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The effect of website design and structure on disorientation and lostness in hyperspace

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Abstract— E-government is a global Phenomenon used to deliver government information and services via the Internet and other digital means to citizens. Many e-government websites failed to achieve their full potential due to poor design. Poor design always leads to disorientation and lostness in hyperspace. Lostness has therefore become the initial focus of our research on evaluating e-government websites. Being `lost in hyperspace' is a complex problem, which limits the efficiency and promise of e-government websites. The objective of this paper is to measure the level of lostness in e-government website. It also aims to gather empirical data on lostness with the objective of providing an evidence that lostness and disorientation are affected more by design more than by unfamiliarity. We conducted four experiments to compare the lostness in two different websites. The results showed that government websites should devote more attention to avoid the lostness and disorientation and that help the user get what he is looking for in an easy way within the shortest time.

Keywords— : E-government, Lostness, disorientation, usability, efficiency.

I. INTRODUCTION

E-government involves the automation or computerization of existing paper-based procedures that will prompt new styles of leadership, new ways of debating and deciding strategies, new ways of transacting business, new ways of listening to citizens and communities, and new ways of organizing and delivering information [26]. The e-government can also be defined as "the use of technology to enhance the access to and delivery of government services to benefit citizens, business partners and employees" [11]. According to a study documented in [27], E-government refers to the delivery of national or local government information and services via the Internet or other digital means to citizens or businesses or other governmental agencies, and E-government is a one-stop Internet gateway to major government services. It also refers to the ability to obtain government services through non-traditional electronic means, enabling access to government information and transactions at any time anywhere and in conformance with equal access needs. In addition, e-government offers the potential to reform the public sector and create a good relationship between citizens and government [14]. In such an environment, citizens have increasingly been able to interact with e-government by searching for government information and getting government services through websites without time and space limitations. The website works like a channel or window between government and citizens. The question here, if this channel or website is complex or not easy to use, what is the result? Firstly, the user will get frustrated. Secondly, the user will not return to this website and may be he/she will discourage the others who intended to visit this website. On the Web, usability is a necessary condition for survival. If a website is difficult to use, people leave it [24]. Moreover, the user will use back the old style of dealing with government face to face or through phone. The result of that will be a huge loss for government who designed such an unusable website.

Therefore, usability problems refer to aspects that make the application ineffective, inefficient, and difficult to learn and use. From the above-mentioned definitions, we can define the usability in e-government context as ease of use and satisfaction that citizens get while accessing the government website to get information or services. Usability is very critical in E-Government, as even one usability problem can adversely affect millions of citizens; it can cost them time and money [12]. Many poorly designed and unusable systems exist which users find difficult to learn and complicated to operate. In addition, If websites are not well structured, users can become disoriented or lost and will not be able to (efficiently) find the information they want [29]. These systems are likely to be under-used, misused or fall into disuse with frustrated users maintaining their current working methods. The outcome is costly for the organisation using the system [22]. Moreover, usability is qualitative or quantitative measure of the relative factors with which a novice user interacts with an E-Government website to accomplish the user's goal [3]. Qualitative (e.g. user satisfaction, or difficulty of use), or quantitative (e.g. task completion time, number and typology of errors, number of successfully accomplished tasks, the amount of time users invoke help (verbal, on- line help, manual)).

In objective quality assessment, metrics are used as the primary tool for assessing quality which quantifies some characteristic or attribute of a computer software entity [29]. One of the most common problems in the field of hypermedia is that users tend to become disoriented: they lose one's sense of location and direction in non-linear

