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Research Paper

The Impact of Users' Cognitive Style and Browsing Experience on Their Disorientation Levels during Web Interaction

Naiemeh Bahraini[1], Mahdieh Mirzabeigi[2*], Hajar Sotudeh[3]

1. PhD Candidate, knowledge and information science, Shiraz University, Shiraz, Iran
2. Associate Professor at Knowledge &Information Science Department, School of Education & Psychology, Shiraz University, Shiraz, Iran
3. Associate Professor at Knowledge &Information Science Department, School of Education & Psychology, Shiraz University, Shiraz, Iran

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***Corresponding author**
Email:
mmirzabeigi@gmail.com

Abstract

Background and Objectives: The present study aimed to investigate the impact of users' verbal, imagery and bimodal cognitive style, and browsing experience on their disorientation level during web browsing.

Methodology: In order to extract the data obtained from users' transaction files, a hybrid approach, including the content analysis method and the think-aloud technique, was utilized. The statistical population in this study included all of the undergraduate students at Shiraz University, and the sample consisted of 90 voluntary undergraduate students.

Findings: According to the results, no significant difference was observed among the cognitive styles as far as disorientation level was concerned. However, novice users experienced higher levels of disorientation in comparison with experienced users. In addition, it was observed that there is a significant difference between the users who had different levels of experience and cognitive styles in terms of disorientation in browsing. The verbal and novice users also experienced higher levels of disorientation compared to the verbal and experienced users.

Discussion: Due to the limited understanding of the role which cognitive style plays in guiding users during web browsing, the results of the present study appeared to be useful in providing a better understanding of the factors influencing the users' performance in browsing process and thereby the need to consider them in user modeling and training.

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Introduction

Providers and designers have provided various strategies (e.g., keyword searching and browsing) for users' better interaction with web-based information sources. Perhaps, previously, it was a commonly held belief that the common strategy for finding information in the web is keyword searching where the user attempts to find the information of interest by entering keywords. However, many studies have illustrated that the common strategy which is utilized to obtain information from the Web involves browsing and following the hypertext links (Katz and Byrne, 2003; Teevan et al., 2004; MacFarland, 2005; Sauro, 2012). The reason justifying the popularity of this method amongst the users is the fact that it provides a general overview of either physical or conceptual space, it monitors the search process, it requires lower levels of knowledge, and finally, it simply describes information etc. (Marchionini, 1997). Browsing on Web, inherently, is regarded as an interactive activity based on the mental structure and the acquired knowledge of the users, and it emphasizes following the links (Chen and Ford, 1998). However, orientation through following the links, as the main strategy for browsing has some problems; as the users may not know where they are, how to return to the optimal path and what the next step is while following the links (Sunawan and Xiong, 2017). In other words, due to its nonlinear nature, hypertext structure may be so complex for the users to the extent that they become confused and get disoriented while browsing (Park, 2018). Users become rapidly disoriented in a complex hypertext environment, which provides many links and multiple tools (Lee, 2013; Park, 2018), and too much information can lead to an overload of information and disorientation, and making decisions becomes more difficult for users (Lo and Wang, 2012; Park, 2018).

Disorientation is defined as the tendency to lose one's sense of location and direction in a web site. People who feel disoriented may become frustrated and lose interest, and may also work less efficiently (Ahuja and Webster, 2001; Herder, 2003, Bayazit, Bayram and Cumaoglu, 2018). According to Janez and Rosales (2016), hypertext users can show efficient or disoriented navigation patterns. An efficient navigation pattern is generally task-related and the nodes visited are the key to carrying out tasks. On the other hand, a disoriented navigation pattern consists of randomized or inefficient navigation patterns. These patterns include skipping relevant nodes or visiting unimportant nodes several times. When users become disoriented, they do not have a clear conception of the relationships within the system, they do not know their present location in the system in relation to the display structure, and they find it difficult to decide where to look next within the system (Elm and Woods, 1985). In this case, they will face problems during browsing due to lack of knowledge of the structure and the links which exist in the system. Thus, having prior knowledge in addition to browsing experience about hypertext can help in alleviating this problem. In this regard, many studies have illustrated the effective role of browsing experience on disorientation and have concluded that experienced users confront less disorientation in comparison to their less experienced or novice counterparts during the process of browsing (Dietrichson, 2001; Calisir and Gruel, 2003; Herder and Juvina, 2004; Chen et al., 2006; Kheshtzar and Mirzabeigi, 2019). Disorientation is regarded as one of the information system challenges that can be seen in the web environment which requires more efforts to reduce it. While recent research is concerned with the use of the web, they have provided valuable information about orientation and disorientation activities of the users in keyword searching (Gwizdka and Spence, 2007; Kinley and Tjondronegoro, 2010). However, there is scarce information about the differences of user disorientation according to cognitive characteristics and the level of experience in the process of browsing (Graff, 2005; Kinley et al., 2014; Bayazit, Bayram and Cumaoglu, 2018). Cognitive style is considered as one of the users' cognitive characteristics which may influence the level of their disorientation. Riding and Rayner (1998) define cognitive style as an individual's preferred and habitual approach to organizing and representing information (Park, 2018).

