
New Methods For Multimodal Interaction

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Motivation

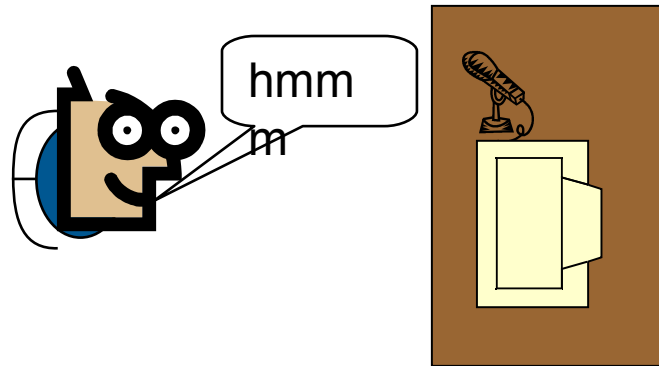
- Conventional devices are not designed for disabled users
- People with upper limb impairment can use:
 - Speech recognition
 - Eye tracker

- Conventional devices are not designed for special purposes (like gesture communications)
- Gesture communication is more natural
- Accelerometer is a cheap gadget that can add a great value to existing devices.



Non-verbal Vocal Interaction (NVVI)

- NVVI (Non-Verbal Vocal Interaction) is a part of vocal interaction, but other sounds than speech are used such as:
 - Whistling
 - Humming

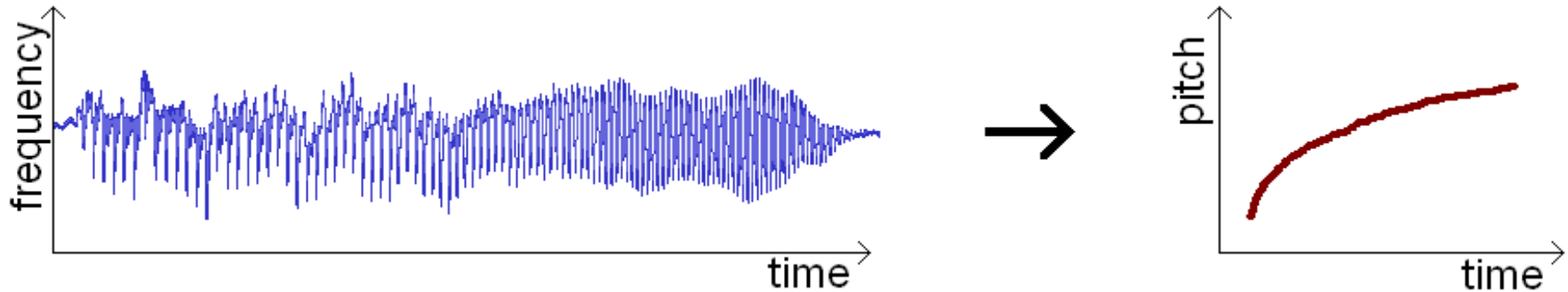


- Video sample – mouse cursor emulation



NVVI, How does it work ?

- Fundamental frequency (pitch) of a recorded sound is computed by U3I library

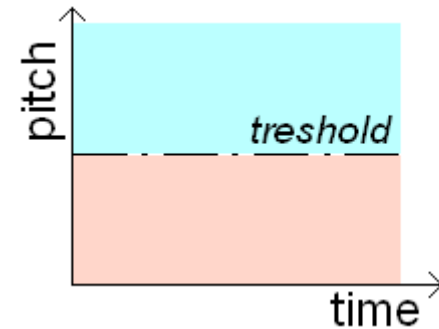
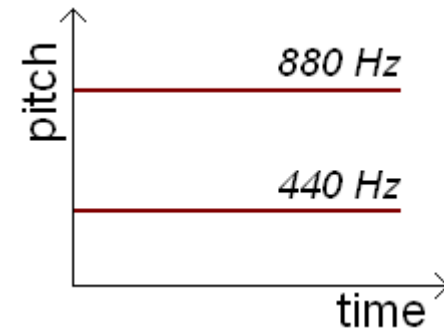


