Natural Throw and Tilt Interaction between Mobile Phones and Distant Displays

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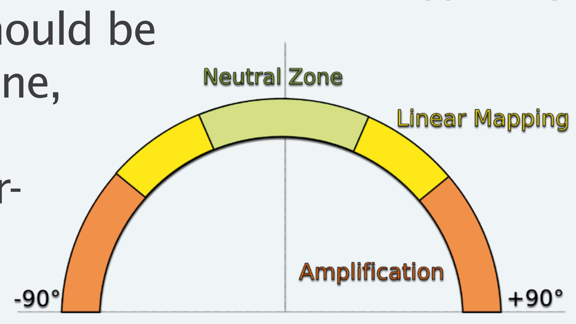
Motivation & Approach

Ubiquitous mobile phones are still limited in terms of their screen size and the amount of information they can display. To overcome these restrictions, this work addresses the seamless combination of sensor-enabled phones with large displays. An intuitive basic set of tilt gestures is introduced for a stepwise or continuous interaction with both mobile applications and distant user interfaces (UIs) by utilizing the handheld as a remote control.

In addition, we introduce throwing gestures to transfer media documents and even running interfaces to a large display. To improve usability, data and interfaces can be thrown from a mobile phone to a distant screen and also fetched back to achieve mobility. We demonstrate the feasibility of the interaction methods with several advanced application prototypes facilitating a natural flow of interaction.

Tilt Interaction with Mobile and Distant UIs

- In the domain of personal media management and home entertainment, many tools rely on a simple set of interactions (e.g. a mobile music player with hierarchical lists of music items).
- There is a basic set of interactions to be supported by a mobile phone: up, down, left, and right movements of a cursor position, some widget highlight, or a direct mapping to navigate a movable application space (e.g. maps).
- Movements can either be **discrete (stepwise)** or **continuous (fluent)**. For the latter we distinguish between a **linear** and **non-linear mapping** of movements to interface changes.
- This set of interactions is supported by recognizing corresponding tilt gestures with an off-the-shelf sensor-enhanced mobile phone.
- Users can easily perform tilting gestures in all directions along the x and y axes.
- Discrete interaction: The phone is simply moved back to the neutral resting position after each interaction step.
- Continuous interaction: A neutral zone and – typically – two additional zones should be defined. One allows for fine, linear control in the near field, the other for accelerated, exponential control for distant parts.



