What's going on with iPhone touch performance?

- A performance comparison between Apple iPhone 5S and iPhone 5C

Apple released two new iPhones to market few weeks ago, the new flag ship model 5S and the cheaper 5C model. We measured the performance of these devices with OptoFidelity touch panel measurement devices to find out what is the actual difference for an end user in most commonly used tasks like browsing the web or opening a camera application. We used Samsung Galaxy S3 as a reference. Yes, we know that S3 is an over one year old model but it is still a good smartphone for everyday use.

Our measurements pointed out that iPhones are fast but there is a significant lack of touch accuracy which definitely correlates the real user experience.

Application latency measurement with OptoFidelity WatchDog

We measured application latencies by using OptoFidelity WatchDog measurement device. *OptoFidelity WatchDog* is a camera based measurement tool which measures latencies based on human interaction (touching the device) and optical events that take place on the display of the device. With these measurements we can get accurate values for latencies so we don't have to worry about the subjectivity of end users.
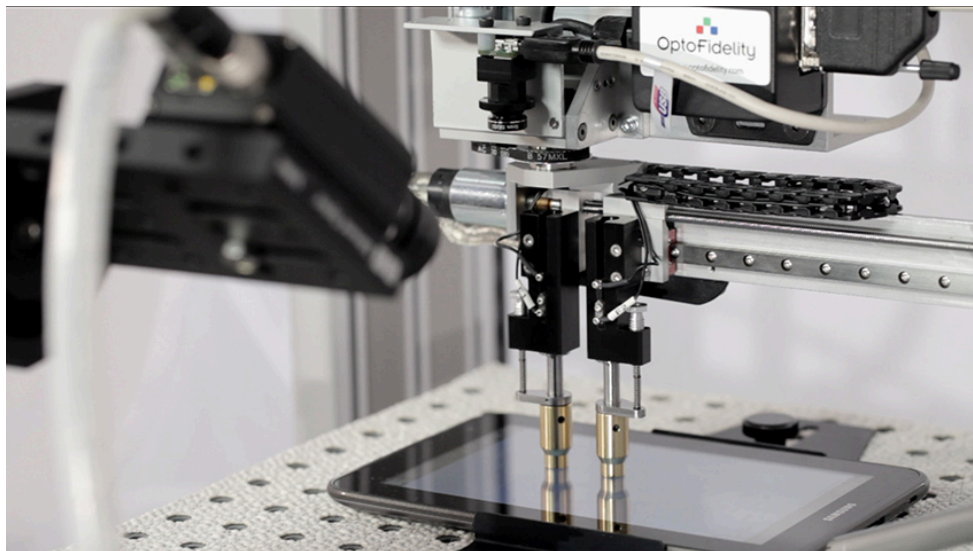

Image 1: OptoFidelity Watchdog integrated to desktop robot

The first test case was to open www.optofidelity.com web page with the default browser that comes with the smartphone. Smartphones were connected to Wi-Fi access point. Measurement was completed when the web page was completely loaded. Before executing the measurements, there weren't any applications running in the background (not even the browser), and every measurement was repeated 10 times. The average of those 10 measurement results was reported.

Web browser opening time [s]

Device	Time [s]
iPhone 5S	~6.0
iPhone 5C	~7.4
Galaxy S3	~9.1
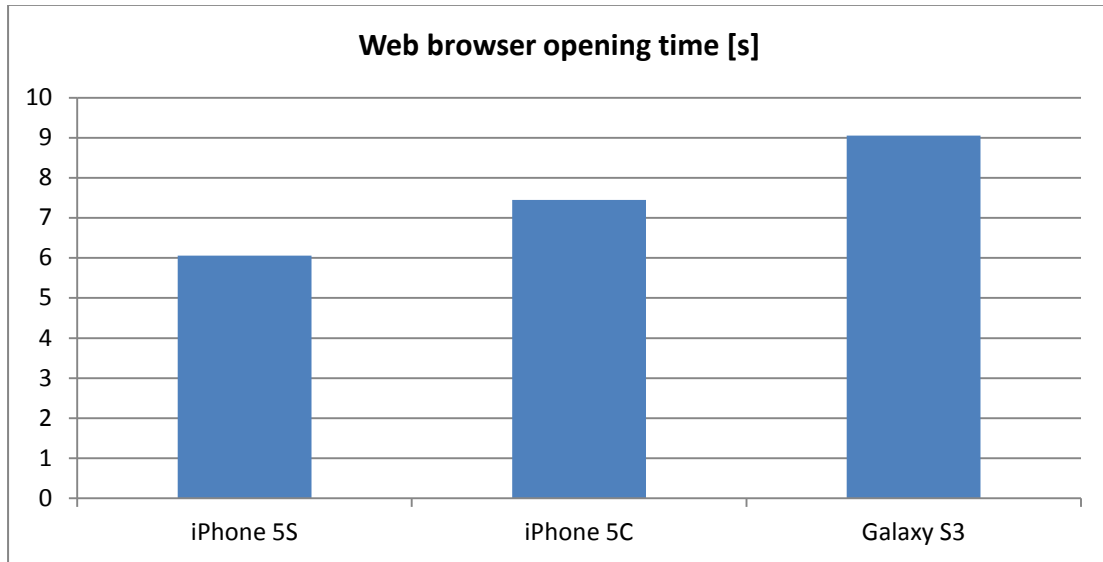
The second test was on the opening time of camera application. Camera application is one of the most used applications in smartphones. We measured application opening latency with WatchDog. Results were gathered the same way as in the previous measurement.

