

Digital Device User Experience Research

Conceptual Framework For Quantifying Tablet User Experience

► Major Points

- **User experience of tablets and smartphones is one of the most important aspects of the overall perceived value of these devices.** This report sets out to conceptualize and structure ways of describing, analyzing, and if possible, quantifying some key aspects of user experience.
- User experience depends on **tangible** and **intangible** aspects; intangible aspects can be grouped into **objective and subjective intangibles**.
- The user experience of connected digital devices, and tablets in particular, is determined by three major aspects: **hardware user experience**, **software user experience**, and **device universe**
- This report presents **methodologies for quantifying some of the key aspects** of these three areas.

User Experience is arguably the most important aspect of a connected digital device such as a tablet or a smartphone.

Since these devices are very closely meshed with our everyday lives and our social interactions, a device with a bad user experience can be deeply frustrating, even inhibiting. However, discussing—let alone measuring—user experience seems almost impossible; as soon as we try to do so, we run into complex and confusing issues. As a result, the reviews and expert opinions that are meant to help us differentiate between different models and to guide us in the process of selecting the right device for our personal needs often bypass user experience issues and focus on sometimes arcane technical specifications.

Given the importance tablets and smartphones are increasingly taking in our lives, this incapacity of discussing and measuring what turns out to be one of the most important aspects of the overall value proposition is slowly turning into a serious problem.

We need to be able to discuss objectively what value these devices bring the user, or we are going to be increasingly swamped by hundreds of different models we can not really tell apart any more.

Since 2012, Pfeiffer Consulting has embarked on an ongoing, independent research project to establish some objective criteria for comparing, discussing and measuring the user experience of digital devices. And in doing so, it became immediately clear that it was not enough to discuss some aspects of user experience, but that we would need to establish a coherent conceptual framework that would provide a solid foundation for the research, and could grow and expand as we tackle different devices and future developments.

The present document describes the key aspects of this conceptual framework. We will expand and refine the notions in this document as we progress in our research.

Andreas Pfeiffer, March 2013

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I Basic Concepts

I-1 Introduction

I-1.1 The starting point

At the outset of this research was a simple but preoccupying question: ***Have we lost the capacity to talk about the important aspects of technology?***

More precisely, have we become incapable of properly assessing the actual value users derive from these increasingly popular, not to say ubiquitous, devices? As we did ten or twenty years ago, we tend to focus on features: processor speed, camera resolution, screen resolution, but we don't realize that this has become not only inappropriate, it has a the annoying side-effect of pushing tablets and smart-phones into categorizations which stay woefully removed from the actual value a user derives from such a device.

As a result, we see side-by-side comparisons of, say, the Kindle Fire HD and the iPad Mini, implying that they are as similar as two PCs coming from different vendors, totally overlooking the fact that in terms of overall device value proposition and in terms of user experience, the two devices are utterly different—but in ways we have a hard time quantifying in an objective manner.

I-1.2 Inventing the conceptual framework

Tablets such as the iPad are unique in the history of widely adopted consumer products: **they are the first widely adopted devices that do not have a clearly defined primary use.** (So much so, in fact, that when the first iPad was launched in early 2010, most pundits predicted that it wouldn't sell "since nobody needed one")

It became clear very quickly that the concepts and vocabulary used to describe technology are grossly inefficient when it come to describing these new devices.

In other words, to describe and quantify the user experience of devices such as tablets, we needed to come up with a new conceptual framework that does not rely on the computer/features paradigm currently used when discussing such devices.

