Abstract

In non-game web applications, one of the problems in User Interface (UI) design is that not all users will perceive the UI as easy to use. If the users are unable to perceive the UI as easy to use, problems in user experience may arise, this is especially so for users using web applications for cloud-based chat and collaboration web services. In order to tackle this problem, this study will identify if the freedom of the user to customize his/her own UI is proportional to the user’s perceived ease of use (PEOU) of the UI. A random sample of 50 participants aged 15 to 35 years were invited to use Dropbox™, Google Drive™ and Microsoft’s OneDrive™, before being interviewed about their individual user experiences for each menu interface type. It was found that the ability of the user to customise own UI is linked to the user’s sense of control over the UI. Since the sense of control over the UI is illustrated to directly impact perceived user efficiency levels, it is highly likely that the customisability is proportional to user’s PEOU of the UI. Thus by developing a software that can allow both developers and users to collaborate and cooperate in the creation of user preferred UI design would be able to enhance user satisfaction.

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Keywords: Human-centred user interface design design; Customisability; Adaptable UI; Perceived ease of use; Cloud computing; User experience

1. Introduction

Among the project-based collaboration web services available, usage of file storage, sharing and collaboration web applications have been on the rise. With the cloud computing market at $8.1 billion, and there being 300 million, 200 million, and 250 million end users for Dropbox™, Google Drive™ and Microsoft’s OneDrive™

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respectively, the audience being catered to is ever-growing [1, 2, 3, 4]. The user interface (UI) design, however, is not yet fully adaptable for the average consumer. This is an issue, as there can be no “one-size-fits-all” design, given the sheer size of the target audience, and their presumably equally diverse needs. A customizable user interface design, on the other hand, benefits both the client and the developer – it gives freedom to the client to create a platform specific to his/her own needs, and such a function would help the developer cater to a wider range of customers.

Therefore, this research study investigated how user experience can be enhanced through customizable UI design in an academic setting. The aim is to find an answer to the research question: “Is the freedom of the users to customise their own UI proportional to their perceived ease of use of the UI?”

The participants who undertook this study were students aged 18 to 23 years, and studying in Singapore. The Technology Acceptance Model (TAM) was applied in this study [5], where enhancement of user experience was measured in terms of the Perceived Ease of Use (PEOU) of a particular UI, which leads to acceptance of that UI. To answer the research question, the following hypotheses that users will perceive a web application is easy to use will be discussed:

- (H1): Their mental model of how it works corresponds to how it actually works
- (H2): They feel they are in control while using the application
- (H3): The application shows clarity, and
- (H4): When they perceive that the application is easy to use, they will complete more tasks in that application within a shorter duration.

### Nomenclature

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Customisable UI</td>
<td>User controls change exhibited by UI (or: adaptable)</td>
</tr>
<tr>
<td>Adaptive UI</td>
<td>System controls change exhibited by UI</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>Degree to which a person believes that using a particular system would be effortless (PEOU)</td>
</tr>
</tbody>
</table>

#### 1.1. PEOU

PEOU is defined as the “degree to which a person believes that using a particular system would be free from effort”. It is critical in studying user response to Information Technology (IT) as it has been indicated to affect usage intention, or motivation to use, of a particular technology [5]. According to TAM, perceived usefulness and perceived ease of use motivate technology usage and acceptance.

It follows, then, that if users are unable to perceive the UI of an application as easy to use, problems in user experience may arise, and these problems would deter and discourage the user from using the application. It has been shown that students will only consider cloud computing to be effective if they find that there is no additional effort needed to learn how to use it [5]. Most of these students, however, will in time be employed in various companies. Considering how cloud services are so widely used in the business world, it would only be most favourable, to both company and student, that the student finds such services to be effective in an academic environment from the very beginning.

Cloud computing provides invaluable benefits to students, such as cost-effectiveness and worldwide accessibility, and can be used for group projects and online classes [5]. Despite this, students have a variety of needs, all of which are not necessarily addressed by a single cloud computing user interface. Interfaces designed to address the general user’s needs often do not address needs of the individual users. A custom-built UI would be more appropriate, as it caters directly to such needs [6]. On the other hand, concurrently using several of such services would mean extra effort on the student’s part to learn how to navigate and utilize each website. A single cloud service is insufficient, and using too many could become tedious. Such tedium would lead to a low PEOU, and hence lower probability of acceptance of cloud computing by the student [5].
A possible solution to this issue could come from how cloud computing is used in a business setting. Studies on the use of cloud services for project management by business indicate a growing trend of customisability, with the reasons cited being the diverse needs of individual employees, varying data security regulations, and difference demands of different companies [7, 8].

Thus, how cloud customisation can enhance the perceived ease of use of the application by students in Singapore became the focus of the study.

1.2. Dropbox™, Google Drive™, and OneDrive™

Dropbox™, Google Drive™ and Microsoft’s OneDrive™ were chosen due to their popularity as project management, team collaboration and online storage tools. Dropbox™ is used in various ways in nearly 4 million business with clients like National Geographic [3, 4]. Google Drive™ had an estimated 175 million regular active users as of July 2013 [2]. A 2014 report from BI Intelligence indicates nearly 90% of internet users worldwide use cloud services, and Microsoft OneDrive™ is catching up position-wise in the consumer cloud space, alongside Google Drive™ [1]. These figures, however, may not accurately reflect the situation in Singapore.

