

A Virtual Dancer "Cindy"

Interactive Performance of a Music-controlled CG Dancer

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No.1

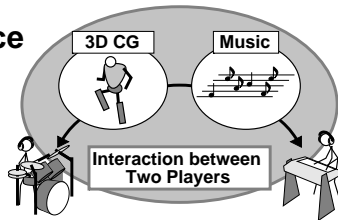
1996/10/10 LCC96

1. Introduction

□ Interactive Performance

• Multimodal Interaction

Virtual dancer enables two players to interact through music and 3D computer animation (auditory and visual information)



• Our Goal

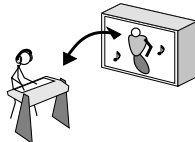
Achieve a new mode of interaction in which CG and music are closely integrated by a LCC

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□ Previous Performance

• Interactive system between a player and a LCC

Interaction between human players was not considered

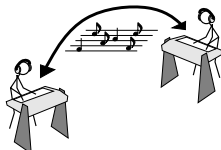


• Conventional Jam Session

Musical interaction between players is essential

Exchange

auditory information
 auxiliary visual information (gestures)



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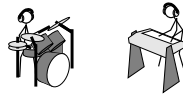
□ Virtual Dancer "Cindy"

• Enhance visual interaction in a jam session



• Provide two players with more expressive way to communicate

• Two players Choreograph Cindy together by their musical improvisation in real time Play different roles in choreographing



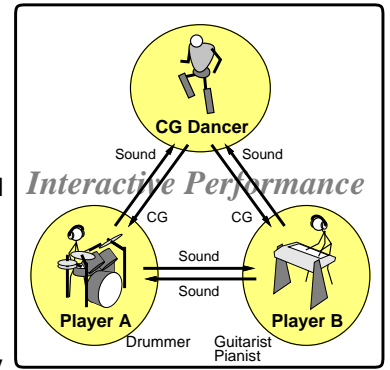
• Cooperation between players is important to make music good to make the dance full of variety

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2. Interactive Performance of Cindy

□ Overview

- Two players improvise on different musical instruments
- Cindy is controlled and choreographed by musical performance
- Cindy does not move in time to the music autonomously



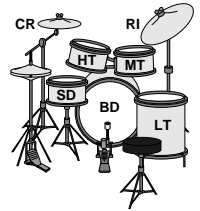
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□ Player A (Drums)



• Seven kinds of drum-sounds

- | | |
|-------------------|------------------|
| Bass Drum (BD) | } Basic Motions |
| Snare Drum (SD) | |
| Low Tom (LT) | } Accent Motions |
| Middle Tom (MT) | |
| High Tom (HT) | |
| Crash Cymbal (CR) | } Showy Motions |
| Ride Cymbal (RI) | |



• Each is mapped to a different dance motion

• Control the timing of each dance motion by the onset time of the drum-sound

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□ Player B (Guitar, Piano, etc.)



• Parameters periodically derived from performance

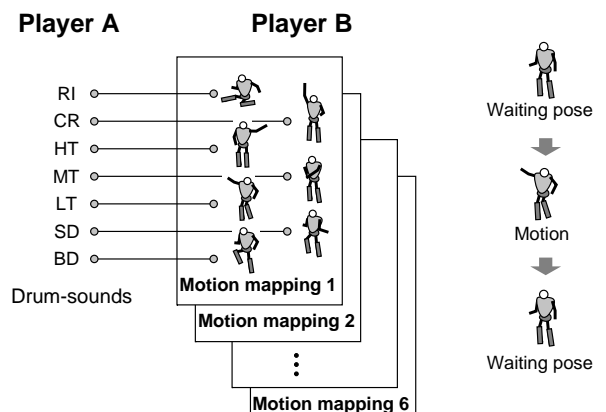
- NumNotes: The number of notes
- AvePitch: Average pitch
- ChordMeas: Whether a single note or chord is played

• Switch six predefined sets of mapping between drum-sounds and dance motions

- | | |
|----------------------------|------------------------------|
| 1) Normal motions | Default |
| 2) More cheerful motions | NumNotes: Many |
| 3) Quiet and small motions | NumNotes: Few |
| 4) Hand-raising motions | AvePitch: High |
| 5) Dynamic motions | ChordMeas / NumNotes: Large |
| 6) More dynamic motions | ChordMeas / NumNotes: Larger |

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□ Mapping between drum-sounds and motions

