Investigating the Impact of Familiarity and Product Conditions on the Ease of Use of a Product

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ARTICLE INFO

ABSTRACT

Ease of use is one of the main criteria that customers consider when making a purchase decision. In order to provide a pleasant experience to the customers, offering products or services consisting of advanced features and functions is no longer enough, due to the existing competition in the global market. In reality the ease of use of any product is influenced by the conditions of the product and the familiarity of the user. This study examines the influence of the familiarity and the product conditions on the ease of use of a product and the results would be a valuable guidance to the manufacturers in order to identify how the ease of use level of a product deviates from the standard level, when the usage hours of the product would increase.

Introduction

In recent years, manufacturers have given priority on creating value for their customers in the form of experiences. In order to provide a pleasant experience to the customers, offering products or services consisting of advanced features and functions is no longer enough, due to the existing competition in the global market (Johnston and Kong, 2011). Therefore, designers are attracted towards improving the ease of use of products in order to increase the customers' satisfaction.

People nowadays expect the product they purchase to be easy to use, to function properly for a long period of time and that the product can be repaired and used again without any major dispute (Johlke and Iyer, 2013). When considering the previous studies on ease of use and usability, the declining conditions of the product with time has been considered as the sole factor that affects the ease of use, and the other factors have been considered as constant (Sahan, 2017).

However, in practice the user of any product gets familiar with a product when using it for a particular period of time (Flavian and Guinaliu, 2005). According to Luhmann et al., (1988), familiarity is the knowledge people have of a product, based on their experience and previous contacts.

Over the usage phase of a product, due to the continuous use the conditions of the product decreases, even though the familiarity of the user increases. This study examines the behavioral pattern of the ease of use of a product, with the influence of familiarity of the user and conditions of the product.

Objective of work

Examine the behavioral pattern of the ease of use of a product, with the influence of familiarity of the user and conditions of the product.

Scope and Limitations

● This study does not compare the ease of use of different products. It only explains how the conditions of the product and the familiarity of the user, influence on the ease of use of a product when the usage hours of a product increases.

● A case study would be conducted in order to validate this study.

Relationship of Ease of Use with the Product's Conditions and Familiarity

In order to develop a mathematical model, the relationships between the parameters ease of use, product conditions and familiarity have to be identified. For this purpose, the dimensions of ease of use product conditions and familiarity were studied.

From studying the dimensions of product's conditions and ease of use it is clear that there is a relationship between the two factors. Except the easy to learn property of the ease of use all the other dimensions have significant relationship towards the dimensions of product conditions.

Also, when considering the dimensions of product conditions, expect for the conformance and perceived quality all other dimensions are linked directly towards the ease of use dimensions. This is because these two dimensions of product conditions are applied on a product before the product is operated or used for a particular task. Thus, these two cannot be linked with the ease of use properties.

	Effectiveness	Efficiency	Engaging	Error Tolerance	Easy to Learn
Performance	✦	✦		✦	
Features		✦		✦	
Reliability			✦	✦	
Durability			✦	✦	
Aesthetic Property			✦		✦
Serviceability				✦	
Conformance					
Perceived Quality					

Table 1. Relationship matrix for dimensions of product's conditions and ease of use.

By investigating the dimensions of familiarity and ease of use, it is clear that there is a significant relationship between all the dimensions of ease of use towards the familiarity of a user.

When considering the dimensions of familiarity all the factors generally imply about how the existing knowledge of a certain product influences on the current use of a product. Thus, in general the prior experience and previous exposures help a user in getting experience on a particular product. This results in the ease of use of a product to increase with the increase in familiarity.

Ease of use dimensions					
Familiarity dimensions	Effectiveness	Efficiency	Engaging	Error Tolerance	Easy to Learn
Prior experience	✦	✦		✦	✦
Repeated exposure	✦	✦		✦	
Level of processing	✦	✦			✦
Study duration	✦	✦		✦	✦
Forgetting rate			✦	✦	

Table 2. Relationship Matrix for Dimensions of Familiarity and Ease of Use.

Methodology

Generally, if a user can perform a task using a particular product within the first few trials, that product can be said to be an easy to use product. Effort and focus are the two main factors that influence when attempting any task using a particular product. Effort is the conscious exertion of power or physical force towards a particular task for a given product. When considering the focus, it is the direct attention or the concentration of the user towards a given task.

● **Ease of use behavior with familiarity**

The effort and focus that is exerted in order to perform a certain task depends on the two factors the conditions of the product and the familiarity of the user. In this section the relationship between the familiarity and the ease of use, is discussed with relation to the effort and focus.