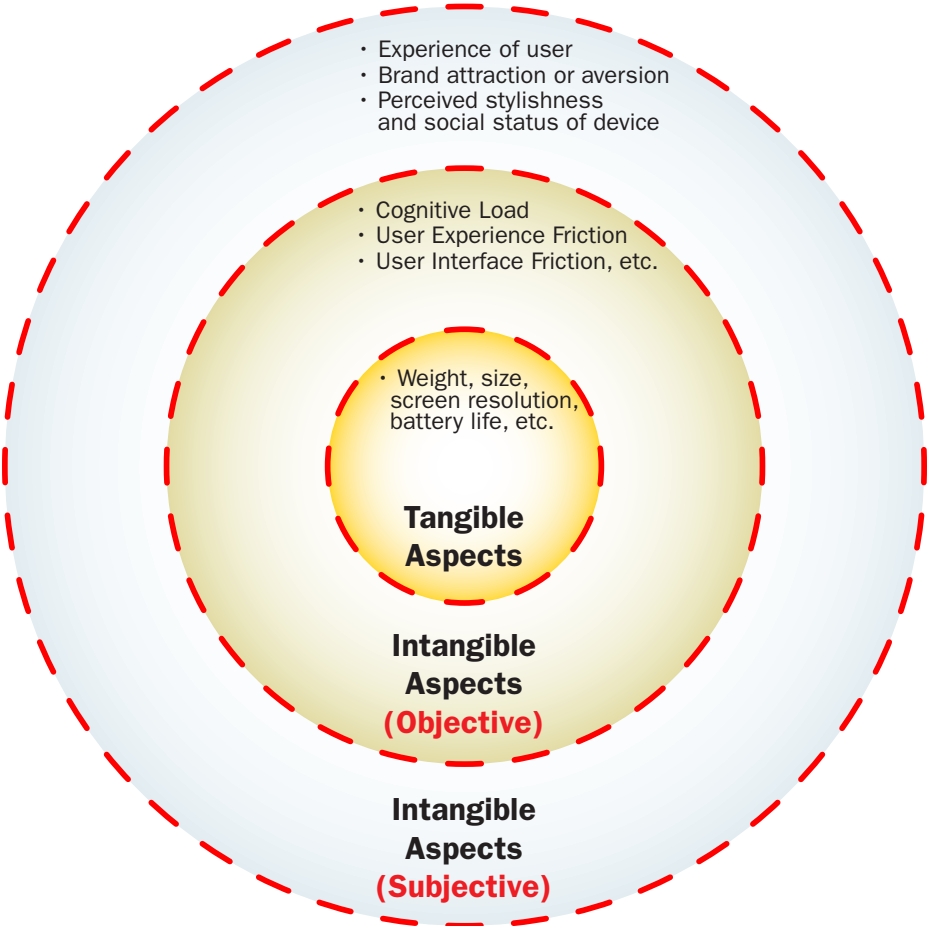
I-2 Defining User Experience

I-2.1 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.



User experience is dependent on tangible as well as intangible aspects. The distinction between objective and subjective intangibles is essential.

I-2.2 Objective vs. subjective intangibles

The distinction between objective and subjective intangibles is a very important first step on the way to quantifying some aspects of user experience.

▶ Objective intangibles

In the case of devices that are as new to the market as tablets, **objective intangibles are shaping an important part of the user experience**, since most casual users are discovering these devices for the first time, and are exposed to new user interface paradigms they have no prior knowledge of. (Personal computers, on the other hand, have been around so long that most potential users have pre-existing expertise with the operating system, which will dominate their user experience significantly, and reduce the impact of objective intangibles.)

▶ Subjective intangibles

There is no doubt that **some subjective intangibles weigh heavily on the perception of a device**, and therefore will have a direct impact on the subjective user experience.

Brand luminosity (aspect like brand attraction or brand rejection), as well as **personal taste** and **experience** will play a considerable role in shaping the perceived comfort level. As a result, it will be hard for a person used to Apple's devices, for instance, to have an objective appreciation of the user experience of tablets or smartphones using Android, and vice-versa. There are other subjective intangibles that have a strong impact as well: aspects such as **gender** and **age** also contribute very significantly to the user reality.

In the future we will explore subjective intangibles more closely; for the time being, we are limiting this research to objective intangibles.

I-3 The Need for a Reference Configuration

I-3.1 Defining the Ideal Device

When we started thinking about conducting user experience benchmarks it became quickly obvious that we could not just simply compare the different devices among themselves: Since the tablet market as we know it today is pretty much the result of the incredible, and, it has to be said, rather unexpected, success of the original iPad, Apple has had a strong impact of the expectation consumers have of a tablet, not to mention the fact that Apple patented some aspects that are indispensable to a frictionless user-experience, such as the physical home-button the iPad alone provides.

In other words, while some other tablets manage to exceed the iPad in certain hardware specifications, (screen resolution of some models for instance), the general consensus of reviewers seems to be that in terms of overall user experience Apple's device has an edge. Yet when you look more closely, you can see that even the iPad is far from perfect: it is clearly too fragile, for instance, and battery life, while excellent when compared to a laptop computer, could still be much better.

