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Assessing User Trust to Improve Web Usability

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Abstract: The technological advancement has significantly influenced the style of human-computer interaction, especially for World Wide Web. The users can now afford to choose amongst multiple websites offering similar services. The website which provides a usable interface along with requisite services, scores over its competitors. User interaction with a website is driven by two major factors- the performance factors associated with the site and the emotional factors associated with human being. Amongst the emotional factors, trust is a dominant driving factor of web usage. The more a user trusts a website, more shall be the usage and vice-versa. Trust has almost always been specified qualitatively. This study presents a distinct method of measuring user trust on a website, by considering the features of that website. Four distinct states of a feature are considered in the study. Each of these states has a different impact on user trust formation. The method proposed considers the features, their states and their contribution towards trust formation to compute the user trust on a website. Such a measure can be effectively employed to determine the trust level of a website as perceived by its users. Comparison of different websites with respect to their trust levels can therefore, provide the designer an insight into the weak features of that site. Identifying and correcting these, can help in retaining the users and hence increase the usability of that site.

Key words: Website, features, feature states, trust

INTRODUCTION

The emerging field of Human–computer interaction that deals with the study of user interfaces and their usability is gaining importance. Broadly speaking usability refers to the ease with which a product can be used, learned and provides satisfaction to its users. The various existing standards provide different definitions of usability.

ISO/IEC 9126-1[1] defines usability as "The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions". ISO 9241-11[2] defines usability as "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". IEEE Std. 610.12[3] refers to usability as "The ease with which a user can learn to operate, prepare inputs for and interpret outputs of a system or component. All these standards mention human factors such as likeability and satisfaction affecting usability, but due to the absence of any direct numeric measure of such factors, the focus of attention has remained on the performance issues related to usability such as the efficiency, efficacy etc.

The study of effect of human issues such as trust, emotions on usability has therefore remained limited. In this study we study the relationship of trust with web usability and present a distinct approach to measure trust.

Trust is a complex concept. Although we trust an individual or an organization, yet trust does not exist in that individual or organization. It lies in the trustee's perception. In that respect we can say it is analogous to the concept of beauty. Like beauty, trust lies in the view of beholder. Like beauty, trust is difficult to quantify. It is a fuzzy concept where we can specify the degree of user trust on an individual or an organization.

Fogg and Tseng[4] specify trust as a "positive belief about the perceived reliability of, dependability of and confidence in a person, object or process". Shneiderman[5] define trust as "the positive expectation a person has for another person or an organization based on past performance and truthful guarantees". The multidimensional facet of trust[6] comes into forefront because of the different ways it is explored in different fields. Public administrators explore trust that the public has in public institutions[7], psychologists study trust amongst people[8], research in commercial areas is restricted to explore the factors that can affect trust in commercial relationships[9,10] etc. We, in our study focus on the relationship between user trust and web usability.

Figure 1 depicts the lifecycle of development of trust in an e-commerce environment[11].

The stages where the usability of the website gets affected alongside the development of trust are presented in the figure. In the initial trust formation stage, when initial look of the site encourages a visit to the site, the usability level of the site increases