Camera application opening time [s]

Device	Time [s]
iPhone 5S	~0.68
iPhone 5C	~0.70
Galaxy S3	~1.43
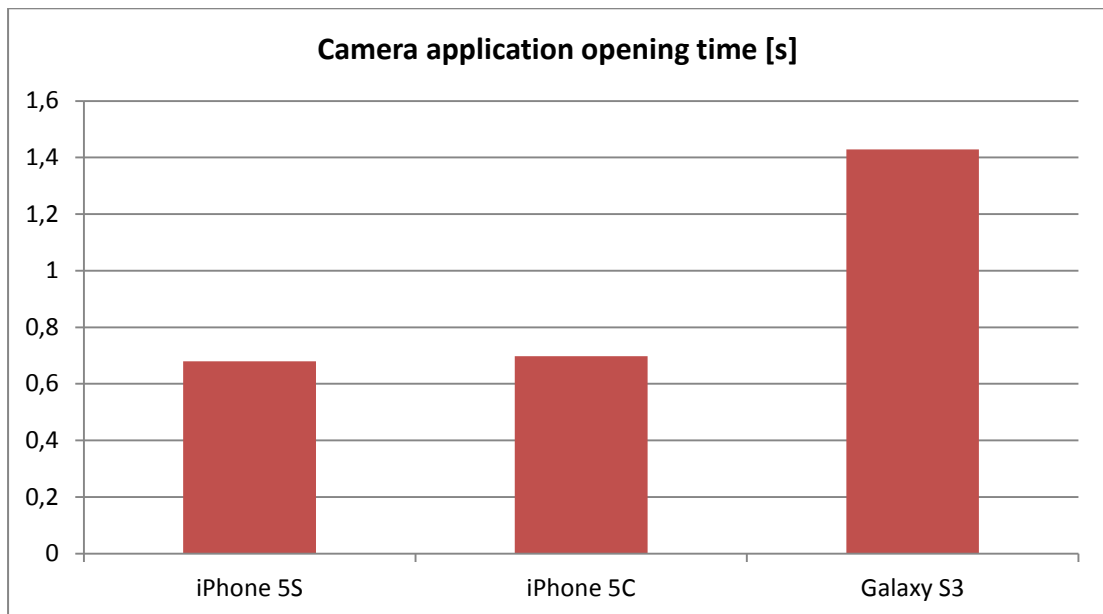
Touch Accuracy measurement with OptoFidelity Touch Panel Performance Tester

We also wanted to measure the performance of the touch screen. Because resolution in iPhone 5S and iPhone 5C is the same, we assumed that the touch accuracy and linearity should be the same. Of course we measured both. We used OptoFidelity TPPT (Touch Panel Performance Tester) to measure all three smartphones.

OptoFidelity Touch & Test® is a test platform for touch device testing. PDT stands for panel performance device level testing. OptoFidelity Touch & Test measures the touch panel accuracy. This tester includes a robot with an artificial finger. The tester compares the coordinates of robot to the coordinates captured from the touch device.

