## **2013 Tablet User Experience Benchmarks** Complete Benchmark Report (7-inch Tablets)

## Major Points

- User experience of tablets and smartphones is **one of the most important aspects** of the overall perceived value of the device.
- Key aspects of the overall user experience are hardware user experience, cognitive load, user experience friction and app store sophistication.
- Pfeiffer Consulting has developed **methodologies to quantify key parts of the user experience**.
- This report documents a benchmarking project comparing four medium-sized tablets: the Amazon **Kindle Fire HD** (7-inch), Apple's **iPad mini**, the Google **Nexus 7**, and the Samsung **Galaxy Tab 2** (7-inch).

## Key Findings

- There are significant differences between tablets in hardware user experience. This research shows that the iPad mini offers the best hardware user experience, followed by the Nexus 7.
- With a score of 28, **the iPad mini has a significant lower cognitive load than other 7-inch tablets** in the survey, contributing to greater ease of use and better user experience.
- The User Experience Friction Index calculated from this research ranges from 25 for the iPad mini to **122.50 for the Kindle Fire HD**. (Lower numbers indicate a better score.)
- App store sophistication has been quantified in several ways, and shows significant differences between the three major app providers. (See chart.)









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# I Executive Summary

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## **I-1 Overview**

### I-1.1 About this report

This report presents the complete results and methodology of a research project conducted by Pfeiffer Consulting in late 2012 and early 2013. The aim of the research project was **to find ways of quantifying some aspects of user experience of digital devices** such as tablets and smartphones, and **to execute a first set of benchmarks and user experience evaluations** with four representative examples of mid-size tablets currently on the market.

The tablets covered by the research were the Amazon Kindle Fire HD (7-inch), Apple's iPad mini, the Google Nexus 7, and the Samsung Galaxy Tab 2 (7-inch).

#### I-1.2 Quantifying user experience

The research project found that **there are several ways of quantifying some key aspects of user experience that can be documented and are objectively verifiable**. The conceptual framework and the precise methodology have been documented in detail in the methodology study<sup>1</sup> available on www.pfeifferreport.com

#### I-1.3 Key aspects of user experience

Key Aspects of tablet user experience are **hardware user experience**, **cognitive load** and **user experience friction (UXF)**. Another essential aspect of the overall tablet user experience is the **sophistication of the app store** available for a device. (See "Background and Methodology" on page 37 for details.)

The device user experience is **the sum or accumulation of a large number of minor aspects**, which, taken individually, may seem unimportant or inconsequential, but taken as a whole will make the difference between a device that is perceived as pleasant to use, and a device that is merely functional.

Whether these differences are perceived as important or not is up to the individual user to decide. **But there is no doubt that they exist:** all of the aspects we are looking at in this research are clearly perceptible and in many cases quantifiable.

## I-1.4 Reference configurations

In order to provide an objective analysis of the devices covered in this research, Pfeiffer Consulting has established **a reference configuration that combines optimal values for 12 essential user-experience-related hardware character-istics**, and allows the research to calculate an overall hardware user experience index that compares a specific device to the ideal configuration. (See "2013 Tablet Reference Configuration (Medium-Size Tablets)" on page 42 for details.) In addition, a **reference definition for app stores** was created, defining criteria of app store sophistication that can be rated using the App Store Evaluation Grid. (See "2013 App Store Reference Definition" on page 43 for details.)

1 Conceptual Framework For Quantifying Tablet User Experience, Andreas Pfeiffer, 2012-2013

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## I-2 Key Results

## I-2.1 Hardware User Experience Index: Key Results

Hardware user experience has been quantified comparing 12 essential criteria of each benchmarked device with the reference configuration. The Hardware User Experience Index shows the average value for these criteria. (See "Hardware User Experience" on page 12 for details.)

#### Key Results

Click here for complete results In the benchmarks, **Apple's iPad mini obtains the highest hardware user experience score** with an overall score of 74.03%, **followed by the Nexus 7** with a score of 59.39%. **Both the Galaxy Tab 2 and the Amazon's Kindle Fire HD obtain a hardware user experience score well under 50%** of the reference configuration. (Higher figures indicate a better result.)

## I-2.2 Cognitive Load Index: Key Results

The cognitive load index is based on a empirical analysis of the user interface and application environment pre-loaded on each device. (See "Cognitive Load" on page 46.)

#### Key Results

Click here for complete results The cognitive load analysis showed significant differences between the different devicess. With a cognitive load index of 28, Apple's iPad mini the best score in this area, followed by the Kindle Fire HD with a score of 60, and the Nexus 7 with a score of 89. The device with the highest cognitive load is Samsung's Galaxy Tab 2, with a score of 116, over four times higher than the best score in this benchmark. (Lower figures indicate a better result.)

## I-2.3 User Interface Friction (UXF): Key Results

The UXF index presented here relies on counting, describing and documenting design decisions, user interface elements or device behaviors that are incoherent, confusing or annoying. (See *"Benchmark Methodology" on page 45.*) All UXF occurrences surveyed are documented in detail in this report.

#### Key Results

Click here for complete results There are considerable differences in terms of user interface friction between the different devices benchmarked. With a score of 25 the iPad mini has by far the lowest UXF rating in this survey, compared to just over 100 for the Nexus 7 and the Galaxy Tab , and 122.50 for the Kindle Fire HD.

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## I-2.4 App Store Sophistication: Key Results

The research analyzed the dominant app store for each platform (the iPad App Store from Apple, Google Play (Apps) for Android, and the Amazon Appstore for the Kindle Fire HD) using the **App Store Evaluation Grid** defined for this research. The App Store Evaluation Grid compares 8 key characteristics of each app store in the survey to the 2013 App Store Reference Definition, rating them on a scale from 1 to 5 (A higher score indicates a better result). The index that is established presents the average of all 8 criteria. (See "App Store" on page 46.)

In addition, **the sophistication of content curation was quantified** by establishing a precise count of specially selected apps, number of featured tabletoptimized apps, and specially selected groups of apps.

#### Key Results

None of the surveyed app stores are coming close to the ideal score of the reference definition. Apple's App Store for iPad fares best, with a score of 3.5, while Google Play only scores 2.1, and the Amazon Appstore obtains a rating of 2.

In terms of content curation (i.e. the intelligent selection and arrangement or grouping of apps for specific interests and uses) the iPad App Store is far ahead of the competition: it features, for instance, close to 2300 specially selected, tablet-optimized apps, compared to 181 for Google Play, and none for the Amazon Appstore.

That being said, we believe that a much bigger effort could be provided by the major players in this field where competition barely exists. The App Store will be an important part for the future of digital devices, and app stores need to reflect this by helping and guiding users.

#### **I-2.5 Future Perspectives**

This benchmark project is the first tangible result of an ongoing research project into user experience of digital devices. As hardware is increasingly commoditized, resulting in a market place where hardware specifications are not sufficient any more to distinguish between different models, user experience research will play an increasingly important role in guiding users in appreciating the differences that can exist between different devices.

Future research project will analyze other tablet types as well as smartphones and other devices as they become available. Please contact us with questions or suggestions at **research@pfeifferreport.com** 

Click here for complete results

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## I-3 Key Results: Overview by device

I-3.1 iPad mini

Hardware User Experience:

While the overall hardware user experience is excellent, the iPad mini has some weak areas that hamper the hardware user experience to some extent. First of all, screen resolution is the lowest in its class: the iPad mini displays exactly the same number of pixels the original iPad. Strangely, however, in terms of user experience, that shortcoming seems to be more of an issue on the smaller screen than on the bigger models. At close to 8 hours, battery life of the iPad mini is almost as good as on larger models, yet falls behind the Google Nexus which lasted well over nine hours in our tests.

Cognitive Load and User Experience Friction:

In terms of user experience and cognitive load, the iPad fares far better than the competition, displaying the lowest cognitive load and least user interface friction in our benchmarks. On a newly activated iPad, the user has to deal with the contents of one single screen; the user interface is designed to be figured out by a completely unexperienced user, and while there are some small confusing aspects, they are minor especially when compared to the competition.

In other words, the iPad mini is clearly the small tablet device that comes the closest to the reference definition established for this research.

Device Universe:

Not surprisingly (given Apple's historic position in the tablet market), **the iPad offers the most mature, sophisticated and discoverable device universe cur-rently available**, standing heads and shoulders above the competition.

Yet the situation is not all rosy either. Like all other on-line stores, Apple is locking the user into a local market place: if you are in the US, no need to try and purchase music or films from the french iTunes store, unless, that is, you have an account in that store.

This is of course in large part due to copyright constraints that have little to do with Apple, **but that does not mean that we do not perceive this as a serious limitation of the user experience of a device—and one that applies to all devices in this benchmark.** 

## I-3.2 Nexus (7inch)

#### Hardware User Experience:

**Overall, the Nexus (7inch) provides very good hardware user experience: excellent battery life, high resolution screen, standard connector, well implemented basic physical controls.** One drawback, which it shares with the other devices excepted the iPad min is the aspect ratio of the display area: at 16:10, it adopts a wide-screen aspect ratio close (but not identical) to most movies. The downside is that in portrait mode, the screen is very narrow, making typing, for instance, less comfortable than on a 4:3 display.

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#### Cognitive Load and User Experience Friction:

While the hardware is generally pleasant to use, the Nexus (7inch) suffers from a high cognitive load and significant user interface friction. This is mostly due to Android, which combines incoherent and confusing user interaction paradigms, and feature overload that might be acceptable for a PC operating system, but stand in the way of a pleasant, unconstrained casual user experience on a tablet.

#### Device Universe:

Google is definitely hard at work to turn Google Play into a sophisticated and reach on-line destination for content and apps. For the time being, however, there is still a lot lacking before Google Play can pretend on being a mature device universe for tablets: apps are generally developed for smart-phones (hardly surprising since Android is mostly distributed on handsets), tablet apps are poorly flagged and hard to find. Content seems to focus on the most popular main-stream items, lacking both the depth of choice and the store-infrastructure to provide a pleasant browsing experience.