documents [20]. Being disoriented or lost is one of the fundamental difficulties, which users experience when trying to navigate a website[25]. This problem is aggravated by the fact that users need to maintain track of their tasks, their previous actions and their current context. This additional effort has been given the term cognitive overhead. Both disorientation and cognitive overhead may lead users to get 'lost in hyperspace'[25]. Navigation support that is adapted to user goals, preferences and knowledge, and to the context of use, is seen as a proper way of providing adequate navigation support for varying user needs [18]. User navigation is highly dependent on a document's structure, observed navigation patterns need to be compared to this structure [20]. Navigation plays a crucial role in the design of website structure because it determines the path to be travelled to reach a required web page. In the environment of a Website, navigation is the process through which the users achieve their purposes in using Website, such as to find the information that they need or to complete the transactions that they want to do [29]. Since lost in hyperspace is a complex problem, a multi-disciplinary approach is necessary to draw upon and integrate knowledge and findings in seemingly diverse disciplines such as Cognitive Psychology, Artificial Intelligence and Software Engineering, and to integrate this knowledge into human-computer interaction [30] . Subjective lostness was best predicted by similarity to the optimal path and time on task. The best overall predictor of success on individual tasks was similarity to the optimal path, but other predictors were sometimes superior depending on the particular web navigation task [17]. Users can become lost because of the non-linear nature of hypertext systems [8] and, if there is considerable cross-referencing among pages, looping behavior may result [6]. Foss stated in [15] that, a lost or disorientated user of hypertext systems may also suffer from a number of other problems like: arriving at a particular point in a document then forgetting what was to be done there; forgetting which sections have been visited or altered; not knowing if there are any other relevant frames in the document; neglecting to pursue digressions that were planned earlier; and neglecting to return from a digression

Furthermore, Theng and his colleagues stated that the "lost in hyperspace" phenomenon refers to any of the following conditions: users cannot identify where they are; users cannot return to previously visited information; users cannot go to information believed to exist; users cannot remember what they have covered; and users cannot remember the key points covered [30]. Otter and Johnson documented in their study that the main strength of hypertext-based systems is that they have a flexible structure and give users a great deal of freedom to browse and interact with the information contained within them. The use of hypertext is important since it offers an extremely powerful way of accessing and organizing information [25]. On the other hand, if there is considerable cross-referencing among pages, looping behavior may result [6]. In addition, getting lost, or disoriented, is known to be one of the most important problems in hypertext navigation, yet there have been a few attempts to assess and quantify lostness[17]. Gwizdka and his colleagues [17] attempted to determine whether lostness and task success can be predicted using measures such as: the time spent on the navigation task and the speed of clicking; the number of visited pages, the number of re-visited pages, and the ratio of revisited to visited pages; the similarity of the user navigation path to the optimal path; and the ''shape'' of the web navigation graph.

Lostness is a measure of efficiency sometimes used in studying behaviour on the web [28]. There are two measures to assess user lostness. The first one was introduced by Smith in [28]. The second one was proposed by Ahuja and Webster in [1]. It is concerned with the accuracy of users' mental models of websites. Since Ahuja and Webster used questionnaire-based measures of lostness, that make it difficult, if not impossible, in most studies conducted in real-world contexts, the successful assessment of lostness based on observable real-time user behavior would be of great practical value [25]. In the context of web search and navigation, implicit measures can be used to predict user satisfaction, user lostness, or task success. Fox et al. in [16] used implicit measures of user interest and satisfaction on web search tasks. They found that time on a web page, click through, and what a user did after visiting a search result or how a user ended a search session were good predictors of user satisfaction. Herder and Juvina found in [19] that time spent on a web page was a good indicator of user lostness on web navigation tasks. However, despite a long history of research on hypertext and more recent studies in the area of web navigation, relatively little is known about the statistical relationships among web navigation patterns, lostness, and success on information-seeking tasks [17]. In our work we used the Smith method [28] to calculate the lostness. Lostness (L), is then calculated using the following formula:

$$L = sqrt[(U/N - 1)^2 + (O/U - 1)^2]$$

where:

U: The number of unique web pages visited while performing the task.

N: The total number of pages visited while performing the task, counting revisits to the same page.

O: the number of web pages on the optimal path that must be visited to accomplish the task.

This formula calculates the degree of lostness on a scale from 0 to 1, where 0 indicates no lostness at all. From her usability study, Smith [28] concluded that a user is lost when L is 0.42 or higher.

A primary aim of our work is to find out how citizens become lost when using e-government websites. While reviewing the literature, we found some authors stated that unfamiliarity with various hypertext systems was declared as a common cause of lostness by subjects [25]. A secondary aim is to gather empirical data on lostness with the objective of providing an evidence that lostness and disorientation are affected more by design more than by unfamiliarity. We present the results of four empirical studies that examine the relationships between the design of website and lostness.