When considering the familiarity of a user, it increases with the usage period of a particular product. When this happens the effort and focus a user has to put in order to complete a particular task would decrease. When the user has to exert less effort and focus in order to perform a task it would result in the increase of the ease of use of the product as shown in the graphs given below. Therefore, it is clear that the familiarity and ease of use of a product has relationship towards the effort and focus required to complete a task.
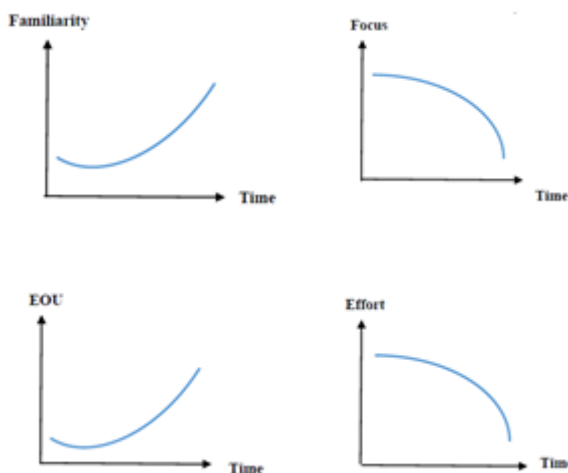

Figure 3. Relationship between familiarity of user and EOU.

● **Ease of use behavior with product conditions**

The product conditions of a particular product also have influence on the ease of use of a product. The way in which these two factors are related to the effort and focus exerted while attempting a task is shown in this section.

When considering the conditions of a given product, during the usage phase of a product deterioration would occur. Due to this decline of product conditions, the user of the product may require to exert more effort and focus when attempting a given task. The increase in the effort and focus would result in the drop of the ease of use of the product, since a lot of time has to be taken in order to perform a task from the product in that instance.
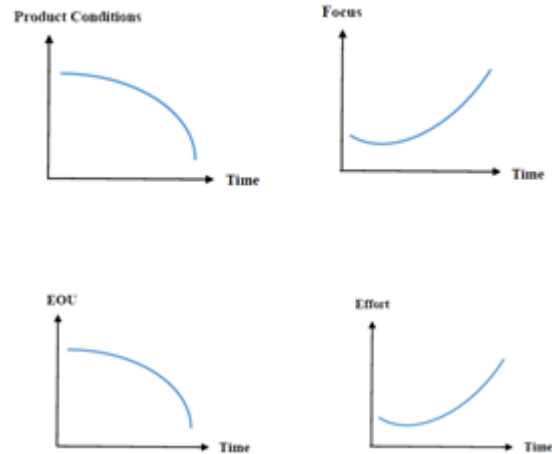

Figure 4. Relationship between products conditions and EOU.

The ease of use of a particular product can be related to the number of attempts a particular user takes to complete a task successfully. If a product is easy to use, a task could be completed using that product in the first couple of attempts. The user may feel the difficultness of a product to increase, with the increase in the number of attempts a user has to take in order to complete a task.

When considering a general task, a certain amount of effort must be exerted by a user to complete it. The effort that a person has to exert consists of two main components, focus and execution. For a general task to be completed every user has to initially focus on it, and that requires a certain amount of time. After a user focus on the task, a certain amount of time is required to execute the task. Therefore, a general task would require more time to complete than an ideal task.
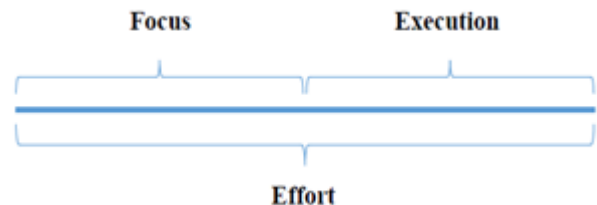

Figure 5. Elements in a general task.

When considering an ideal task, no focus time is required in order to perform the task and thus, the effort the user has to exert would be same as the execution time of the task. This type of task requires less effort when compared to a general task.

Figure 6. Elements in an ideal task.

The familiarity factor was developed based on the concept that in most situations the users require more than one attempt to achieve success. In the initial stages in which the product is new to the user, the familiarity is very low and the user requires more attempts to complete a task. Initially, the user would commit several failed attempts before achieving a successful outcome.

When considering the ease of use of a product in an ideal scenario, a user should be able to complete a task in the very first attempt and the person should not use any focus during the task. In this case the execution time would be equal to the effort that the user has to exert in completing the task. Basically, it can be identified as the execution time without any constraints.

In reality this scenario doesn't exists since a person might take few attempts before achieving a successful outcome. In this case the time a person spends on the general task would increase when compared to the task without any constraints.
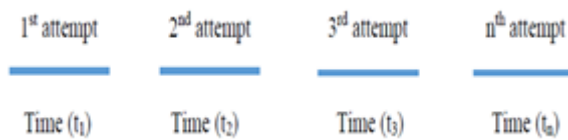

Figure 7. General scenario of any task.

