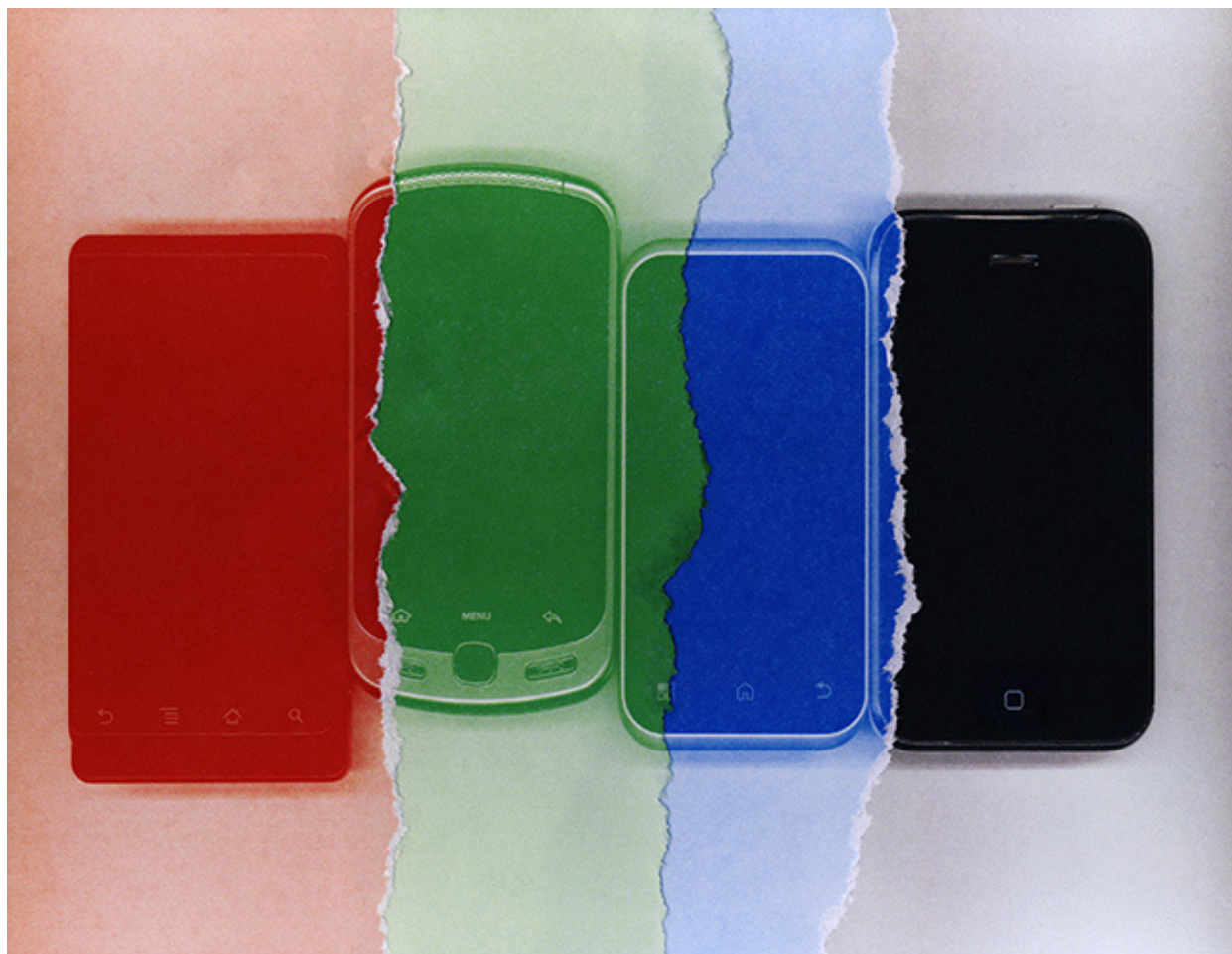




FRIYA GANAPATI GEAR 03-04-10 8:00 PM

FINGER FAIL: WHY MOST TOUCHSCREENS MISS THE POINT



YOU'RE NOT CRAZY, and neither are we: The touchscreen on the Apple

iPhone really is more responsive than the screens on the BlackBerry Storm, the Motorola Droid, the Nexus One and many other phones, even though all of these devices use essentially the same touch-sensing hardware.

Though handset makers buy their touchscreens as components from the same select pool of suppliers, a good touchscreen experience requires more than just hardware. It requires a bit of design alchemy blending software, engineering and calibration for the perfect feel. Few smartphone makers have managed to get that balance right, say experts.