So how could we conduct credible user experience benchmarks of tablets in an intellectually honest way, without automatically comparing every competing device to the current market leader? The answer was actually quite simple: **by defining an ideal device, a reference configuration that would combine an ideal set of user experience-related characteristics both in terms of hardware, user interface and device universe.** Of course no existing device comes even close to this imaginary reference: this means that by comparing the existing devices to this ideal configuration would allow us to quantify each contender in a more balanced and unbiased way.

In the second section of this report we will discuss this reference configuration in detail.

I-4 Aspects of User Experience

I-4.1 Defining the basic concepts.

What are the components of user experience, and how can we measure them? That was the question we asked when we started on this research project, and we soon realized that as simple as the question may seem, answering it in a coherent way turns out to be much more complex than we initially anticipated. What do we mean by user experience? What are the aspects we need to take into account? Which part of user experience is dependent on the user, and which part can be objectively perceived and, hopefully, quantified?

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: **a) hardware user experience, b) general operating system usability**, and finally,

the **c) device universe**. We will discuss every single aspect in detail below, but to sum things up, here is what they are all about.

▶ **Hardware User Experience**

Some aspects of the hardware have a direct impact on user experience: quality of display, screen calibration, implementation of physical controls, battery life, are all aspects that, if insufficient, are immediately noticeable; other specifications, such as the number of megapixels of the built-in camera, will have little or no noticeable repercussions on the overall user experience, nor on the quality of the images the built-in camera produces, for that matter.

▶ **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.

That's where things are becoming more complex: to assess the user experience of a tablet, we need to look not so much at *what* it does but *how* it does it. And that requires taking into account how simple or complex the general operating environment is.

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**. This is one of the important aspects of any technology device, and there are very significant differences between the different models of tablets available. We will examine them in detail below.

▶ **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.

Unfortunately, the device universe is not only the most important part of perceived value of a tablet, it is also the hardest to properly evaluate. Manufacturers proudly announce impressive claims of hundreds of thousands of apps, books, videos and millions of tracks of music—but in reality, these cryptic numbers do not really allow us differentiate between the quality and scope of the available material: numbers say very little about the quality of the apps, and even less about the quality of app-environment which is meant to guide the user to the app that is actually meaningful to his or her particular situation.

Fortunately there are at least some ways in which we can begin to evaluate the overall quality of the device universe.

I-5 Hardware User Experience: Details

I-5.1 Which hardware aspects impact user experience

Only relatively few hardware aspects have a direct and noticeable impact on the user experience of a tablet or other digital device.

Some are obvious, such as battery life. Others may only impact certain application areas, despite the fact that the manufacturer may put a lot of marketing efforts behind them: powerful graphics processors are a good example: developed mainly for fluid gameplay, their power will be barely noticeable in less graphics-intensive aspects of tablet use. Yet others have retained the aura of quality and power, while most consumers will never notice their direct impact: the number of megapixels the built-in camera provides is meaningless for the actual perceived quality of photos, yet megapixels are still very popular as marketing items.

For this research we decided to **focus only on hardware aspects that directly impact user experience**, and to forego the more arcane characteristics that might be important for a desktop PC but are meaningless on a consumer device, at least for the average user.

We singled out several hardware related issues for our analysis: **battery life** of course, as well as **screen resolution** are both very important for a tablet device. As far as the display goes, other aspects are equally important, but frequently overlooked, such as **screen calibration**, and, not to be overlooked, the **aspect ratio** of the device.

This last point may require some explanation. **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 mode, others, such as watching movies, in landscape mode, the design of the device needs to adopt an aspect ratio that accommodates both modes equally well; in fact, devices that adopt a wide-screen aspect ration (16:9 or 16:10) 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.

Other hardware aspects may seem minor and are often overlooked, yet they can have a tremendous impact on everyday ease of use and user experience.

A good example are the **physical controls**, the buttons and switches used to switch the device on and off, to **control volume** or **display luminosity**, or to lock the automatic rotation of the tablet display when the tablet is turned around. (In some cases, a bad design decision in this area can induce very significant user experience friction: the Kindle Fire HD, for example, uses an on-off switch that is not physically raised over the body of the tablet as with all other devices we have tested, nor is it visually distinguishable from the body. As a result, each time one wants to switch the device on, it takes what seems like minutes turning the device around to locate the almost indistinguishable power button, which, to make matters worse, is located right next to a similarly shaped design element, the volume button.)