Link to test measurement demo video: https://www.youtube.com/watch?v=q_sxn1hZu78

Image 2: OptoFidelity TPPT

First we performed an accuracy measurement. We tapped the phones across the screen and compared the actual touch position with reported coordinates. PASS/FAIL limit for our accuracy test is ±1 mm. Green point indicates pass and red one fail.
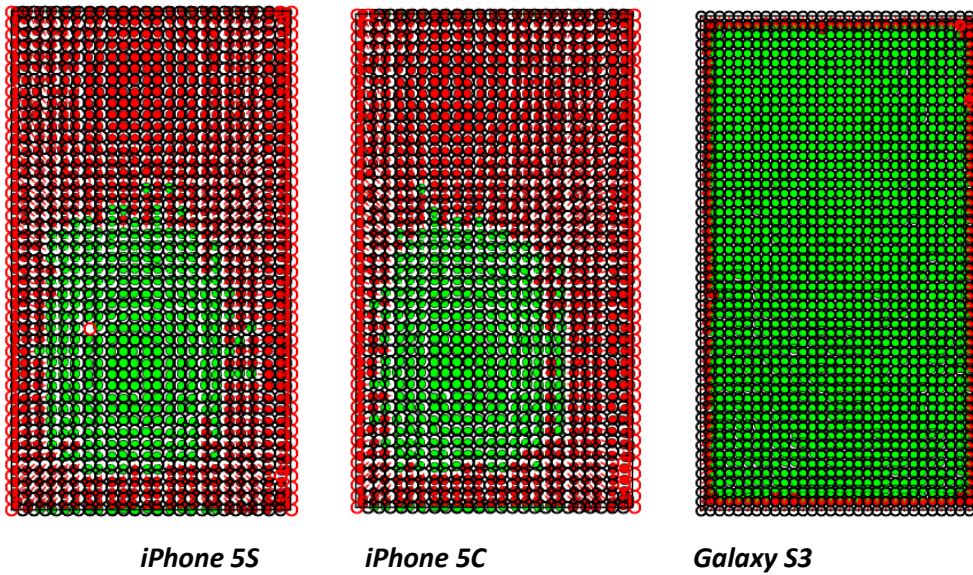
iPhone 5S　　　　**iPhone 5C**　　　　**Galaxy S3**

Image 3: Touch accuracy

Results were highly surprising. According to the results, iPhone's touch performance is extremely bad near the edges and there is also a different offset on the top of the screen compared to the lower part of the screen.

Let's see how this bad edge performance affects the use of these devices.

The effect of bad edge performance

Many users may have already found out that it is not very easy to press letters Q and P on the virtual keyboard of an iPhone 5S or iPhone 5C. This is because the touch accuracy on the sides is not as good as in the center of the screen. When we look the results closely, you can see how the test results correlate with the end user performance.

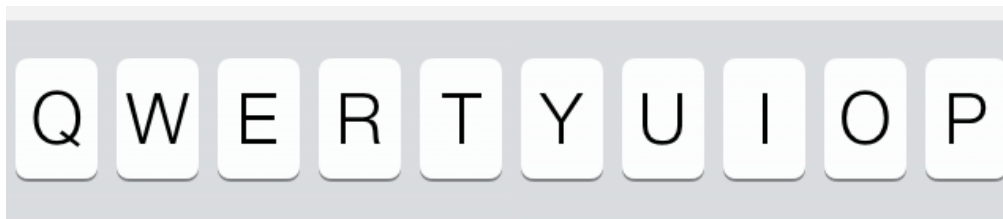**First a normal iPhone iOS 7 virtual keyboard:**

Image 4: Virtual keyboard of iPhone 5S

When we look at the measurement result of that area, red and green points as well as black and red circles indicate how the device reacts robot touch. Green points indicate that measurement inaccuracy is less than 1 ± mm. Red points indicate that measurement inaccuracy is more than 1 mm. Black circles show the point where robot touches a sensor. Green and red points inside or outside circles indicate also, where the device under test thinks robot is touching. And red circles indicate that the device has not reacted to the touch of the robot at all.

You can clearly see the touch sensor inaccuracy on the left and right side of the screen:
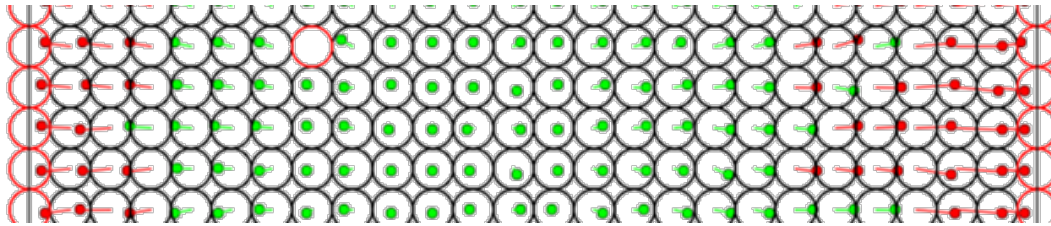
Image 5: Touch accuracy of iPhone 5S (QWERTY row)

