Modeling Trust in the Mobile User Experience: System Quality Characteristics Influencing Trust

Philip Lew
XBOSoft
Woodbridge, VA, USA
philiplew@gmail.com

Luis Olsina
GIDIS_Web, School of Engineering, UNLPam
General Pico, La Pampa, Argentina
olsinal@ing.unlpam.edu.ar

***Abstract*—As the mobile world continues to expand an Internet of Things and Networks of Everything, we find that our lives, while becoming more convenient also come with ties. These ties are based on many interconnections between people and software, and it is critical to ensure that we trust these ties in the software that we use. Modeling, evaluating, and improving the end user's trust in the mobile apps requires systematic frameworks and strategies. To this end, we are proposing an adaptable and flexible quality model and framework – borrowing from general accepted ISO 25010 modeling concepts while enhancing our previous work in quality in use modeling – by representing specific system quality characteristics that may influence trust from the quality in use standpoint. The resulting trust modeling framework can be used for evaluation and improvement of trust targeted for different mobile apps.**

Keywords—Trust; quality model; system/system-in-use quality view; mobile user experience

I. INTRODUCTION

With advent of smartphones and other mobile devices (such as tablets), users have quickly shifted from conventional desktops to highly sophisticated mobile devices coming in a variety of shapes and sizes from wearables to 'internet of things' devices where many specialized devices or appliances such as thermostats, refrigerators, blood pressure monitors, etc. are connected to the internet and enable you to control them remotely. Their connectivity has led to rapid adoption of software applications on mobile smartphones with specialized applications (mobile apps) that enable you to track data and extract trends while you control and configure them. No matter how "smart" and sophisticated these devices are, they do have User Experience (UX) challenges.

But what is UX? UX, now a common household term, still has no unanimous definition or standard [3]. Some may think of UX as aesthetics or 'wow factor'. In the end, there are UX 'best practices' or style guides published from many different points of view (i.e., Apple, Google, Microsoft [1], [6], [12], among others) but these are usually heavily dependent on context and domain.

With mobile apps, UX becomes even more complex due to the mobile platform's inherent characteristics, some of which include:

- *Wide audience*: From desktop to web-based was one level of user diversity. Now with mobile, user personas have expanded far beyond traditional 'computer users' and cover not only wider demographics but also wider geographies.
- *Environmental conditions*: Because the environment in which mobile devices are used is constantly in flux, their applications must adapt and change behavior accordingly based on numerous contextual factors.
- *Personal association*: Mobile smartphones are not simply electronic gear. Because users take them everywhere, they become personal belongings due to personalization including settings, data, software applications, etc.

So it is not surprising that Mobile UX (MUX) has gained serious attention as companies yearn to gain market share with apps that are not differentiated by features. Some of the key factors or characteristics that are mostly considered when designing MUX [4], [11] include: Interface aesthetics, Efficiency, Effectiveness, Content, and User customizability.

These factors focus on how the phone and its software operate, how the buttons work, and how easy it is to complete everyday tasks. Few think of the users' experience in terms of trust. Yet without trust, users will either quickly become dissatisfied and use another application or subconsciously not use the application again due to a 'feeling' that they have but may not even understand or know is present. If users cannot trust that their applications are secure and come from a trusted source, they will lose confidence not only in the applications, but also in the operator providing the service.

Before beginning the evaluating and improving trust in software, we need a model to characterize the concept. Shifting to thinking about trust in a common context, what characteristics of your friends and the people around you instill a sense of trust? What makes you trust them? Some possible characteristics or behavior include:

- They are on time.
- They do what they say they will do (sense of commitment).
- They are straightforward — easy to 'read' and not complicated.
- They are clear in their communication (clarity of text such as terms and conditions, etc.).

So when you think about a software application, it should fulfill these same basic requirements (among others) in order to instill trust. How can we transpose those 'trustworthy' human characteristics to a software application?

To make sure that our applications foster and give our users a sense of trust (in our companies and the software we provide), we need to understand and define trust in this context. The objective is to design our applications (system quality characteristics) with trust in mind, and then evaluate applications in order to improve their fostering of trust with our user base as part of Quality in Use (QinU). In other words, we want to purposely design our mobile apps such that they optimize the "*Degree to which a user or other stakeholder has confidence that a product or system will behave as intended.*" (Trust definition as a sub-characteristic of Satisfaction in the ISO 25010 QinU model [9]).