I-6 Understanding Cognitive Load

I-6.1 Basic concepts

Cognitive load is an important aspect when considering the user experience of a computer system or a tablet. In the simplest terms, the cognitive load is the sum of elements you need to learn and get familiar with in order to use the device spontaneously and intuitively.

This means that every item, every app, every user interface element in a system adds to the overall cognitive load since, even if you do not use a specific feature or app, it still is there and contributes to the sum of information that your attention is confronted with.

For a developer, cognitive load is, in a certain way, the flip-side of a feature, the price he pays for adding a new capability: each new feature requires terminology, a user interface, a behavior that needs to be defined, and subsequently learned by the user. The more features a device has, the higher the cognitive load. And while certain features may be easy to guess and to learn, others, which may seem perfectly straightforward to the developer, can present seemingly insurmountable problems for the unexperienced user. And, of course, the more features, the higher the cognitive load - and, for many users, the exasperation of dozens and dozens of only vaguely grasped user interface items, apps, widgets and icons we may or may not need—and may have no desire to learn.

Yet the number of features is going up, not down.

Modern technology development is intensely feature-driven: features are what is used to market most devices, features are what is used to distinguish one device from its competition. And features are relatively easy to define - much easier, in any case, then to implement in a graceful and simple fashion.

Which brings us back to cognitive load - or rather, the absence thereof in an ideal device. **A consumer device should be self-evident: intended for the average consumer, it should not be built on the assumption that the user will bring pre-existing knowledge.** A good consumer device should be so simple that the average user should be able to pick up the basic operation in a few seconds.

I-6.2 Why is cognitive load important?

For the consumer, especially an inexperienced one, cognitive load is one of the first elements of user experience he encounters as soon as he switches on a new device. What happens when an unexperienced user first tries out a new gadget? Don't even mention reading the manual (if indeed there is one) - most of us will play around with a device and see if we can find our way around. And that's when cognitive load kicks in. How many elements do we see, how many icons do we have to get used to? How do we find what we are looking for? How do we decide what we need and don't need?

There is no doubt that cognitive load has a strong impact on user experience, since even when we do know our way around a device and its user-interface, more

elements means more potential confusion, more hesitation when looking for something, more ways to get lost. And while one may down-play the importance of cognitive load, of a device, actually looking at all the elements that need to be taken in by the user is very instructive.

I-6.3 How can we quantify cognitive load?

Cognitive load can be quantified, but it takes some time and effort. A good starting point is to count the number of elements a device exposes to the user. How many user interface elements, icons, apps, widgets etc. does the user see when he starts using a device (that is, before personalizing and adding or deleting elements from the device)?

The result is an easily verifiable number—but even more interesting than the number is the display of the levels and layers of user interface you have to get comfortable with in order to find your way around the device.

Apart from being helpful for evaluating the user experience of a device, **cognitive load should be taken into account much more systematically by device manufacturers** as an aspect that has serious consequences on ease of use and quality of user experience, and that needs to be managed and streamlined. As tablets become more and more pervasive in our lives, user experience will be the great distinguishing feature between them - and cognitive load is an essential part of it.

I-7 User Experience Friction

I-7.1 What exactly is User Experience Friction, and how can it be measured?

The operative question should of course be: **what is a good, frictionless user experience?** Well, that should be fairly simple: an ideal device should provide a completely natural user experience. **We should be able to use it without having to learn anything, and nothing should inhibit our expected use of the device.** Interactions should be intuitive, every operation should be smooth and natural. We should not have to wait for the device to do anything, nor should the device keep us guessing at what is necessary to achieve a certain goal.

User Experience Friction (UXF) is basically anything which separates the device we use from that ideal user experience: we all know what UXF is when we experience it, (although of course UXF may represent something completely different for every one of us.) 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. If you rent a car that inexplicably has reversed the side of the blinker on the steering wheel of the car, we experience friction: where the hell is the blooming thing? When you press the wrong button to re-open the doors of an elevator because it is badly labelled: UXF again.