## I-3.3 Galaxy Tab 2 (7inch)

#### Hardware User Experience:

The Galaxy Tab 2 (7inch) falls significantly short of the reference definition as well as competing devices in almost every key aspect, including battery life which is less then half of other devices (and only 40% of the reference device). Screen resolution is also almost the lowest in its class, and the device is heavier than tablets that have a much larger screen and twice the battery life.

#### Cognitive Load and User Experience Friction:

In terms of software user experience, the Galaxy Tab 2 (7inch) rates badly in this benchmark project: the device has the highest cognitive load ratio of all devices we have tested, and the Android user interface customized by Samsung adds significant user interface friction, especially for non-technical users.

#### Device Universe:

While Samsung Galaxy Tab 2 (7inch) users have access to two separate stores, the Samsung app store and Google Play, what it offers still significantly lacks scope compared to the reference definition used here, and is clearly inferior to the device universe available for the iPad.

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## I-3.4 Kindle Fire HD (7inch)

#### Hardware User Experience:

The Kindle Fire has some strong hardware aspects that positively impact the user experience. Screen resolution is very good, sound quality is excellent, clearly best in it's class, and battery life is good, (though not as good as the best small tablets on the market). Yet the overall hardware user experience remains a frustrating one: the device is quite heavy and thick, and while it is actually wider than the iPad mini, the display area is actually 20% smaller than the iPad mini. Worse, some poor design decisions such as confusing connectors and hard-to-spot power button hamper the user experience on a permanent basis.

#### ▶ Cognitive Load and User Experience Friction:

However, it is in terms of software user experience that the Kindle Fire HD rates the most poorly. The user interface is both confusing and inconsistent. Amazon has developed its own user interface paradigms, different from both iOS interaction and from Android—but does not hold up well in the comparison with its competitors: at 122.5, the Kindle Fire HD has the worst user experience friction score in this benchmark.

#### Device Universe:

**The Kindle Fire HD presents an extremely incoherent device universe,** very rich in terms of books (which are of course also available on other tablet devices), and extremely poor in terms of apps, since the Kindle Fire HD is not compatible with standard Android apps and can only run programs specifically developed for Amazon's proprietary version of Android.

This is more than a little confusing: While Amazon markets the Kindle Fire HD as a direct competitor to the iPad, the two devices are profoundly different in their overall scope and value proposition: the Kindle Fire HD is a competent interface to Amazon's various stores, and if the user looks for a device that will help him navigate his kindle books and download content from Amazon, the Kindle Fire HD will do fine.

On the other hand, for the user who expects the potential and versatility of the best tablets on the market, it falls significantly short of the competition, not to mention the reference configurations used for this benchmark.

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# **III Introduction**

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## III-1 About this document

#### **III-1.1 Overview**

This document presents the first wave of results from the **2013 Tablet User Experience Benchmarks** conducted by Pfeiffer Consulting in early 2013, which is part of an ongoing research project focusing on the evaluation and quantification user experience on mobile connected devices.

#### III-1.2 Aim of the research

# This research project was developed and executed to provide tangible, verifiable measures of the user experience of medium-size tablets<sup>1</sup>

The benchmark report covers the results for 4 different tablet devices introduced in late 2012. These tablets represent the different approaches to mediumsized tablets by four major vendors, Apple, Amazon, Google and Samsung.

- ▶ The following tablets were covered in the present research project:
  - Apple iPad mini
  - Amazon Kindle Fire HD (7-inch)
  - Google Nexus 7
  - Samsung Galaxy Tab 2 (7- inch)

These benchmarks are part of ongoing, in-depth research into different aspects of the user experience of digital devices, and will be expanded to cover other devices such as full-size tablets and smartphones.

#### III-1.3 Background and methodology

See "Background and Methodology" on page 37 The second part of the report also exposes some of the key aspects of the background research, the conceptual framework and the research methodology that was defined to allow the kind of user experience benchmarking that was the aim of the project. Readers who are interested in an in-depth discussion of the conceptual framework and the benchmarking methodology should refer to the conceptual framework study<sup>2</sup> for a detailed discussion of user experience benchmarking for digital devices.

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<sup>1</sup> By medium-sized tablets we understand tablets that have display measuring around 7 inches diagonally, as opposed to small tablets which are essentially oversized smart-phones, and full-screen tablets such as the original iPad, with a screen measuring approximately 10 inches in diagonal

<sup>2</sup> Conceptual Framework For Quantifying Tablet User Experience, Andreas Pfeiffer, 2012-2013



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## III-2 About the Benchmarks

#### III-2.1 Context of benchmarks

It is impossible to talk about user experience without talking about context: the context of the user (familiarity with device, technological expertise, personal preferences) and the envisaged type of usage (professional, casual...), among others things.

The context that has been defined for this first wave of user experience research is that of an **unexperienced user**, and of **casual**, **non-professional use**.

#### **III-2.2 Basic considerations**

The device user experience is **the sum or accumulation of a large number of minor aspects, which, taken individually may seem unimportant or inconsequential, but taken as a whole will make the difference between a device that is perceived as pleasant to use, and a device that is merely functional.** Whether these differences are perceived as important or not is up to the individual user to decide. But there is no doubt that they exist: all of the aspects we are presenting in this research are clearly perceptible and in many cases quantifiable.

#### **III-2.3 Areas of benchmarking**

The benchmarking project covered 3 distinct areas of user experience:

- Hardware-related user experience aspects
- Software-related user experience aspects
- App store sophistication and user experience aspects

## III-3 Benchmark Overview - Hardware

#### III-3.1 Hardware

See "2013 Tablet Reference Configuration (Medium-Size Tablets)" on page 42 The hardware benchmarks compared the four devices analyzed in this research project with the 2013 Reference Configuration (Medium-Size Tablets) established by Pfeiffer Consulting for this research. **Only hardware aspects directly impact-***ing user experience were analyzed.* 

The following hardware aspects were covered in the benchmark:

- Screen resolution
- Screen aspect ratio
- Screen area
- Screen calibration
- Weight
- Battery life
- Presence of industry standard connector
- Presence of raised power button

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- Presence of physical home button
- Presence of physical rotation lock switch
- Presence of physical volume control
- Presence of physical luminosity control

Data for individual criteria were compared to the reference configuration. The average number for all criteria is used as **Hardware User Experience Index** for each device, expressed as a percentage of the reference configuration that obtains a 100% rating.

#### **III-3.2 Hardware fluidity benchmark**

The hardware fluidity benchmark provides a precise figure of the speed at which the screen display adapts when a device is switched between vertical and horizontal display mode.

Rotation fluidity was measured for three different situations: with the central app screen of the device, in the mail app, and with a complex web-page. The final figure is an average of the three individual benchmarks and provides a time in seconds for each device. (Lower numbers indicate a better result.)

## **III-4 Benchmark Overview - Software**

#### III-4.1 Cognitive load analysis

See "Cognitive	Cognitive load is an essential aspect of software user experience. The bench-
Load" on	marks consisted in counting every single element of cognitive for each device. El-
page 46	ements of cognitive load were extensively documented. The Cognitive Load Index
	produced for each device is based on the total count of cognitive load elements

#### **III-4.2** User experience friction analysis

See "UserUser experience friction has been defined as any user interface element, interac-<br/>tion or design aspect that limits the overall user experience of a device, within the<br/>context chosen for the specific research.Friction (UXF)" on<br/>page 46UVE<br/>page 46

UXF analysis has been conducted on a very granular level for each device. UXF occurrences have been listed and rated according to their long-term impact on user experience, to provide a precise User Experience Friction Index for each device. Elements of user experience friction were extensively documented.

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## III-5 Benchmark Overview - App Store

### III-5.1 Scope of analysis

The research project analyzed the dominant app store available for each device:

- Apple App Store for iOS
- Google Play for Android
- Amazon Appstore for Kindle

The analysis focused exclusively on the app store part of each provider.

### **III-5.2 App Store Evaluation Grid**

See "App Store" on page 46 and "2013 App Store Reference Definition" on page 43

The App Store Evaluation Grid was devised by Pfeiffer Consulting to provide a means of rating app stores based on empirical observation. The evaluation grid is based on the *2013 App Store Reference Configuration*. It lists eight essential characteristics of app stores in terms of user experience and rates them on a scale from 1 to 5. A higher score is better. Once the grid is completed, an overall score for each app store is calculated. The complete App Store Evaluation Grid is reproduced below.

Score	1 (worst)	2	3	4	5 (best)
Featured tablet-optimized apps	very few	few	some	mostly	all
Perceived quality of presented apps	very low	few pro	some pro	mostly pro	All pro
Documentation of apps	minimal	user ratings only	Short description and user ratings	short description, user comments and representative screenshots	Reliable independent review and recommendations
Search environment	minimal	basic	ok	very good	Excellent
Editorial content and recommendations	minimal	some generic	pervasive generic	some specialized	pervasive and specialized
Needs and activity based selection and categorization	very little	little	generic	some sophisticated	pervasive and sophisticated
Intelligent groupings and selections	very few	few top-level	some top level	some multi-level	pervasive and multi-level
Intelligent discovery assistance	minimal	search and basic categorization	some in-context suggestions	dedicated tool	pervasive assistance

The App Store Evaluation Grid allows graduated rating of the different essential qualities an app store should provide

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#### **III-5.3 Key Qualitative Elements Count**

The second method of app store analysis relies on precise count of key elements of content selection content curation in an app store to help users find apps that correspond to their needs.

The benchmarks consisted in counting every single element of selection, grouping or content curation present in an app store.

The following core aspects of app store sophistication were surveyed:

- Number of specially selected "featured" apps
- Number of specially selected tablet-optimized apps
- Number of curated groups and selections

The benchmark relied on granular empirical observation, and produced a precise count of elements of app store sophistication for each app store, allowing an objective comparison between different app stores.