According to Riding and Cheema (1991), the cognitive style of the individuals can be divided into two major dimensions of holistic-analytical, and verbal-imagery. According to their view, individuals with a holistic-analytical cognitive style, process the information as a whole or in details and the individuals with verbal-imagery cognitive style, process information in the form of words or images. The holistic-analytical cognitive style dimension is a common method which by means of which individuals think about the information and see and organize it as a whole or in parts. This style affects the way users learn and organize information. The verbal-imagery dimension is a cognitive style by which the person processes information in a verbal or imagery form while representing or thinking. In other words, this dimension refers to the ways in which a person represents knowledge through words or in form of images (Kinley and Tjondronegoro, 2010). Recent studies have indicated that due to the fact that holistic users tend toward the structured collection and they are dependent on information system context, they become more disoriented compared to analytical users during browsing (Kinley et al., 2014; Kinley et al., 2010). However, no study has yet examined verbal-imagery users` disorientation during browsing. Therefore, it is necessary to identify the groups with the risk of becoming disoriented by recognizing the level of disorientation during browsing. It is important to note that users may identify and distinguish different methods of information processing which are expected to cause disorientation and should be taken into account when designing interactive systems. In addition, it can be useful for internet design training and assistive tools such as training courses on information literacy aimed to the better understanding of users' difficulties in the process of browsing and also the use of links in searching for information. Given the above mentioned statements, the present study attempts to identify the potential group at the risk of becoming disoriented during web browsing while examining the potential role of cognitive style in web browsing.

Background

In the large and multiple space of networks, disorientation is considered as the most common issue which users face, and in order to examine disorientation, the weaknesses in their performance should be evaluated, instead of examining the emotion of the users (Elm and Woods, 1985). By accepting this approach and additionally with respect to the development of the Internet and the World Wide Web, various studies have addressed the issue of becoming disoriented in this context. Some studies have examined disorientation amongst users with different cognitive styles, especially with regard to Witkin`s (1962) field-dependent and field-independent styles. In this context, Seufert et al. (2007), Moos & Azevedo (2008), Qin and Patrick (2009), Chen and Macredie (2010), Ruttun and Macredie (2012), and Sanchiz, Chevalier and Amadieu (2017) have examined the effect of cognitive style on users' interaction with hypertext and have outlined some of the browsing characteristics of the field-dependent and field-independent users. These studies have indicated that novice field-dependent users get more disoriented with the bold and unrelated signs and they easily get disoriented by the path and continue browsing the hypertext with more difficulties; hence, they feel more confusion, frustration and distress. They have stated that field-dependent users tend to be guided through learning processes, they have less analytical approaches, and they need a guide to reduce their level of disorientation and find their related information. However, field-independent users have fewer tendencies to utilize a guide and adopt an analytical approach for the purpose of learning. Additionally, females get more disoriented in comparison to males. Flexible paths are more suitable for experts while structured content is useful for novice users. Meanwhile, prior knowledge makes older people reduce the number of web pages they visit and feel less disoriented.

Another group of previous studies has taken the holistic-analytical and verbal-imagery cognitive styles into account, including Riding and Cheema's (1991); Meanwhile, Kinley and Tjondronegoro (2010); Kinley

et al. (2010); Mohamad (2012); Lee (2013); Kinley et al. (2014); Lugli (2017) which have investigated the impact of cognitive style on browsing style, searching information and users' disorientation, and the relation between these factors. The results of these studies revealed that verbal users who have a sporadic style, are not patient during their searching and they frequently scan the result pages, making them confused, dissatisfied and disappointed from search results. In contrast, imagery users have a structured style, and possess an organized searching style as well as a step-by-step navigation system. Additionally, the analytic-verbalizers perform better when they receive the instructional format which suits their cognitive preferences, and the novice-users become more disoriented in the network structures rather than hierarchical structures. Individuals who have an analytical approach can control their paths through complex environments whereas holistic individuals are disoriented in a hypertext environment that has more links and browsing tools. However, individuals with Landmark style revisit previous pages more often to test other links, and this shows their disorientation. Additionally, they spend more time and find less information in comparison with route users and survey users, since they use less useful and linear strategies in terms of time and actions. Landmark users use less mouse cursor movement in comparison with route users and survey users, and they tend to navigate only in a delimited environment and avoid wider spaces because of their fear of becoming disoriented.