To accomplish this, we propose a model for trust whereby characteristics of a software product or system influence trust while in-use as part of the UX for mobile apps. We make use of our previously proposed 2Q2U (*internal/external Quality, Quality in use, actual Usability and User experience*) V2.0 quality model [14] and instantiate system characteristics that would 'influence' an end user's trust in a real context of use, also referred to QinU.

Hence, this vision paper contributes in: 1) Identifying and characterizing key influencing characteristics and sub-characteristics of the external quality focus (for a system, in our case, a mobile app) that we ascertain may 'influence' satisfaction/trust of the QinU focus (for a mobile app in-use); 2) Proposing a subset of 2Q2U V2.0 system quality characteristics and sub-characteristics to represent the key influencing factors for trust, which will be further transformed in questionnaire items in order to determine the perceived importance given by end users; and 3) Illustrating cases for mobileapp features that exemplify our defined characteristics and show their potential impact in mobileapp trust.

The ultimate goal for determining the most relevant system quality factors influencing trust is to further use the SIQinU (*Strategy for Improving Quality in Use*) strategy, which allows improving QinU incrementally, from changes made on the system. That is, SIQinU has proved to support the QinU/external quality/QinU evaluation and improvement cycles effectively, in a real company [10].

Following this introduction, Section II reviews recent related work and delineates opportunities for improvements along with our motivation for this work. Section III shows the proposal of utilizing our past work, the 2Q2U modeling framework, in order to delineate system characteristics that may influence end user trust for mobile apps. In Section IV, we discuss the usefulness of the proposed framework in the context of examples where these defined system characteristics may influence user trust. Section V draws our main conclusions and outlines future work.

II. Related Work and Motivation

UX has recently come to the research forefront for mobile apps due to the shift in emphasis to satisfying the end user and the particular characteristics of mobile apps that make MUX a key determining factor on their survival and prosperity. Even though the ISO 25010 model [9] for QinU depicts Trust as a sub-characteristic of Satisfaction, its above quoted definition needs more detail and understanding to make it useful for mobile apps. Furthermore, there are no practical inferences as how to link Trust from the QinU focus depending on the external quality characteristics and attributes of a mobile app that can influence Trust. This section examines the related work with an eye for improvement opportunities for modeling and relating Trust. First, for a better motivation, we revise the concept of quality view.

The quality view concept [15] stems from the association between an evaluated target entity –pertaining for example to the software product, system, or system in-use entity super category- and its corresponding quality focus –internal quality, external quality, or QinU respectively. In turn, for a quality focus, a tailored quality model which includes characteristics, sub-characteristics and measurable attributes can be arranged for any evaluation goal purpose.

Fig. 1 shows three entity super categories and their corresponding quality focuses. Also, it depicts the 'influences' and 'depends on' relationships for their quality focuses. Therefore, the underlying hypothesis supported by both theoretical and empirical evidence [9], [10], [13] is that evaluating and improving external quality – e.g., a mobile app is a means of influencing or effecting positively QinU –i.e., the same mobile app used by real users in a real context of use.

Regarding the Trust concept, it has been defined over the years for different entities, situations and user viewpoints. For instance, Rotter [16] defines interpersonal trust as "*A generalized expectancy held by an individual that the word, promise, oral or written statement can be relied on*".

From a business or psychological point of view, there are many models or frameworks that depict trust as a composite of several traits or characteristics. In Covey and Merrill's book [5], they depict trust for professional relationships through four core values; Intent, Integrity, Capability and Results. These values are then decomposed further into more distinct characteristics. They state: "*Simply put, trust means confidence. The opposite of trust –distrust– is suspicion*".

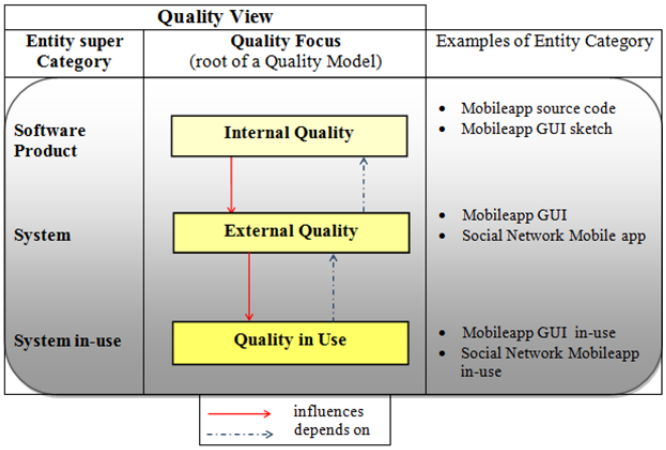

Fig. 1. Entity super categories/quality focuses and their relationships for evaluating quality.