II. EXPERIMENTAL SETUP

Part of the results of our usability test experiment has been used in our previous work [5],[4] to measure the effectiveness of e-government websites. Other part of the data from the same experiment and the three other experiments are used here, so we use the same experiment setup. To avoid unreliable and biased results, the design of a user test evaluation and its

execution should be carefully planned and managed. The researcher followed the framework proposed in the literature [9],[31] and [2] to conduct the usability test and collect the data. The framework has the following steps, 1) define the goals of the test, 2) define the user sample to participate in the test, 3) select tasks and scenarios, 4) define how to measure usability, 5) prepare the material and the experimental environment. Each individual session will consist of a set of tasks and a questionnaire for the participants to complete. The individual evaluations will take place in the following order, a) a performance evaluation in which each participant is asked to perform a series of real-life tasks, b) a questionnaire after each performance evaluation to gather additional insights from the participants about Mysore District's website.

Details of the Experiments:

Four experiments were conducted in two phases. In Phase 1, two experiments were conducted for the existing website of Mysore district. We will refer to the website as Website 1 and the experiments as Experiment 1 and Experiment 2. In Phase 2, two experiments were conducted for the new proposed website. We will refer to the website as Website 2 and the experiments as Experiment 3 and Experiment 4.

Participants:

Typically, the test was conducted on a group of potential users in the age group ranging from 20 years to 30 years who had knowledge of computer and internet who volunteered for this domain study. In Experiment 1, there were twelve participants with different backgrounds. Experiment 2 had 22 participants doing Master's degree in Computer Science. In Experiment 3, there were seventeen participants doing Master's degree in Computer Science. Experiment 4 had eighteen participants with different backgrounds.

Evaluation Tasks:

The tasks were intended to be general, simple, and from the reality of citizens' daily needs. Test participants attempted completion of the tasks as shown in Table 1.

TABLE I TASKS ATTEMPTED

Tasks	Task description
T 1	Find important centers of learning in Mysore.
T 2	Download the application form of birth registration.
T 3	Find the page that gives information about tourist places in Mysore.
T 4	Find the Public Grievance System.
T 5	Find the contact details of Karnataka Urban Water Supply and Drainage Board.

Procedure:

Users were asked to complete a series of routine tasks. Sessions were recorded and analyzed to identify the success rate, give-up rate, time spent on task, number of pages visited per task, etc. Mysore district website (www.mysore.nic.in) and the redesigned website were selected for this test. It serves as an information gateway to Mysore district citizens to get information and services. An online usability test was conducted using a live version of www.mysor.nic.in located on the internet and the new proposed website located in the internet for the purpose of this study. Loop11 online tool (avilable in www.loop11.com) was used to capture the participant's comments, navigation path, heat map, overall satisfaction ratings, questions and feedback. A usability test was intended to determine the extent to which an interface facilitates a user's ability to complete routine tasks.

Data Collection:

The data were collected in an excel file. The first round after exporting the data is to prepare the data for analysis. The second round is filtering the data. The filter was used to check the data against the participants who were not serious and completed the test without care. For that we put some criteria and a threshold. The threshold used for the time spent in task is less than 5 seconds and for the page viewed is 1 page per task. The Filter used was:

if (Pages Viewed =1 and the Time spent <5 sec) for more than 2 tasks, then the participant is considered not serious, delete the participant's data

By implementing, the above filter two participant from Experiment 1 and four participant from Experiment 4 were deleted. Some of them spent 2 seconds in each page and visited only 1 page per task. It means that they were only navigating through the test by clicking the next button only. The participants were coded as p 1, p 2… to p n, where n is number of participants in each experiment.

Data Scoring:

The data was scored, using the approach found in the literature [31]. A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. If the participant abandoned (gave-up) the task, did not reach the correct answer, or performed it incorrectly, the task was counted as a "Failure." The time was calculated in seconds. The number of visited pages was recorded.

Confidence interval (C.I):

We calculated the confidence interval (C.I) for a mean that specifies a range of values within which the unknown population parameter, in this case the mean, may lie[10]. The width of the confidence interval gives us some idea about how uncertain we are about the unknown population parameter. A very wide interval may indicate that more data should be collected before anything very definite can be said about the parameter[21]. We calculate these intervals for different confidence levels, depending on how precise we want to be. We interpret an interval calculated at a 95% level as, we are 95% confident that the interval contains the true population mean. We could also say that 95% of all confidence intervals formed in this

manner (from different samples of the population) will include the true population mean[23]. We use the overlap in confidence intervals to check for statistical significance.