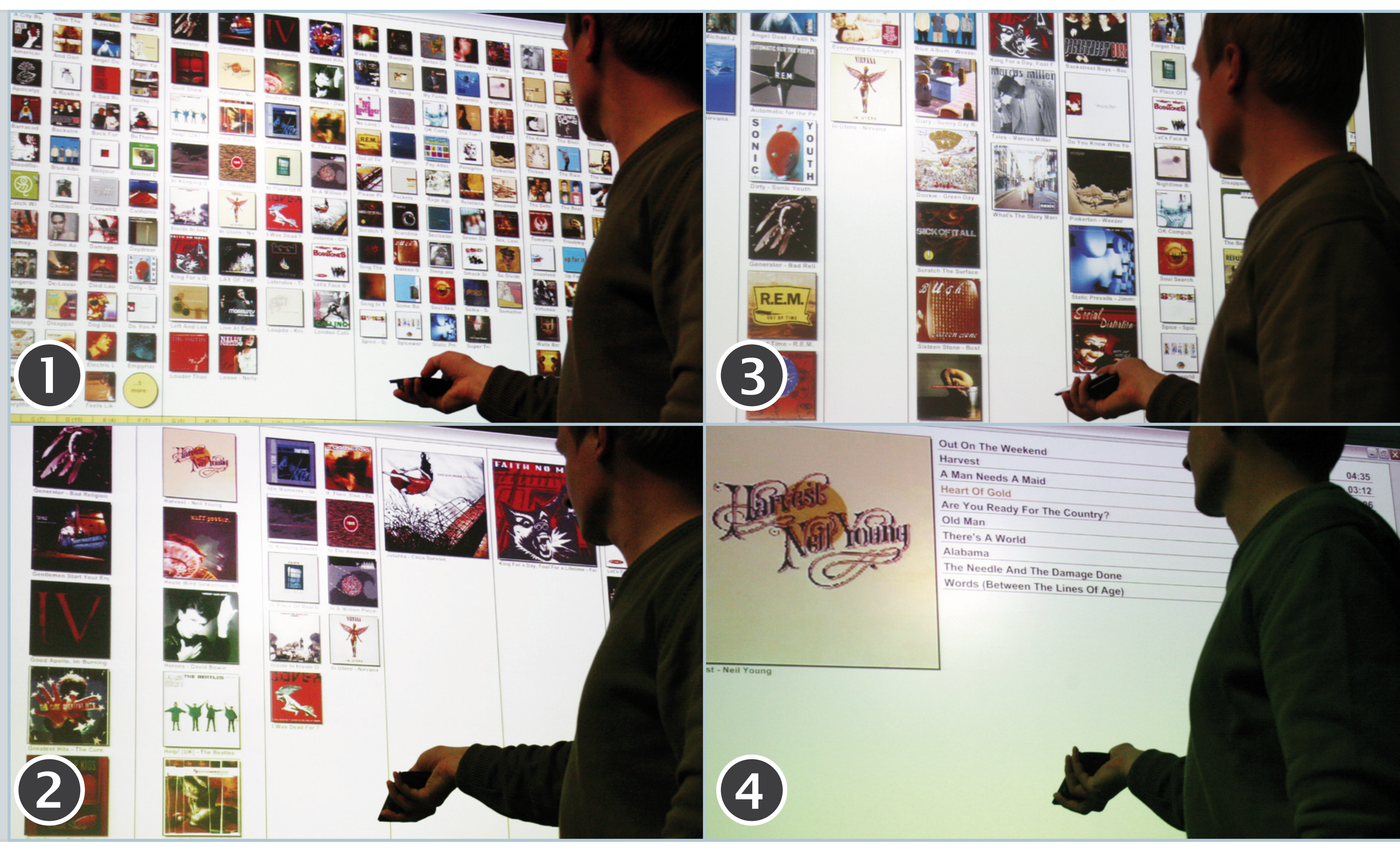
- This set of basic tilt gestures is either used on the mobile phone alone or by using it as a remote control operating a distant UI.

Application 1 — A Zoomable Music Browser

Tilt Interaction

Using discrete tilt gestures to operate Mambo on a large screen.

1. All albums arranged by name
2. Zoom to selected albums
3. Albums arranged by time
4. Selected album.



Application 2 — Navigating 3D Digital Globes

Tilt Interaction

Remotely operating Google Earth

Tilt, zoom & pan mode using tilt gestures

Remote Media Manager — Application 3

Throw & Tilt Interaction

Throwing images to a large display and fetching them back

Browsing various media using tilt gestures in different views:

Google Earth, matrix view & coverflow view

Throwing Data and UIs to Wall Displays

- To improve usability, data (e.g. media documents) can be thrown from a mobile phone to a distant screen and managed from the distance using tilt gestures.
- To achieve mobility, they can also be fetched back by rapidly moving the phone towards the user's body.
- We contribute the concept of even transferring a running user interface (i.e. state of an application, configuration and other data) by using throwing and fetch-back gestures.
- Conceptually, throwing the interface can be seen as just switching displays but also as providing improved application functionality on the distant device.

Several advanced application prototypes were implemented for Nokia N95 and iPhone with an additional PC server component. WiFi is used for communication, the low-latency UDP for transmitting sensor data and the reliable TCP for file and other data transfer. Gesture recognition is done by evaluating force vectors delivered by the accelerometers.

UI & SE

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