More recently, Hoffman *et al.* [8] modifying the Rotter's definition looking at human trust in automation and IT, define trust as "*the expectation that a service will be provided or a commitment will be fulfilled*". They also state that "*From a user's point of view, security is extremely important in trusting that computer-based technology will perform the user's intended requested function. However, factors other than security can be as important from the user's perspective*". They propose a new trust model in [8], which incorporates Security, Privacy, Safety, Usability, Reliability, and Availability factors. They ascertain that "*a comprehensive trust model of computer-based technology must predict how usability, reliability, privacy, and availability (and possibly other factors), as well as security, affect user trust*".

Bart *et al*. [2] have developed a conceptual model that links consumer perceptions of website characteristics and consumer characteristics to perceptions of trust in a website and performed an empirical study to contrast a couple of research questions. In their model, security, privacy, navigation and presentation, brand strength, advice, order fulfillment, community features, and absence of errors are the website characteristics.

Finally, Harley [7] summarizes that "*Websites must establish trust and present themselves as credible to turn visitors into customers*". She has used in her recent studies four credibility factors, namely: Design quality, up-front disclosure, comprehensive and current content, and connection to the rest of the web.

All the above work is valuable sources of knowledge to our research. However, we observe that are no extended quality models and framework that deal with the external quality characteristics and sub-characteristics of a mobile app that can influence Trust from the QinU viewpoint, in which Trust is one out of four sub-characteristics related to Satisfaction, as per ISO [9].

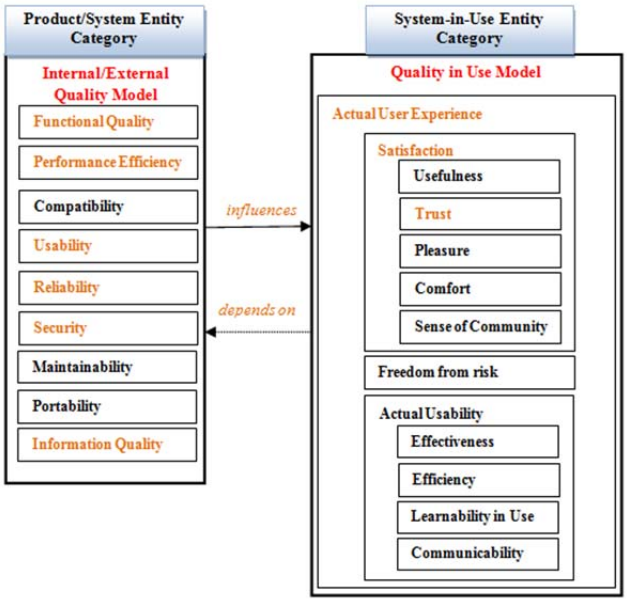

Fig. 2. Quality model characteristics and relationships between quality views in 2Q2U V2.0

In 2012, we developed the 2Q2U V2.0 quality models and framework borrowing from many general-accepted ISO 25010 modeling characteristics, concepts and relationships, adding and rephrasing others, as discussed thoroughly in [14]. Fig. 2 represents quality model characteristics in 2Q2U V2.0 for the quality views (entity categories and quality focuses) depicted in Fig. 1. Besides, Fig. 2 highlights (in orange) the external quality characteristics that may influence Trust/Satisfaction and consequently, Actual UX.

What is noteworthy about Fig. 2 is that when examining the ISO 25010 standard in its subsections 3.6 and 3.7, it defines a 'primary user' as a "*person who interacts with the system to achieve the primary goals*." Also it shows how the system or product quality characteristics of Functional Suitability (Functional Quality in Fig. 2), Performance Efficiency, Usability, Reliability and Security have an influence on the QinU for primary users. However, the influence relationship is not targeted for Trust, but rather for general QinU characteristics as a whole.

These issues will be analyzed in the following section.