III. RESULTS AND DISCUSSIONS

The values used to measure lostness in the Smith method [28] are:

O: the number of web pages on the optimal path that must be visited to complete the task. By reviewing the existing website (Website 1) in Phase 1, we found that the optimal paths for Task 1 to Task 5 are 2, 4, 2, 2, and 2 respectively. Phase 2, the optimal paths for Task 1 to Task 5 in the proposed website (Website 2) are 2, 2, 2, 2, and 3 respectively.

N: The total number of pages visited while performing the task, counting revisits to the same page. It has been calculated by loop11 online tool.

U: The number of unique web pages visited while performing the task. It has been calculated manually by reviewing each participant's path for each task and counting only the unique pages.

In our study, we started with Phase 1. In general, all participants found that the website mysore.nic.in was unclear, not straightforward and not easy to use. The usability test identified many major problems including: the lack of categorization of topics on the home page; confusion over apparent duplicative use of some terms; confusion of terms and abbreviations; the users found many orphan pages; they couldn't return to home or previous page; lack of site index or site map; lack of search facility; lack of help or FAQ page; and lack of colour contrast between text and background.

In Phase 2, firstly we proposed a new website after considering all the problems that had been found in Phase 1. We used the same contents of Website 1 to rebuild the structure of the website. Secondly, we tested the proposed website using the same procedure.

Experiment 1:

TABLE II RESULT OF LOSTNESS FROM EXPERIMENT 1

	Page Views					**Unique Pages visited**					**lostness**					
P	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	**Ave**
P 1	3	5	2	4	5	2	4	2	3	4	0.3	0.20	0.00	0.42	0.54	0.30
P 2	2	3	2	3	6	2	3	2	2	5	0.0	0.33	0.00	0.33	0.62	0.26
P 3	2	10	3	3	6	2	9	3	2	6	0.0	0.56	0.33	0.33	0.67	0.38
P 4	7	32	3	5	13	6	27	3	4	11	0.7	0.87	0.33	0.54	0.83	0.65
P 5	1	1	1	1	1	1	1	1	1	1	1.0	3.00	1.00	1.00	1.00	1.40
P 6	4	17	3	1	9	3	12	3	1	7	0.4	0.73	0.33	1.00	0.75	0.65
P 7	2	3	2	4	3	2	3	2	2	3	0.0	0.33	0.00	0.50	0.33	0.23
P 8	2	8	2	2	3	2	7	2	2	3	0.0	0.45	0.00	0.00	0.33	0.16
P 9	2	7	2	3	2	2	5	2	2	2	0.0	0.35	0.00	0.33	0.00	0.14
P 10	1	1	2	3	1	1	1	2	2	1	1.0	3.00	0.00	0.33	1.00	1.07
P 11	2	3	3	3	1	2	3	3	2	1	0.0	0.33	0.33	0.33	1.00	0.40
P 12	2	3	5	5	3	2	3	5	3	2	0.0	0.33	0.60	0.52	0.33	0.36
Ave	2.5	7.8	2.5	3.1	4.4	2.3	6.5	2.5	2.2	3.8	0.3	0.9	0.2	0.5	0.6	.50
SD	1.6	8.9	1	1.3	3.7	1.3	7.2	1	0.8	3	0.4	1	0.3	0.3	0.3	0.39
C.I	0.92	5.03	0.57	0.74	2.07	0.73	4.09	0.57	0.47	1.70	0.23	0.57	0.18	0.16	0.18	0.92

Table 2 shows the result of Experiment 1. Task 2 recorded the highest value of lostness (mean=0.9, SD=1, C.I=0.57) when compared to the other tasks. The number of web pages on the optimal path that must be visited to successfully complete Task 2 is 4 pages whereas other tasks need 2 pages to successfully complete each task. This result indicates that the more the depth of the optimal path the more the user gets lost. In addition, this lostness in hyperspace affects the success rate. The success rate of Task 2 is 0. Fig. **1** shows the different levels of lostness for Experiment 1. Error bars represent a 95% confidence interval for the mean. C.I shows that there is no significant difference (at the p=0.05 level for the C.I) in lostness between tasks.

