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Evaluation of Setup Procedures on Mobile Devices based on Users' Initial Experience

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Abstract
Users' initial perceptions of their competence are key motivational factors for further use. However, initial tasks on a mobile operating system (OS) require setup procedures, which are currently largely inconsistent, do not provide users with clear, visible and immediate feedback on their actions, and require significant adjustment time for first-time users. This paper reports on a study with ten users, carried out to better understand how both prior experience and initial interaction with two touchscreen mobile interfaces (Apple iOS and Google Android) affected setup task performance and motivation. The results show that the reactions to setup on mobile interfaces appear to be partially dependent on which device was experienced first. Initial experience with lower-complexity devices improves performance on higher-complexity devices, but not vice versa. Based on these results, the paper proposes six guidelines for designers to design more intuitive and motivating user interfaces (UI) for setup procedures. The preliminary results indicate that these guidelines can contribute to the design of more inclusive mobile platforms and further work to validate these findings is proposed.

Keywords: setup procedures, user interface design, android, ios, prior experience, touchscreen devices, motivation, ICT

Introduction

Given the importance of first-time use as a key element in motivating the digitally excluded to use new technology, this paper focuses on using theories of motivation, such as Self-Determination Theory [1] and Flow Theory [2, 3], in line with similar past work [4] to make setup tasks maximally motivating and to establish new design practices for consistent initial setup tasks.

Although the effect of prior experience on initial user interactions has been well documented [5, 6] this work has not been effectively transferred to the improvement of setup procedures, with the focus instead being on the user interfaces post-setup. This paper investigates how the research on prior experience could be applied in this area with the additional assumption that the products/services optimised for users with limited or non-existent technological experience will also be easier for everyone to use.

Methods

This study aimed to understand how both prior experience with touchscreen mobile interfaces and initial interaction with an interface affected setup task performance and reaction to both the task and interface. The data collection methods were comprised of two questionnaires as well as observations of users attempting a setup task and a regular use task.

Questionnaires

Two questionnaires were used over the course of the study to aid this investigation. The first was a Technology Familiarity Questionnaire, which gathered information regarding participants' previous experience with mobile devices in addition to mobile device ownership and frequency of use. The second questionnaire was the Intrinsic Motivation Inventory [7], a 22-item inventory that gathers information about users' task enjoyment, perceived competence, anxiety, and feelings of autonomy.

Study Procedure

Participants were first asked to fill out the technology familiarity questionnaire. Upon completion, they were asked to set up an email account (a pre-existing Gmail account) on two tablet devices, one running an iOS operating system and one running Android, and then to send an email from that account. Which device was set up first was counter-balanced across participants predetermined prior to meeting the users. After each setup task, participants were asked to fill out the Intrinsic Motivation Inventory. Participants were asked to think aloud during the task, and all sessions were video-recorded.

All experimental sessions occurred in a laboratory setting. Prior to the sessions, all participants were asked to read and sign a consent form that complied with ethical guidelines devised following ethical standards and codes of practice of the British Psychological Society. Participants were also given a sheet with written instructions explaining what the study required them to do.

Sample

Study participants were recruited through personal connections in Cambridge, UK. Since it was previously found [8] that the technology generation and age of a product user will affect their expectations and skills to interact effectively with a product, it was important to recruit users from different age groups for this study. The initial sample included 12 participants, two of whom were excluded randomly from the final analysis to ensure the correct counter-balance. The final sample had ten participants (four females, six males) and included at least three participants in each predefined age groups (20-39, 40-55, 56+) in order to investigate any potential role of age in prior experience, task success, and participant reaction.

Results

This section reports on the results from the Technology Familiarity Questionnaire, the motivation questionnaire and the user observations.