III. Trust Models and Framework: Proposal and Discussion

The aforementioned references are quite numerous and elaborate in terms of trust concepts both in and surrounding the domain of web apps, computing in general, and business. However, none of them ties together a cause and effect, or design actions and check results paradigm, taking into account the grounds of quality view modeling [15]. In simple words, they rather propose 'do this' and it will result in trust.

Hence, the aim of the proposed model and framework is twofold: first, extracting and specifying characteristics of the 2Q2U V2.0 framework (Fig. 2) to specifically model external quality characteristics that we ascertain may influence system-in-use trust. And second, extend previous work [10], [11], [14] into the mobile domain whereby system characteristics that influence trust can be used in an iterative manner to improve the end result, trust by the end user in whatever product, system or service is being evaluated.

As such, our model defines those characteristics of system quality that influence the system-in-use characteristic, Trust, an ISO 25010 sub-characteristic of Satisfaction.

Security, safety, and privacy are generic trust factors that deserve consideration when modeling trust. In maintaining alignment with ISO 25010, we build on previous work and supplement information quality as another characteristic of system quality that has an influence on trust. Additionally, we re-categorize some of the characteristics enumerated by [8] as sub-characteristics in the model. Our resulting quality models and framework for trust are depicted in Fig. 3.

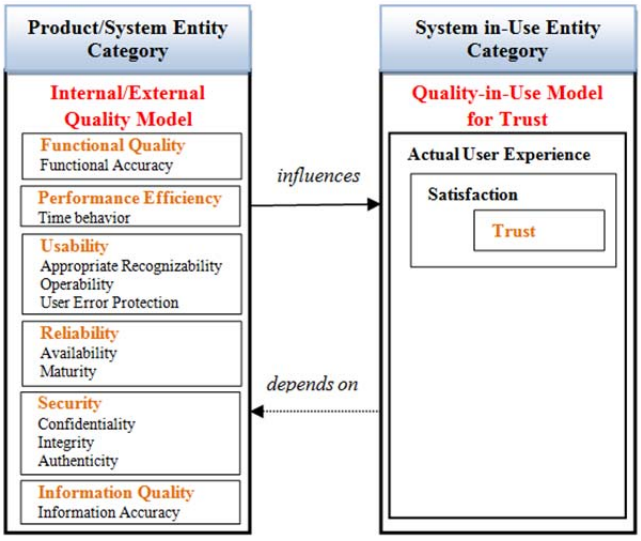

Fig. 3. Proposed quality models and framework for evaluating trust; characteristics and sub-characteristics form the product/system quality view that may influence the trust characteristic form the system in-use quality view.

Note that we tailor this external quality model (left side of Fig. 3) with only those characteristics and sub-characteristics that we ascertain may influence the actual UX from the trust sub-characteristic (QinU) point of view. Each of the characteristics in the model can be decomposed into sub-characteristics and measurable attributes that can be specified in a requirements tree. Additionally, this also can be instantiated in questionnaire items, as we comment later on. Table 1 defines these characteristics and sub-characteristics. Additionally, Table 2 defines QinU characteristics and sub-characteristics, in which Trust (1.1.2) is included.

Let's examine some of the system quality characteristics and discuss how they could influence trust in the end (primary) user, for instance, Functional Accuracy (1.1. in Table 1) and its sub-characteristics, Correctness (1.1.1) and Credibility (1.1.2). If the application does not provide the expected result or behavior in a credible and dependable manner, it is the same as a person who does not do what they said they would do. Do you trust them?

TABLE I. DEFINITION OF 2Q2U EXTERNAL QUALITY CHARACTERISTICS AND SUB-CHARACTERISTICS THAT MAY INFLUENCE SYSTEM-IN-USE TRUST. NOTE THAT THOSE DEFINITIONS THAT MATCH TOTALLY WITH ISO 25010 ARE QUOTED [9]; MOST OF THE REMAINDER ARE TAKEN FROM [14]