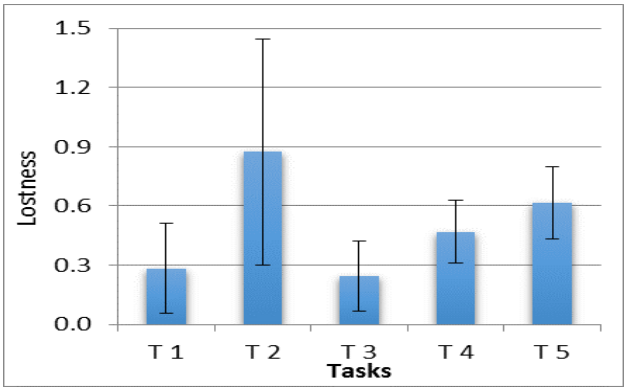

Fig. 1 Result of Lostness from Experiment 1

(Error bars represent a 95% confidence interval for the mean)

Experiment 2:

In Table 3, the results of Experiment 2 are shown. Task 2 also recorded the highest value of lostness (mean=1.16, SD=1.1, C.I=0.44) when compared to the other tasks. Fig. **2** shows the different levels of lostness for Experiment 2. Error bars represent a 95% confidence interval for the mean. C.I shows that there is significant difference (at the p=0.05 level for the C.I) in lostness between Task 2 and the other tasks.

TABLE III RESULT OF LOSTNESS FROM EXPERIMENT 2

	Page Views					Unique Pages visited					lostness					
P	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	**Ave**
P 1	5	9	2	4	6	4	6	2	2	5	0.5	0.47	0.00	0.50	0.62	0.43
P 2	2	9	5	3	5	2	6	3	2	5	0.0	0.47	0.52	0.33	0.60	0.39
P 3	4	6	2	3	5	4	5	2	2	5	0.5	0.26	0.00	0.33	0.60	0.34
P 4	4	4	1	6	5	3	3	1	3	4	0.4	0.42	1.00	0.60	0.54	0.59
P 5	4	3	2	2	3	4	3	2	2	3	0.5	0.33	0.00	0.00	0.33	0.23
P 6	7	1	2	3	2	6	1	2	3	2	0.7	3.00	0.00	0.33	0.00	0.80
P 7	9	7	16	2	2	8	6	10	2	2	0.8	0.36	0.88	0.00	0.00	0.40
P 8	2	1	1	1	1	2	1	1	1	1	0.0	3.00	1.00	1.00	1.00	1.20
P 9	8	4	3	2	7	7	4	3	2	7	0.7	0.00	0.33	0.00	0.71	0.35
P 10	9	16	8	2	2	5	8	6	2	2	0.7	0.71	0.71	0.00	0.00	0.43
P 11	6	3	2	4	3	6	2	2	2	2	0.7	1.05	0.00	0.50	0.33	0.51
P 12	26	2	2	2	2	20	2	2	2	2	0.9	1.00	0.00	0.00	0.00	0.39
P 13	4	3	2	2	1	4	2	2	2	1	0.5	1.05	0.00	0.00	1.00	0.51
P 14	2	2	5	4	4	2	2	4	4	4	0.0	1.00	0.54	0.50	0.50	0.51
P 15	7	1	1	1	1	6	1	1	1	1	0.7	3.00	1.00	1.00	1.00	1.34
P 16	2	2	2	2	2	2	2	2	2	2	0.0	1.00	0.00	0.00	0.00	0.20
P 17	2	1	2	3	1	2	1	2	2	1	0.0	3.00	0.00	0.33	1.00	0.87
P 18	2	9	1	3	11	2	9	1	2	8	0.0	0.56	1.00	0.33	0.80	0.54
P 19	2	10	4	7	3	2	10	4	5	3	0.0	0.60	0.50	0.66	0.33	0.42
P 20	6	6	4	5	1	3	4	3	4	1	0.6	0.33	0.42	0.54	1.00	0.58
P 21	12	1	2	3	1	10	1	2	2	1	0.8	3.00	0.00	0.33	1.00	1.03
P 22	7	2	5	7	4	6	2	4	5	4	0.7	1.00	0.54	0.66	0.50	0.68
Ave	6.0	4.6	3.4	3.2	3.3	5	3.68	2.77	2.45	3	0.44	1.16	0.38	0.36	0.54	0.58
SD	5.3	3.9	3.3	1.7	2.5	4	2.7	2	1.1	2	0.3	1.1	0.4	0	0.4	0.30
C.I	2.21	1.65	1.39	0.72	1.04	1.69	1.15	0.84	0.46	0.85	0.14	0.44	0.17	0.13	0.16	0.12