Some studies such as Amadieu et al. (2009, a, b), Shih et al. (2012), Crabb and Hanson (2014), Cui et al. (2015), and Adda et al. (2016), Sanchiz et al. (2017), Kheshtzar and Mirzabeigi (2019), Reisoğlu, Çebi and Bahçekapılı (2019) have addressed the impact of users' experience on the level of disorientation in interaction with the World Wide Web. These studies have illustrated that experienced users do not feel disoriented or confused, whereas low-experienced users will easily get disoriented and confused. This is more obvious in the comparative review of the two different environments for better browsing. For instance, users with lower levels of prior knowledge of the conceptual network map were more disoriented in comparison with the hierarchal conceptual map, while the structure of the conceptual map did not impose much pressure on the users with prior knowledge. In addition, users with lower levels of prior knowledge achieve a better comprehension of hierarchical structure as opposed to the network structure, and they feel less disoriented. In a network structure, the prior knowledge helps the users so that they feel less disoriented. Scholars believe that by perusing the user's browsing, their disorientation can be understood. Users who are not skillful at categorizing concepts and are unwilling to make decisions when facing a number of options can become disoriented in a "deep" Web structure, and users who lack the ability of processing stimuli based on their complex relationships, become disoriented in broad website structure. Additionally, if the conceptions of the scope of records or pages which are continuously being retrieved by the user possess a great meaningful distance, then their browsing behavior is unstructured and the user is disoriented. This is due to poorly organized and inadequately structured content.

The results of different studies demonstrate that individual differences including experience and cognitive style as well as information system characteristics in some cases are considered as the factors influencing the users' disorientation while web searching. In order to examine the impact of these factors on disorientation, some studies have been conducted using qualitative and quantitative methods. These methods include questionnaires, interviews, cognitive style analysis tests, think aloud protocols, session recording and searching logs. Several methods have been used in the literature to understand and measure disorientation. These methods can be classified under four main topics: performance, subjective opinions, metrics and optimal path. It is noteworthy that recent studies are mostly focused on users with field-dependent and field-independent cognitive styles in keyword searching context. On the other hand, there are few shreds of evidence indicating that users with verbal cognitive style as opposed to users with imagery

cognitive style, and users with holistic cognitive style in comparison with users with analytical cognitive style, become more disorientated in web during keyword searching. Meanwhile, observing and understanding these differences can be effective in developing information retrieval systems and can help to improve browsing for users who face browsing problems more than others (Elm and Woods 1985; Otter and Johnson 2000). In addition, similar cultural and social studies are required to be conducted in terms of users' cultural and social differences and other individual differences in different communities.

Research objectives

The present study aims to investigate the impact of users' cognitive style and different experiences on disorientation while Web browsing. In this regard, the secondary objectives of this research are outlined as follows:

Identification of the differences in disorientation level among both experienced and novice users

Identification of the differences in disorientation level among users with bimodal, imagery and verbal cognitive style

Research questions

Is there a significant difference between experienced and novice users in terms of their disorientation level?

Is there a significant difference between users with bimodal, imagery and verbal cognitive styles in terms of their disorientation level?

Is there a significant difference between experienced and novice users with bimodal, imagery and verbal cognitive style in terms of their disorientation level?

Methodology

The present study adopted a mixed approach (quantitative and qualitative). That is, a quantitative content analysis was utilized for transaction log analysis with web environment, and the think-aloud technique was used in order to complete and enrich the findings of the quantitative phase. The statistical population of the study included undergraduate students of Shiraz University. Due to this fact that the process of representing a session for the purpose of data collection was a time-consuming process, and participants had limited time, their collaboration was very important. In addition, particular participants with bimodal, verbal and imagery cognitive styles were required to participate in the study. In order to identify and select the participants, using typical random sampling methods was not possible. Thus, a non-random sampling method of purposive type was used. Meanwhile, according to the recommendation of experts in this field, in order to determine the sample size, following other studies concerned with the measurement of information searching behavior of users during their interaction with the retrieval system in 1- or 2-hour sessions (e.g., Ford et al., 2001; Spink and Dee, 2007; Spink et al., 2006 and Kinley and Tjondronegoro, 2010), a maximum sample size of 90 voluntary students (n= 30 of each cognitive styles) was specified. Chen et al. (2006) believe that the results of research on the role of gender in disorientation are different. In some studies, such as Chen and Macredie (2010), differences between males and females have illustrated the superiority of males, while in the other studies, this has not been observed. Accordingly, in this research, attempts were made to control for the gender role, and equal numbers of males and females were selected as the participants.

Additionally, in order to collect the data, Riding's computer-based cognitive style analysis test was utilized with the purpose of determining the participant's cognitive style. Although more than thirty theories have been proposed in the field of cognitive and learning styles, the one put forward by Riding and Cheema (1991) has been used more frequently than others. This is because of the comprehensiveness and compatibility it has with other previous theories (Kinley, 2013; Yuan and Liu, 2014).