When we combine these two images we can see that letters Q, O and P are on areas which are failing our touch accuracy test:
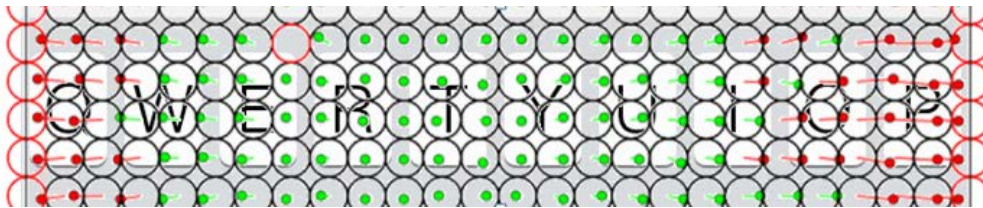

Image 6: Two previous images on top of each other

Everybody can do this same test with a real device. For example: you can try to tap the letter P (English keyboard) when your finger is close to the right side of the screen. In many cases smartphone does not react to your tap because touch result is reported outside of the button (as seen on Image 6). Also letters I, O and P are not responding as well as letters E,R,T,Y and U because the touch accuracy is not constant. This will cause extra typing errors that are not actually caused by the end user but the smartphone.

Touch accuracy comparison iPhone vs. Samsung Galaxy S3

For comparison we did the same test with Samsung Galaxy S3. It has the same kind of virtual keyboard but touch accuracy is a lot better across the screen:

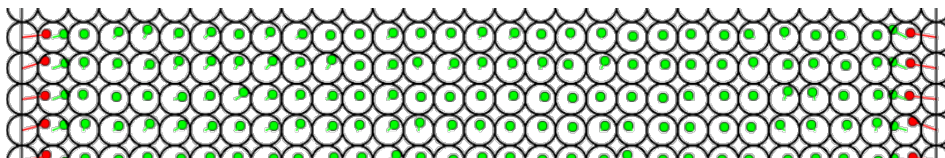*Image 7: Virtual keyboard of Galaxy S3*

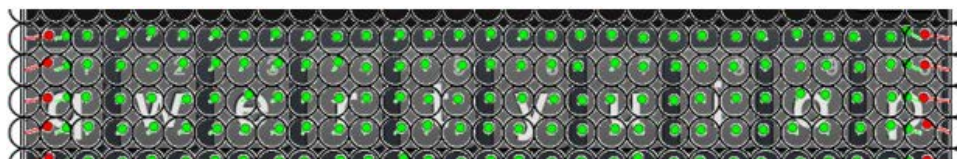*Image 8: Touch accuracy of Galaxy S3 (QWERTY row)*

Image 9: Two previous images on top of each other

Because the touch accuracy is more even in Galaxy S3 than in iPhone 5S and iPhone 5C, you get a lot less typing errors, and letters which are close to the edge are working better. You can also test this by tapping letters on the edge and typing long text messages.

Conclusion

Apple iPhone 5S is a really fast smartphone that could improve its touch performance. With Apple iPhone 5C you get a slightly slower smartphone that has the same issues with touch screen as iPhone 5S. If you prefer metal over plastic, iPhone 5S is your choice from Apple smartphones.

Today when mobile devices are getting more and more sophisticated, user actions with device are expanding user experience and the quality of device are becoming major differentiators in mobile business. By reliably testing touch accuracy, latency, scroll performance or other features that strongly affect the real end user experience mobile and touch device manufacturers can achieve real market benefits without sacrificing user experience.

Company behind the results

OptoFidelity is a Finnish high technology company specializing in test and measurement automation. Our focus is on non-intrusive testing and measuring devices from the end-user point of view.

Our mission is to fight against poor manual testing and show that investment in right testing automation can pay back in more qualified applications and devices as well as more satisfied end-user user experience.

We have several test systems and testing tools which can be used separately or for building a complete, fully automated test system. Most of our products are scalable and can also be integrated to customers own testing automation system or our partners script test or software testing tools.

Learn more about our test automation solutions on http://www.optofidelity.com/products-and-services/test-automation

You can also watch our other test automation demo videos at http://www.youtube.com/channel/UCxZMoLkyOc7rMwKuTrNp6HQ