1.3. Customisability and PEOU

Customisability of a UI, defined as the user controlling the change exhibited by the UI, entails both consistency of content available and accuracy of action executed by the system in response to user input [9, 10]. Findlater and McGrenere [11] carried out a study and found that the adaptable interface was preferred against static and adaptive interfaces. They also suggested that enabling users to control their UI design resulted in higher perceived efficiency levels, and thus greater overall satisfaction. Prior to Findlater and McGrenere’s [11] work, Reinecke and Bernstein [12] had also showed that users’ perceived usability of the customizable UI caused their performance to increase, and the expected level of effort required to use the customised UI effectively was decreased. Hence, the customisable UI was preferred. This indicates that the enhanced usability experienced by a user when allowed to customise his own UI has a direct impact on the user’s PEOU of the UI.

2. Method and materials

Fifty students studying in Singapore, aged between 18 and 23 years, were invited to participate in a questionnaire and interview about the UI design of Dropbox™, Google Drive™ and OneDrive™. Of the 50 questionnaires circulated, 39 responses were received. Of these 39 respondents, 17 were interviewed.

The interviews were conducted while the respondents used each of the three interfaces to complete two tasks, to share files with three peers and to communicate with at least one peer via the interface in the respective mobile apps. All interviewees have accounts in the three applications. The interviews intended to analyse the usability of the sites in terms of controllability and efficiency.

3. Results and discussion

Approximately 70% of respondents used file sharing and cloud storage services at least once a month. 47% used cloud computing for file access and sharing with peers while only 25.5% used it for team collaboration during projects. 78% found Google Drive™ most effective for such tasks, 22% cited Dropbox™, but none found OneDrive™ to be as effective.

During the interview session, all participants were able to complete both tasks (sharing of files with 3 peers and communicating with at least one peer via the interface in the respective mobile apps) in less than three minutes for Google Drive™ and Dropbox™ with minimal mistakes, but on average spend about five minutes for OneDrive™, with multiple instances of trial and error.

Of the seventeen students interviewed, eleven of them (64.7%) felt most in control whilst using Google Drive™, and the reasons most commonly cited were that of having used it for a long time. Six students (35.3%) felt most in
control using Dropbox™. Reasons being that it was clear and organised, and thus easy to intuitively derive how to accomplish a certain task. This indicated a lack of familiarity with OneDrive™, which could be due to their being exposed to Google Drive™ and Dropbox™ more often, and little need to find an alternative to these two sites.

The mistake-free navigation of Dropbox™ and Google Drive™ indicated that the participants’ expectation of how both sites worked corresponded to how it worked in reality. Their mental models of the two sites were thus aligned with the information architecture of the sites. This was also indicative of a relatively higher sense of control when using the UI of these two, particularly of Google Drive™, as compared to when using OneDrive™. There is therefore a link between H1 (mental model leads to PEOU) and H2 (sense of control results in PEOU).

The higher efficiency levels of participants while using Dropbox™ and Google Drive™ showed that their sense of control over the UI increased usage efficiency. This shows that H2 has a direct impact on H4 (PEOU leads to greater usage efficiency).

For qualitative feedback of the UI design in the questionnaire, a continuous numerical scale from 1 to 10 was used. The results are shown in Table 1.

<table>
<thead>
<tr>
<th>Property tested of UI</th>
<th>Number range on scale</th>
<th>Interpretation of scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clarity</strong></td>
<td>1 – 2</td>
<td>Extremely unclear and difficult to understand</td>
</tr>
<tr>
<td></td>
<td>3 – 4</td>
<td>More information would be required prior to gaining ability of self-navigation</td>
</tr>
<tr>
<td></td>
<td>5 – 6</td>
<td>Clear enough for self-navigation with some trial and error</td>
</tr>
<tr>
<td></td>
<td>7 – 8</td>
<td>Self-navigation with minimal trial and error</td>
</tr>
<tr>
<td></td>
<td>9 – 10</td>
<td>Extremely clear and intuitive; self-navigation with no trial and error</td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td>1 – 2</td>
<td>Very difficult</td>
</tr>
<tr>
<td></td>
<td>3 – 4</td>
<td>Difficult</td>
</tr>
<tr>
<td></td>
<td>5 – 6</td>
<td>Neutral</td>
</tr>
<tr>
<td></td>
<td>7 – 8</td>
<td>Easy</td>
</tr>
<tr>
<td></td>
<td>9 – 10</td>
<td>Very easy</td>
</tr>
</tbody>
</table>

25% of the questionnaire respondents found the Dropbox™ UI to be extremely clear and intuitive, and were capable of self-navigation with no trial and error (ranked 9-10). 62.1% found the Google Drive™ UI to be clear and self-navigation was possible with minimal trial and error (ranked 7-8). 65.7% found that OneDrive™ was clear enough for self-navigation with some trial and error (ranked 5-6).