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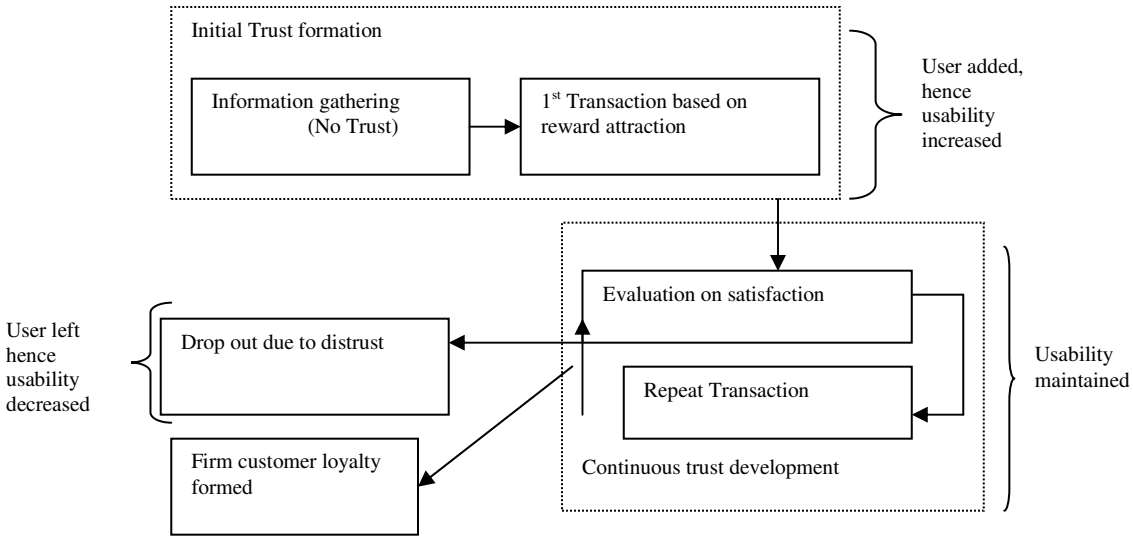

Fig 1: The e-commerce trust development lifecycle

(mentioned as 1st transaction based on reward attraction, in the figure). The "Evaluation on satisfaction" stage is a direct consequence of the presence of usability of the site. More usable the site more shall be the user satisfaction and hence continuous trust development. However a dissatisfied user leaves the site (mentioned as drop out due to distrust), thus decreasing the usability of that site. It is therefore clear that usability and trust of a site go hand in hand. In the initial trust formation stage, usability increases; it is maintained during the continuous trust development stage and decrease with loss of trust.

Since trust plays a significant role in online commerce, a lot of work has been directed to identify the factors affecting trust in e-commerce. Cheskin's report[12] identifies six primary components affecting e-commerce trust. These are the Seals of Approval, Brand, Navigation, Fulfillment, Presentation and Technology. Customer view of security and privacy control, integrity, competence and third party recognition and legal framework are considered mandatory for trust in Internet shopping[13]. Elements such as personal experience, familiarity, affiliation and belonging, transparency, factual signals and heuristic cues have been mentioned as trust engendering elements[14]. The role of customer's need, motivation, willingness, capacity and the seller's ability, benevolence and integrity in Internet purchasing behavior has also been explored[15]. We present here a compiled list of factors considered to influence trust. Although the list presented is not exhaustive, yet it encompasses most of the factors referred to in the literature. These are:

* Appeal of a website-refers to the look of the site. Does it go with what site is intended for? The aesthetic look of the website is examined through this factor.
* Competence of the website- encompasses both the technical competence and financial competence of the site. Is the site technically sound to deliver what it promises? The security and the privacy issues linked with the site are considered in this factor.
* Intention of the site- Does the site reflect what it aims to do? The transparency in the functioning of the website and organizations is explored through this factor.
* Duration of relationship- How long the user has been associated with the website or in the past with the organization hosting the website.
* Reputation- refers to the branding of the company. The web seals attached to the website can help in building of reputation.

It was observed that the trust on a website was significantly affected by the design of that website, especially the features of the site[16]. The features of a website can be in four distinct states. These are "*Irritant", "Chaotic", "Assuring" and "Motivating"*[17]. These states influence the degree of usability of a website. A feature is said to be in irritant state, if the user dislikes a feature to the extent that he/she would forsake the use of a website, if that feature is present. Features bound to create confusion regarding their supposed usage are termed as chaotic features. These can be simplified and thus changed to assuring state, with a little effort. However, if left ignored these might degrade to irritant state. Features in assuring state instill a level of confidence in the user. These are features, which the user is accustomed to see and thus is comfortable to use in similar websites. The assuring features however, do not guarantee the user's return to the site. The absence of assuring features can lead to dissatisfaction of the user. Some sites might have features, which are unexpected but welcome by

the users. Such features are classified to be in motivating state. A user is motivated to use the site when such features are present.

The prioritization of the trust factors and determination of the contribution of feature state towards user trust formation paved way to compute the user trust on a website.