Technology Familiarity Questionnaire

Norman (2002) [9] posits that young users are more open-minded about employing novel problem solving strategies and are less afraid of making errors. Older individuals are believed to employ slower approaches to reduce the risk of error when interacting with technology [8]. Based on these previous findings, the initial assumption in this study was that younger users would be more familiar and at ease with using mobile touchscreen-based devices than their older counterparts. However, at least with respect to prior experience with modern mobile

devices, only a slight generational effect between the three age cohorts was observed in this study. In particular, by grouping users according to their previous touchscreen device experience, it was found that the level of experience varied in the youngest age group as widely as it did in the other age groups, regardless of the fact that all users in the youngest age group had touchscreen device experience. It would be important to investigate this in the future with more participants from each age group.

Furthermore, all but two participants used their mobile phones daily. Three out of ten users owned and used a touchscreen mobile phone and only one user used a tablet device daily, while three additional participants used a tablet device monthly or less frequently. Eight participants had previously setup their mobile phones on their own, of which six had setup email and calendar functions, nine had setup contact lists, one had setup a back-up solution, and one had setup a multimedia account.

Setup

To illustrate the dynamics of an interaction session, the task was defined as setting up an IMAP (Internet Message Access Protocol) email account on a freshly installed Apple iPad running iOS 5.1 and a Samsung Galaxy Tab running Android 4.0. Whilst this walkthrough of a setup procedure fails to recognise specific abilities of the user, it aims to clarify the differences in setup procedures in relation to regular use tasks.

Timing

One of the aims of this study was to measure differences in how long participants took to complete setup tasks and to investigate any effects on user motivation. Both setup time and overall time were measured and then broken up into an average time per step[1] within the setup procedure. This allowed for an analysis of timing independent of the setup route taken. In addition, the ratio of correct steps to overall steps was calculated for each participant. Setup times are shown in Figure 1.

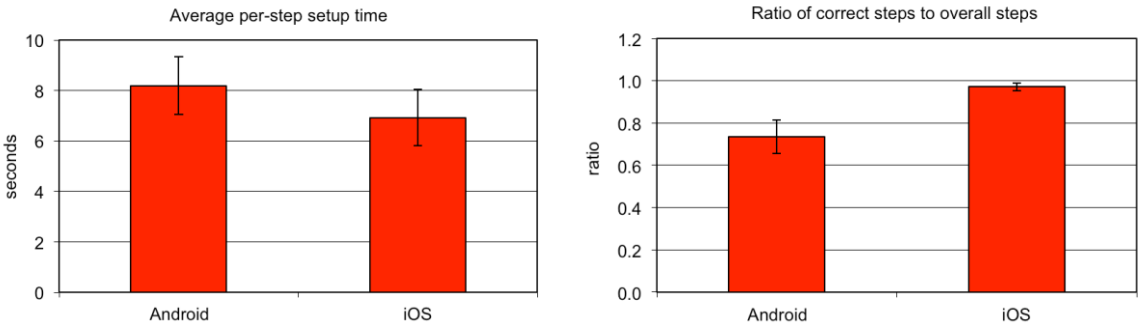

Figure 1: Average setup time and setup ratio on each device

Overall, the iOS setup tasks took less time than the Android setup tasks. In addition, the ratio for iOS was significantly better compared to Android ($t(7) = 3.532$, $p < 0.05$)[2]. However, there was a good deal of variation depending on which device was used first. The Android setup time seemed to be improved by using an iOS device first (as shown in Figure 2), but the

[1] A *step* is defined as an individual registered interaction with the device, excluding typing.

[2] Three participants did not understand the instructions and hence did not complete the task and were excluded from the analysis; participants that understood the instructions but did not complete the task were included in the

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correct step ratio suffered, indicating perhaps that experience with the iOS system was not entirely transferrable to the Android interface. In contrast, initial experience with an Android device did not seem to improve iOS timing or ratio. This data would seem to indicate not only that the iOS system is easier to set up, but also that initial experience with a lower-complexity device improved performance on a higher-complexity device, but not vice versa.