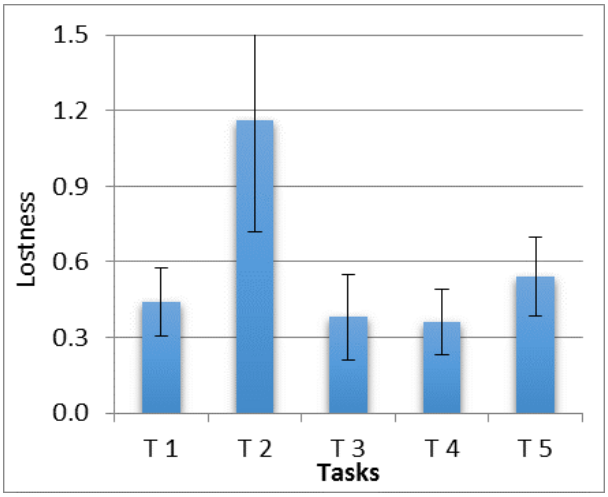

Fig. 2 Result of Lostness from Experiment 2

(Error bars represent a 95% confidence interval for the mean)

Experiment 3:

Table 4 shows the results of Experiment 3. Task 5 recorded the highest value of lostness (mean=0.32, SD=0.5, C.I=0.23) when compared to the other tasks. The number of web pages on the optimal path that must be visited to successfully complete Task 5 is 3 pages whereas other tasks need 2 pages to successfully complete each task. This result indicates that the more the depth of the optimal path the more the user gets lost. In addition, this lostness in hyperspace affects the success rate. The success rate of Task 5 is 82%. Fig. **3** shows the different levels of lostness for Experiment 3. Error bars represent a 95% confidence interval for the mean. C.I shows that there is no significant difference (at the p=0.05 level for the C.I) in lostness between tasks.

TABLE IV RESULT OF LOSTNESS FROM EXPERIMENT 3

	Page Views					Unique Pages visited					lostness					
P	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	**Ave**
P 1	2	2	2	2	4	2	2	2	2	4	0.0	0.00	0.00	0.00	0.25	0.05
P 2	2	2	2	2	2	2	2	2	2	2	0.0	0.00	0.00	0.00	0.50	0.10
P 3	2	2	2	2	2	2	2	2	2	2	0.0	0.00	0.00	0.00	0.50	0.10
P 4	2	2	2	2	3	2	2	2	2	3	0.0	0.00	0.00	0.00	0.00	0.00
P 5	2	2	2	2	3	2	2	2	2	3	0.0	0.00	0.00	0.00	0.00	0.00
P 6	2	2	2	2	3	2	2	2	2	3	0.0	0.00	0.00	0.00	0.00	0.00
P 7	2	2	2	2	2	2	2	2	2	2	0.0	0.00	0.00	0.00	0.50	0.10
P 8	2	1	2	2	3	2	1	2	2	3	0.0	1.00	0.00	0.00	0.00	0.20
P 9	2	2	2	2	3	2	2	2	2	3	0.0	0.00	0.00	0.00	0.00	0.00
P 10	2	5	2	3	2	2	3	2	3	2	0.0	0.52	0.00	0.33	0.50	0.27
P 11	2	2	2	1	2	2	2	2	1	2	0.0	0.00	0.00	1.00	0.50	0.30
P 12	2	2	2	2	4	2	2	2	2	4	0.0	0.00	0.00	0.00	0.25	0.05
P 13	2	2	2	2	3	2	2	2	2	3	0.0	0.00	0.00	0.00	0.00	0.00
P 14	2	2	3	6	3	2	2	3	4	3	0.0	0.00	0.33	0.60	0.00	0.19
P 15	3	2	2	2	2	3	2	2	2	2	0.3	0.00	0.00	0.00	0.50	0.17
P 16	2	5	3	1	3	2	3	3	1	3	0.0	0.52	0.33	1.00	0.00	0.37
P 17	2	3	2	2	1	2	2	2	2	1	0.0	0.33	0.00	0.00	2.00	0.47
Ave	2.1	2.4	2.1	2.2	2.6	2.1	2.1	2.1	2.1	2.6	0.02	0.14	0.04	0.17	0.32	0.14
SD	0.2	1.1	0.3	1.1	0.8	0.2	0.4	0.3	0.7	0.8	0.1	0.3	0.1	0.4	0.5	0.14
C.I	0.12	0.50	0.16	0.51	0.37	0.12	0.20	0.16	0.31	0.37	0.03	0.14	0.05	0.17	0.23	0.07

