

Exploring the design space of programmable friction for scrolling interactions

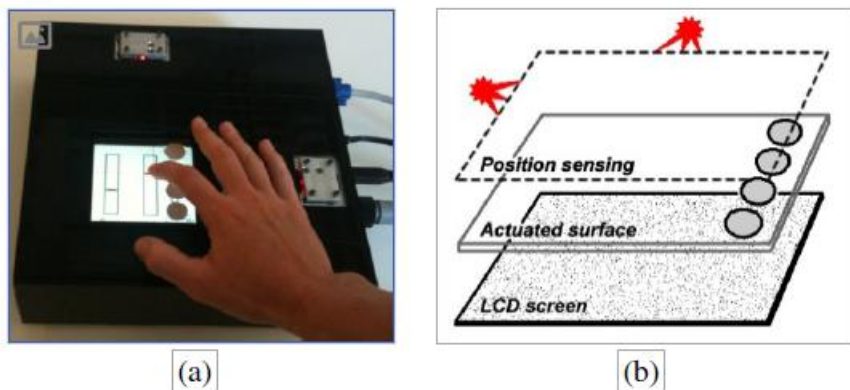
Ultrasound Swipe

【Summary】:

Study swipe gestures for touch screens.

【Apparatus】:

We used a Large Area Tactile Pattern Display (LATPaD) [13], an experimental touchscreen that reduces the friction experienced by a sliding finger on its surface by creating a 'squeeze film' of air using imperceptible high-frequency vibration (Figure 1). Vibrations are created by piezoelectric actuators bonded along one side of a glass plate that rests atop an LCD screen, while fingerpad position is measured with a laser-based optical system, resulting in a 57 × 76 mm haptic touchscreen. Tactile effects are produced by altering the amplitude of vibrations, and hence the amount of friction, as the fingerpad slides against the touchscreen.



【Contribute】:

- **Scenario 1 – Document navigation with vertical scrolling.** A document is scrolled by dragging its content along the length of the screen. Feel: distinct detents and textures as elements of the document (headers, images, markings) scroll through the screen.
- **Scenario 2 – Video navigation with multi-rate scrubbing.** A stream is navigated by sliding against different horizontal sliders, each controlling scrubbing at different rates. Feel: different densities of detents on each slider, indicating the rate; distinctive detents distinguish minor and major tick marks, display annotated locations, and indicate transitions between sliders.
- **Scenario 3 – List navigation with circular scrolling.** A long list is navigated with a continuous circular gesture. Feel: rate of flow as a stream of detents; and distinct detents on transitions between groups of items or on marked items.
- **Scenario 4 – List navigation with rate control.** A long list is navigated by engaging a joystick-like controller, with scrolling rate proportional to the pressure applied. Feel: resistance when engaging the spring-like controller.
- **Scenario 5 – Numeric entry with slider.** A numerical value is entered by sliding horizontally against a controller. Feel: distinct detents on minor and major tick marks.

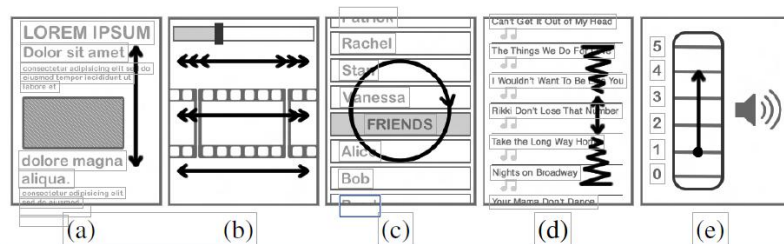


Figure 2: Five scrolling scenarios sampling the design space: (a) document navigation with vertical scrolling, (b) video navigation with multi-rate scrubbing, (c) list navigation with circular scrolling, (d) list navigation with rate control, and (e) numeric entry with slider.

【Experiments】:

the identifiability of a set of six tactile detents (E1); the factors affecting the counting of detent sequences (E2); the comparability of detent densities (E3); the synchronization of tactile feedback to on-screen events (E4); and the most realistic rendering for a spring-like resistance (E5).

【Important Reference】 :

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