COMPUTING TRUST

A consensual view of different users regarding the priority of each of the trust factor, listed earlier, with respect to website usability was determined using Intuitionsitic Fuzzy Sets (IFS)[18,19]. Although fuzzy logic is helpful in capturing fuzzy concept such as human thoughts, yet it is unable to capture the uncertainty associated with the human thought process. This can be captured via IFS. Every user opinion can be recorded in the form of a triplet <x, y and z> where x represent the set of users who agree with a concept, y who disagree and z who are not sure. Using IFS the trust factors were prioritized in the following order of their importance: Reputation, appeal, competence, intention of the website and the duration of relationship. Table 1 lists the ranks, based on the priority order associated with the trust factors. Higher the priority of the trust factor, higher is the rank assigned to it.

Table 1: Ranks assigned to trust factor

Trust factor	Rank
Reputation	5
Appeal	4
Competence	3
Intention	2
Relationship	1

Table 2: Weight associated with each feature state

Feature state	Weight
Assuring	3
Motivating	2
Chaotic	1
Not present	0
Irritant	-1

The contribution of each feature state towards user trust formation in a website has also been determined, using IFS, in our previous work[16]. It was found that features in assuring state contributed maximum towards trust formation, followed by features in Motivating and chaotic state. Irritant features evoked a feeling of distrust amongst users. Table 2 presents the weights associated with each of the feature state, based on their contribution levels. A feature state has a higher weight if it contributes more towards user trust formation. It needs to be pointed out that a feature state in irritant state contributes towards distrust formation; hence it is assigned a negative weight. A feature not present obviously does not contribute any weight, but we explicitly assign it a weight of zero, as during comparison of websites, it is indicative of the fact that one website has a feature not possessed by the other.

Table 3: User information

User characteristic	Number of users
Educational Qualification	
Postgraduates	21
Undergraduates	24
Computer knowledge	
Limited to use of internet	25
Comfortable with use of packages like MS-office	15
Expert in programming	5
Internet usage	
Very frequently	33
Occasionally	9
Rarely	3
Conducted online bookings	
Yes	19
No	26

Table 4: Features and the trust factors to which they contribute

Feature	Trust factor	Rank
Color combination	Appeal	4
Site information	Intention	2
Affiliation	Reputation	5
Search facility	Competence	3
Link names	Intention	2
Link explanation	Intention	2
Customization	Relationship	1
Page scrolling	Competence	3
Online booking	Competence	3
Promotional aspect	Relationship	1

The following algorithm quantifies the trust level of a website, based on the perception of website features by the users.

Step 1: Identify the features on a page of the website
Step 2: Obtain the usability expert opinion regarding the belongingness of each feature to a trust factor.
Step 3: Assign rank according to the priority of that factor (as specified in Table 1).
Step 4: Identify the state of that feature and assign weight depending on this state (from Table 2).
Step 5: For every feature compute the trust value according to the following equation:
Trust = Rank * weight
Step 6: This trust value shall be in the range of [-1, 15]
Where -1 indicates distrust on that feature and 15 indicates maximum trust
Step 7: Computed trust value of the website
$= t_1 + t_2 + t_3 + \ldots\ldots\ldots + t_n$
Where n is the number of features and t_i is the trust value computed for the ith feature

Fig 2: Algorithm to compute trust value

The algorithm is in a generalized form. More trust factors can be added after determining their priority using IFS[18,19] and assigning rank to them.

CASE STUDY

A study of three airline websites was conducted to implement the proposed algorithm. A total of 50 users from different strata of society were chosen to examine

Table 5: States of features in the websites

Feature	Lufthansa	Air India	British airways
Color combination	Irritant	Assuring	Motivating
Site information	Chaotic	Irritant	Chaotic
Affiliation	Chaotic	Chaotic	Chaotic
Search facility	Not present	Not present	Assuring
Link names	Assuring	Chaotic	Chaotic
Link explanation	Not present	Not present	Chaotic
Customization	Motivating	Not present	Motivating
Page scrolling	Irritant	Irritant	Irritant
Online booking	Assuring	Assuring	Assuring
Promotional aspect	Assuring	Chaotic	Assuring

Table 6, derived from Table 2 and 6, depicts the weight, associated with each feature for each site.