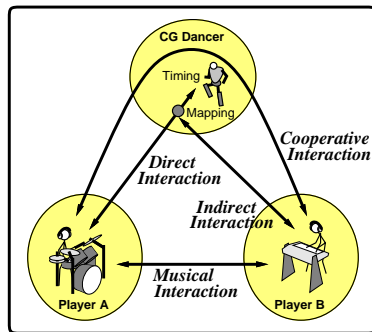


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3. Three Kinds of Interaction

Interaction between players through music

- Musical interaction
- Improvise while reacting to each other's performance
- Cooperatively try to make music good



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4. Implementation

Distributed Computing Environment

- SGI Indigo2 Extreme x 2
- Ethernet
- MIDI (Musical Instrument Digital Interface)
- RMCP (Remote Music Control Protocol)

Communication protocol on the UDP/IP based on the server-client model
MIDI data of players' performances are broadcast as RMCP packets



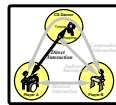
Allocate different tasks on several computers
Achieve good load-balancing

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Interaction between each player and Cindy

Direct interaction (Player A)

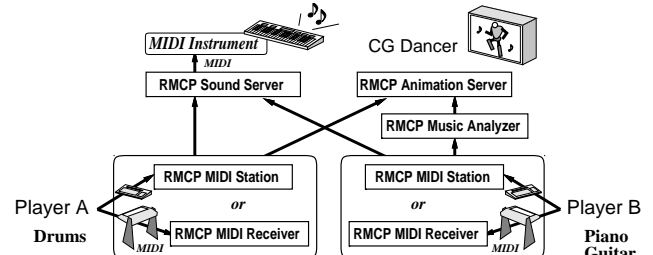
- Determines the timing of dance motion
- Directly changes Cindy while looking at the dance motion
- Cannot determine the motion mapped to each drum-sound



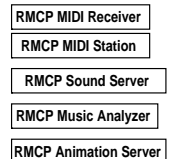
maintain the rhythm in music
determine the timing of dance

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RMCP Servers and Clients



1. Take each player's performance as input
2. Output sounds of players' performance
3. Analyze player B's performance
4. Display Cindy on 3D computer animation

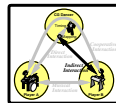


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Interaction between each player and Cindy

Indirect interaction (Player B)

- Switches the mapping set
- Indirectly changes Cindy while confirming the change of the mapping by looking at dance motions made by A
- Cannot make Cindy move by himself



characterize the mood in music
determine the mood of dance

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5. Experimental Results

Conditions

- Improvised music such as rock, pop, and fusion
- Player A played the drums on a synthesizer keyboard
- Player B played a melody or chords on a MIDI guitar

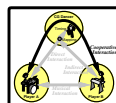
Results

- Choreographed Cindy directly and indirectly by improvising
- To vary Cindy's motions they tended to make performance more varied than performance in a conventional session
- Interacted visually to change the motions cooperatively

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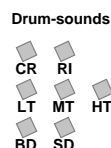
Interaction between players through Cindy

- Cooperative interaction
- Choreograph Cindy cooperatively to make the dance full of variety
- Player A tries to change motions in a manner appropriate to the current mapping that player B selects
- Player B tries to change the mapping in a manner appropriate to the way that player A currently plays



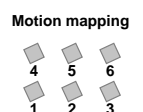
Video Explanation

Player A



Currently played drum-sounds

Player B



Current mapping set

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□ Examples of Cindy's motions

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6. Conclusion

□ Summary

- **Interactive performance system in which two players and Cindy interact through music**
- **Three kinds of interaction**
 1. Interaction between players through music
 2. Interaction between each player and Cindy
 3. Interaction between players through Cindy
- **Implemented on distributed workstations**
- **Achieved an interesting new interaction that cannot be achieved through music alone**

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□ Design of Interactive Performance

- **Avoid mismatches between media and keep harmony**
- **Perform three kinds of interaction simultaneously without feeling disharmonious**

Use the drums, which mainly maintain the rhythm in music,
guitar, which characterizes the mood in music,
in the ^{direct} interaction determining the ^{timing} of dance
_{indirect} mood

- **Consider harmony between the dance motions and the mood of the improvised performance**

Cheerful motions are selected when performance is cheerful
Quiet quiet

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□ Future Work

- **Design other interactive performances**

Interactive performance system for three or more players
for other LCCs

- **Remote interactive performance**

Our implementation facilitates
use of the system in settings where
the players are not in the same physical location

- **Interactive performance via Internet**

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