For the interviewees, although they were able to understand the layout and functionality of the sites, they still expressed dissatisfaction about the following aspects of the UI design:

- Functions of Dropbox™ sidebar were unclear
- Icon function in Dropbox™ were unclear
- Thumbnails used in Google Drive™ menu made it appear cluttered
- More clicks were required to access hidden functions in OneDrive™, causing difficulty in navigation
- OneDrive™ has a cluttered and non-intuitive dashboard layout design

This indicated that most of the participants preferred Dropbox™ and Google Drive™ to OneDrive™, however, Google Drive™ appeared to be the most popular interface by comparison.

On the whole, 91.9% felt that being given the ability to customise would increase their level of efficiency. 81.1% felt that they would be able to complete their tasks more efficiently if all the three UIs were consistent in appearance and functionality. This supports earlier literature on how consistency of content available to the user after
customisation is required before a customised UI can be desirable to an individual. Once again, users had perceived that control over their UI would increase their own efficiency.

66.7% of the questionnaire respondents found Dropbox™ to be either neutral or easy to use. 72.3% felt that Google Drive™ was either neutral, easy/very easy to use. For OneDrive™, 27.1% felt that it was easy to use. This indicates that the majority of the participants found Google Drive™ to be easy to use. Similarly, majority of the participants found that Google Drive had a clear and intuitive UI design. Hence, H3 (clarity leads to PEOU) is supported.

4. Conclusion

Considering that Dropbox™ and Google Drive™ fared the best in terms of clarity of the UI, and that the Google Drive™ UI was reported to bring about the highest user efficiency levels due to the majority of participants feeling most in control with that UI, it can be postulated that clarity, and sense of control are prerequisites for a UI to be perceived as easy to use. Correspondence between expected and observed result while interacting with the UI has also been shown to be clearly linked with these factors, particularly with the user’s sense of control. Thus, hypotheses H1 to H3 were supported.

In this study, the user’s sense of control over the UI is illustrated to directly impact the perceived user efficiency levels, however, it is unclear if user efficiency is directly affected by user’s PEOU of the UI.

Since the ability of the user to customise his own UI is linked to the user’s sense of control over the UI, it is highly probable that the customisability is proportional to user’s PEOU of the UI. However, the limitations of this study make it difficult to conclude this relationship in the affirmative. Thus, to obtain a conclusive result for hypothesis 4, and likewise for the research question, a future experiment investigating user performance while using a customizable UI could be carried out. Sample size could also be increased. Further research could also be carried out to explore how customisability affects the user’s control over an UI.

This study, however, has explored the user activity pertaining to Dropbox™, Google Drive™ and OneDrive™, and found that Google Drive™ is the most popular among locals in an academic setting. The potential demand for customisability has also been identified. More studies on how customisability of the Google Drive™ interface might enhance user performance in Singapore schools could be carried out. The implications these might have on education can also be explored. Table 2 on the following page summarized the findings obtained in this study.

Table 2. Summary of findings obtained from this study

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Status</th>
<th>Remarks</th>
<th>Future Research Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 User’s mental model of how UI works corresponds to how it actually works results in PEOU</td>
<td>Supported</td>
<td>Participants could use Dropbox™ and Google Drive™ quickly with minimal mistakes, showing they were clear of how to complete given tasks using these UIs. This indicates how they expect the UI to work is the same as how it works in reality.</td>
<td>Increase sample size</td>
</tr>
<tr>
<td>2 Users feel sense of control when using UI results in PEOU</td>
<td>Supported</td>
<td>Google Drive™ UI was reported to bring about the highest user efficiency levels due to the majority of participants feeling most in control with that UI. Majority of participants considered Google Drive™ to be easy to use. User’s sense of control appears to be proportional to usage efficiency, and also directly affects PEOU. Can be considered a prerequisite of an easy-to-use UI.</td>
<td></td>
</tr>
</tbody>
</table>
Hypothesis | Status | Remarks | Future Research Direction
--- | --- | --- | ---
3 Clarity of UI enables PEOU | Supported | Approximately two-thirds of the participants found the UI of Google Drive™ clear, and about 70% of these participants found Google Drive™ easy to use. Google Drive™ was consistently the preferred UI amongst the participants. Thus, there is a clear relationship between clarity and enhanced PEOU. |  

4 PEOU results in greater usage efficiency | Inconclusive | User’s sense of control over UI is directly proportional to usage efficiency; however, it is not clear if usage efficiency is due to PEOU caused by sense of control or simply by sense of control alone. Investigate user performance using a customizable UI |  

Research Question

Is the freedom of the users to customise their own UI proportional to their perceived ease of use of the UI?

Inconclusive | Three things were considered: Customisability of UI linked to user’s sense of control over UI User’s sense of control increases user performance efficiency User’s sense of control is a prerequisite to an easy-to-use UI Thus it is highly likely that customisability directly impacts PEOU. However, the nature of this relationship, whether proportional or not, remains to be affirmed. It should also be noted that there is an underlying assumption that customisability will only enhance PEOU if the customisation mechanism is intuitive and effortless. Investigate how customisability affects user control over UI |  

References