- Measured properties:
 - Pitch (frequency of a tone)
 - Length
 - Volume



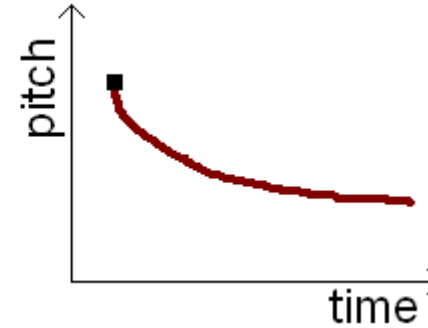
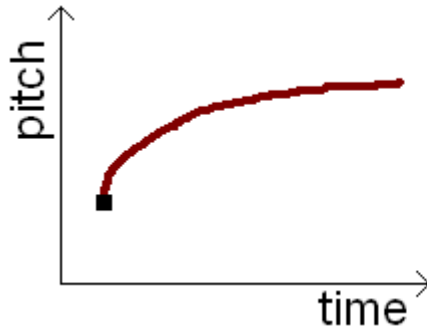
NVVI Approaches

- Application commands can be mapped to pitch and/or length of tone
- One certain pitch, e.g.:
 - move up: 880 Hz
 - move down: 440 Hz
- Pitch range, e.g.:
 - move up: above the threshold
 - move down: below the threshold



NVVI Approaches (cont.)

- Voice gesture: short melodic pattern of defined pitch profile and/or length, e.g.:

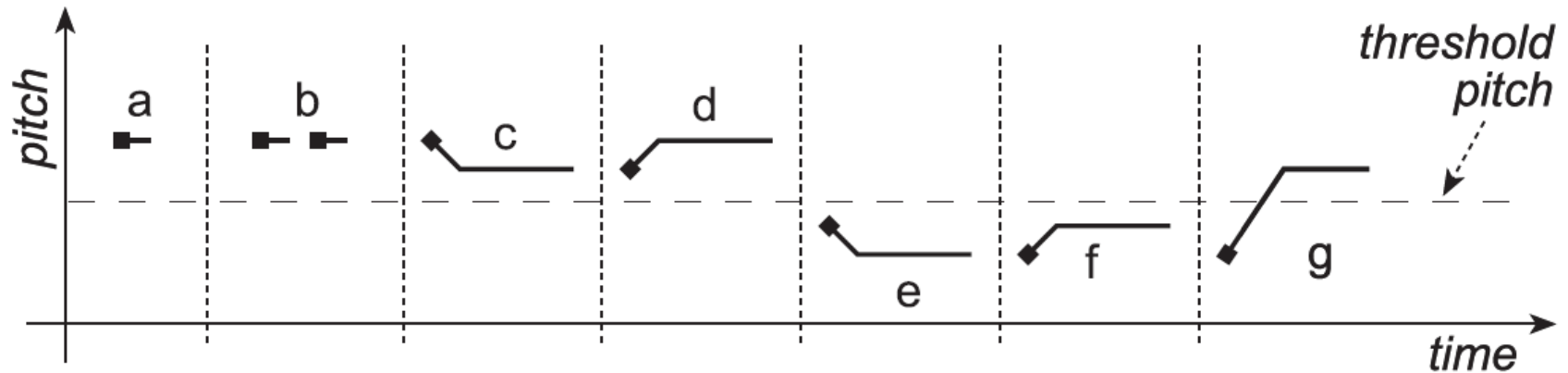


- move up: increasing pitch
- move down: decreasing pitch



NVVI Applications

- Acoustic Control of Mouse Pointer

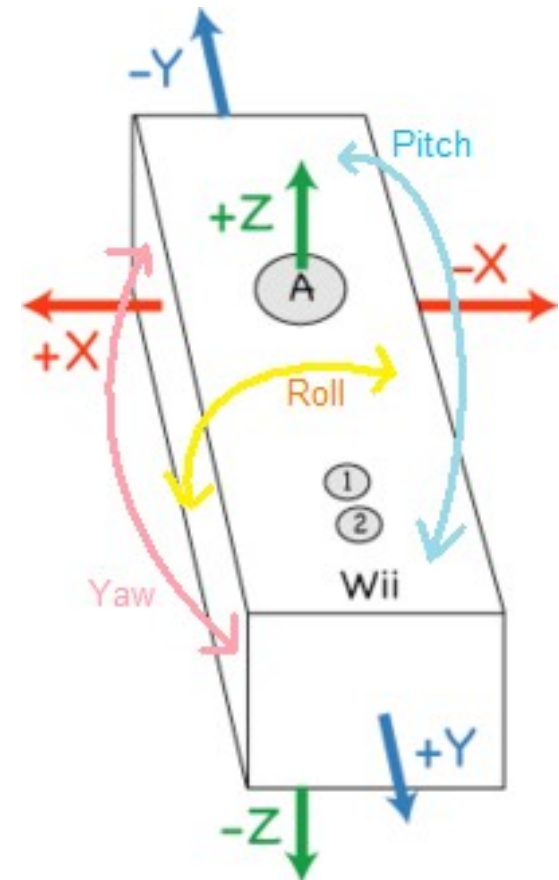


- Non-speech Operated Emulation of Keyboard
- Non-speech Input for Real-time Control of Computer Games (Tetris)



Accelerometer-based Interaction

- Accelerometer-based Interaction is performed by a device that can measure its acceleration
- Nintendo Wii Remote Controller
 - Equipped with 3 accelerometers
 - Gravity force measured
- 6 degrees of freedom:
 - 3 linear translation directions (X,Y,Z)
 - 3 rotation angles (pitch, roll, yaw)



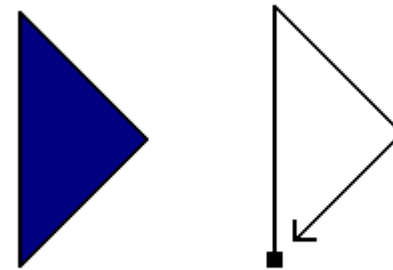
Accelerometer-based Interaction Approaches

■ Rotation

- Measuring pitch and roll
- Mouse cursor emulation
- Horizontal and vertical scrolling
- Useful when continuous change of a value is needed

■ Gestures

- Playing games
- Controlling devices at home
- Controlling GUI

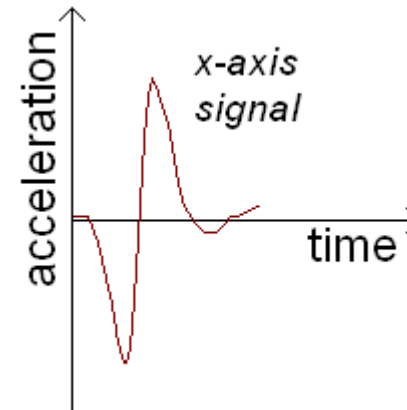


play gesture



Accelerometer-based Interaction, Implementation

- Gestures are recognized from accelerometers signals
- Example:
 - swinging the WiiMote right