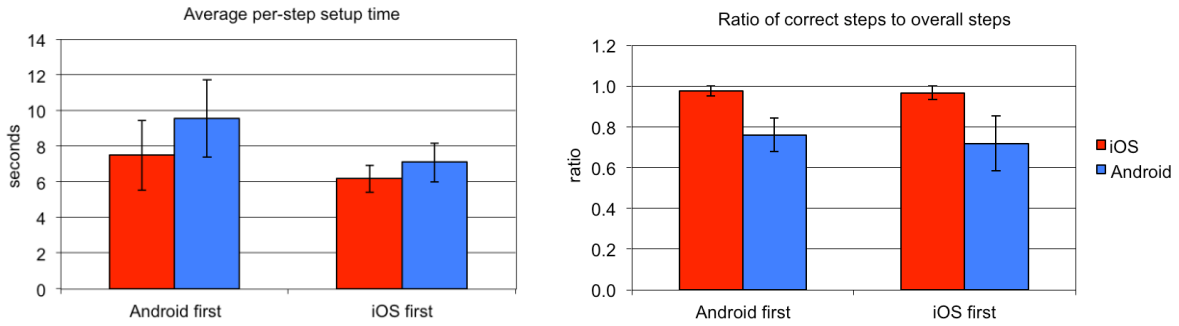

Figure 2: Setup times and ratios separated by which device was used first

It bears mention that one participant took significantly longer on the setup tasks than any other participant but has not been removed from analysis due to the already small number of participants. This participant was also in the oldest age group and had relatively low levels of prior experience with touchscreen mobile technology, so inclusion in the analysis was appropriate as low-experience users are often those most excluded by setup procedures.

Setup Quality Descriptor

Based on these results, a new setup quality descriptor can be introduced that defines the ratio of per step timings of a setup task (e.g. setup of email account) and per step timings of a first-use regular task (e.g. sending the first email) of the same user. This can easily be determined and allows the designer to see if his/her setup procedure requires a significantly longer time on average, per step, than the regular use task.

Motivation Questionnaire

In order to gain insight into motivational effects of setup procedures, the 22-question form of the Intrinsic Motivation Inventory [7] was used to assess participants' reaction to each interface after their experience with each device. During analysis, sets of questions measuring Interest/Enjoyment, Perceived Competence, Pressure/Tension (anxiety), and Autonomy were combined into a score for each sub-inventory. The results are shown in Figure 3.

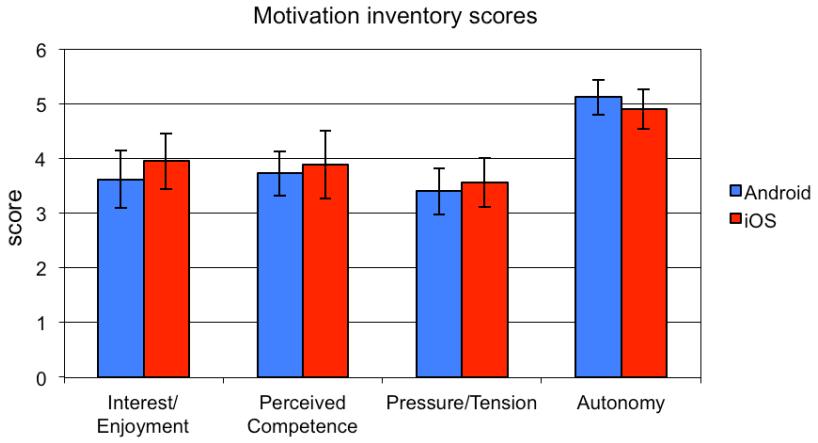

Figure 3: Overall motivation inventory scores

There were no apparent differences in the overall reaction to each device; both Android and iOS devices received nearly identical motivation evaluations when device order was not accounted for. In general, however, participants seemed to find the iOS setup task easier, with the timing for iOS setup being nearly a minute faster and the ratio of correct to incorrect actions being about 20% higher.