UXF is a fact of life. In the physical world we don't think much about these things, because we have prior knowledge that they can occur: we know car

designs differ from one another; we know there is no universally agreed upon way of labeling equipment, and so on. Even on computers, most of us have acquired enough knowledge to find our way around basic options, although we may have difficulty in finding a specific setting or command (UXF again, of course)

On recently invented devices such as tablets or smartphones, the situation is more complex. **Not only are these devices new, so we have had much less time to develop and acquire universally accepted usage patterns, but worse, their feature-set and behavior is not yet frozen: every new generation of device or operating system brings new possibilities, and therefore new areas of UXF.**

The situation becomes even more complex when you have to deal with competing vendors and operating systems, which make it difficult for vendor B to use the most efficient discoveries of vendor A. Case in point: Apple had a very smart idea when designing iOS: every iPhone, iPad and iPod Touch has a physical home button that sits outside of the display area. The idea being that wherever you are on the device—maybe in an app that has frozen, or one that has a badly designed user interface and provides no clear way to quit, or maybe just stuck in a communication problem that makes an app freeze—pressing the Home Button gets you into safe, known territory.

Quite understandably, Apple patented this discovery. As a result, no Android device can have a physical Home button without infringing on Apple's patent. So? Well, Android has a Home button, too - but it is an icon that is part of the user interface of the operating system. This results in numerous occurrences of UXF, because the Home icon may simply not be available in the app you are using, or it may show inconsistent behavior.

There are many other examples of UXF: any kind of unexpected behavior can produce friction. If you are used for every application to work in both portrait and landscape mode, an application that only works in one mode and forces you to physically turn the device in order to use it produces friction. Other examples can simply be the result of confusing UI design: the Samsung implementation of Android currently found on its GalaxyTab 2 tablets displays an icon for capturing the content of the screen right next to the Home and Back icon. Why? Do we really need to make screen grabs as often as we hit the back icon? To make matters worse, the icon design resembles the design some application use to trigger a Zoom function - which means that an unexperienced user will simply hit this icon to view a bigger version of what is on the screen—and wind up with a screen capture that needs to be manually deleted.

The really important question, of course, is: can we quantify UXF? Is there a way of measuring the friction different devices impose on the user? Can we rate devices according to their user experience, the way we rate their processors or screen resolution?

I-7.2 The importance of the platform

So how can you go about measuring something as evasive as UXF? The first step is to look at the context. Using a tablet is not at all the same thing as using a personal computer. Nobody expects to learn how to use a PC without some explanations and help. Somebody has to show you the basics, the general UI principles, the menu system, how folders work, what applications are, how to save a file and so on.

A tablet is completely different: a tablet (and a smartphone for that matter) are intended to be consumer devices. Their use is meant to be intuitive, their user interface should not require learning. There is a distinct need for immediacy. The user experience of smartphones and tablets is much more physical than with a PC. Just as in the real world, you touch the objects represented on the tablet, interact with them directly. And while using a PC is in our mind often associated with working, or at least with doing something for a prolonged period of time, a tablet is intended for very casual use: it has to be on immediately—you certainly don't want having to type a log-in and password each time you want to use it.

It is important to remind ourselves of these differences because they define the user experience we expect from a tablet. In other words, aspects that are completely acceptable on a personal computer are experienced as UXF when you use a tablet or a smartphone. Having to type a log-in or password is one example, but there are many others. On a PC, applications can take seconds or in some cases minutes to load. We don't like it - but we have accepted that this can happen. After all, when we launch an application like Word, Excel or Photoshop, we don't expect to quit it immediately: we are going to do something work-related, which is likely to take time.

Tablet and Smartphone apps are quite different: having to wait for them to load is experienced as friction, we expect them to react immediately. But that is only one example of many others: swiping behavior, rotation-speed when we turn the tablet, inconsistent scrolling behavior, inconsistent user interface operation are all aspects that are much more annoying on a touch-device than when they occur on a computer.

In fact, when we look closely, we realize that UXF 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 is up to the individual user to decide. But they exist, can be observed, and, at least to some extent, quantified or measured.

II Defining the Methodology

II-1 Basic Principles of Analysis

II-1.1 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 that they exist can not be questioned: all of the aspects we are looking at in this research are clearly perceptible and in many cases quantifiable.