Beigi (2001) has modified this test for the Iranian population and established its reliability and validity. Accordingly, his scoring method was used in order to analyze the results of the cognitive style analysis test. In addition, in order to measure the level of users' experience, a short self-made questionnaire was used. In order to calculate the level of experience, each of the 14 questions was scored from 1 to 3, with the minimum and maximum scores being 14 and 42, respectively. The cut point was obtained with the fraction 14 of 42 and was divided by 2. Those whose scores were lower than the cut point were considered as novice and those whose scores were higher than cut point were considered as experienced. Face validity of the experience questionnaire was confirmed by three professors in the field of knowledge and information science. In order to assess content validity, the questionnaire was handed to 25 experts in the field of information retrieval. Afterwards, 11 individuals responded to the questionnaire and they confirmed its validity based on their own judgment. In order to assess the reliability of the questionnaire, Cronbach's alpha was calculated to be 0.834, which was acceptable. In addition, the level of disorientation was calculated according to Smith's score (1996) by using transaction log analysis. This score was calculated according to the following formula:

$$L = (\frac{n}{s} - 1)^2 + (\frac{r}{n} - 1)^2$$

Where (s) is the total nodes, which are available during browsing, (r) is the total node which is required for browsing and (n) is the number of different nodes visited during browsing and reviewing. These measurements were done and controlled by observing the transaction log files by two of the researchers (Bayazit et al., 2018). The validity of this scale for measuring disorientation was established by Smith (1996) and Otter and Johnson (2000), and it has been widely used by many other scholars. In addition, due to the fact that disorientation is associated with users' feelings, the think-aloud technique was utilized in order to enrich quantitative findings. To this aim, all of the users' conversations were recorded using Software Camtasia Studio 8.6.0. Then they were transcribed. Paragraphs with phrases referring to disorientation, such as "I'm confused", I'm nervous", "I can't continue", "I do not know what to do", "I'm bored" and "I've become disoriented" were encoded and were used in order to answer the research questions. Additionally, for the purpose of conducting the research, participants' cognitive styles were determined using Riding's computer-based cognitive style analysis test. At the next stage, the participants entered the second phase of the study for determining their cognitive styles. In this phase, participants responded to a short questionnaire which included their demographic information, the level of skill and experience with computer and the Internet, browsing experience, and the familiarity with websites for selling products.

In this study, the level of difficulty of the tasks was controlled. Three tasks with three difficulty levels of simple, semi-complex and complex were prepared according to Zhang (2012) framework. The complexity levels were controlled by three factors of the clarity of the information required to answer the question, the distribution of the answers, and the extent to which a higher level cognitive activity, such as synthesizing information, is required to complete the task. A simple task consists of a well-defined question, and it is clear that which kind of information it does require to be answered. The answer is on a web page and a lower amount of cognitive effort is required to perform the task. A complex task is an open question of whose required information is less definite, and the answer is often derived from several web pages. In order to respond to such a task, high levels of cognitive activities such as comparing, interpreting, and combining information are necessary (Zhang, 2012). A semi-complex task is a task whose question has more information clarity and response dispersion, and it needs fewer cognitive activities in comparison with a complex task. Initially, eight tasks were determined and evaluated from the aspect of the influence they get from the website drawbacks so users could achieve the final results. Afterward, these were sent to the experts in the field of information retrieval so they review each task and score it in the range of 1 to 5 (1 for simple tasks and 5 for complex tasks). The complexity level is the sum of the points given by the experts.

Accordingly, each participant completed three tasks (i.e., simple, semi-complex, and complex) by means of browsing and following the links in the two Iranian e-commerce websites, namely Digikala[1] and Zanbil[2]. The reason for choosing these two websites was that they were among the well-known websites for purchasing products and their language was Persian, which allowed the public to browse through different layers of hypertexts in various categories. It should be noted that the two different websites were utilized to control the possible impact of the user interface and also to observe how the information was arranged based on users' search. The rotating task was randomly used for each user in order to prevent the effects occurring due to possible bias and to control the effect of learning during data collection. To this aim, the participants were not allowed to complete the tasks in a specific order. Before initiating the session, necessary descriptions regarding the recording of users' interactions during browsing, the differences between keyword searching and browsing, and the scoring and think aloud technique were discussed with the participants. In addition, the approximate time needed was explained, and in this phase the participants were asked about their willingness to cooperate in order to consider the awareness of the users regarding the browsing process and searching sessions.

Findings

The comparison of disorientation in novice and experienced users

The comparison of disorientation in novice and experienced users was done by means of Whitney Yeoman test in order to assess the quantitative difference in data with non-normal distribution. The results indicated that there is a significant difference between the two groups of novice and experienced users in terms of disorientation (U: 663/0000, sig: 0.005).

Table 1. The obtained results from Whitney U test (The results were utilized for examining the differences between experienced and novice users in terms of disorientation)

Variable	Mean Score Experienced And Novice	U Statistic	Z Statistic	Significance Level
DISORIENTATION	0.30 and 0.38	666.000	-2.817	0.005

The data regarding mean score for both users indicated that novice users with a mean score of 0.38 become more disoriented than the experienced users with a mean score of 0.30 (Figure1).