Table 6: Weight associated with each feature in each of the website

Feature	Lufthansa	Air India	British airways
Color combination	-1	3	2
Site information	1	-1	1
Affiliation	1	1	1
Search facility	0	0	3
Link names	3	1	1
Link explanation	0	0	1
Customization	2	0	2
Page scrolling	-1	-1	-1
Online booking	3	3	3
Promotional aspect	3	1	3

these sites. Of these 3 users could not make it at the time of survey and 2 reported their inability to give any conclusive reports. The users belonged to different cultural, educational background with the commonality between them that they all regularly traveled and were aware of the travel formalities. The demographic information of the users is presented in Table 3.

To simplify the study, only the home page of the concerned websites was studied, with limited features under scrutiny. The services of usability expert were used to classify features according to the trust factor to which they contribute.

A total of 10 features were carefully selected (so that each trust factor is given a probability to be represented) and classified according to trust factor to which it contributes. The following features were selected in each home page: Color Combination, Site information, Affiliations, Search facility, Link names, Link explanations, customization, Page scrolling, online booking and promotional aspect.

After the users explored the sites, they were asked to report how much trust they would place on these sites. As expected the users could not quantify the amount of trust they had on each of the site, but their remarks were worthy. These varied from *"Very Trust worthy"," Good to look at", "Can try for my online flight booking next time"* to *"was put off by the site"*. Of the 45 users, 26 considered British airways to be trust worthier than the remaining two, 12 voted in favor of Air India airlines and 7 were for the Lufthansa airlines.

These remarks were then used to compare with the actual results on the trust computed by the algorithm.

Fig. 3: Home page of Lufthansa airlines

Fig. 4: Home page of Air India website

EXPERIMENTAL RESULTS

Table 4 depicts the consensual view of the usability experts regarding the trust factor these features contribute to. The third column in the table lists the rank associated with each of these factors (derived from Table 1). The users were requested to identify the feature state for each of the listed features, as per their usage of the respective sites.

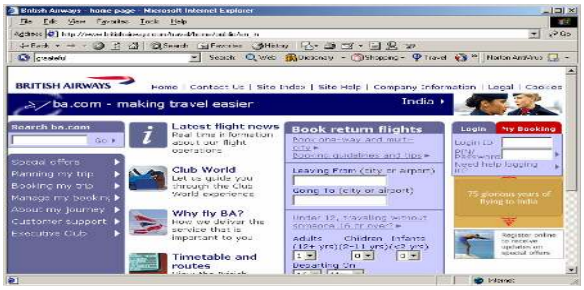

Fig. 5: Home page of British Airways website

Table 5 lists the user consensual opinion regarding the feature state for the features of each of these websites.

Using Table 4 and 6 we calculate the trust level of home page, as per the algorithm proposed.

British Airways = 4*2+ 2*1 + 5*1+ 3*3+2*1+2*1+1*2+3*(-1) +3*3+1*3 = 39

Air India = 4*3 + 2*(-1) +5*1+ 3 *0 +2*1+2*0+1*0+3*(-1) +3*3+1*1= 24

Lufthansa = 4* (-1) +2*1 +5*1 + 3*0+2*3+2*0+1*2+3*(-1) +3*3+1*3 = 20

The results are in line with the survey response.

CONCLUSION

User trust on a product has always been critical for the acceptance of that product. A website is no exception. However, trust has by far remained a qualitative concept. This study proposes a distinct quantitative measure of user trust on a website. The dynamic calculation of trust, based on the features of the website, can be of significance in continuously assessing the trust level and hence usability of the site. Measuring trust numerically this way provides an edge over the trust determination through questionnaires and survey, as it can act as yardstick for comparing the trust levels of different websites. In today's era where users quickly shift from one site to another, such a measure can be helpful to web designers for designing websites to retain their users and hence improve the website usability.

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