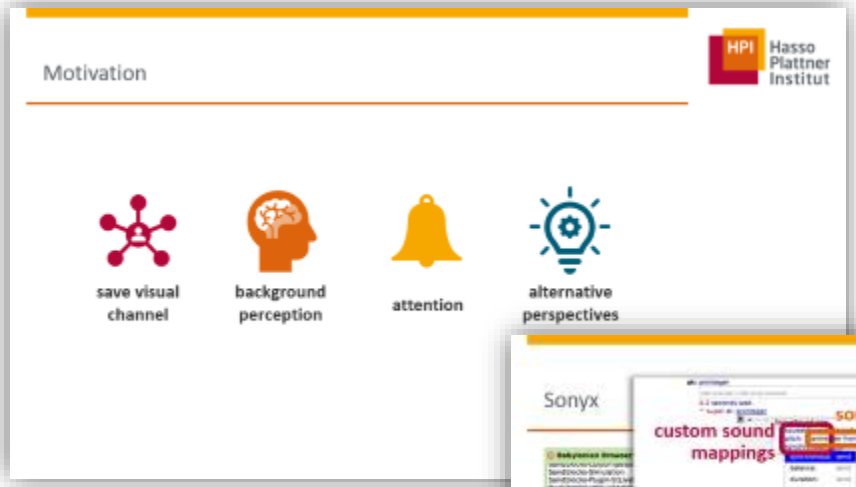
Evaluation: Operationalization

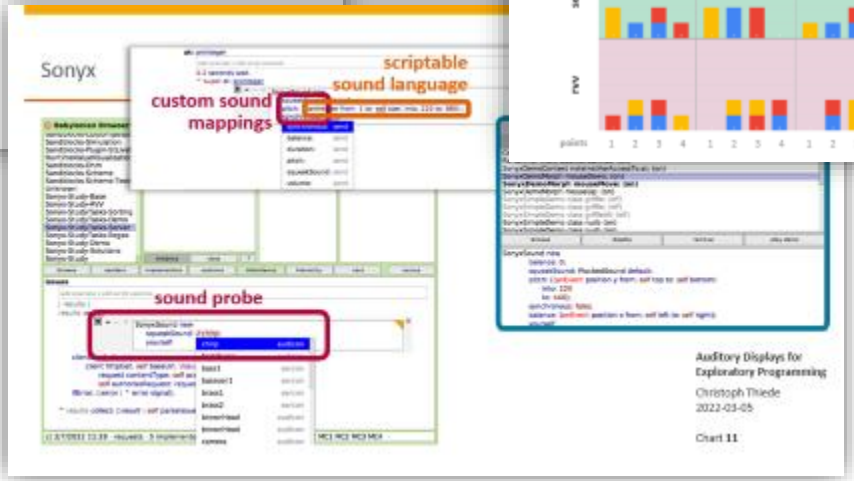


Future Work

- Can programmers benefit from **monitoring state changes** via sound probes?
- How can we **aggregate probe sound events?**
- How can we make **listening to probe sound more interactive?**
- How can we improve the **convenience of the sound probe editor?**
- Can we improve the **understanding of software architectures** by **sonifying dynamic software metrics?**

Summary





GitHub:

https://github.com/LinqLover/sonyx

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Chart **16**

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