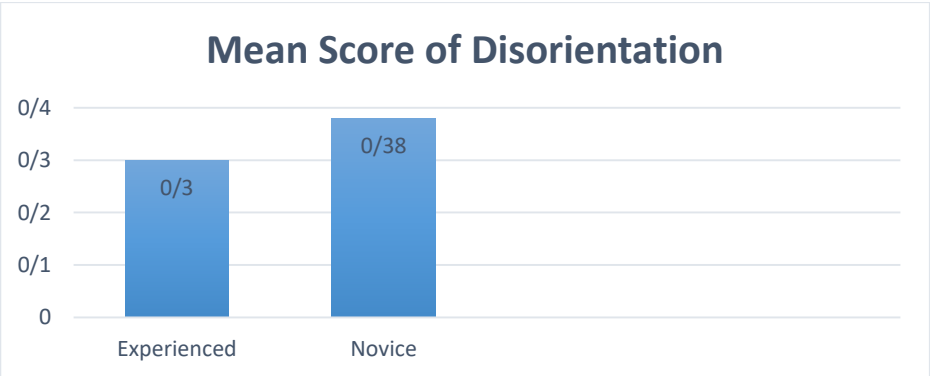

Figure 1. Mean score of disorientation for novice and experienced users

1 WWW.Digikala.com
2 WWW.Zanbil.ir

The users' disorientation during web interaction obtained by think-aloud technique was collected in the findings section to enrich the quantitative data. According to the results of think-aloud technique, 27 novice users mentioned their disorientation during their think aloud process, and 46 experienced users did not indicate any disorientation. For example, a participant who was regarded as a novice user, expressed his disorientation as follows:

"By clicking on the type of product, I do not see the results. How and where can I see the results? After observing the results, what should I do? I do not know where I am in the web site? I cannot find the given product by browsing the subject categories."

Another novice participant mentioned that:

"I do not know where the comparison tool for the website is located. I cannot browse the given product, what should I do? "

The novice users' think-aloud was fraught with phrases such as "I do not know", "I cannot," and especially "I got confused". Given the fact that they constantly expressed their lack of knowledge regarding their previous and current place on the web, it can be concluded that the novice users became disoriented during the process of web browsing. In contrast, the assessment of experienced users' think-aloud indicated that they were not disoriented to the extent novice users were in their browsing. More than half of the participants did not mention anything about their experience of disorientation directly and indirectly, and of course all of them were experienced users.

For instance, a participant stated that:

"… In order to find a television, I went to the links for digital commodities and I observed that there is not any television there, but I saw a monitor and followed that category, suddenly I found out that the given specification is not concerned with monitors, and I noticed that I had made a mistake and returned in order to review the hierarchy…"

Another participant stated that:

"At first, I didn't notice the aerator for a face is required. Therefore, I found the aerator for the environment. After reviewing the specifications, I found out that these two are different and then I found the website related to the given product…"

Two experienced users found their mistakes so fast during think-aloud technique. This was due to their ability of correcting their mistakes wherever they were disoriented. However, the novice users did not possess such ability. The novice users could not act in a way similar to the experienced user; thus, the novice users gradually became disoriented.

The comparison of disorientation in users with different cognitive styles

In order to examine the differences among users with bimodal, verbal and imagery cognitive styles in terms of disorientation, Kruskal-Wallis test was used since data distribution was not normal. The results indicated that the significance level was higher than 0.05. In other words, there are no significant differences among users with verbal, bimodal and imagery cognitive styles in terms of disorientation level as shown in Table 2.

Table 2. Results of Kruskal-Wallis test (The results were used to examine the differences among the users with bimodal, imagery, and verbal cognitive styles in terms of disorientation)

Variable	Chi-Squared Test	Degree of Freedom	Sig
Disorientation Level	2. 361	2	0.307

Analysis of the think-aloud data regarding the users with different cognitive styles was similar to the quantitative findings of users with verbal, bimodal and imagery styles, which indicated that there is no significant difference in terms of experiencing disorientation. Accordingly, 10 verbal users, 9 bimodal users

and 8 users with imagery cognitive style mentioned this in their think aloud. For instance, a participant with bimodal cognitive style stated that:

"… I almost experienced at least one problem in every task; I did not find the brand of the perfume, and I was looking for it very much. I did not know where the TV specifications are, and I did not even know I should have looked for a profile. Additionally, for finding the humidifier machine, I could not use the site comparison tool feature even after so much effort; And after I found the comparison tool, I did not know how to use it ... "

In addition, another participant with a verbal cognitive style expressed that:

"…Why are all these windows opened, I did not click on any links to prevent opening extra pages… I do not know in which window I should continue my search…both of the websites are lookalike, and I cannot distinguish them and find out which website I presented…I am confused..."

Another participant with an imagery cognitive style expressed his disorientation as below:

"…. Everything on the website attracts my attention, I know on which website I present, it is obvious from its layout, but there is no specification of the goods in one of the websites ... Instead of a requested feature, I chose another feature and the result was not shown…I thought that the website has a problem… In addition to the requested features, I chose several other features by myself…I have problems with these features…my time is wasting…what should I do?"