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# **IV** Complete Results and Analysis

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## **IV-1 Hardware User Experience<sup>1</sup>**

## **IV-1.1** Hardware User Experience Index



See "Benchmark Details -Hardware" on page 7 and "2013 Tablet Reference Configuration (Medium-Size Tablets)" on page 42 The Hardware User Experience Index is calculated based on 12 hardware criteria that directly impact user experience: battery life, screen resolution, weight, etc. The data collected are then compared to the 2013 Tablet Reference Configuration, an ideal device that could not be built at reasonable cost at today's state of technology. (In fact, in order to get close to the reference device, a tablet would need to combine the best characteristics of a lightweight e-reader, such as weight, and battery life, with the performance and screen resolution of the best tablets on the market today.)

Needless to say, none of the devices available on the market today could reach the score of the reference configuration.

<sup>1</sup> For a detailed discussion of the benchmark methodology and its background please refer to Conceptual Framework for Quantifying Tablet User Experience, Andreas Pfeiffer, 2012-2013

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#### IV-1.2 Hardware User Experience Index: Benchmark Data

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The table below illustrates the different aspects taken into account by the Hardware User Experience Index, and provides a good insight into the differences between the four tablets covered in this survey.

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	Kindle (7-ir	Fire HD 1ch)	Google	Nexus 7	Samsung G (7-ir	alaxyTab 2 1ch)	iPad	mini	Referenc	e Device
	Data	%	Data	%	Data	%	Data	%	Data	%
Screen Resolution	216	72.00%	216	72.00%	170	56.67%	163	54.33%	300	100.00%
Aspect Ratio*	16*10	50.00%	16*10	50.00%	16*10	50.00%	4*3	100.00%	4*3	100.00%
Screen Area	141.4	82.21%	141.4	82.21%	139.6	81.16%	171.2	99.53%	172	100.00%
Battery Life (hours)	6.45	64.50%	9.15	91.50%	4.1	41.00%	7.45	74.50%	10	100.00%
Screen Calibration	fair	70.00%	fair	70.00%	fair	70.00%	Excellent	100.00%	Excellent	100.00%
Weight	395g	40.00%	336g	50.00%	340g	50.00%	309g	60.00%	<200g	100.00%
Standard Connector	Yes	100.00%	Yes	100.00%	No	0.00%	No	0.00%	Yes	100.00%
<b>Raised Power Button</b>	No	0.00%	Yes++	100.00%	Yes ++	100.00%	Yes ++	100.00%	Yes ++	100.00%
Home Button	No	0.00%	No	0.00%	No	0.00%	Yes ++	100.00%	Yes ++	100.00%
<b>Rotation Lock</b>	No	0.00%	No	0.00%	No	0.00%	Yes ++	100.00%	Yes ++	100.00%
Volume Control	Yes	50.00%	Yes++	100.00%	Yes ++	100.00%	Yes ++	100.00%	Yes ++	100.00%
Lumnosity Control	No	0.00%	No	0.00%	no	0.00%	No	0.00%	Yes ++	100.00%
	Total	44.06%	Total	59.64%	Total	45.74%	Total	74.03%	Total	100.00%

This table displays the results of the hardware user experience comparison of the 4 tablets in the benchmarking project, and the data for the reference configuration. Entries in red indicate results that are best in their class and closest to the reference configuration.)

#### \* Note: About Aspect Ratio

The aspect ratio, the proportional relationship between width and height, is very important for a multi-purpose device such as a tablet: Since some tablet-based activities such as reading or writing are usually more efficiently done in portrait or vertical mode, others, such as watching movies, in landscape or horizontal mode, the design of the device needs to adopt an aspect ratio that accommodates both portrait and landscape mode equally well.

The only aspect ratio for which this is the case is 4:3. In fact, devices that adopt a widescreen aspect ration (16:9 or 16:10) such as the Nexus 7 or the Galaxy Tab 2 (7-inch) may leave less unused space when watching a movie, yet used on portrait mode they tend to reduce usability over devices that adopt a more squarish 4:3 aspect ration, such as Apple's iPad. (It is interesting to note that the iPad mini actually displays movies at exactly the same size than the wide-screen tablets in this benchmark.)

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## IV-2 Hardware User Experience: Analysis

#### IV-2.1 Hardware user experience: iPad mini

iPad mini	74.03%	Ref. Device: 100%
		Higher is better

Overall, **the iPad mini obtains the highest hardware user experience score** of the four tablets benchmarked for this project. The key strong points of the iPad mini are weight, aspect ratio and screen calibration and battery life, as well as conveniently implemented buttons and controls.

#### Key limitations

Compared to the reference device as well as the competition, the iPad mini underperforms in some areas, such as screen resolution (the lowest of the devices compared) and absence of a standard connector.

#### IV-2.2 Hardware user experience: Nexus 7

Nexus 7	59.39%	Reference Device: 100%
		Higher is hetter

The Nexus 7 offered the best hardware user experience of Android tablets tested.

The key strong points of the Nexus 7 are impressive battery life, very good screen resolution and well implemented buttons and controls.

#### Key limitations

On the negative side, the Nexus 7 lacks some crucial controls, such a rotation lock switch and physical home button, and suffers from somewhat disappointing screen calibration.

## IV-2.3 Hardware user experience: GalaxyTab 2 (7-inch)

Galaxy Tab 2 (7-inch)	45.74%	Reference Device: 100
		Higher is het

The GalaxyTab 2 obtained only a relatively modest score in terms of hardware user experience.

#### Key limitations

The GalaxyTab 2 has some significant limitations in terms of hardware user experience: battery life was less than half than the Nexus 7, screen resolution is significantly lower than Google's tablet. Screen calibration on the benchmark unit was disappointing as well.

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#### IV-2.4 Hardware user experience: Kindle Fire HD (7-inch)

Kindle Fire UD (7 inch)	43 4 40/	
Kindle Fire HD (7-Inch)	<b>43.14</b> %	Reference Device: 100%

Higher is better

In its current state, the **Kindle Fire HD has the lowest hardware user experience score in this benchmark**. Despite some interesting aspects such as screen resolution, Amazon's tablets has some serious user experience issues.

#### Key limitations

The Kindle Fire HD is the heaviest device in its class, yet battery life is disappointing compared to the competition, let alone to the reference configuration. In addition, badly implemented controls make the device more frustrating to use than it could be.

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## **IV-3 Hardware Fluidity Benchmarks**

## **IV-3.1 Screen rotation benchmarks**



Switching a tablet device from landscape to portrait mode and back occurs constantly, and for a pleasant user experience, it is an operation that should to be performed in a fluid, unobtrusive way.

The results represent the average of 3 individual benchmarks, conducted using a web browser, an e-mail app and the main app screen respectively. **The iPad mini was almost twice as fast as the competing tablets in this benchmark.** 

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## IV-4 Software User Experience: Cognitive Load<sup>1</sup>

## **IV-4.1 Cognitive Load Index**



See "Aspects of User Experience" on page 38 Cognitive load is an important aspect of the software user experience, particularly on a device that has been around for a relatively short time, since users who are adopting the device have little or no pre-existing knowledge of the conventions and expected usage patterns.

The cognitive load index presented here is based on a empirical analysis of the user interface and application environment pre-loaded on each device. The chart on this page presents the overall count of elements a user is confronted with. Later in this section, the cognitive load elements for each device are documented in detail.

In the case of the Kindle Fire HD, two figures were established. The higher number takes into account the number of books, apps, videos, magazines etc. that the device advertises—even before users log into their account. This contributes to the overall cognitive load and can potentially confuse inexperienced users.

<sup>1</sup> For a detailed discussion of the benchmark methodology and its background please refer to *Conceptual Framework for Quantifying Tablet User Experience*, Andreas Pfeiffer, 2012-2013

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## **IV-5 Cognitive Load - Detailed Documentation**

## IV-5.1 Cognitive load analysis: iPad mini

The iPad mini has by far the lowest cognitive load of all devices covered in this research. In fact, when one first switches on a new iPad, everything that a user is confronted with in terms of user interface elements, icons and apps fits in one or two screens, making it easy for an inexperienced use to find his way around the device. The fact that the iPad is often perceived as easier to use than other devices on the market is probably at least partially linked to its low cognitive load.

## IV-5.2 iPad mini cognitive load elements



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## IV-5.3 Cognitive load analysis: Nexus 7

While the Nexus 7 has a lower cognitive load than for instance the Galaxy Tab, it has a much higher element count than the iPad, and suffers from some of the particularities of Android that would be more appropriate on a personal computer than on a handheld device, such as the presence of apps as well as widgets, which is likely to be confusing for an inexperienced user.

## **IV-5.4 Nexus 7 cognitive load elements**



The Nexus 7 has almost 3 times the cognitive load count of the iPad mini, making it harder for inexperienced users to find their way around the device.





## IV-5.5 Cognitive load analysis: Galaxy Tab 2

While the Nexus 7 and the Galaxy Tab 2 are using in principle the same version of Android, Samsung has heavily customized the user interface of the operating system to add features—and by the same token has significantly increased the cognitive load of the device, adding, for instance, "mini-apps" in addition to apps and widgets, duplicating functions covered by both in the process. While power-users may appreciate some of these refinements, a casual user is likely to find the cognitive load of the Galaxy Tab 2 somewhat overbearing.

## IV-5.6 Galaxy Tab 2 cognitive load elements



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## IV-5.7 Cognitive Load Analysis: Kindle Fire HD

Like Samsung, Amazon uses a customized version of Android as the core operating system for the Kindle. But Amazon has defined the user interface for the tablet not so much as an operating system but as a store front that is intended to expose as many purchasable goods to the user as possible.

In terms of cognitive load this choice creates a strange situation, since the line between elements of the operating system and goods on display is **continually blurred.** While this may be fine with seasoned Amazon customers, it can feel overburdening for users who are looking for a standard tablet.

#### **IV-5.8 Kindle Fire HD cognitive load elements**



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## IV-6 User Experience Friction (UXF) Benchmarks<sup>1</sup>

## IV-6.1 Overall UFX Index



See "Benchmark Methodology" on page 45 The UXF index presented here relies on counting, describing and documenting design decisions, user interface elements or device behaviors that are incoherent, confusing or annoying.