When considering a general scenario in equation, execution time without constraint refers to a task that requires no focus time to complete it. This time can be denoted by deducting the focus time used for the event, by the total time for the successful attempt.

$$\text{Ease of Use} = \frac{\text{Avg. Effort for 1st attempt} - \text{Avg. Focus time}}{\text{Acual time for successful outcome}}$$

Equation 1. General scenario for ease of use

The focus time required for a particular task cannot be calculated directly, therefore in conducting the experiment for the implementation section, two events were created for every experiment for the sole purpose of calculating the focus time. According to previous research when considering the relationship between the ease of use of a product and the products conditions, an equation has been developed by introducing a shape parameter based on the number of attempts required to complete a given task successfully. This previously developed equation satisfies the graph illustrated above between the ease of use of a product and the number of attempts that is required to get a successful outcome (Sahan, 2017).

$$\text{Ease of Use} = \frac{\text{Avg. Effort for 1st attempt} - \text{Avg. Focus time}}{\text{Avg. Acual time for successful outcome}} * \frac{n(2 + \ln(n))}{(n + 1)}$$

Equation 2. The previous ease of use equation (Sahan, 2017)

However, when considering day to day life, not only the conditions of the product affect the ease of use of a product, but the familiarity of the user with regards to the product and the task also affects the ease of use of a product. Therefore, when considering the relationship of both the factors towards ease of use the existing equation requires some modifications. Therefore, a familiarity factor is introduced to the existing equation, in order to provide a much more reliable value for the ease of use of a product.

The familiarity factor was developed based on the concept that in most situations the users require more than one attempt to achieve success. In the initial stages in which the product is new to the user, the familiarity is very low and the user requires more attempts to complete a task. Initially, the user would commit several failed attempts before

achieving a successful outcome. But, even when considering the same task, the levels at which each participant may fail would be different. Consider a situation where one user fails at the initial stage of the task and another user fails at the final stage of the same task, even though the number of failed attempts are same there is a difference in the level of familiarity of the two users. This should be taken into consideration since the familiarity aspect is considered as a variable in this study. In order to take this factor into consideration the familiarity factor is designed and is computed for each user separately, since the familiarity factor would be different for each user depending on the position at which they commit the failure. The average value is taken for the familiarity factor for the computation of the ease of use score.

$$\text{Familiarity Factor (F)} = \frac{\text{Avg. Effort for 1st attempt}}{\text{Avg. Total for all the failed attempts to be successful}}$$

Equation 3. Familiarity factor (F)

The modified mathematical model is generated by considering this factor and is computed in the scenarios where the familiarity of the user is not constant.

$$\text{Ease of Use} = \left(\frac{\text{Avg. Effort fot 1st Attempt} - \text{Avg. Focus Time}}{\text{Avg. Actual time for successful outcome}}\right)\left(\frac{n(2 + \ln(n))}{n + 1}\right)F$$

Equation 4. Modified ease of use equation

This modified equation mentioned above is used in this study in order to examine the influence of the two factors familiarity and products conditions, on the ease of use of a product. In order to validate this model a case study was conducted.

When this equation is used for a scenario which considers the familiarity of the user as constant, the familiarity factor is considered as some constant value. In this case the shape of the graph would remain the same but due to the presence of the factor the graph would be shifted by some factor. Since, only the **shape of the graph** is of importance, the actual value of the familiarity factor is not required to be calculated in this scenario. But when the familiarity of the user is considered as a variable the familiarity factor is calculated using the procedure mentioned in the sections above.

● **Case study – High Heeled Footwear**

High heels shoes was selected as the product for the case study since the deterioration of the conditions of the product could be clearly observed and also the familiarity of a user influences immensely when using this product.

Two experiments were designed each having two different events for the participants to perform. Experiment 01 in this case study consists of a task which is uncommon and lot harder for participants to complete. Experiment 02 consists of an event that is a day to day task for many women. These two experiments are contrasting each other since they have been designed in order to verify that the type of task does not influence on the variation of the ease of use level of a product.

The two events in each experiment were designed as A and B with event A being a general scenario of attempting a task, such that the participant may require a lot of effort in order to perform the task successfully, while event B was designed such that the ideal scenario of ease of use can be observed. The participant has to be able to complete this event in one attempt and the effort that the user puts into the completion of the task would be the same as that of the execution time for this event.

Experiment 01

Event A: Walking wearing Heels for 10m on a U-shaped railing of width and height 6 inches

Event B: Walking wearing Heels for 10m with no Restrictions

Experiment 02

Event A: Walking down a staircase of 25 steps (each step of height 5 inch) while carrying an equal weight of 2 kg in each hand. The distance between the two markers is 5 inch and the participant has to walk within the given limit.