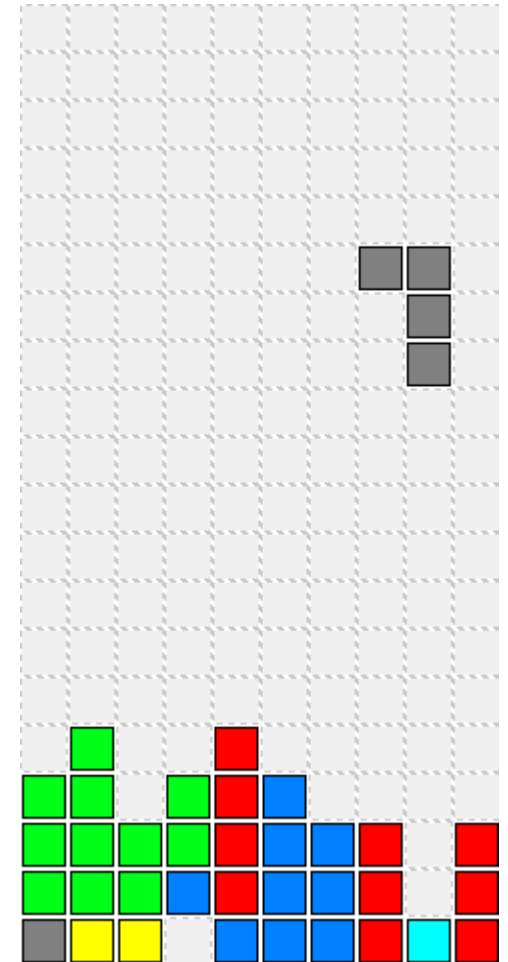


- Possible implementation:
 - Automaton for each gesture
 - There are several libraries for accelerometer-based gesture recognition



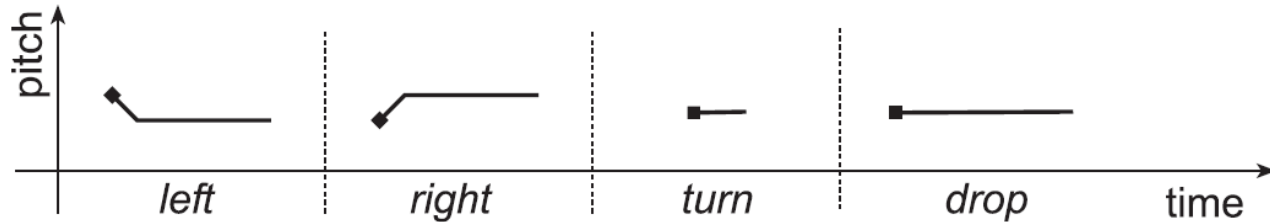
Example: Multimodal Tetris

- The falling block can be rotated or shifted to the sides
- Blocks are randomly selected
- When a row is completed, it is removed
- Game ends when there is no space for a new block



Example: Multimodal Tetris (cont.)

■ NVVI Gestures



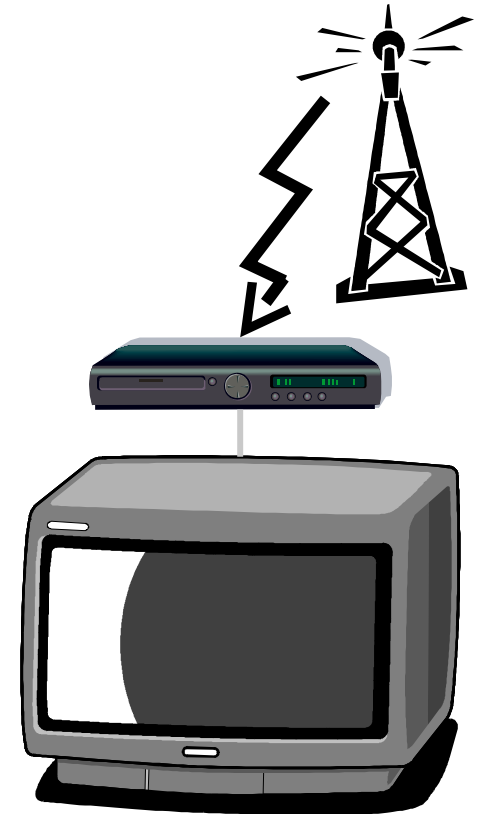
■ Wii Gestures:

- Move left – Swing left
- Move right – Swing right
- Turn – Swing up
- Drop – Swing down



Future Work

- Vital Mind project – iDTV (interaction with digital TV)
- Design of NVVI and accelerometer-based gestures control for a set-top-box environment
- Accelerometer-based mouse emulation (user studies)
- Accelerometer-based keyboard emulation



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Thank you for attention



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