In a second phase, these UXF occurrences are rated on a scale from 1 to 10, the lower numbers corresponding to UXF elements that are noticeable, but do not have long-term impact on user experience; higher numbers are for UXF occurrences that remain noticeable, confusing or annoying even once the user has grown accustomed to the device.<sup>2</sup>

2 As an example, a confusing icon design would be rated as a low UXF number, while aspects such as the absence of a physical Home button continues to create friction throughout the lifespan of the device, and would be rated as a high UXF number.

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<sup>1</sup> For a detailed discussion of the benchmark methodology and its background please refer to *Conceptual Framework for Quantifying Tablet User Experience*, Andreas Pfeiffer, 2012-2013



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## **IV-7 User Experience Friction: Benchmark Analysis**

#### IV-7.1 iPad mini: Key elements of user experience friction

See "iPad User Experience Friction Details" on page 49 for the complete list of UXF instances. Of all the devices covered in this benchmark, the iPad mini is the only one that has clearly benefited from a concerted effort to keep the user interface as coherent and a friction-free as possible: even the UXF occurrences we found in this research were minor compared with some of the other tablets.

Key elements of UXF on the iPad mini are user interface design decisions that can be confusing for inexperienced users. Take for example multiple ways of interacting with a single control: pressing the Home button twice brings up the search screen, while double-pressing the same button displays the task bar—and a long press displays Siri on recent models.



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#### IV-7.2 Nexus 7: Key elements of user experience friction

See "Nexus 7 User Experience Friction Details" on page 50 for the complete list of UXF instances. In terms of UXF, both the Nexus 7 and the Galaxy Tab 2 suffer from user interface issues inherent in the Android operating system. As a result, they share complexities and incoherences that might not be indispensable in a tablet operating system for consumers. Why does a tablet need both apps and widgets? Why is it so complicated to remove an item from an Android device? **The result is a degree of user experience friction that is frankly disappointing on a device that offers very good hardware specs at a reasonable price.** 



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### Nexus 7: Key elements of user experience friction (Cntd.)



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#### IV-7.3 Galaxy Tab 2: Key elements of user experience friction

See "Galaxy Tab 2 User Experience Friction Elements" on page 53 for the complete list of UXF instances. Samsung's customized version of Android is quite different from the one Goggle uses for the Nexus. Unfortunately, this customization has also resulted in additional instances of user experience friction, such as the confusing decision to add "mini-apps" alongside the apps and widgets which are common for Android.

Overall the Galaxy Tab 2 has a user experience friction index of 102, compared to 24 for the iPad.



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## Galaxy Tab 2: Key elements of user experience friction (Cntd.)



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#### IV-7.4 Kindle Fire HD: Key elements of user experience friction

See "Kindle Fire HD User Experience Friction Elements" on page 56 for the complete list of UXF instances. At 122.5, the Kindle Fire HD has the highest User Experience Friction Index of all the devices teste here. The Kindle Fire HD is marred by an unusually high number of UXF occurrences, some of which remain annoying even when one is accustomed to the device, such as the power button which is very hard to locate, or inconsistencies in icon display that can make it unnecessarily difficult to return to the Home screen.



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#### Kindle Fire HD: Key elements of user experience friction (Cntd.)



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## IV-8 App Store User Experience: Key Results<sup>1</sup>

### IV-8.1 The App Store Evaluation Grid: Key Results

See "Benchmark	From a users perspective the app store is the essential part of the device uni-
Methodology" on	verse. The value a user derives from a tablet will be directly linked to the quality
page 45	of the apps and the app store.

The role of a good app store is to be as useful as possible to help users find apps that are meaningful to them, to fulfill the potential a tablet has. And this means going beyond simple aggregation and popularity ratings.

See "2013 AppThe evaluation methods used for this research quantify some of the key as-<br/>pects of the three dominating app stores for tablets, Apple's App Store, Google<br/>Play, and the Amazon Appstore, and compares them to the 2013 App Store Refer-<br/>ence Definition established by Pfeiffer Consulting for this research project.



The App Store Evaluation Grid rates 8 key aspects of app store sophistication on a scale of 1 to 5, and compares them to the reference definition, providing a good overview of the sophistication of an app store. Detailed results for each app store are presented on the following pages.

1 For a detailed discussion of the benchmark methodology and its background please refer to *Conceptual Framework for Quantifying Tablet User Experience*, Andreas Pfeiffer, 2012-2013

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## **IV-9 App Store Evaluation Grid: Detailed Analysis**

## IV-9.1 App Store Evaluation Grid: Amazon Appstore



Higher is better

**The Amazon Appstore is clearly the least sophisticated of the three dominant app marketplaces currently available.** This is of course not helped by the fact that (since Amazon uses a highly customized version of Android), the Kindle Fire HD cannot run the wide range of standard Android apps and has to rely on software specifically ported to this platform. But even given this limitation, Amazon could do a better job in guiding the user to worthwhile apps.

This is all the more disappointing since in terms of content, Amazon has been expanding their offer significantly since the launch of the first Kindle Fire and has clearly developed a wide range of best practices for on-line commerce.

App Store Evaluation Grid: Amazon Appstore						
Score	1 (worst)	2	3	4	5 (best)	
Featured tablet-optimized apps	very few	few	some	mostly	all	
Perceived quality of presented apps	very low	few pro	some pro	mostly pro	All pro	
Documentation of apps	minimal	user ratings only	Short description and user ratings	short description, user comments and representative screenshots	Reliable independent review and recommendations	
Search environment	minimal	basic	ok	very good	Excellent	
Editorial content and recommendations	minimal	some generic	pervasive generic	some specialized	pervasive and specialized	
Needs and activity based selection and categorization	very little	little	generic	some sophisticated	pervasive and sophisticated	
Intelligent groupings and selections	very few	few top-level	some top level	some multi-level	pervasive and multi-level	
Intelligent discovery assistance	minimal	search and basic categorization	some in-context suggestions	dedicated tool	pervasive assistance	

Despite the fact the Amazon is a market leader in on-line commerce, the Appstore for Kindle remains limited in scope: the selection appears much more limited than on Google Play or Apple's App Store; there is no clear distinction which apps have been optimized for Kindle Fire (many of the apps appear to be simple ports of Android phone apps), and there are almost no intelligent groupings and selections to target specific interests and uses.

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## IV-9.2 App Store Evaluation Grid: Google Play (Apps)



Higher is better

While Android developers have produced hundreds of thousands of apps for this operating system, finding the right one for specific needs is not easy. **Google Play does not go far beyond the baseline functionality of an app store**, providing essentially aggregated lists of apps sorted by user ratings, and organized in a fixed set of basic categories. Most annoyingly, there is no clear way to distinguish tablet-optimized apps from phone apps.

App Store Evaluation Grid: Google Play (Apps)						
Score	1 (worst)	2	3	4	5 (best)	
Featured tablet-optimized apps	very few	few	some	mostly	all	
Perceived quality of presented apps	very low	few pro	some pro	mostly pro	All pro	
Documentation of apps	apps minimal user ratings only		Short description and user ratings	short description, user comments and representative screenshots	Reliable independent review and recommendations	
Search environment	minimal	basic	ok	very good	Excellent	
Editorial content and recommendations	nt and minimal some generic pervasive generic		pervasive generic	some specialized	pervasive and specialized	
Needs and activity based selection and categorization	activity based very little little generic sor		some sophisticated	pervasive and sophisticated		
Intelligent groupings and selections	very few	few top-level	some top level	some multi-level	pervasive and multi-level	
Intelligent discovery assistance	minimal	search and basic categorization	some in-context suggestions	dedicated tool	pervasive assistance	

Google Play offers only very basic qualitative enhancements for app discovery: tablet-enhanced apps are not clearly recognizable; there is a complete lack of editorial content and recommendations, and only very basic selections and groupings of apps according to the needs of specific users.

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## IV-9.3 App Store Evaluation Grid: Apple App Store



Higher is better

**Apple's App Store for the iPad is clearly the most sophisticated one we have surveyed.** Unlike with the competition, there is for instance a clear distinction between iPad optimized apps and apps for the iPhone—by comparison, locating specifically optimized tablet apps for Android is very difficult. And while the iPad App Store lacks proper editorial content and recommendations, it offers a much wider range of specially selected apps for specific interests and occupations, as well as a dedicated "Genius" function that is intended to provide smart recommendations based on the apps a user has already purchased.

App Store Evaluation Grid: Apple App Store					
Score	1 (worst)	2	3	4	5 (best)
Featured tablet-optimized apps	very few	few	some	mostly	all
Perceived quality of presented apps	very low	few pro	some pro	mostly pro	All pro
Documentation of apps	minimal	user ratings only	Short description and user ratings	short description, user comments and representative screenshots	Reliable independent review and recommendations
Search environment	minimal	basic	ok	very good	Excellent
Editorial content and recommendations	torial content and minimal some generic		pervasive generic some specialized		pervasive and specialized
Needs and activity based selection and categorization         very little         little		generic	some sophisticated	pervasive and sophisticated	
Intelligent groupings and selections	very few	few top-level	some top level	some multi-level	pervasive and multi-level
Intelligent discovery assistance	minimal	search and basic categorization	some in-context suggestions	dedicated tool	pervasive assistance

While Apple's App Store for iPad offers a wide range of suggested apps and specially selected groups of apps for different interests, its reach could be expanded by adding proper reviews and recommendations, and app-related editorial content that would be an additional incentive to visit the store.

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## **IV-10 App Store Key Qualitative Elements Count**

### IV-10.1 Key Qualitative Elements: Number of specially selected apps

See "App Store" on page 46 One of the simplest ways of analyzing the quality and sophistication of a tablet app store is to simply count the number of recommended or selected apps or groups of apps that target specific interests - in other words, to give evidence of the effort of content curation that the app store provider puts into guiding different types of users towards apps that might be of interest to them.

While all app stores provide automatically generated lists of apps sorted by user ratings and category, in order to be truly helpful to the user, app stores need to provide selections and groupings of apps that can not easily be automated.



The first level of app store curation that was surveyed in this project is the number of specially selected apps, counted by visiting every single section of the store. As the chart above underlines, the differences between the three app stores in this respect are significant.