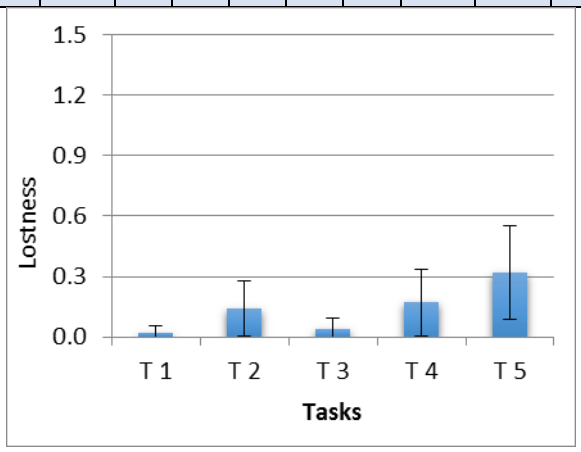

Fig. 3 Result of Lostness from Experiment 3
(Error bars represent a 95% confidence interval for the mean)

Experiment 4:

Table 5 shows the results of Experiment 4. Task 5 recorded the highest value of lostness (mean=0.32, SD=0.2, C.I=0.10) when compared to the other tasks. The success rate of Task 2 is 83%. Fig. 4 shows the different levels of lostness for Experiment 4. Error bars represent a 95% confidence interval for the mean. C.I shows that there is no significant difference (at the p=0.05 level for the C.I) in lostness between tasks.

TABLE V RESULT OF LOSTNESS FROM EXPERIMENT 4

	Page Views					Unique Pages visited					lostness					
P	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	T 1	T 2	T 3	T 4	T 5	**Ave**
P 1	1	2	2	2	2	1	2	2	2	2	0.00	0.00	0.00	0.00	0.50	0.10
P 2	1	1	1	1	1	1	1	1	1	1	0.00	0.00	0.00	0.00	0.00	0.00
P 3	2	2	2	2	2	2	2	2	2	2	0.00	0.00	0.00	0.00	0.50	0.10
P 4	2	2	2	2	2	2	2	2	2	2	0.00	0.00	0.00	0.00	0.50	0.10
P 5	2	2	2	2	4	2	2	2	2	4	0.00	0.00	0.00	0.00	0.25	0.05
P 6	2	2	2	2	2	2	2	2	2	2	0.00	0.00	0.00	0.00	0.50	0.10
P 7	2	2	4	2	5	2	2	4	2	3	0.00	0.00	0.50	0.00	0.40	0.18

P 8	2	2	2	2	3	2	2	2	2	2	0.00	0.00	0.00	0.00	0.60	0.12
P 9	4	7	5	2	6	3	5	4	2	4	0.42	0.66	0.54	0.00	0.42	0.41
P 10	2	2	2	2	5	2	2	2	2	4	0.00	0.00	0.00	0.00	0.32	0.06
P 11	2	2	2	2	4	2	2	2	2	4	0.00	0.00	0.00	0.00	0.25	0.05
P 12	2	2	2	2	2	2	2	2	2	2	0.00	0.00	0.00	0.00	0.50	0.10
P 13	2	2	2	2	2	2	2	2	2	2	0.00	0.00	0.00	0.00	0.50	0.10
P 14	2	2	1	2	3	2	2	1	2	3	0.00	0.00	0.00	0.00	0.00	0.00
P 15	2	2	2	1	2	2	2	1	1	2	0.00	0.00	1.12	0.00	0.50	0.32
P 16	2	2	2	2	3	2	2	1	2	3	0.00	0.00	1.12	0.00	0.00	0.22
P 17	2	2	2	2	3	2	2	1	2	3	0.00	0.00	1.12	0.00	0.00	0.22
P 18	2	3	3	2	3	2	3	3	2	3	0.00	0.33	0.33	0.00	0.00	0.13
Ave	2.0	2.3	2.2	1.9	3.0	1.9	2.2	2.0	1.9	2.7	0.02	0.06	0.26	0.00	0.32	0.13
SD	0.6	1.2	0.9	0.3	1.3	0.4	0.8	0.9	0.3	0.9	0.1	0.2	0.4	0	0.2	0.11
C.I	0.27	0.57	0.44	0.15	0.61	0.19	0.36	0.42	0.15	0.42	0.05	0.08	0.20	0	0.10	0.05

