RWTH

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WESTFÄLISCHE
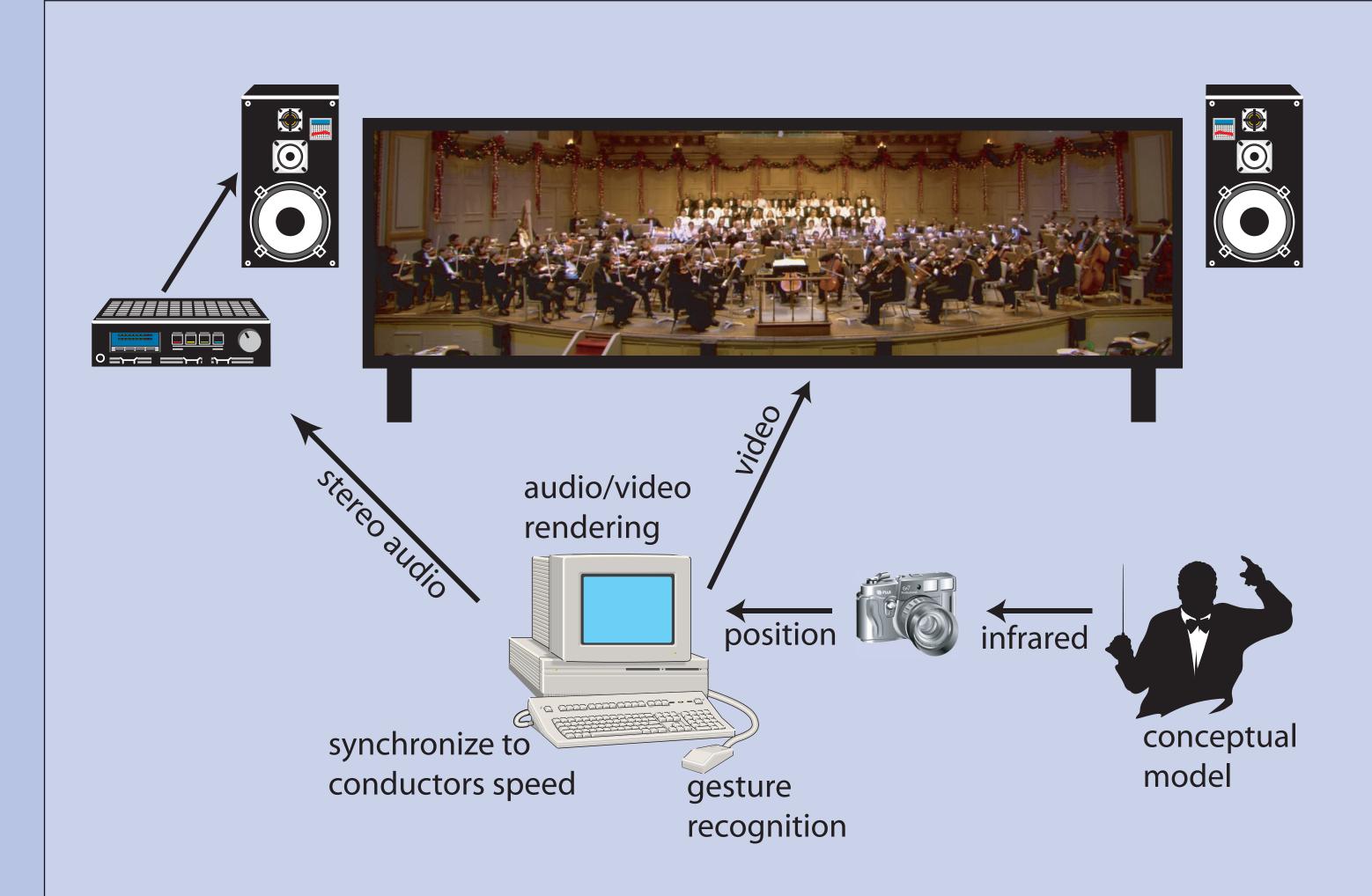TECHNISCHE
HOCHSCHULE
AACHEN

Personal Orchestra

A Series of Interactive Music Exhibits

- **Conducting** is a unique way to interact with digital time-based media.

- Since 2000, we have been doing research on how to conduct **real orchestral audio/video recordings**

- Our work has resulted in several public interactive exhibits

- The **HOUSE OF MUSIC VIENNA**, Austria, 2000

  - World's first system to allow users to conduct an actual A/V recording of an orchestra

  - Permanent exhibit, featuring the world-famous Vienna Philharmonic Orchestra

- The **Boston Children's Museum**, USA, 2003

  - First conducting system specifically designed for children, featuring an A/V orchestral recording

  - Real-time audio time-stretching with better quality

- The **Betty Brinn Children's Museum**, Milwaukee, USA, 2006

  - Much improved real-time audio time-stretching

  - Adaptive gesture recognition, based on cognitive models of conducting

  - Semantic Time Framework, used for this and future exhibits

HOUSE OF MUSIC VIENNA

How To Conduct

- Move the baton up and down regularly to **conduct the orchestra**.

- Conduct faster to **increase the tempo**.

- Make larger movements to let the orchestra **play louder**.

- Conduct towards certain **instrument groups** to make them **play louder**.

Research Challenges

- **Conceptual Models of Conducting Gestures**
  The system needs to adapt to the **differences in the conducting style** between professional conductors and novices.

- **Synchronizing the Orchestra to the Conducting Gestures**
  Contrary to ordinary media, our video and audio material is augmented with **semantic information**, namely the **beats** of the piece the orchestra is playing. We developed the **Semantic Time Framework** to work with such enriched media.

- **Time-Stretching**
  The audio and video **playback speed** needs to change to follow the conductor—without changing the audio pitch. **PhaVoRIT**, our time-stretching algorithm, achieves this in **real time** and at **world-class quality**.
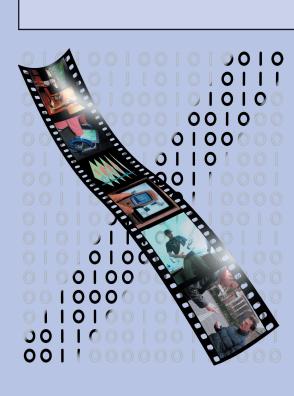
- **Gesture Recognition**
  The baton position needs to be tracked and interpreted as conducting gestures. We are developing a system which detects gestures from **professional conductors** as well as **non-conductors**.

- **Baton Hardware**
  Batons need to be untethered, low-latency, robust and easy to replace. Currently we are using a **sensor-based infrared solution**.

- Implementation
  Our systems run on Apple hardware under Mac OS X.

MEDIA COMPUTING GROUP