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#### **IV-10.2** Key Qualitative Elements: Number of specially selected tablet apps

A sophisticated app store should provide users not only with sophisticated selections of apps, but also with a clear distinction between phone apps and apps that were conceived or optimized for tablets.



The second level of key qualitative elements count surveyed the number of featured tablet-optimized apps.

At the time of the research (early 2013) the Amazon Appstore did not feature any specially designated tablet-optimized apps; Google Play featured a single "Staff Picks for Tablets" section containing at that time 118 apps. By contrast, Apple's iPad APP Store only featured iPad-optimized apps, displaying iPhone apps only if specifically requested to do so.

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### **IV-10.3** Key Qualitative Elements: Number of curated groups and selections

The most important aspect of app store curation is the creation of special groups of apps for particular users: Targeted educational apps for instance, apps for specialized areas such as health professionals, or activity-related selections, let's say apps for running a small business.



The third level of key qualitative elements count surveyed the number groups and special selections across the entire app store. Apple's iPad App Store is leading, with a total of 203 groups of specially selected apps. With a score of 81, the Amazon Appstore<sup>1</sup> fares better than Google Play, which had only 34 groups at the time of the research.

<sup>1</sup> Amazon's score is actually dependent in large part on the high number of selections of magazine apps grouped by genre. These are in most cases ported from iPad apps of the same publications—adapting digital magazines for iPad to Kindle format is trivial compared to porting the code of an Android app to Amazon's tablet, and since the Kindle is already well established as a reading device, the push for digital magazines is a natural evolution of the platform, and the o,e area where the Amazon Appstore offers a wider range of products than Google Play, but without reaching the vast number of magazines available for the iPad.

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# V Background and Methodology

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## V-1 Defining User Experience

#### V-1.1 Tangible vs intangible

User experience of a digital device depends on two factors: tangible, hardware related aspects, and intangible aspects.

Only a relatively small portion of what constitutes the overall user experience of a digital device is dependent on tangible, hardware-related factors; most aspects of user experience are intangible, making it much harder to discuss them in an objective way.

To make matters worse, there are **two distinct kinds of intangible aspects: objective intangibles and subjective intangibles**. Subjective intangibles include aspects that are directly linked to personal taste and experience and defy objective quantification; Objective intangibles, on the other hand, are all the aspects that seem hard to pin down, but can actually be observed and objectively described, and therefore quantified in one way or another. (This research focused exclusively on objective intangibles.)

## V-2 Aspects of User Experience

#### V-2.1 Defining the basic concepts.

If we look at a device strictly from a user's perspective, there are several aspects that define the user experience of a tablet or smartphone. In fact, there are **three distinct levels of user experience**, that need to be analyzed independently: **hardware user experience**, **general operating system usability**, and finally, the **device universe**. We will discuss every single aspect in detail below, but to sum things up, here is what they are all about.

#### V-2.2 Hardware user experience

Some aspects of the hardware have a more direct impact on user experience than others: quality of display, screen calibration, implementation of physical controls, battery life, are all aspects that, if insufficient, are immediately noticeable and have a perceptible negative impact; other specifications, such as the number of megapixels a built-in camera can deliver, will have little or no noticeable repercussions on user experience.

#### V-2.3 Software usability

While important, hardware aspects represent only a relatively small part of the overall perceived user experience. Much more important from a user's perspective than the hardware is the operating system, or, more precisely, the coherence and efficiency of the user interface of a device.

#### **Background and Methodology**

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#### Cognitive Load and User Experience Friction<sup>1</sup>

In order to evaluate the software user experience, the first thing to take into account is the **Cognitive Load** it places on the user.

How many user interface elements does the user have to be comfortable with? How many interactions have to be learned? How complex is the operating environment, the basic interaction model and user interface logic it provides? How easy to use—and to figure out—is it really? How intuitive are the interactions?

The second important concept is **User Experience Friction (UXF).** On the most basic level, UXF is the slow-down or friction that occurs when the user experience of a device deviates from our expectation or knowledge—and it can occur in every area of our life. UXF is one of the important aspects of any technology device; there are very significant differences in UXF between the different models of tablets available.

#### V-2.4 App Store and Device Universe

Finally - and most importantly - there is what could be called the **device universe**: the environment of apps, content (music, videos, books, etc.) and accessories a user of a specific tablet has access to, and which are indispensable to open up the full potential of a tablet device.

There are hundreds of thousands of apps for both of the major tablet platforms on the market. In fact, the number of available programs for a tablet platform is quickly becoming a significant problem a tablet user faces: how do I find the one app that I want, the one that corresponds to my needs at a given point in time? And how can I find out which app is optimized for the device I use? How can I browse and discover the vast number of available options? How can I make some serendipitous discoveries in the glut of seemingly indistinguishable apps?

That's why the **quality of the app store is of such vital importance to the overall perceived value a user derives from a tablet**. In this benchmark project, we propose some basic classification of the app stores available, and of the help they provide to the user in navigating what is quickly becoming the library of the future.

<sup>1</sup> For a detailed discussion of cognitive load and user experience friction please refer to *Conceptual Framework for Quantifying Tablet User Experience*, Andreas Pfeiffer, 2012-2013



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## V-3 Basic Principles of Analysis

#### V-3.1 Basic considerations

The device user experience is the sum or accumulation of a large number of minor aspects, which, taken individually may seem unimportant or inconsequential, but taken as a whole will make the difference between a device that is perceived as pleasant to use, and a device that is merely functional.

Whether these differences are perceived as important or not is up to the individual user to decide. But there is no doubt that they exist: all of the aspects we are looking at in this research are clearly perceptible and in many cases quantifiable.

#### V-3.2 About digital devices: Basic thoughts

- Digital devices are **increasingly** and **more and more deeply ingrained** into our lives.
- The value digital devices procure is a mixture of tangible and intangible aspects.
- Intangible aspects are increasingly important in the perception of the value we derive from a digital device.
- Intangible aspects can be grouped into **objective intangibles** and **subjective intangibles** aspects.
- Objective intangible aspects are independent of the user and **can be** perceived, described and to some extent quantified and rated.

Objective intangible aspects include **user** interface friction, cognitive load, etc.

• Subjective intangible aspects are wholly dependent on the personality profile and experience of the user.

Subjective intangible aspects include aspects such as familiarity, technical experience, and brand perception.

#### **V-3.3 Guiding Principles**

- Principle N°1
  - A tablet is not a small computer, a tablet is a new class of connected device for intuitive tactile data interaction and consumption.
- Principle N° 2
  - It is impossible to judge a tablet out of context.

There are two basic types of contexts: **consumer/casual** and **professional**, but the line between the two contexts is increasingly blurry.

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- Principle N° 3
  - The context for a consumer tablet is primarily recreational and social. The aim of a consumer tablet is to provide easy, unconstrained access to mobile apps and content.
- Principle N° 4
  - As a consumer device, a tablet should not require learning or getting used to.

Every usage principle should be **intuitive and easily discoverable**, **not requiring any prior knowledge**.

- Principle N° 5
  - Interaction should be totally unambiguous.

Only absolutely indispensable user interface elements should be presented to the user. Any user interface element should have a unique, coherent unambiguous and easily discovered behavior.

- Principle N° 6
  - The contexts for professional use of tablets can be viewed in **two distinct ways:**

As an intuitive, lightweight, tactile extension of a professional workflow, allowing the use of specifically developed vertical apps that complement rather than replace desktop applications.

As a **lighter, touch-enabled laptop replacement** that allows the use of desktop applications crucial to a specific work environment. (In this use-case, there is actually little functional difference between a professional tablet and a light, touch-enabled laptop.)

- Principle N° 7
  - Based on the context defined above, **it is possible to define a reference device** that would offer the best combination of hardware characteristics and user interface principles to provide the most unconstrained overall user experience.
  - It is possible to compare existing devices to this ideal reference, and to assess where a specific device imposes user experience limitations or user experience friction on the user.

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## V-4 Defining the Reference Platform

#### V-4.1 Basic notions

The aim of the reference platform is to provide a conceptual model of a device that would constitute, at the time of writing, **the ideal device**, not only in terms of **hardware characteristics** (insofar as they impact user experience directly), but also in terms of **user interaction model and principles**, and finally in terms of **device universe in general, and app store in particular.** 

The last point may need some explanation. As we have already pointed out at an earlier point in this document, tablets are the first devices that do not have a clearly defined primary use; tablets are purchased not so much to fulfill a predetermined set of functions, but as an access point to future development. Just as a consumer buys a DVD player not so much for the DVD he owns but for the ones that will be purchased or rented in the future, a **tablet is purchased to provide access to the vast library of apps and content that is available for the device and those that will be developed in the future.** Therefore, the device universe, as defined in the first part of this report, is an inherent part of the device value proposition; the quality of the apps and the app store in particular will to a large degree determine the value a user derives from the tablet he owns, and the efficiency of the app store environment in helping the user to find the right apps and content will be an important part of the overall user experience.

## V-5 2013 Tablet Reference Configuration (Medium-Size Tablets)

#### V-5.1 Basic Principles and Context

The device should be **compared and judged like a physical device/object** that is built/manufactured for everyday, intense use. **Other than the limitations inher-ent in an electronic touch-screen device, the ideal tablet should not impose anyfriction or limitation on its natural use**.

The context that has been defined for this first wave of user experience research is that of an **unexperienced user**, and of **casual**, **non-professional use**.