“If you think that no other touchscreen out there is as good as the iPhone, its not all in your head,” says Chris Verplaetse, vice president of the Moto Development Group, a product design and development firm. “It’s like asking what makes a Mercedes door close like a Mercedes door and a Hyundai door close like one though they use the same steel. There’s clearly a difference.”

Variables include engineering details such the calibration of the touch sensor so it can separate the signal from the noise, the quality of the firmware and the level of integration of the touch experience into the phone’s user interface. There are also more difficult-to-quantify things such as as the level of the company’s commitment to making the best touchscreen experience possible.

“Many layers account for the performance of a touchscreen,” says Verplaetse. “But it all comes down to how well the electronics and the mechanical hardware are integrated.”

As cellphones became more powerful, allowing users to surf the internet and check e-mail, handset makers started to add touch capability to their

phones. The earliest screens were resistive touchscreens, where two thin metallic layers are separated by a narrow gap. A finger pushing down on the top layer makes contact with the bottom surface and the point of contact is computed by the accompanying electronics.

But resistive touchscreens didn't make most consumers happy because they weren't responsive enough — you had to really push and hammer away at the display with your fingernail or a stylus to get it to respond.

The capacitive touchscreen in Apple's iPhone changed the game, because it's not pressure-sensitive. Instead, this kind of technology responds to the electrical properties of your skin, not the pressure of your finger, to figure out where you're touching the screen. For the first time, just a light tap could open an application or a flicking gesture could get the screen scrolling. Best of all, it seemed effortless.

A projected capacitive touchscreen — the kind that's usually used in phones — has a glass insulator coated with a transparent conductive layer. The layer is etched into a gridlike pattern. When a finger touches the surface of the screen, it distorts the electrostatic field. That can be measured as a change in capacitance. The location of the touch is computed and it is passed on to a software application that relates the touch into actions for the device.

In theory, all capacitive touchscreens should offer consumers the same experience, but they rarely do, says Andrew Hsu, a technology strategist for Synaptics, one of the biggest touchscreen component makers.

“Capacitive touch-based handsets involve a lot of development work and quite a bit of engineering expertise in order to give them their ‘magical’ quality,” says Hsu.

IT'S NOT JUST ABOUT HARDWARE

Smartphone users have no way to measure exactly how well the capacitive

sensor system on their phone is actually working. Their perception is based on the feedback they see on the screen, says Hsu. That means a touchscreen could be quite fast and accurate, but if the visual display doesn't keep up, it won't feel smooth or responsive.

That's where well-designed user interfaces and quality firmware come into play.

"Some systems are better at it than others," says Hsu.

Synaptics ran tests comparing the iPhone touchscreen to the original BlackBerry Storm. They found that the Storm's touchscreen sensor responded well, which pointed the finger at the underlying firmware.

It's also a reason why BlackBerry maker Research In Motion was able to fix some of the lag and the bugginess of the screen that reviewers had initially complained about. Subsequent updates to the Storm's software significantly improved its responsiveness to touch.

Another problem is separating signal from noise, which some phones are better at than others.

A perfectly designed and well-tuned capacitive sensing system would require no pressure to detect the presence of a user's finger. But to get there, handset makers have to solve what Hsu calls the "needle in a haystack problem."

The amount of signal that your finger contributes when it touches the sensor is very small compared to the noise already present in the system. To accurately sense it and compute its location requires some software magic.

“Even if you design the entire touchscreen right, once you put it into the device, there’s an impact from other sources that emit electromagnetic interference, such as the wireless unit,” says Hsu.

That’s where an ASIC, or application specific integrated circuit, is needed to measure and amplify the signals. Apple reportedly designed its own ASIC for the iPhone’s touchscreen, while most other companies buy an ASIC from one of the touchscreen chipmakers.

FINDING THE RIGHT BALANCE



In January, Moto Labs, Moto Development Group's research group, tested different touchscreens by using a drawing program to draw a few straight lines on the display. On a good touchscreen, users can draw clean, straight lines, say the researchers, while inferior touchscreens show lines that look

jagged (see the photo above). The jagged lines happen because the sensor size may be too big, the touch-sampling rate may be too low, or the algorithms that convert gestures into images don't faithfully represent user inputs.

Moto Labs' tests showed the iPhone had the most precise lines, though there was loss of sensitivity around the edges. The HTC Droid and Nexus One also did well, while the Motorola Droid's touchscreen came out at the bottom.

Though Palm Pre wasn't included in that test, Moto says the Pre's screen responded well. Meanwhile, a Palm Pre Plus user recently complained about the device's poor touchscreen.

Palm wouldn't comment about that particular complaint, but the company says the Pre and Pre Plus have been designed to optimize the touch experience. For instance, the Pre and the Pre Plus have a "soft arc" on the top surface to allow for gestures without interference from the edges. And Palm tries to tweak the touchscreen through firmware updates.