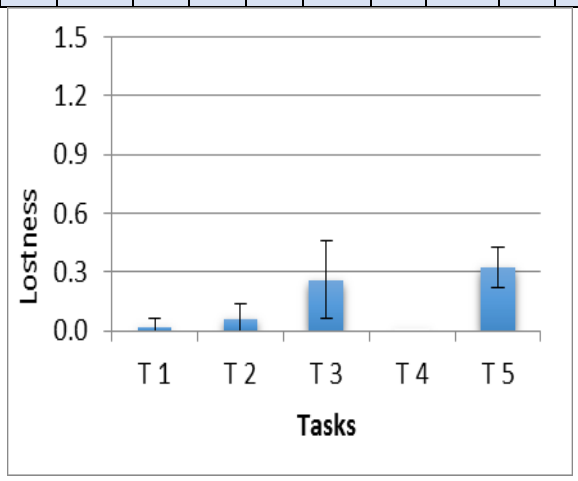

Fig. 4 Result of Lostness from Experiment 4
(Error bars represent a 95% confidence interval for the mean)

The average lostness result of Phase 1 is 0.54 (SD=0.06 & C.I=08). It shows that the lostness is critical in Website 1, more than 0.42 [28]. The average lostness result of Phase 2 is 0.135 (SD=0.007 & C.I=01). It shows that the lostness in Website 2 is very low when compared to Website 1. In the other hand, the participants in Experiment 2 were Master in Computer Science students. They are familiar with website and hyperspace more than the participants in Experiment 1, but the lostness in Experiment 2 (0.58) is more than Experiment 1 (0.50). The familiarity factor also was not supported in Phase 2. The participants in Experiment 3 were Master in Computer Science students and the participants in Experiment 4 were not Computer Science students, but the lostness in Experiment 3 (0.14) is more than Experiment 4 (0.13). It indicates that familiarity does not affect the lostness.

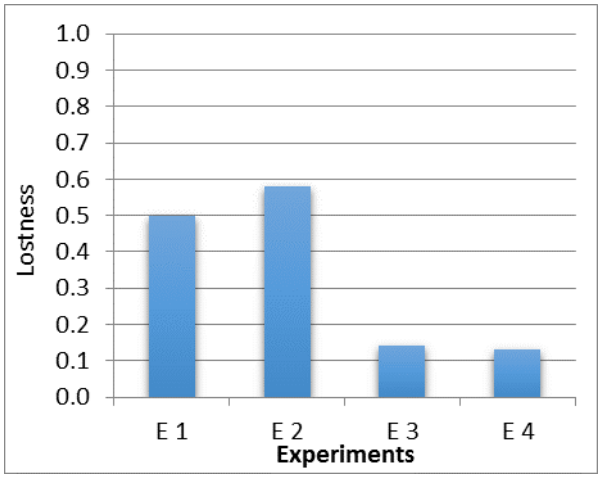

Fig. 5 the average results of lostness

Website 2 has a good web design and clear structure when compared to Website 1. The result of t-Test shows that there is significant difference for the means (p=0.05 & sig. (2-tailed) is 0.000) in lostness between Website 1 and Website 2. It

supports our claim that a good website design can help to reduce the lostness in hyperspace and improve the success rate. In Website 1, the average success rate from both experiments is 18.5% compare to 88.5% success rate in Website 2.

IV. CONCLUSION

In this work, we presented the results of four usability test experiments on a selected e-government website and a redesigned website. The results showed that the existing e-government websites did not fulfil the needs of citizens. The possibility of being lost in these websites is very high. That will lead to wasting time, unsuccessful tasks and dissatisfaction. The average rate of lostness is critical 0.54. Our finding showed that the lostness in hyperspace can be caused by bad design and complex structure. We also found that familiarity dose not significantly affect lostness in hyperspace. This result indicates that the more the depth of the optimal path the more the user gets lost. The result of Phase 2 showed how a good web design could lead to high rate of success and reduce lostness in hyperspace.

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