#### V-5.2 Hardware

#### **Core Specifications**

- Aspect Ratio
- Weight
- Screen resolution
- Battery life
- Build Quality
- Durability

- 4:3<sup>1</sup>
- Light enough to be held in one hand for a prolonged period of time
- >300ppi
- >1 week at normal use
- High
- Sturdy enough not to require a protective case

1 See "Note: About Aspect Ratio" on page 13

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#### **Physical controls**

On-off switch

• Volume control

Rotation lock

• Luminosity control

- Physical Home button
- Essential (it is very important to be able to interact with the device from outside of the OS user interface shell)
  - · Easy to spot, and to locate by touch
  - Sunken (so as not to press it accidentally)

between basic operation and application)

- Raised
- Asymmetrical positioning to allow locating it without having to look for it
- Raised
- Asymmetrical positioning
- Raised
- Asymmetrical positioning

 No specific OS concepts that need to be acquired/learned

• Completely coherent, unambiguous operations

• Application specific

· Easily discoverable

• Intuitive/simple

Raised

Invisible

• Simple

#### **Core user experience characteristics**

- Operating system • Invisible (OS only acts as the intermediary
- File System
- Customization
- Interactions
- Discoverability of options
- Rotation behavior

#### Usability

- Speed of rotation
- Keyboard

Ubiquitous H/V switch (OS and Apps)

· Completely fluid scrolling and panning

Only basic, simple multi-touch gestures

- Real-time zooming in all applications
- Near-immediate
- Replica of physical keyboard
- Arrow keys
- Always present numbers/symbols/accents
- Simple activation/deactivation of predictive text entry (if available)

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- - Fluidity



## V-6 2013 App Store Reference Definition

#### V-6.1 Basic Approach

The app store should not be envisioned as a simple market place to purchase apps, but **as a tool that empowers the tablet user to reach the full potential of his device** - whatever his interests or level of expertise.

#### V-6.2 Device universe

Applications	<ul> <li>Clear, pervasive distinction between tablet-apps and phone-apps</li> </ul>
Sophistication/Coherence	<ul> <li>Extensive range of applications specifically designed for tablet use</li> </ul>
App Store/Discoverability	Sophisticated ways of browsing/discovering
	<ul> <li>Support for demo versions</li> </ul>
	<ul> <li>Sophisticated basic categorization</li> </ul>
	<ul> <li>Needs-based activity-centric categorization</li> </ul>
Content Discovery	<ul> <li>High-quality editorial content, discussion groups, social connection</li> </ul>
	<ul> <li>Enough content to induce users to come back regularly</li> </ul>
	<ul> <li>Low-level curation and groupings</li> </ul>
• Music	<ul> <li>All of digitally available music</li> </ul>
• Print	• All of digitally available books and magazines
• Video	<ul> <li>All of digitally available videos</li> </ul>
<ul> <li>International Scope</li> </ul>	• Access to content from around the world. (There should not be any country- or vendor-specific limitations on the content available for the device.)
<ul> <li>Accessories</li> </ul>	Wide range of accessories and add-ons

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## V-7 Benchmark Methodology<sup>1</sup>

#### V-7.1 Hardware

For the initial user experience benchmarks, focusing on small tablets, a significant subset of the 2013 Tablet Reference Configuration were used.

The principle was to take into account only hardware aspects that directly impact user experience. Below is the list of hardware characteristics and the method of quantification chosen for this first wave of benchmarks:

Hardware Characteristics

Screen Resolution:	Benchmark results show the actual screen resolution of the benchmarked device, expressed as a percentage of the reference screen resolution.
Aspect Ratio	The reference configuration stipulates a screen aspect ratio of 4*3 <sup>2</sup> .
Screen Area	The actual screen area of the benchmarked device is expressed as a percentage of the reference configuration
Battery Life	Battery life is benchmarked by playing a looped video with maximum brightness until the device shuts down.
<ul> <li>Screen Calibration</li> </ul>	Screen calibration is benchmarked by comparing display of a selection of high- quality reference photographs and videos displayed on the tablet with the same image displayed on a calibrated computer display.
• Weight	Weight is measured in grams and compared to the weight of the reference device
<ul> <li>Industry Standard Connecto</li> </ul>	r The benchmarks notes presence/absence of an industry standard connector, as opposed to a proprietary one.
Buttons and Controls	
<ul> <li>Raised Power Button</li> </ul>	Takes into account presence and implementation of a raised power button
Home Button	Takes into account presence of a physical Home button
Rotation Lock	Takes into account presence of rotation lock button
Volume Control	Takes into account presence and implementation of physical volume control
<ul> <li>Luminosity Control</li> </ul>	Takes into account presence and implementation of physical luminosity control

1 For a detailed discussion of the benchmark methodology and its background please refer to Conceptual Framework for Quantifying Tablet User Experience, Andreas Pfeiffer, 2012-2013

2 See "Note: About Aspect Ratio" on page 13

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#### V-7.2 Cognitive Load

Cognitive load analysis has been conducted by establishing a precise count of all user interface elements present on a device in its factory configuration.

#### Icons and user interface elements

User interface elements that allow the user to interact with the device (with the exception the icons that designate discreet apps or widgets).

#### Destinations

As destinations we defined specific places in the device environment that a user goes to in order to complete a specific goal. (Home screen, search screen, App Screen, etc.)

#### ▶ Apps, widgets, etc.

The last group of cognitive load elements are apps, and, if present, other app-like elements such as widgets or "mini-apps"

#### V-7.3 User Experience Friction (UXF)

UXF analysis consisted in establishing a complete list of observed UXF occurrences, rating these instances according to a pre-established weighting system, based on the selected context for the benchmarks.

#### Weighting system

**UXF occurrence were rated on a scale from 1 to 10**, the lower numbers corresponding to UXF elements that are noticeable, but do not have long-term impact; higher numbers are for UXF occurrences that remain noticeable, confusing or annoying even once the user has grown accustomed to the device.<sup>1</sup>

#### V-7.4 App Store

#### Two distinct evaluation methods

In order to quantify some of the differences between app stores, two evaluation methods have been used: a dedicated **App Store Evaluation Grid**, and a **comprehensive count of key distinguishing elements.** 

#### The App Store Evaluation Grid

The App Store Evaluation Grid was defined by Pfeiffer Consulting to provide a way of rating empirical observations of app stores. The App Store Evaluation Grid takes eight key app store characteristics, and asks the researcher to rate every single one on a scale of 1 to 5, the higher number being a better score.

Once completed, the App Store Evaluation Grid provides an overall score of a specific app store that can be documented and compared with others.

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<sup>1</sup> As an example, a confusing icon design would be rated as a low UXF number, while aspects such as the absence of a physical Home button continues to create friction throughout the lifespan of the device, and would be rated as a high UXF number.



The following criteria are covered by the 2013 version of the App Store Evaluation Grid:

- Featured tablet-optimized apps
- Perceived quality of presented apps
- Documentation of apps
- Search environment
- Editorial content and recommendations
- Needs and activity based selection and categorization
- Intelligent groupings and selections
- Intelligent discovery assistance

#### Key Qualitative Elements Count

The second method of app store benchmarking relies on the presence and number of key elements of content curation. This is based on the analysis that in order for an on-line app store to rise above the baseline functionality of providing apps sorted by category and popularity, the store provider needs to make available apps more accessible by providing special selections, groups, featured apps, distinction between tablet and phone apps, etc.

All app stores analyzed for this research provided some content selection; it is the precise count of these elements that reveals the differences between a more or less sophisticated app store.

#### Aspects of App Store sophistication surveyed

The following core aspects of app store sophistication were surveyed:

- Number of specially selected apps
- Number of specially selected tablet-optimized apps
- Number of curated groups and selections

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## VI-1 User Experience Friction (UXF): Detailed Documentation

#### VI-1.1 Note

Tablet user experience is **the sum or accumulation of a large number of minor aspects**, which, taken individually may seem unimportant or inconsequential, but taken as a whole will make the difference between a device that is perceived as pleasant to use, and a device that is merely functional.

The following pages provide a detailed list of the occurrences of UXF revealed by this research, taking into account the context chosen for the research, that of an **unexperienced user**, and of **casual**, **non-professional use**.

The benchmarks are using a basic weighting system that rates any UXF occurrence on a scale from 1 to 10, the lower numbers corresponding to UXF elements that are noticeable, but do not have long-term impact; higher numbers are for UXF occurrences that remain noticeable, confusing or annoying even once the user has grown accustomed to the device.<sup>1</sup>

It is of course up to the user to decide whether these instances of user experience friction are perceived as important or not. But there is no doubt that they exist: all of the UXF occurrences documented here are clearly perceptible, as this documentation shows.

#### VI-1.2 iPad UXF Details

#### • iPad mini: Total UXF Score 25

#### **1** Absence of a physical brightness control button

While most tablets adapt to ambient lighting to some extent, this feature did not provide satisfactory results in our benchmarks. A physical brightness control, similar to the physical volume control most tablets provide, would improve the overall user experience. **UXF Rating: 6** 

#### **2** Notifications area

To access notifications, the iPad user has to pull down the notification area, which is displayed by making a swiping gesture downwards from the top border of the iPad. The user interface provides no visual cue for the presence of the notification area, which also tends to slide out inadvertently when the user touches the top border. This can be confusing for inexperienced users. **UXF Rating: 4** 

#### **3** Confusing on-off buttons

To switch a feature in the Settings app on or off, the iPad displays a slider switch. However, a sliding motion with the finger does not always work, especially on a small tablet: in fact, it is necessary to simply tap on the button, rather than slide. This can be confusing for inexperienced users. **UXF Rating: 4** 

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<sup>1</sup> As an example, a confusing icon design would be rated as a low UXF number, while aspects such as the absence of a physical Home button continues to create friction throughout the lifespan of the device, and would be rated as a high UXF number.



#### 4 Task Manager

Displaying the task manager is not as intuitive as it may seem, and inexperienced users may wonder what the apps are. Are they currently running and therefore using up memory and potential battery, or are thy just the apps that were recently launched? The user interface does not provide any indications on this, which can confuse inexperienced users. **UXF Rating: 4** 

#### 5 Confusion between 2 clicks vs double click on Home button

On the iPad, the user has to differentiate between several actions on the Home button. Besides pressing once, which takes the user out of the current app to the latest app screen that was displayed, there are two clicks, which display the search screen, and double-click which will display the task bar at the bottom of the screen—and a long press displays Siri on recent models. Differentiating between these different actions can be confusing for an inexperienced user.