2Q2U External Quality (sub-) Characteristic name	**Definition** (Note that all definitions start with the phrase "Degree to which")
1. Functional Quality	… a product or system provides accurate and suitable functions which meet stated and implied needs when used under specified conditions.
1.1 Functional Accuracy	… a product or system provides functions which are correct and credible.
1.1.1 Correctness	… a component/function provides the correct results with the stated degree of precision and consistency.
1.1.2 Credibility	… a component/function is reputable and verifiable.
2. Performance Efficiency	… a product or system uses the appropriate amount of resources relative to the performance obtained under stated conditions.
2.1 Time Behavior	… the response and processing times and throughput rates of a product or system, when performing its functions, meet requirements [9].
3. Usability	… the product or system has attributes that enable it to be understood, learned, operated, error protected, attractive and accessible to the user, when used under specified conditions.
3.1Appropriate Recognizability	… users can recognize whether a product or system is appropriate for their needs [9].
3.2 Operability	… a product or system has attributes that make it easy to operate and control [9].
3.3 User Error Protection	… a product or system protects and prevents users against making errors and provides support to error tolerance.
4. Reliability	… a system, product or component performs specified functions under specified conditions for a specified period of time [9].
4.1 Availability	… a system, product or component is operational and accessible when required for use [9].
4.2 Maturity	… a system, product or component meets needs for reliability under normal operation [9].
5. Security	… product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization [9].
5.1 Confidentiality	… a product or system ensures that information and data are accessible only to those authorized to have access and that anonymity is preserved when required.
5.2 Integrity	… a system, product or component prevents unauthorized access to, or modification of, computer programs or data [9].
5.3 Authenticity	… the identity of a subject or resource can be proved to be the one claimed [9].
6. Information Quality	… a product or system delivers accurate and suitable information which meets stated and implied needs when used under specified conditions.
6.1 Information Accuracy	… a product or system delivers information that is correct, credible and current.
6.1.1 Correctness	… which information is correct both semantic and syntactic for a given language.
6.1.2 Credibility	… the information is reputable, objective, and verifiable.

TABLE II. DEFINITION OF 2Q2U QINU CHARACTERISTICS AND SUB-CHARACTERISTICS IN WHICH TRUST IS INCLUDED. NOTE THAT SUB-CHARACTERISTICS FOR 1.2 AND 1.3 ARE NOT SHOWN (SEE [9], [14])

2Q2U Quality-in-Use (sub-) Characteristic name	**Definition**
1. Actual User Experience	Degree to which a system in use enable specified users to meet their needs to achieve specific goals with satisfaction, actual usability, and freedom from risk in specified contexts of use.
1.1 Satisfaction	Degree to which user needs are satisfied when a system is used by specified users in a specified context of use [9].
1.1.1 Usefulness	Degree to which a user is satisfied with their perceived achievement of pragmatic goals, including results of use and consequences of use [9].
1.1.2 Trust	Degree to which a user or other stakeholder has confidence that a product or system will behave as intended [9].
1.1.3 Pleasure	Degree to which a user obtains pleasure from fulfilling their personal needs including; acquiring new knowledge and skills, communicating personal identity and provoking pleasant memories.
1.1.4 Comfort	Degree to which the user is satisfied with physical comfort [9].
1.1.5 Sense of Community	Degree to which a user is satisfied when meeting, collaborating and communicating with other users with similar interest and needs.
1.2 Freedom from Risk	Degree to which a product or system mitigates the potential risk to economic status, human life, health, or the environment [9].
1.3 Actual Usability (synonym Usability in use):	Degree to which specified users can achieve specified goals with effectiveness, efficiency, learnability in use, and without communicability breakdowns in specified contexts of use.

Likewise, looking at Security (5) and Confidentiality (5.1), if your information is not protected and suddenly you start receiving emails that you did not sign up for (same company that develops the software) or from other related companies (they sold your name and email), then that behavior not only destroys or lowers trust in the end user for the software being used but also the company behind the software.

For Information Quality (6), if the information presented cannot be verified as correct and credible, such as data presented incorrectly in the wrong currency or that which does not align with data in other places in the application such as order totals, with postage and taxes in an ecommerce application, then that leads to lack of trust.

When looking at Usability (3), in terms of Operability (3.2) and User Error Protection (3.3), if an application is difficult to navigate to where you want to go, and then if you make a mistake that is either hard to recover or you get an error message that is difficult to decipher, this is the same as talking to a lawyer that you cannot understand. And we all know what that does to trust.

Just based on these examples, it is easy to see that through our design (having in mind these system characteristics and attributes) we can generate trust in the end user.

