

A Reactive Environment for Dynamic Volume Control

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C I R
M M T Centre for Interdisciplinary Research
in Music Media and Technology



Overview

We explore the design and testing of a reactive environment for musical performance. Driven by the interpersonal interactions amongst musicians, our system gives users real-time control over certain aspects of their performance, enabling them to change volume levels dynamically simply by moving around. It differs most notably from the majority of ventures into the design of novel musical interfaces and installations in its multi-disciplinary approach, drawing on techniques from Human-Computer Interaction, social sciences and ludology. Our User-Centered Design methodology was central to producing an interactive environment that enhances traditional performance with novel functionalities. During a formal experiment, musicians reported finding our system exciting and enjoyable. Ultimately, we hope that our approach can be of guidance to interface developers working on applications of a creative nature.

Understanding the User

User Observations

- Sheds lights on the *what* and *how* of performance
- “Fly-on-the-wall” approach
- Observed 15 different musicians in 5 bands
- We noted differences in interactions between musicians based on their familiarity with one another
- We also found that volume adjustments mid-session was often cumbersome for musicians



Non-Leading Interviews

- Sheds lights on the *why* behind performance

Step 1: Interviews

- Conducted with 5 male and 1 female musicians, ages 18 to 42

Step 2: Content Analysis

- Grounded Theory (GT) approach
- Determined top 4 motivations for musicians:

Enjoyment
Self-Expression
Creative Engagement
Interaction with Others

Step 3: Validation

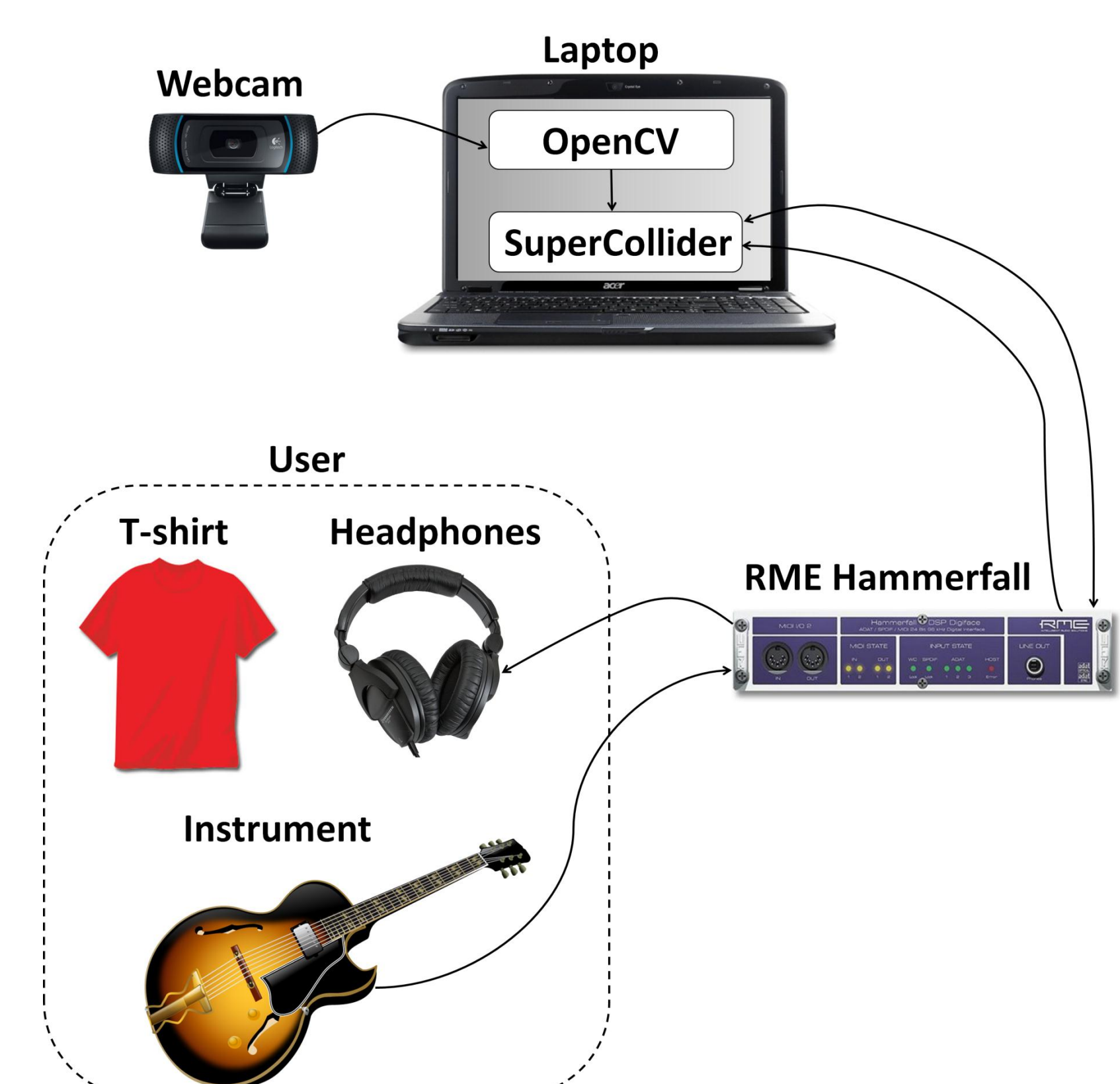
- Online survey asked musicians to rank different motivations by importance
- Completed by 15 male and 6 female musicians, ages 18 to 42
- Confirmed top 4 motivations listed above