UXF Rating: 3

#### 6 Music player in task bar

The task bar on the iPad displays not only apps, but also basic controls for the Music Player, even when no music is playing, or indeed no music is present on the device. While this feature may be useful to experienced users, it can be confusing for inexperienced users who might wonder why these controls show up next to a list of apps. **UXF Rating: 2** 

#### 7 Inconsistent rotation behavior

The switch between portrait and landscape modes is not pervasive. It can easily occur that the user tries to switch to the other view and nothing happens. This can be annoying even for experienced users. **UXF Rating: 2** 

#### VI-1.3 Nexus 7 UXF Details

#### • Nexus 7: Total UXF Score 100.5

#### **1** Absence of a physical home button

The Android tablets analyzed for this benchmark project do not offer a physical home button. This presents a serious usability limitation even for experienced users, since for a frictionless user experience the Home button should be external to the software environment. **UXF Rating: 10** 

#### **2** Deleting elements is very unintuitive

Deleting items on the Nexus is unintuitive: pressing an icon on a personal page results in the display of an "X Remove" icon in the top icon bar of the device, but it is not enough to click on this icon to remove the selected item, it is necessary to drag the item on top of the X for deletion. This can be confusing for inexperienced users - and can remain annoying. **UXF Rating: 8** 

#### **3** Mac users need Android File Transfer utility for installing content and files.

Currently, Mac users are not well supported by Android tablets: a special file transfer utility is required to copy items between the Mac and the Android device. It is up to the user to figure out where items such as photos and movies need to be copied to be available on the tablet. **UXF Rating: 7** 

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#### **4** Absence of a rotation lock switch

The rotation lock switch is an important hardware component of the Tablet Reference Configuration established for this benchmark project. The absence of a rotation lock switch can be annoying even for experienced users since switching inadvertently from portrait to landscape mode can happen very easily. UXF Rating: 7

#### **5** No physical brightness control of screen

While most tablets adapt to ambient lighting to some extent, this feature did not provide satisfactory results in our benchmarks. A physical brightness control, similar to the physical volume control most tablets provide, would improve the overall user experience. **UXF Rating: 6** 

#### 6 Impossibility to delete apps on the app screen (even custom installed ones)

On the Nexus, the App/Widgets screens can not be modified. This means that even downloaded apps can not be deleted from these pages; this can only occur on personal pages, which can be confusing for inexperienced users.

#### UXF Rating: 6

#### 7 Placing items is unintuitive

Placing items from the APP/Widgets screens to personal pages is unintuitive, and can lead to unexpected results. For instance, if there is no space on the personal page, there is no indication that the item has not been placed. For a first-time user, this can be confusing and unintuitive. **UXF Rating: 5** 

#### 8 Incompatibility with large files

Currently, Android devices are limited to files smaller than 4GB. Since many HD movies can significantly exceed this size limit, transferring them to the device is impossible. **UXF Rating: 4** 

#### **9** Keyboard: Home icon directly under space bar, can trigger context switch

The main icon bar of the Nexus 7 places the Home icon directly under the spacebar of the keyboard. This can lead to inadvertently hitting the Home button and switching context, which can be very confusing even for experienced users. UXF Rating: 4

## **10** User interface icons stay available in games, can interrupt game if hit accidentally.

The basic user interface icons (Back, Home...) remain present in many apps and games. This can lead to leaving a game in the middle of an action if one touches one of the icons by accident. **UXF Rating: 4** 

#### **11** File format limitations

In our benchmarks, several popular video and image formats could not be displayed on the Nexus 7. **UXF Rating: 4** 

#### **12** Hidden pull-down menus with no visual cues

The Nexus 7 uses two pull-down menus, one to access what looks like notifications and the list of completed tasks, one that provides direct access to groups of settings. There is no name or visual cue to indicate the presence and the nature of these menus, making it hard for inexperienced users to find and understand them. **UXF Rating: 4** 

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#### **13** Inconsistent icon layout and presence in horizontal and vertical

In certain instances, the screen displays a different set of icons and presentations in portrait and landscape mode, adding to confusion of inexperienced users. UXF Rating: 4

#### **14** Confusion between apps and widgets

Android distinguishes between apps and widgets, a distinction inherited from computer operating systems, but without any clearly explained necessity on a tablet, since many smaller apps are similar to widgets on a computer. For an inexperienced user, this contributes to the overall cognitive load and can be confusing.

#### UXF Rating: 4

#### **15** Apps can be launched, widgets have to be placed.

Apps can be launched directly from the App/Widgets screens. Widgets, on the other hand need to be placed on a personal page first. This can be confusing for an inexperienced user. **UXF Rating: 3.5** 

#### **16** Duplication between apps on personal screens, app screen and favorites bar.

There is no way to organize the Apps/Widgets screens. Apps need to be dragged to personal screens for organization. It can easily occur that an app is placed several times, And there can easily be duplication between apps in the favorites bar and the personal screen. This contributes to overall cognitive load and can be confusing for inexperienced users. **UXF Rating: 3** 

#### **17** Inconsistent scrolling behavior sometimes very choppy)

Scrolling behavior is inconsistent on the Nexus 7: while it is generally fluid, it can be very choppy in some instances. **UXF Rating: 3** 

#### **18** Inconsistencies between Home and Back behaviors

The Home and Back icon of the main tool bar can produce inconsistent and unpredictable outcomes in some situations, which can be confusing for inexperienced users. **UXF Rating: 3** 

#### **19** Inconsistent icon interaction (press to move, but not everywhere)

Pressing the icon of an app or a widget for a moment allows the user to pick it up and move it to a different place. However, this behavior is not pervasive: pressing an icon can lead to different outcomes depending on the context, which can be confusing for inexperienced users. **UXF Rating: 3** 

#### 20 Inconsistent rotation behavior

The switch between portrait and landscape modes is not pervasive. It can easily occur that the user tries to switch to the other view and nothing happens. This can be annoying even for experienced users. **UXF Rating: 2** 

#### **21** Redundant access to Google services (icons, apps, app groups, info bar...)

Several screens on the Nexus 7 provide redundant access to Google services: for instance, the icon for Google Play can be available in two distinct parts of the screen, adding to cognitive load and potential confusion for inexperienced users. **UXF Rating: 2** 

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#### **22** Keyboard: redundant language icons

The keyboard displays two redundant ways of changing the language used. In addition, the icon for switching the language is visually associated with the space bar, which can lead to unwittingly switching keyboard layout while typing.

#### UXF Rating: 2

#### 23 Icons that have no effect or unusual behavior

Some user interface icons on the Nexus 7 produce no result when pressed (downward pointing v on the sleep screen), and only show up in certain circumstances. Others behave in an inconsistent way: the dotted circle icon needs to be pressed for a little bit and then dragged before providing direct access to Google search. These inconsistencies contribute to overall cognitive load and can be confusing for inexperienced users. **UXF Rating: 1** 

#### **24** Favorites bar confusing apps, destinations and groups

The application bar at the bottom of the screen look like it is providing access to favorite apps. In fact, it mixes apps, groups of apps, and an icon that gives access to the Apps/Widgets pages. This can be confusing for inexperienced users.

UXF Rating: 1

#### VI-1.4 Galaxy Tab 2 UXF Details

#### • Galaxy Tab 2: Total UXF Score 102.5

#### **1** Absence of a physical home button

The Android tablets in this benchmark project do not offer a physical home button. This presents a serious usability limitation even for experienced users, since for a frictionless user experience the Home button should be external to the software environment. **UXF Rating: 10** 

#### 2 Mac users need Android File Transfer utility for installing content and files.

Currently, Mac users are not well supported by Android tablets: a special file transfer utility is required to copy items between the Mac and the Android device. It is up to the user to figure out where items such as photos and movies need to be copied to be available on the tablet. **UXF Rating: 7** 

#### **3** Absence of rotation lock switch

The rotation lock switch is an important hardware component of the Tablet Reference Configuration established for this benchmark project. The absence of a rotation lock switch can be annoying even for experienced users, since switching inadvertently from portrait to landscape mode can happen very easily. UXF Rating: 7

#### 4 No physical brightness control of screen

While most tablets adapt to ambient lighting to some extent, this feature did not provide satisfactory results in our benchmarks. A physical brightness control, similar to the physical volume control most tablets provide, would improve the overall user experience. **UXF Rating: 6** 

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#### **5** Useless/confusing screen capture icon

The main icons bar at the bottom of the Galaxy Tab screen offers an icon that could be confused for a Zoom function but in fact triggers a screen capture. It is not clear why this functionality is at the same level of importance in the user interface as the Home and Back button. This can be annoying even for experienced users. **UXF Rating: 6** 

#### 6 Device does not show up on Macs in our tests

While in theory, the Galaxy Tab 2 should allow Mac users to transfer files to the device using Android File Transfer, none of the four different Macs in our lab on which we tried to complete this operation recognized the tablet when it was connected to the computer. The only way we found to transfer files was using a Windows emulator.

#### 7 Confusion between apps, widgets and "mini-apps"

Android distinguishes between apps and widgets, a distinction inherited from computer operating systems. On the Galaxy Tab 2, the user also has "mini-apps", which are accessed from a second row of pop-up icons at the bottom of the screen and duplicate features of other apps and widgets. Even for an experienced user, this contributes to the overall cognitive load and can be confusing. **UXF Rating: 5** 

#### 8 Placing items is unintuitive

Placing items from the APP/Widgets screens to personal pages is unintuitive, and can lead to unexpected results. For instance, if there is no space on the personal page, there is no indication that the item has not been placed. For a first-time user, this can be confusing and unintuitive. **UXF Rating: 5** 

#### **9** Deleting items is unintuitive

Deleting items on the Galaxy Tab 2 is unintuitive: pressing an icon on a personal page results in the display of a trashcan icon in the top icon bar of the device, but it is not enough to click on this icon to remove the selected item, it is necessary to drag the item on top of the icon for deletion. This can be confusing for inexperienced users.