When device order is accounted for, however, the data paints a much different picture. The reactions to both Android and iOS seem at least partially dependent on which device is experienced first, as shown in Figure 4. For example, the Interest/Enjoyment of an iOS device was markedly higher if the higher-complexity Android device was experienced first. Anxiety during use was also lower for the Android after iOS experience.

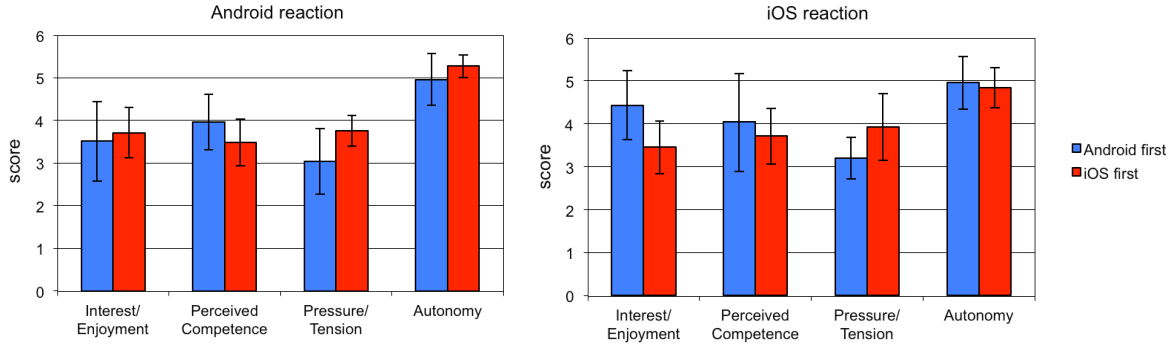

Figure 4: Inventory scores by device separated by which device was used first

In addition, the questionnaires show that experience gained during the exposure to the first tablet device used (regardless of whether it was Android or iOS platform) improved participants interaction with the second tablet.

Prior experience with mobile phones and touchscreen devices did not correlate significantly with motivation. Positive correlations were unsurprisingly found between setup time on the iOS platform and those who had set up similar email and calendar applications before, but no other significant correlations were found. Similarly, age correlated negatively with perceived competence scores ($r(10) = -.634$, $p < 0.05$) but not with any other questionnaire items.

Due to the small number of participants in this study, it was not possible to reach statistical significance for any comparison of mean response values. Nonetheless, the trends present in the data indicate several interesting areas for further investigation.

Setup Design Options

Before data was collected, the available routes through the setup procedure on each device were analysed and subsequently categorised. The categorisation of these pathways is shown in Figure 5. Decision points throughout the route of a setup procedure are defined by this categorisation and can be analysed relative to user efficiency given the nature of the task, the clarity of the goal of the task, and the breadth of prior experience of the user.

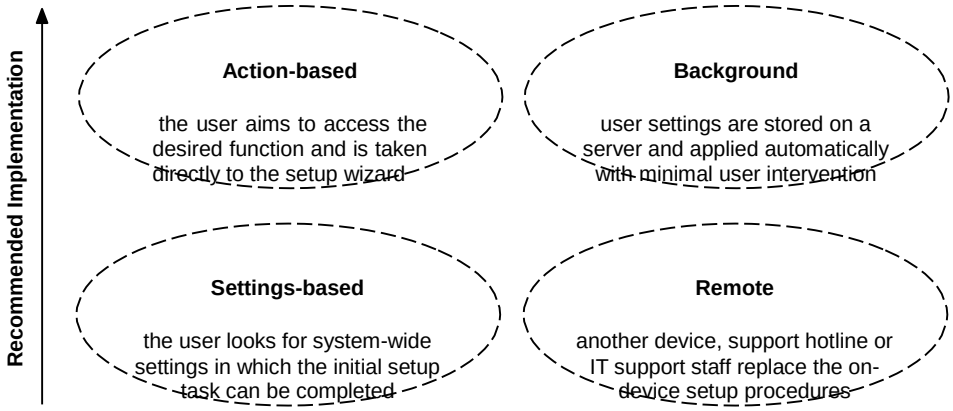

Figure 5: Categorisation of setup procedures [10]