As it can be observed, users with diverse cognitive styles have used phrases such as "I am tired, "what to do", "I am confused", "I am nervous", "I am annoyed", etc. to point out their disorientation while browsing the web. It can be argued that the disorientation may have nothing to do with their cognitive styles since as it was mentioned earlier, the number of users that expressed their disorientation was almost equal in all three types of cognitive styles.

The comparison of the disorientation level of users with different cognitive styles and experiences

In order to investigate the differences between novice users and experienced users with different verbal, bimodal and imagery styles in terms of the disorientation level, Kruskal-Wallis test was used for data with non-normal distribution. The results of this test illustrated that the significance level is below 0.05, and the zero assumption is rejected. Therefore, there is a significant difference among the six groups of participants in terms of their disorientation (Table3).

Table 3. Results of the Kruskal-Wallis test (The results were used to examine the differences between the novice and experienced users with bimodal, imagery, verbal cognitive styles in terms of disorientation)

Variable	Verbal –Novice	Verbal– Experienced	Bimodal – Novice	Bimodal- Experienced	Imagery – Novice	Imagery - Experienced	Chi-Squared Test	Degree Of Freedom	Sig
Disorientation	0.43	0.27	0.35	0.28	0.36	0.35	16.208	5	0.006

In order to examine the differences of disorientation between the two groups of participants more accurately, Whitney U test was performed separately and in pairs. The results indicated that there is a significant difference between the two groups of verbal – experienced and verbal – novice in terms of disorientation (Table 4). The mean score of disorientation for verbal-experienced users was 0.27, and for verbal-novice users, it was 0.4 (Table 3). In other words, verbal-experienced users were less disoriented compared to verbal novice users.

Table 4. Results of Whitney U test (The results were used in order to examine the difference between novice and experienced users with bimodal, imagery and verbal cognitive styles in terms of disorientation)

Group Of Users	U Statistic	Z Statistic	Sig
Verbal – Novice And Verbal Experienced	33.000	-3.284	0.001
Bimodal – Novice And Bimodal Experienced	76.000	-1.514	0.130
Imagery – Novice And Imagery – Experienced	99.000	-0.560	0.576

Quantitative data analysis indicated that there is a difference between novice and experienced users with a particular cognitive style in terms of disorientation in think aloud process, and novice users with different cognitive styles expressed their disorientation while browsing whereas experienced users with different cognitive styles had fewer problems regarding their disorientation.

For instance, an experienced participant with an imagery cognitive style stated that:

"… I had the experience of searching and browsing one of the websites. In my opinion, the other websites that I have not browsed were similar to the one that I had experienced it…"

In addition, another experienced participant who was verbal indicated that:

"… I did not have any problem in browsing; I just wanted to complete it fast…"

The issue of disorientation has been mentioned by many experienced users. This could be attributed to the unfamiliarity of users with those given websites, since some of the participants stated that they were confused in the first task; however, their concerns were resolved during the next tasks.

For instance, one participant stated that:

"At first, I did not know where the specifications for the product are mentioned, and therefore I was confused. Then browsing the website more accurately, I found them. Hence, I had a problem with the first phase of the tasks…"

In addition, the complexity of the tasks can be another reason for some of the experienced users' feeling of being disoriented, since these participants had started their searching and browsing with complex tasks.

For instance, an experienced participant expressed that:

"…. At first, I did not know exactly what is required in the scenario. I was able to find the given product, but I did not notice all the specifications which it required, and therefore by selecting some of the specifications, it seemed that I had got confused, so I reviewed all the steps but I could not find the problem, so I got completely confused…".

Discussion

The qualitative and quantitative findings of the present study indicate that the level of users' experience affects their disorientation. According to the qualitative findings, novice participants expressed their confusion and disorientation. Failure in observing the results, lack of awareness of the current location on the website, and failure in finding the given products by means of browsing, can lead to spending more time and using unrelated and repeated nodes, which can cause confusion for the participants and ultimately lead to their disorientation. On the other hand, the state of disorientation which was expressed by some experienced participants during the think-aloud process, would raise this question: is there a reverse relationship between the level of experience and the level of confusion? Hence, there remained the question: What is the reason for users' confusion? Two potential reasons can be stated in this regard: Firstly, the unfamiliarity of the participants with the content structure of the websites, and task complexity can be one reason. Secondly, the difference between users' definition of disorientation and their real definition of confusion can be regarded as another reason. In other words, experienced users who indicated their disorientation during their think-aloud were able to remember the path due to their experience, and thereby they visited fewer repeated and unrelated nodes, and according to the Smith score, were less disorientated. Accordingly, these users expressed that they felt they are disorientated while they were not actually

