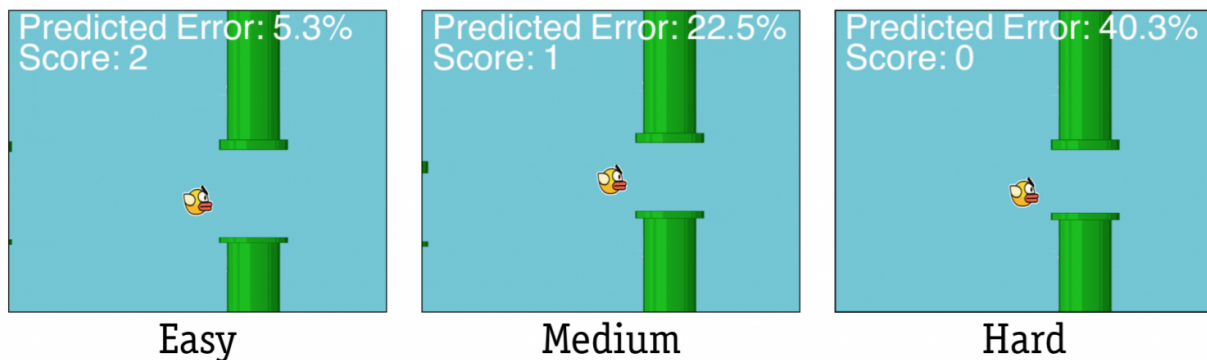


A theory explains why gaming on touchscreens is clumsy

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The new model can be used to predict player performance when designing game levels. Credit: Aalto University

New research challenges the belief that touchscreens are worse input devices because they lack physical buttons. The reason is that key press timing in touchscreen input is unpredictable. When timing is made more predictable, performance improves.

A research group at Aalto University, Finland, propose a new theory of computer input explaining for example why serious gamers avoid touchscreens and why playing a piano on a touchscreen is so awkward.

"The common view before this work was that the lack of physical buttons is critical, but you also have tactile feedback from the surface of

a touchscreen. Another false belief was that touchscreens are slower, but that is not the case anymore," Dr. Byungjoo Lee explains.

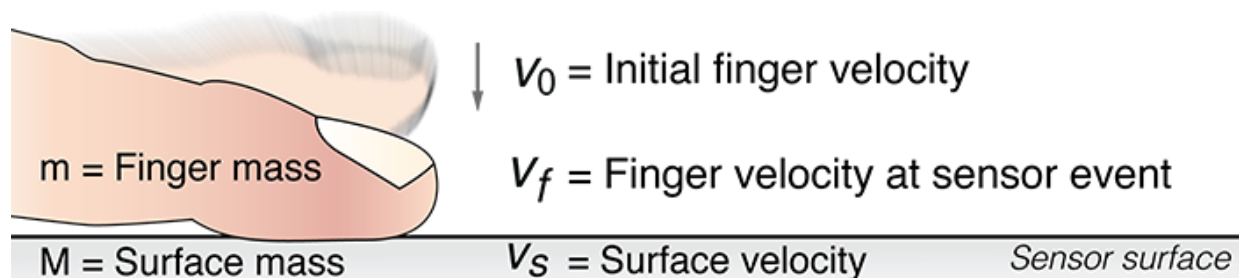
The group conducted experiments where participants were asked to tap a display when a target would appear. The data showed large differences between physical keys and touchscreens in how reliably users could time their presses.

"We found a systematic pattern in [timing](#) performance that we could capture mathematically," Dr. Lee tells.

The researchers proposed a new theory explaining that there are three sources of error that make timing very hard with touchscreens.

First, people are not able to keep the finger at a constant distance above the surface. The finger is always moving, and even the slightest movement hampers our ability to time precisely. By contrast, when using physical keys, the finger rests on the key, eliminating this source of error.

Second, when the finger touches the surface, it is hard for the neural system to predict when the input event has been registered. Typically software detects the touch when the finger first touches the display. But users cannot sense this event so it is not predictable for them.



Users are most accurate in timing tasks when the touch event is registered when the contact area of the finger is largest. This is the time when maximum kinetic energy is transferred to the touch surface. Credit: Aalto University

Third, when the event has been registered on the touchscreen, it still needs to be processed in the application, and in some cases the time that it takes is longer than in other ones, creating another source of latency.

The new theory implies that users' performance can be improved by making touch events more predictable. The researchers showed that by registering the touch event when the finger's contact area on the surface is the maximum, timing performance can be improved significantly.

"Unfortunately, the theory also suggests that touchscreens may never be able to beat physical keys in gaming. The reason is that the finger travel distance varies and creates a source of unpredictability," reveals Professor Antti Oulasvirta.

In the final study, the researchers looked at Flappy Bird, a popular game requiring accurate timing.

"We can finally explain why games that require accurate timing are annoyingly hard on [touchscreens](#). Our model can predict how many points a gamer is able to score in that game," Professor Oulasvirta concludes.

The paper will be presented at the CHI¹⁶ conference in San Jose in May 2016.

More information: Paper: users.comnet.aalto.fi/oulasvir...g-errors-chi2016.pdf

Provided by Aalto University

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