Design and Implementation

- Our understanding of the user informed design specifications
- System should be driven by interpersonal interactions between musicians
- System should allow musicians to balance their own mix interactively
- This led us to define the principal feature of our system:

Dynamic Volume Mixing (DVM)

As two musicians get closer to one another, and the distance between them falls below a pre-determined threshold, they perceive each other's volumes to become louder.



Position Detection

- Implemented in C++
- Each musician is asked to wear a bright t-shirt of a different colour
- OpenCV used to implement colour-tracking algorithm

Audio Setup

- Implemented in SuperCollider
- Each musician receives an individualized mix through closed headphones

User Testing

Preliminary User Feedback

- Informal jazz session to elicit preliminary, qualitative user feedback
- Jazz trio performed with system
- We found that DVM allowed them to better “focus” on each other's solos
- Musicians described system as exciting and enjoyable to use
- This encouraged us to further explore DVM

Formal User Experiment

- Musicians were asked to jam once with DVM, and once without
- Each session lasted approximately half an hour
- System was tested against top 4 motivations for musicians:
 - Enjoyment:** evaluated as “flow” using a modified version of IJsselsteijn's Games Experience Questionnaire
 - Creative Engagement:** evaluated using detailed questionnaire
 - Self-Expression:** evaluated using detailed questionnaire
 - Interaction with Others:** evaluated using position data collected throughout experiment

Band 1:

- 4-piece rock band: vocals, guitar, drum machine and keyboard synthesizer
- Test session unveiled two issues:
 - Threshold for DVM activation should be set according to the size and dynamics of the ensemble**
 - Musicians needed a clearly marked default position to which they could return in case DVM become too “overwhelming”.**
- System was modified accordingly before test session with Band 2

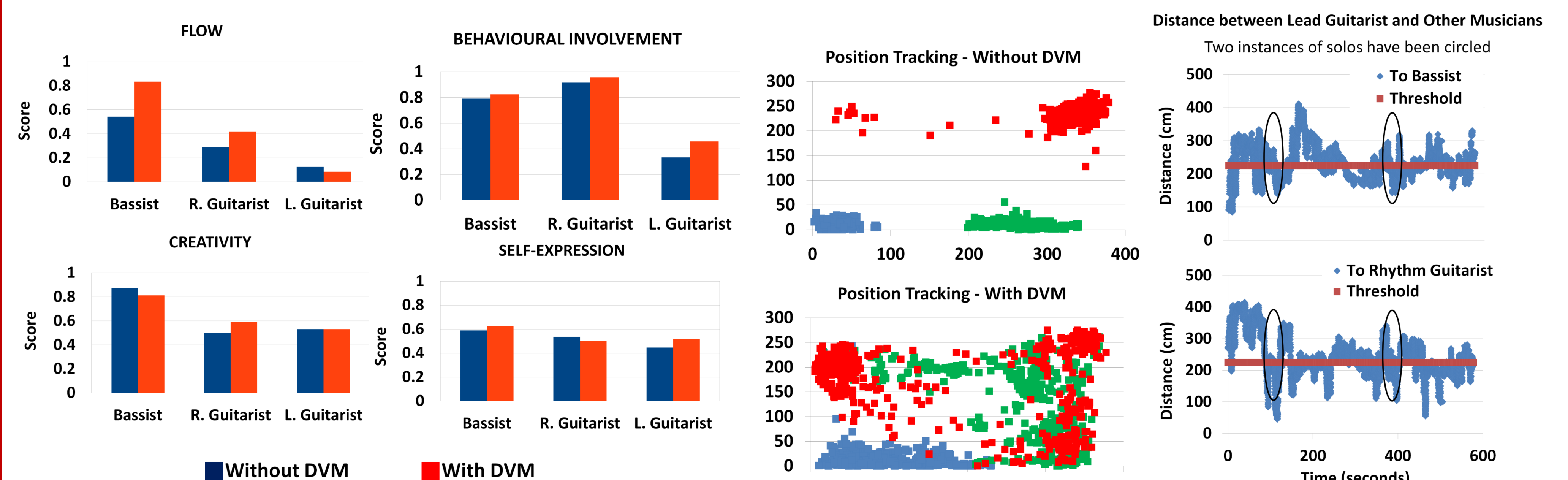


Prototype iteratively modified based on results of user testing

Band 2:

- 3-piece rock band: vocals, lead guitar, rhythm guitar
- Questionnaire analysis shows the majority of performers reporting an equal of improved experience with DVM in terms of Enjoyment, Creativity and Self-Expression
- With DVM, musicians were far more adventurous and made full use of the performance space

RESULTS



References

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