disoriented. These findings are in line with some of the previous studies (Amadieu et al., 2009 a, b; Mohamad, 2012; Shih et al., 2012; Crabb and Hanson, 2014; Cui et al., 2015; Adda et al., 2016, Sanchiz et al., 2017, Kheshtzar and Mirzabeigi, 2019; Reisoğlu et al., 2019) . Amadieu et al. (2009), for example, indicated that users with lower levels of prior knowledge were more disoriented in the conceptual network map in comparison with the conceptual hierarchical map, whereas the structure of conceptual map did not impose many effects on users with higher levels of prior knowledge. In a separate study, Amadieu et al. (2009 b) concluded that users with lower levels of prior knowledge feel less disoriented inside the hierarchical structure. The feelings of disorientation of users with high prior knowledge were not affected by the type of structure. In a network structure, the prior knowledge helps the users to feel less disoriented. Mohamad (2012) showed that novice users become more disorientated in network structures rather than hierarchical structures. Shih et al. (2012) mentioned that there is an inverse relationship between the user's familiarity with computer and their disorientation Experienced users never feel disoriented and confused, while the low-experienced users are easily confused. Crabb and Hanson (2014) reported that the cognitive ability and technological experience had a significant impact on disorientation. These results indicate that cognitive ability and technological experience are assumed to be good benchmarks in order to analyze user satisfaction and performance in web studies. Cui et al. (2015) showed that users who are not skillful at categorizing concepts and are unwilling to make decisions while facing a number of options, can become disoriented in a "deep" web structure, and users who lack the ability of processing stimuli based on the complex relationships, can become disoriented in a wide website structure. According to Adda et al. (2016), if the concepts of the scope of the documents or pages that are retrieved by the user are different from semantic meaning, then the users` navigation behavior is unstructured and the user is disoriented. This is due to the poorly organized and inadequately structured content. It can be argued that by analyzing the findings of the study, those novice users who did not do the act of browsing and were unaware of the system structure, are not able to distinguish related and unrelated nodes. Sanchiz et al. (2017) showed that higher prior knowledge helped older users reformulate queries and improved the processing of the first search engine page consulted. Kheshtzar and Mirzabeigi (2019) concluded that the interactive effect of the level of complexity of tasks and experience on their disorientation was not significant. The interactive effect of the level of complexity of tasks along with gender and experience on users' disorientation was not significant. Reisoğlu et al. (2019) argued that novices' using irrelevant keywords and clicking irrelevant links may have caused them to be misled by the search engines, to deviate from the search task, and to spend their time on irrelevant websites.

In addition, the results indicated that there is no significant difference among users with different cognitive styles in terms of disorientation. Previous studies have not addressed the disorientation of verbal-imagery cognitive styles during browsing. However, Kinley et al., (2014) found that those with imagery cognitive style become less disoriented than those with verbal cognitive style. In addition, for the two dimensions of holistic and analytical natures, the results of studies conducted by Kinley and Tjondronegoro (2010), Kinley et al. (2010), Mohamad (2012), Lee (2013), Kinley et al. (2014), and Lugli et al. (2017) indicated that these users are different in levels of disorientation, and most of the time, holistic users are more disoriented in the web than analytical users. There are some differences between the results of the present study and those of other previous studies in terms of their description. For example, quantitative measurement has not been employed in most of the studies where the users' disorientation is reported based on descriptive evidence and not using statistical analysis. In addition, the sample size of the present study is small, and there is the possibility that the data analysis is affected by this. Thus, a similar study with a larger sample size should be conducted in order to compare its findings with the findings of the previous studies. This study did not also address the cultural, social and educational differences which can in turn influence the findings of the study. Additionally, there is a difference between users with cognitive styles and different levels of experience in terms of disorientation. That is, experienced verbal users become less disoriented than novice verbal users. However, there is no significant difference between experienced and novice users with bimodal and imagery cognitive styles in terms in disorientation. These findings are in line with some of the previous studies. Kinley et al., (2014), for example, indicated that verbal users are impatient and tend to constantly browse the resulted pages and get confused. Regarding the analytical-holistic cognitive styles or

field dependent and field- independent cognitive styles, Witkin et al. (1977) argued that field-dependent users who are low-experienced and novice become more disoriented. Palmquist and Kim (2000), also indicated that experienced field-dependent users utilized fewer nodes than low-experienced field-dependent users. In another study, Kim (2000) demonstrated that analytical users with low-experience face problems in information retrieval. In addition, Graff (2005) and Kinley et al. (2014) reported that users with scattered and irrational browsing strategies become disoriented in complex structures, and these strategies are mostly adopted by novice users. Upon observing the differences between experienced and novice users with bimodal, imagery and verbal cognitive styles in terms of disorientation, it can be concluded that these differences are not affected by the users' cognitive styles but originate from the users` experiences.