II-1.2 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.**

II-1.3 Methodology: 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.

▶ **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 in 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.**

II-2 Defining the Reference Platform

II-2.1 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. Tablets are the first devices sold 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.

II-2.2 Defining the context

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**.

II-2.3 Weighting of user experience aspects

The three aspects defined above (hardware, user interface and device universe) have different weights with respect to the overall user experience. In order to make it possible, over time, to produce an overall user experience index, the different levels have been weighted as follows, expressed as percentage of the global number. (See also illustration on the following page.)

- ▶ **Hardware related user experience aspects:** **20%**
- ▶ **Software-related user experience aspects:** **30%**
- ▶ **Device Universe:** **50%**

The Ideal Tablet Device

Device Universe	<p>Mature, Unconstrained Device Universe</p> <p>Sophisticated Discovery Mechanisms for Apps and Content</p> <p>Expert Rating and Guidance</p>	50%
OS/Software	<p>Streamlined User Interface and Environment</p> <p>Frictionless User Experience</p> <p>Intuitive Interactions</p>	30%
Hardware	<p>Essential Hardware Characteristics</p> <p>Coherent, Well-implemented Physical Controls</p>	20%

Three levels of aspects that will affect overall user experience of a tablet, and their relative weight in the overall user experience index. In an ideal device, none of these levels should produce any user experience friction.

II-3 2013 Tablet Reference Configuration (Medium-Size Tablets)

II-3.1 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 inherent in any electronic touch-screen device, the ideal tablet should not impose any friction 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**.

II-3.2 Hardware

Core Specifications

- **Aspect Ratio**
 - 4:3
- **Weight**
 - Light enough to be held in one hand for a prolonged period of time
- **Screen resolution**
 - >300ppi
- **Battery life**
 - >1 week at normal use
- **Connectivity**
 - WIFI
 - 3G/4G
 - non-proprietary dock/charging connector
 - Bluetooth
- **Memory capacity**
 - 128GB or more
- **Build Quality**
 - High
- **Durability**
 - Sturdy enough not to require a protective case

Physical controls

- **Physical Home button**
 - Essential (it is very important to be able to interact from outside of the OS user interface shell)
 - Easy to spot, and to locate by touch
 - Sunken (so as not to press it accidentally)
- **On-off switch**
 - Raised
 - Asymmetrical positioning to allow locating it without having to look for it
- **Volume control**
 - Raised
 - Asymmetrical positioning
- **Luminosity control**
 - Raised
 - Asymmetrical positioning
- **Rotation lock**
 - Raised

II-3.3 Software

Core user experience characteristics

- **Operating system**
 - Invisible (OS only acts as the intermediary between basic operation and application)
 - No specific OS concepts that need to be acquired/learned
 - Completely coherent, unambiguous operations
- **File System**
 - Invisible
 - Application specific
- **Customization**
 - Simple
 - Easily discoverable
- **Interactions**
 - Only basic, simple multi-touch gestures
- **Discoverability of options**
 - Intuitive/simple
- **Rotation behavior**
 - Ubiquitous H/V switch (OS and Apps)

Usability

- **Fluidity**
 - Completely fluid scrolling and panning
 - Real-time zooming in all applications
- **Speed of rotation**
 - Near-immediate
- **Keyboard**
 - Replica of physical keyboard
 - Arrow keys
 - Always present numbers/symbols/accents
 - Simple activation/deactivation of predictive text entry (if available)

II-4 2013 App Store Reference Definition

II-4.1 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.

II-4.2 Device universe

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

II-5 Benchmark Methodology: Hardware

II-5.1 Defining the Perimeter of Quantification

► 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:

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.
- **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.
- **Screen Calibration** 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
- **Industry Standard Connector** The benchmarks notes presence/absence of an industry standard connector, as opposed to a proprietary one.

Buttons and Controls

- **Raised Power Button** 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
- **Luminosity Control** Takes into account presence and implementation of physical luminosity control

II-6 Benchmark Methodology: Cognitive Load

II-6.1 Core Aspects of Cognitive Load

Cognitive load can be traced and described in a very granular way; for this initial wave of tablet user experience benchmarks, we limited the cognitive load categories to **three essential aspects a tablet user is confronted with and has to get comfortable with**: discreet user interface elements and icons, destinations, and individual apps, widgets etc. that come pre-loaded on the device.