#### 10 Keyboard: UI icons directly under keyboard, can trigger context switch

The main icon bar is placed directly under the keyboard. This can lead to inadvertently hitting one of the icons and triggering an operation or even context switch, which can be confusing even for an experienced user. **UXF Rating: 4** 

#### **11** Incompatibility with large files

Currently, Android devices are limited to files smaller than 4GB. Many HD movies can significantly exceed this size limit, and can therefore not be viewed on Android devices. **UXF Rating: 4** 

#### **12** Incomprehensible popup from keyboard

The virtual keyboard on the Galaxy Tab 2 comprises an icon that, when pressed, displays a field with recently taken screen captures. It is not clear what the function of this field is, nor why it is accessible exclusively through an icon on the keyboard. This can be puzzling even for experienced users. **UXF Rating: 4** 

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#### **13** File format limitations

In our benchmarks, several popular video and image formats could not be displayed on the Galaxy Tab 2. **UXF Rating: 4** 

#### 14 Inconsistent icon layout and presence in horizontal and vertical position

In certain instances, the screen displays a different set of icons and presentations in portrait and landscape mode, adding to confusion for inexperienced users. **UXF Rating: 4** 

#### **15** Apps can be launched, widgets have to be placed first

Accessing the different tools available on the Galaxy Tab 2 can be confusing. Apps can be launched directly from the App/Widgets screens. Widgets, on the other hand need to be placed on a personal page first. This can be confusing for an inexperienced user. **UXF Rating: 3.5** 

#### **16** Duplication between apps on personal screens, app screens and favorites bar

There is no way to organize the Apps/Widgets screens. Apps need to be dragged to personal screens for organization, which duplicates the app. It can easily occur that an app is placed several times, which can be confusing for inexperienced users. **UXF Rating: 3** 

#### **17** Confusing behavior of the Back icon

The back icon does not provide coherent behavior: it does not, as one might expect, take the user back one step, but seems to behave erratically depending on the app that is used. This can be confusing even for experienced users.

#### UXF Rating: 3

#### **18** Inconsistent icon behavior (press/move works on some screens not others)

Pressing the icon of an app or a widget for a moment allows the user to pick it up and move it to a different place. However, this behavior is not pervasive: pressing an icon can lead to different outcomes depending on the context, which can be confusing for inexperienced users. **UXF Rating: 3** 

#### **19** Confusing Home Screen (Access to apps is not clear)

The home screen of the Galaxy Tab 2 could be confusing to an inexperienced user: the "Music Hub" for instance, could be mistaken for the Music Player, but will not show music the user has installed on the tablet. Access to apps and widgets is only available through a small icon in the top right corner. This contributes to overall cognitive load and user experience friction. **UXF Rating: 3** 

## **20** Mini apps come from a different place than apps and widgets, installation is different.

Mini Apps are accessed and installed in a different way from apps and widgets, which adds to cognitive load and can be confusing for inexperienced users.

UXF Rating: 2.5

#### **21** Inconsistent rotation behavior

The switch between portrait and landscape modes is not pervasive. It can easily occur that the user tries to switch to the other view and nothing happens. This can be annoying even for experienced users. **UXF Rating: 2** 

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#### 22 Inconsistent scrolling behavior (sometimes very choppy)

Scrolling behavior is inconsistent: while it is generally fluid, it can be noticeable choppy in some instances. **UXF Rating: 2** 

#### 23 Confusion between Samsung App Store and Google Play

The Galaxy Tab 2 provides access to two app stores: Google Play, available on the home screen, and the Samsung App Store. There is no indication what the difference between the two is, and which one should be used. This adds to the confusion for inexperienced users. **UXF Rating: 2** 

#### 24 Double lock screen

In some situations, for instance when an alert is displayed, the Galaxy Tab 2 displays two successive, different lock screens. This contributes to overall cognitive load and can be confusing for inexperienced users. **UXF Rating: 1** 

#### 25 Useless greyed out icons in toolbar

Frequently, small, greyed-out icons appear in the menu bar. Sometimes, touching them produces no result. Sometimes an icon is displayed several times. This contributes to overall cognitive load and can be confusing for inexperienced users. **UXF Rating: 1** 

#### VI-1.5 Kindle Fire HD UXF Details

#### • Kindle Fire HD: Total UXF Score 122.5

#### **1** Badly designed power button, very hard to locate

The power button on the Kindle Fire HD is designed and positioned in a way that even after weeks of regular use it is impossible to locate without actually turning the device around and locating the power button with your eyes. This can quickly become irritating. **UXF Rating: 10** 

#### **2** No physical home button

The absence of a physical Home button can be a significant usability limitation. UXF Rating: 10

#### **3** Built-in camera—but without an app to use it

Like most tablets on the market, the Kindle Fire offers a built-in camera—yet there is no app available to take pictures. (Apps to use the camera can be purchased on the Amazon app store, however.) **UXF Rating: 10** 

#### **4** Presence/Absence of key control icons (only favorites icon in many places)

On many screens, the Kindle Fire HD does not display the Home and Back icon, only the icon for displaying favorites. The only way to access the Home button is to switch first to a different screen that displays the complete set of icons. This can be confusing even for experienced users. **UXF Rating: 8** 

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#### 5 Bad use of screen real estate

The user interface design of the Kindle Fire makes inefficient use of the screen real estate: icons for apps, for instance, are significantly larger than on other devices (despite the fact that the display has one of the highest resolution screens in its class). This can result in a feeling of being constricted by the available space.

#### **6** No Background picture, no customization

Most tablets provide simple ways of customizing the general appearance and organization of a device. The Kindle Fire HD lacks most of these capabilities. In particular, there are no ways of using a background picture or even of changing the background color. This can be considered annoying by relatively inexperienced as well as experienced users. **UXF Rating: 7.5** 

#### 7 Confusing USB and HDM connectors

The micro-USB connector on the Kindle Fire HD is located next to the similarly sized and shaped micro-HDMI connector. This means that plugging in the device for charging can be confusing, since the connectors can easily be mixed up. An inexperienced user might damage the connector by trying to force the power supply cable into the wrong port. **UXF Rating: 7** 

#### 8 Sub-standard e-mail client

The Kindle Fire HD offers a functional but bare-bones e-mail client that lacks some of the refinements of apps for competing tablets. Most annoyingly, it makes poor use of the available screen resolution, showing less information than a good smart-phone. Curiously, text-size for this display can not be set by the user. (No better alternative was available at the Appstore at the time of our benchmarks.) **UXF Rating: 7** 

#### 9 Absence of rotation lock switch

The rotation lock switch is an important hardware component of the Tablet Reference Configuration established for this benchmark project. The absence of a rotation lock switch can be annoying even for experienced users since switching inadvertently from portrait to landscape mode can happen very easily. UXF Rating: 7

## **10** Mac users need Android File Transfer utility for installing content and files on the Kindle Fire HD

Currently, Mac users are not well supported by the Kindle Fire HD: a special file transfer utility is required to copy items between the Mac and the tablet. It is up to the user to figure out where items such as photos and movies need to be copied to be available on the tablet. **UXF Rating: 7** 

#### 11 Sub-standard web browser

The Kindle Fire HD offers a functional but bare-bones web-browser that lacks some of the refinements of a seasoned browser such as Chrome. (When this research was completed, the Amazon Appstore did not yet offer more sophisticated alternatives.) UXF Rating: 6.5





#### **12** No physical brightness control of screen

While most tablets adapt to ambient lighting to some extent, this feature did not provide satisfactory results in our benchmarks. A physical brightness control, similar to the physical volume control most tablets provide, would improve the overall user experience. **UXF Rating: 6** 

#### **13** General look and feel

Unlike other tablets on the market, the Kindle Fire uses a uniformly black user interface environment, contributing to a look and feel that could be perceived as less welcoming or pleasant to use than tablets that display a colorful background picture. **UXF Rating: 4** 

#### **14** Keyboard: UI icon directly under space bar

The main icon bar is placed directly under the keyboard. This can lead to inadvertently hitting one of the icons and triggering an operation or even context switch. This can be confusing even for an experienced user. **UXF Rating: 4** 

#### **15** Incompatibility with large files

Currently, the Kindle Fire HD, like other Android devices, is limited to files smaller than 4GB. Many HD movies can significantly exceed this size limit, and can therefore not be viewed on these devices. **UXF Rating: 4** 

#### **16** File format limitations

In our benchmarks, several popular video and image formats could not be displayed on the Nexus. **UXF Rating: 4** 

#### **17** Presence/Absence of search box

In portrait mode, the Kindle Fire HD displays a search box just under the icon bar at the top of the screen. Turning the tablet 90 degrees makes the search box disappear - although there would be enough space to accommodate for it. This can be confusing for inexperienced users. **UXF Rating: 3** 

#### **18** Advertisements on lock screen

The Kindle Fire HD displays advertisements on the lock screen. This can be annoying for some users. (Amazon implicitly recognizes that these advertisements can be an issue for some users, since, for a slight premium, the company sells a device that has this feature disabled.) **UXF Rating: 3** 

#### **19** Difficulty of finding key settings

Most tablets allow users to access key settings through a dedicated app, and in some cases also through specifically designed shortcuts. On the Kindle Fire HD, settings are only revealed after the user makes a swiping gesture from the top border down. There is no visual cue for this. It can be difficult for inexperienced users to find the settings. **UXF Rating: 2.5** 

#### 20 Presence/Absence of Quick Links/suggestions

Under the carousel of items that occupies the central space of the Kindle Fire Home Screen is an area that is occupied by a variety of items, depending on the context: "Quick Links", purchasing suggestions, links to web pages. The logic behind what is displayed at the bottom half of the screen can be confusing in the

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beginning, and it can be difficult to find a group of items that one has seen before. Also, in some cases, the space below the carousel remains empty without any clear reason. This can be confusing and also contributes to the overall cognitive load. UXF Rating: 2.5

#### **21** Confusing elements on main screen

The central portion of the Kindle Fire is occupied by a carousel of items available on the device: applications, books, etc. While it is possible to remove items from the carousel, there is no easy way to add items or to reorganize them. This could be confusing for users who have no experience with Kindle devices and expect the Kindle Fire to be organized in a comparable way to other tablet devices. **UXF Rating: 2** 

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