Event B: Walking down a staircase of 25 steps (each step of height 5 inch)

A significant difference in the effort could be seen between the two events in both the experiments.

The two experiments were conducted under three scenarios and results were obtained separately for the three scenarios. In the first scenario the products conditions are varied, while the familiarity of the user is controlled. In the second scenario the familiarity of the user is varied, while the products conditions are controlled and in the third scenario both the familiarity of the user and the products conditions were varied.

Results and Discussion

Graphical results were obtained for the three scenarios separately for both the experiments. The results from both the experiments showed a similar trend and the summary of the results obtained by the three scenarios is given below.

Scenario 1. Products conditions are varied, while the familiarity of the user is controlled

When the usage level of the high heels increases, the ease of use level of the heels decreased. Since the personal products of the participants are not considered in this scenario the familiarity of the user is constant towards the product.
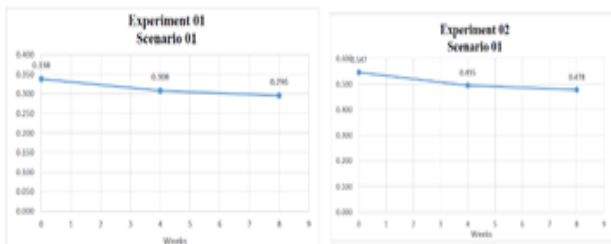

Figure 8. Ease of Use graphs for Scenario 1

Scenario 2. The Familiarity of the user is varied, while the products conditions are controlled

When the familiarity of the user towards the product increases the ease of use level has increased gradually with time. Every participant was given a high heel shoe of the same condition in order to keep the product conditions constant.
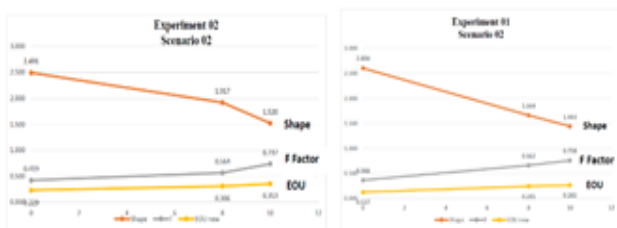

Figure 9. Ease of Use graphs for Scenario 2

Scenario 3. Familiarity of the user and the Products conditions both are Varied

In the third scenario both the familiarity and the product conditions were varied the and the results of the graph show a pattern as given below.
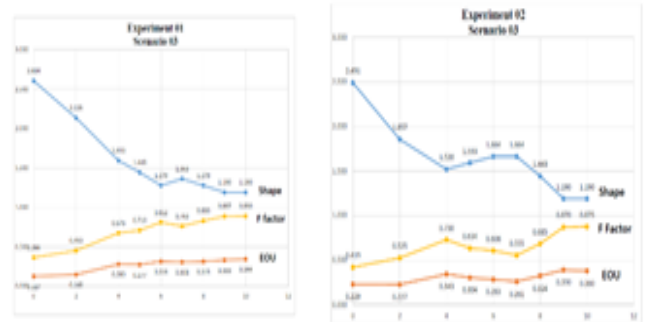

Figure 10. Ease of Use graphs for Scenario 3

Initially the ease of use value is very low. This is because the participants are not used to the product and the task even though the condition of the product is new. The ease of use value shows a sudden increase after the initial stage in the next stage of the graph. This is due to the increase in the familiarity of the user towards product and the task of the experiment. In this stage the condition of the product is not that old, thus the familiarity plays a more prominent role in the ease of use.

Once the product is in the deteriorated state, the user feels the conditions of the product has diminished, but due to the user's familiarity towards the task and the product, the graph takes a constant value when considering the ease of use of the product.

Conclusion

Ease of use is one of the most prominent features when considering the satisfaction of any customer. This is a factor that comes in to play during the usage phase of the product and would have a significant affect to the user of the product.

In previous research regarding the ease of use of a product, only the conditions of a product have been considered as a variable. But in reality, when considering day to day usage of products, the familiarity of the user towards the product also plays an important role towards the ease of use of product. In this thesis, the influence of both the factors product conditions and the familiarity on the ease of use of product was examined and cannot be taken as constant variables.

The existing model for the ease of use of a product has been modified by introducing a familiarity factor. In occasions where the familiarity is considered a variable this factor is computed in order to get an accurate ease of use score.

According to the results, in the first two scenarios each factor is considered separately as variables and the graphical results indicate that the ease of use has an increasing trend with familiarity, and ease of use has a decreasing trend with respect to the conditions of the product.

When considering the 3rd scenario which considers both the product conditions and the familiarity as variables, the familiarity of the user towards the product and the task has more influence towards ease of use than the conditions of the product.

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