Thus in summary, the goal is to take those system characteristics as defined above and shown in Fig. 3 and develop measurable attributes for which you can design and develop a mobile app. Then by using SIQinU and measuring trust from the Actual UX point of view, you can determine the improvement gained by implementing your design or actions (user flows) and also possibly determine what system characteristics can help you garner the greatest improvement in trust.

It is worthy to remark that our primary goal in this research is to explore influences of external quality characteristics for Trust/Satisfaction/Actual UX. But as the reader can surmise, we could explore other influence relationships such as for instance how Security, Reliability, Information and Functional Quality may impact Freedom from Risk (1.2 characteristic in Table 2) or others to Usefulness (1.1.1).

Finally, we performed an exploratory study of 'depends on' and 'influences' relationships between QinU problems and external quality attributes that can be used to improve the application under evaluation (JIRA at that moment [10]). In this study, some Usability and Information Quality external quality sub-characteristics were shown to influence to some extent Actual Usability (1.3 in Table 2) sub-characteristics.

IV. ILLUSTRATING CASES THAT MAY IMPACT TRUST IN MOBILE APPS

In this section, we examine some of the system quality characteristics defined above, and show how they may influence trust in the end user in a real context of use for a mobile app.

If we examine the definitions of the Security characteristic and its related sub-characteristics in Table 1, we can see that these concepts cover important and common aspects of Trust such as confidentiality in using a particular mobile application, or any software application for that matter.

Fig. 4 shows (with annotations) some potential implementations of the Security sub-characteristic confidentiality where in one instance with Kaiser (top) the entire user name is displayed and with Fidelity (bottom), only part of it is displayed.

In Fig. 5, User Error Protection (a Usability sub-characteristic in Table 1) is exemplified in the three screenshots. The first screenshot on the left shows an error code that is incomprehensive to the end user which may cause a decrease in trust. The two other screenshots are much better in that they explain to the user what is happening. This gives users a sense of trust (or not) depending on how user interface information is presented upon errors or failures.

In the many mobile apps that we use in our daily lives, it is easy to find examples of how the system design and flow influences our trust in the software and the company behind it. Going further to specify some attributes for Trust from the

system quality perspective, here are some possible system implementations:

- *Unique account creation availability*: This mechanism is well accepted and should be implemented in all applications with any personal data.
- *Password retrieval availability*: This mechanism enables a user to request a new password provided that there is a specified retrieval method, i.e. an email address or a mobile phone.
- *Multi-step authentication*: This mechanism uses multiple devices to verify the users' identity when doing critical actions such as payment or when a new platform is detected.
- *One-time password or security token availability*: One-time passwords expire after a single usage, thereby preventing hackers from attempting to use a password after it has already been used once. Forcing users to change the password, while they may think it is a nuisance, they also feel more secure.
- *Biometric authentication availability* allows the user authentication based upon the factor of "who you are" including facial and finger print recognition.
- *Terms and conditions*: Clear and easily available for the users to see, read and understand.

Some of these characteristics and their implementations change over time, as do user expectations. For example, the terms and conditions written in small print on the back of most of the credit cards and in most End User License Agreements when you download and install software on your computer or mobile phone. Generally, no one ever reads them; firstly, they are written in very small font, and secondly they are sometimes too complex to be understood. Most downloads onto a mobile device and subsequent installations require "Agreeing to terms and conditions" which are too long. Most of us just check the "agree" checkbox and continue to the installation step. This is especially true for mobile apps due to small screen size and task urgency where most users just click 'agree' without even thinking or reading.