According to our results, the users constantly utilized unrelated and repeated nodes; hence, they got disoriented from the optimal path. After a comprehensive review of the novice verbal users, it can be argued that lack of access to the given information would lead to user disorientation and confusion. These users are unable to distinguish between appropriate paths and unrelated paths. Therefore, designers should use tools for guiding them by showing them their previous and current locations in information systems. The findings of the present study indicate the importance of the impact of the experience on the users' disorientation. In fact, the experience of imagery users leads them to be able to use their abilities more efficiently (Smith, 1966). On the other hand, due to their certain capabilities, experienced users become less disorientated in comparison with novice users. In addition, analysis of users' disorientation shows that novice verbal users are unable to efficiently retrieve the information efficiently. Due to their unfamiliarity with web structure and lack of sufficient experience for using links and nodes, these users are not able to perform similar searching operations as do experienced users. The cognitive style of these users can contribute to this browsing style and can explain why there are such differences between novice imagery users and novice verbal users. In information systems, imagery users are able to locate information with the display content. However, an environment like the web is considered a multimedia environment, and there is the possibility that imagery users could process information better than verbal users and become less disoriented. Therefore, it can be concluded that the level of disorientation while browsing is highly associated with the users` experiences and skills. Therefore, by increasing their level of experience, novice and verbal users will face fewer disorientation problems. This is particularly crucial for verbal and novice users and should be taken into consideration by experts in the realm of information literacy.

Besides, prior to the process of searching, librarians and mentors can help the verbal and novice users to improve their browsing methods. This can be done by providing background information for enhancing browsing searching skills or by familiarizing users with information systems so that their disorientation is reduced. Additionally, users can be instructed about different browsing searching strategies, they can be made familiarized with different information system structures and features which are available in any structure and with various links in an information system.

In addition, it is assumed that understanding cognitive dimensions of information browsing can be helpful for designers and developers to improve efficient user interfaces. Therefore, interactive systems that apply adaptation and personalization techniques that take into account different cognitive styles in their user model have a significant positive effect on users' interactions, assisting them, inter alia, in locating and processing information more efficiently. Therefore, interactive systems should be able to match their environments to individuals' information processing preferences, increasing users' levels of comprehension, accuracy, performance, satisfaction while at the same time minimizing cognitive overload and disorientation. It is generally accepted that cognitive (compared to emotional) elements are more straightforward, since they are easier to measure and easier to quantify, and we have already reached a level in which we can make inferences about how users with different cognitive abilities and preferences can be aided or guided through an adapted and personalized system and/or user interface. The certain visual instructional aids can reduce levels of disorientation and enhance performance.

A common way to reduce disorientation is to provide instructional guidance, in form of visual navigational aids (e.g., maps) and a set of visual cues such as breadcrumbs, highlighting of context, pagination, graphic visualizations, history-based mechanisms, context highlighting, page labels, different

link colors, and link annotations. In order to detect the visited node from non-visited nodes, designers can use visual elements such as font size, boldness or italicization, and they can change the color of the visited node. The main navigation path of the user can also help detect the user's position. Precise tagging for each link can also prevent the user disorientation. It is advisable that in the process of designing the system, designers represent the complex information in a hierarchical structure in order to create less confusion for novice and verbal users. Additionally, it is smart to use well-designed cues that represent thematic and semantic objective structures of the text in order to help users to understand the hypertext and reduce their confusion in browsing. Implementing poor levels of cues in the hypertext leads to low-performance browsing. This style entails trial-and-error clicks and makes users utilize the back button repeatedly, eventually leading the user to experience disorientation and repeat their browsing. Also, tag clouds provide more efficient navigation and facilitate the navigation process in a hypertext environment.

Another way to assist novice and verbal users is to provide adaptive hypermedia that assist the user to gather information and fit with the user's characteristics and real queries. Additionally, they prevent problems such as the overload of information, disorientation, cognitive overload and lack of understanding that usually occur during browsing. Because one of the main goals of adaptive hypermedia is to design more user-friendly systems to minimize the problems caused by traditional hypermedia systems, adaptive hypermedia systems have been built around an individual user's characteristics, such as interests, preferences, knowledge and goals. Therefore, it is necessary to understand cognitive mechanisms to explain differences between individuals as well as the levels of disorientation. Meanwhile, at the time of designing an information system, in order to enhance the users` motivation, focus and self-confidence, the organizational with the information representation and the supportive tools should match cognitive styles. Thus, if users are located on the verge of disorientation, they will not get disappointed and can find their main path and continue their browsing. After learning and understanding the type of information system structure and various links which it contains, users should use those links which have precise tags, and they should pay attention to visual cues and search guides while browsing. In order to overcome the problems identified, a hypermedia system should be designed in a way that can identify the user's interests, preferences, and needs and give appropriate guidance throughout the navigation process.

This study examined the differences among users with bimodal, verbal and imagery cognitive styles that possess different experiences in terms of the disorientation they experience while browsing. It explored a specific context and a dimension of cognitive styles among a small sample of university students, which decreases external validity. Moreover, this study was unable to delve into the details of how individuals interacted with the interface structure. Therefore, it may be suggested that in future studies, the structure of hierarchical websites and the order of their menu be investigated in order to examine their information retrieval process and find out whether their information structure would support and guide users with different cognitive styles.

Conflict of Interest

No conflict of interests has been reported by the authors.

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