"We made touch a central part of the navigation on the device," says Leslie Letts, a spokesperson for Palm.

Getting the perfect touchscreen experience is also a matter of finding the right balance for the display.

One reason why Apple's touch sensor is so sensitive to light touch is that the company uses a 12-volt power source for the sensing lines in the touchscreen sensor, versus the 3- to 5-volt power source that most other component manufacturers have. That higher voltage drive takes a toll on the battery life because it uses up more power, but it also translates into

more accurate sensing, which means a better touch experience, say researchers at Moto.

Other cellphone manufacturers are making the investments to catch up but it will be a while before all touchscreens work as well as Apple's, says J. Daniel Hebert, CEO of Moto Development Group.

"There's a big difference between deferring to a vendor and driving the performance of the system," he says.

One final factor: Steve Jobs. His imperious management style may be off-putting, but he does exercise complete control over the final versions of his company's products, and that hands-on approach at the company's highest levels helps ensure that the whole experience works well — including the feel of the touchscreen.

"For a good touchscreen, you need someone who is a generalist who can ask more than whether the software is complete and whether the hardware is complete," says Verplaetse. "Steve Jobs is an example of someone who probably asks, 'Does this feel right?' when he's looking at a new product."

Photo illustration (top): Jon Snyder/Wired.com

DIY test analysis: Moto Labs

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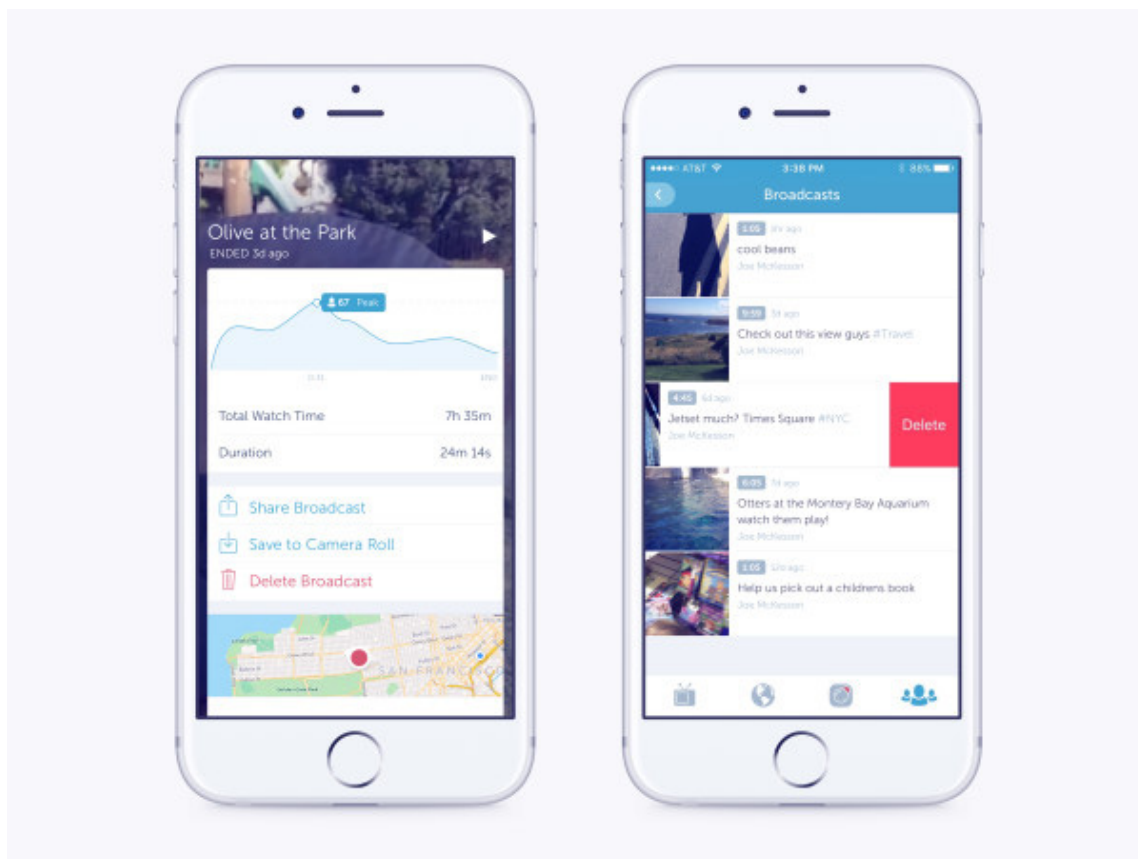


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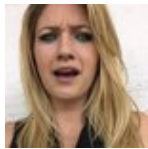
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