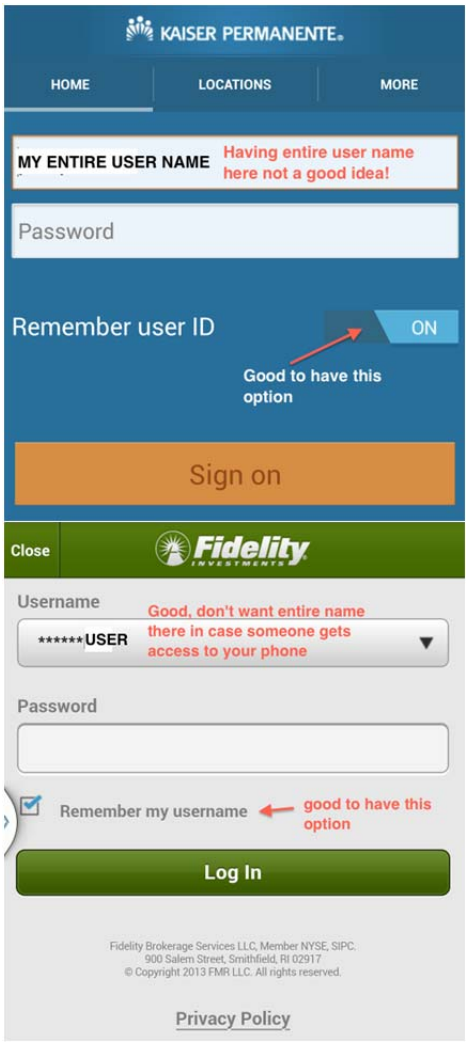

Fig. 4. Security/Confidentiality implementation on a mobile app.

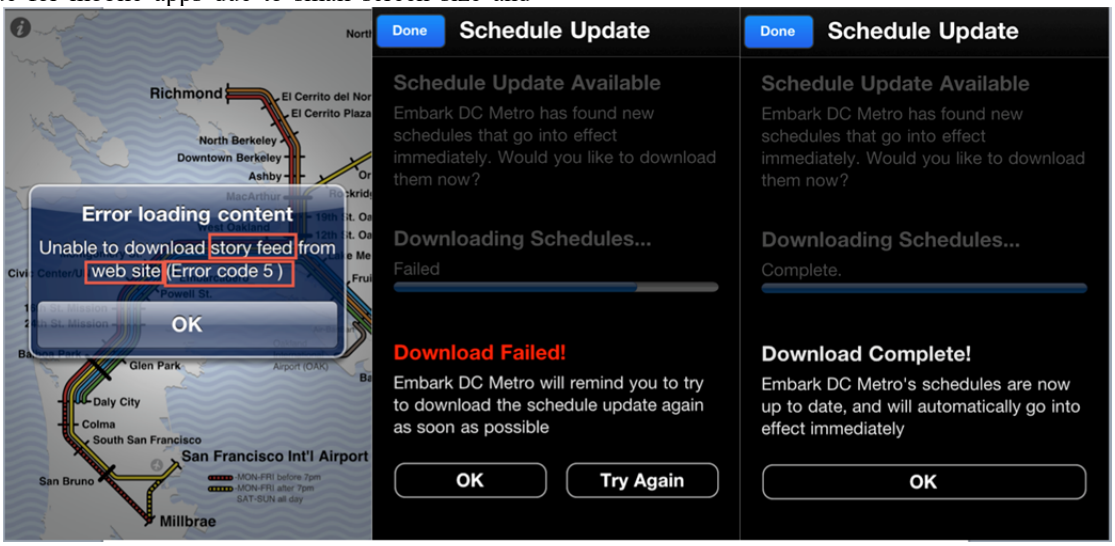

Fig. 5. Mobileapp examples of user error protection.

Product characteristics such as these above commented, would have led to distrust 20 years ago, but today because of user expectations, this has been accepted. This is just one example of how the environment and context is constantly changing and influencing product/system design, the end user's perception and UX in the mobile age.

QinU and any of its characteristics must be evaluated with perceptions, actual tasks and contextual factors in mind. In the real world, one of the most critical factors influencing trust is the risk tolerance of the user which is also dependent on the task they are trying to execute. For example, naturally for a financial app or when providing financial data such as our credit card number, or social security number, risk tolerance is much lower than a news application.

So, in the end, the actual trust experienced by the end user is not only dependent on the system's trust characteristic related implementations (Section III), but also the user in a specific context.

V. Conclusions and Future Work

Globalization was catapulted by the Internet in the late 1990's and first decade of the millennium. In the last decade, mobile smartphones have made Internet access ubiquitous, with "there's an app for that" becoming common everyday language. Now, as the breadth of mobile software grows and the mobile world continues to expand into an Internet of things, designing, evaluating, and improving the end user's trust in these mobile apps requires systematic strategies and approaches.

In this vision paper, our contributions have focused on the identification of characteristics and sub-characteristics of quality models borrowing from many general-accepted ISO 25010 modeling characteristics, concepts and relationships, adding and rephrasing others. We have also instantiated and further developed our previous work with 2Q2U where we have addressed potential influence relationships between the modeled system characteristics and QinU satisfaction and trust.