▶ **Icons and user interface elements**

The first group of cognitive load elements are user interface elements that allow the user to interact with the device, excluding 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. The home screen is a destination, and so is the search screen. On Android, the app screens and widget screens are specific destinations that are distinct from the Home screen; on the iPad, the Home screen and app screen are identical destinations. Mail, Web, Camera, App Store, Music Store, etc. could also counted as destinations

▶ **Apps and Widgets**

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

II-6.2 Quantifying Cognitive Load

For this first wave of research we have limited the quantification of cognitive load to its simplest form, that is, **to the simple count of each element of each group present on a device in its unmodified factory configuration.**

Adding up the number of elements in each group **provides us with a simple and verifiable cognitive load index**; however, especially in the present early phases of user experience benchmarking, it will be essential to document cognitive load elements as extensively as possible to make this data-point resonate with users of the research.

▶ **Future Developments**

There is clearly a lot of potential to expand the concept of cognitive load in many ways, through targeted market research and more granular analysis for instance, in order to provide a richer set of user experience analysis related to this important concept.

Also, as we expand the basic user experience research to cover other devices such as smartphones, for instance, it will be necessary to revisit and redefine the concept of cognitive load to take into account different user needs and contexts.

II-7 Benchmark Methodology: User Experience Friction (UXF)

II-7.1 Core Aspects of UXF

We have defined UXF as anything which imposes any kind of friction on an ideal user experience, obviously **taking into account the context of analysis chosen for the benchmarks** (in this case, that of an unexperienced user, and of casual, non-professional use). In addition, we have limited the analysis in this first wave of UXF analysis to a simple and restrained field: the interaction that occurs between the moment a user switches on a device, and the moment an app is launched.

II-7.2 Benchmarking UXF

As with cognitive load, the initial approach to UXF quantification is a purely empirical one, and relies on the counting and describing of design decisions, user interface elements or device behaviors that are incoherent, confusing or annoying.

▶ Rating UXF Occurrences

For this first wave of benchmarks we have designed **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.¹

As with cognitive load analysis, **it is essential to document UXF occurrences extensively** to make sure the numeric results resonate with the user of the research.

▶ Future Developments

UXF is one of the essential notions for evaluating and quantifying user experience. The methodology described here is only a small first step towards a more mature interpretation of the UXF concept. We are fully aware that it will be important over time to extend and develop the concept to allow more granular analysis, and to back up specific aspects of user experience friction through targeted user studies and market research.

¹ 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.

Potential Elements of User Experience Friction

Device Universe	<p>Mature, Unconstrained Device Universe</p> <p>Sophisticated Discovery Mechanisms for Apps and Content</p> <p>Expert Ratings, Reviews and Guidance</p>	<ul style="list-style-type: none"> ▶ Limited scope of apps and content ▶ Lack of sophistication in app and content stores ▶ Insufficient discovery mechanisms for content and apps ▶ Lack of tablet-specific applications ▶ Protectionist limitations on content ▶ Protectionist limitations on device eco-system
OS/Software	<p>Streamlined User Interface and Environment</p> <p>Frictionless User Experience</p> <p>Intuitive Interactions</p>	<ul style="list-style-type: none"> ▶ Cognitive load ▶ Incoherent implementation ▶ Confusing, un-intuitive UI paradigms
Hardware	<p>Essential Hardware Characteristics</p> <p>Coherent, Well-implemented Physical Controls</p>	<ul style="list-style-type: none"> ▶ Insufficient or badly implemented physical controls ▶ Insufficient hardware specifications

Once we have established the levels of user experience it is relatively straightforward to start outlining the elements of friction that can occur.

II-8 Benchmark Methodology: Device Universe and App Store

II-8.1 Scope

The device universe for tablets and smartphones is growing at significant speed and is increasingly combining a great variety of aspects (content, apps, accessories, etc) that make objective in-depth evaluation extremely complex.

For this first wave of user experience research, **the device universe analysis has been limited to the app store available for each platform.** There are two reasons for this limitation: first of all, apps are the key part of the device universe, and provide most of the potential for these devices. The second reason is that while for apps, a centralized app store is the norm (and in the case of some vendors, an almost unsurmountable walled garden), content such as video and music for these devices can come from a variety of sources.