Summary

It is clear from the motivation inventories, timing and ratio data that initial experience has an important effect on future user experience. A larger pool of participants would likely be able to reveal various ways in which positive and negative initial experiences with a setup procedure affect future learning of, and reaction to, the device. Correlations from the inventories also confirm the existing theoretical basis for the motivation aspect of this research, specifically showing strong correlations between sub-inventories like Interest/Enjoyment, Perceived Competence, and Autonomy as predicted by Self- Determination Theory (the theory on which the Intrinsic Motivation Inventory is based).

Guidelines

The investigation described above can inform guidelines for improved setup design on touchscreen mobile platforms. The following guidelines may also have implications for other touchscreen UI implementations such as car navigation, in-flight entertainment, and retail payment systems.

1. Most participants in this study chose an action-based approach (see Figure 5) – this approach should inform the design of UI architectures. Nonetheless, **the designer should cater for both action-based and settings-based users but with a bias for the former.**

2. A 'background' setup procedure is inherently simpler and relies less on a high level of prior experience and technological familiarity. For these reasons, similar to Guideline 1, **a background setup procedure should be prioritised over remote setup**.

3. User motivation is critical to both interface setup and future interface use. According to Flow Theory [2], clear goals and immediate feedback are necessary to generating an intrinsically motivating experience. As such, the steps leading up to entering the setup procedure are extremely important. **The system should provide the user with a clear, motivating pathway to setup and prompt setup of certain tasks if necessary**.

4. Nearly all participants desired clear and visible feedback (as would be predicted by Flow Theory). **UI designers should not only use subtle animations but also dedicate entire feedback screens** that can be clicked away **to indicate that a task was successful.** Furthermore, **designers may wish to make feedback levels adjustable**, based on the user type.

5. Interface features and task-action sequences that account for the effects of prior experience will be significantly easier to learn and use. However, experience can be negative in situations where similar interface features are associated with different system responses, which may be the case with touchscreen interfaces by different manufacturers. To allow for more intuitive and effective interaction, **a system should account for what people already know** and **the appearance and behaviour of new interface features should be based on previously well-learnt and transferable features**.

6. **Designers should design the setup task so that the average per step time for setup procedures** (e.g. setting up an email account) **is equal to or less than the average per step time of first time use** (e.g. sending the first email).

Conclusions

This paper highlights the importance of improving mobile touchscreen UI setup procedures. Initial tasks on a mobile OS first require setup procedures but are currently largely inconsistent. Because users' perceptions of being able to use software are highly dependent on the success of their first interaction with the software, easy and efficient setup procedures are crucial for creating an overall positive user experience. After comparing user reactions to the same setup task on two different platforms, the following guidelines for setup were developed based on the assumption that users' initial perceptions of competence are key motivational factors for further use [11]:

1. Action-based setup procedures should be used whenever possible.

2. Background setup procedures should be used whenever possible.

3. The interface should motivate the user to complete a setup task.

4. The setup procedure should include clear and immediate feedback.

5. The setup procedure should account for what people already know.

6. Per step, the setup task should ideally take less time than a regular use task.

The findings of this paper are based on consumer tablet devices, but the associated guidelines have widespread applicability in many fields of touchscreen design paradigms, ranging from consumer devices to industry terminals. Nearly every touchscreen device requires the completion of a setup procedure, and this trend will become more dominant with increasing availability of user-customised services on a growing number of platforms. Furthermore, due to the growing presence of touchscreen UIs as the primary interface in a range of products, these guidelines are not only of importance to mobile device and app developers, but are of growing significance to industrial designers in all fields.

Further work aims to validate the proposed guidelines with a larger sample, dedicate studies to the impact of feedback during and after setup procedures, and devise studies to explore the differences between motivation dictated by UI-features and motivation dictated by prior experience.

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