Additionally, we have also shown mobileapp examples of some of these system characteristics with the goal of depicting how implementing these external quality characteristics and sub-characteristics may influence end user trust in their mobile apps.

The next steps in our future work are twofold.

First, we will use this external quality model to transform the sub-characteristics into Likert-like scale questions to determine weights for each characteristic's importance to a given end-user type. This will be done by performing a user survey with primary and expert users (statistically significant) for several mobile apps in order to gauge the relevance of the model's proposed characteristics. This will enable us to determine those sub-characteristics that can influence trust.

Second, we will then use this as a basis to iterate the application to include those changes, and then measure and evaluate trust again, as we did in previous works using SIQinU. Through SIQinU, our ultimate goal is to improve the trustfulness of the application by determining relationships between the system quality attributes that influence trust for the end user when actually using the system (in-use).

Acknowledgment

This work and line of research are supported by Science and Technology Agency of Argentina, in the PICT 2014-1224 project at Universidad Nacional de La Pampa.

References

[1] Apple iOS Human Interface Guidelines https://developer.apple.com/ios/human-interface-guidelines/visual-design/, retrieved by March, (2017).

[2] Bart Y., Shankar V., Sultan F., Urban G.: Are the Drivers and Role of Online Trust the Same for All Web Sites and Consumers? A Large Scale Exploratory Empirical Study. Journal of Marketing, 69:(4), pp.133-152, (2005).

[3] Bevan N.: Extending Quality in Use to provide a Framework for Usability Measurement. LNCS 5619, Springer, HCI Int'l 2009, San Diego, USA, pp. 13-22, (2009) .

[4] Budiu R.: The State of Mobile User Experience, Nielsen Norman Group, March 22, (2015), https://www.nngroup.com/articles/mobile-usability-update/, retrieved by March, (2017).

[5] Covey S., Merrill R.: The SPEED of Trust: The One Thing that Changes Everything, Free Press, 384 pgs., (2006).

[6] Google User Interface Guidelines: https://developer.android.com/guide/practices/ui_guidelines/index.html, retrieved by January, (2017).

[7] Harley A.: Trustworthiness in Web Design: 4 Credibility Factors, Nielsen Norman Group,May 8, (2016), https://www.nngroup.com/articles/trustworthy-design/, retrieved by March, (2017).

[8] Hoffman L., Lawson-Jenkins K., Blum J.: Trust Beyond Security: An Expanded Trust Model, Communications of the ACM, 49:(7), pp. 94-101, (2006).

[9] ISO/IEC 25010: Systems and software engineering. Systems and software Quality Requirements and Evaluation (SQuaRE). System and software quality models (2011)

[10] Lew P., Olsina L., Becker P., Zhang L.: An Integrated Strategy to Systematically Understand and Manage Quality in Use for Web Applications, Requirements Engineering Journal, Springer London, 17:(4), pp. 299-330, (2012).

[11] Lew P., Olsina L.; Relating User Experience with MobileApp Quality Evaluation and Design. LNCS 8295, Springer, Current Trends in Web Engineering, ICWE Int'l Workshops, Q.Z. Sheng and J. Kjeldskov (Eds.), Aalborg, Denmark, pp. 253-268, (2013).

[12] Microsoft, How to Design a Great UX, https://msdn.microsoft.com/library/windows/desktop/dn742462.aspx, retrieved by March, (2017).

[13] Moraga M., Bertoa M., Morcillo M., Calero C., Vallecillo A.: Evaluating Quality-in-Use Using Bayesian Networks. In QAOOSE 2008, Paphos, Cyprus, pp 1-10, (2008).

[14] Olsina L., Lew P., Dieser A., Rivera B.: Updating Quality Models for Evaluating New Generation Web Applications. Journal of Web Engineering, Special issue: Quality in new generation Web applications. Rinton Press, US, 11:(3), pp. 209-246, (2012).

[15] Rivera M.B., Becker, P., Olsina L.: Quality Views and Strategy Patterns for Evaluating and Improving Quality: Usability and User Experience Case Studies, Journal of Web Engineering, Rinton Press, USA, 15:(5&6), pp. 433-464, (2016).

[16] Rotter, J.B.: Interpersonal trust, trustworthiness, and gullibility, American Psychologist, Vol. 35, pp. 1-7, (1980).