II-8.2 Core Aspects of app store evaluation

What makes the difference between a good app store and a less satisfying one? None of the app stores currently available for tablets came close to the 2013 App Store Reference Definition established for this research, yet there are significant differences between the three main app stores analyzed for this research. How can they be evaluated in a coherent and intellectually sound way?

To get a grip on how to quantify the efficiency of an app store, we need to go back to the main problem that needs to be solved: to guide the user through the maze of hundreds of thousands of apps to the ones that correspond to the specific needs of one specific person.

Obviously, all app stores provide baseline functionality: key categories, list of most popular apps, “Staff picks”, and, of course, search. But while search and categorization are important, **we believe that the real added value of an app store lies in content curation:** handpicked selections of apps for specific areas or interest, reviews, intelligent groupings, and tools to aid some form of serendipitous discovery.

II-8.3 Benchmarking the app stores

The user experience quantification we propose for the present research project are based on these observations, and on the basic question a user might ask himself, such as: How many of these apps are actually optimized for a tablet? How good are the apps? How well are they documented? Does the presentation take into account my personal needs, etc.

▶ Two distinct evaluation methods

In order to answer these questions and provide some form of quantification that will at least allow some comparative quantification of the qualities of an app store, we have devised two distinct evaluation methods: a **dedicated App Store Evaluation Grid**, and a **comprehensive count of key distinguishing elements.**

II-8.4 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.

In its current state, 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.

► Criteria for the App Store Evaluation Grid

The following criteria are covered by the 2013 version of the App Store Evaluation Grid (see also illustration below):

- **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**

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

II-8.5 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 the wealth of apps available 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 in user experience 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

II-8.6 Current reach of app store user experience analysis

▶ A first approach

The methods of app store related user experience research presented here are a first approach to a very rich and complex subject.

Combined, the two methods provide a first set of tangible and coherent data on the user experience difference that may exist between app stores from different providers. They are not intended as the be-all and end-all in terms of app store user experience analysis, but rather as a modest first step. Given the importance of app stores in the overall value proposition of digital devices, and the frenzied development activity from independent software developers, however, **it is clear that the notion and concepts of user experience research in this filed will need to evolve significantly.**

II-8.7 Future areas of research

▶ Coherence and relevance of search results

Search functionality available in app stores is one of the prominent areas that require in-depth research and analysis from a user experience perspective. How coherent and relevant are search results and suggestions based on the search? How well supported are natural language searches and activity-based user requests? How easy to use are advanced search methods?

Future developments of this research will cover search in detail.

III Conclusion

III-1 Tablets and Beyond

III-1.1 First steps

User experience is complex. With the present study we have tried to establish a first set of ground rules about understanding and measuring elements of that user experience. It is obvious that it will need to be expanded and developed in many ways.

III-1.2 What we have learned

In the process of researching and elaborating the current study, we have found some basic principles and concepts that can be considered first stepping stones for future efforts:

▶ **Some aspects of user experience can be quantified**

Provided a proper, coherent context, some aspects of user experience can indeed be quantified in a verifiable way, but defining objective valid contexts is difficult for certain aspects of user experience.

▶ **Cognitive load and UXF are essential concepts for user experience**

The two aspects that have emerged as the most powerful differentiators for user experience research are cognitive load and user experience friction (UXF), since they can be empirically surveyed and verified. There is significant potential to refine the methods and metrics for these concepts.

▶ **Contexts need to be refined**

We have stated early on that it is impossible to evaluate user experience without taking into account the context of the user. Since a lot of subjective user experience depends on the personal preferences, experience and taste of the user, it will be necessary to find ways of integrating these aspects into future user experience research.

▶ **The app store is the library of the future**

The enormous (and currently maybe somewhat underestimated) importance of the app store in overall user experience of a device is one of the key findings of this research; it has also become clear that as a method of accessing to enormous richness and diversity of app development, current app stores are in their infancy, and that significant developments in this area can be expected.

III-1.3 Future research

As digital technology continues to evolve at a breakneck pace, this research will be expanded to cover new families of devices and richer sets of user experience criteria, contexts and metrics.

Do not hesitate to contact us with questions or suggestions:

research@pfeifferreport.com