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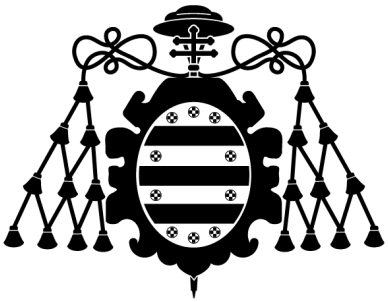

Universidad de Oviedo
Universidá d'Uviéu
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Tesis Doctoral

Programa de Doctorado en Ingeniería Informática

"A structured demographic evaluation approach for interactive technologies based on the identification of high impact usability factors"

Autor: Chaudhry Muhammad Nadeem Faisal

Directores: Martin Gonzalez-Rodriguez y Daniel Fernandez-Lanvin

HCI-RG March 2017

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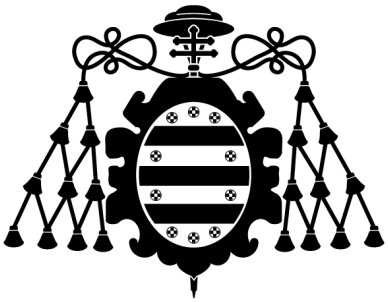

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este experimento demostraron que la familia *sans-serif* es el más popular, mientras que la familia *serif* presentaba la personalidad más atractiva, lo que llevó a un segundo experimento. En el segundo experimento participaron n = 383 estudiantes universitarios y los resultados demostraron que los usuarios tuvieron un tiempo de ejecución más corto en tareas de compra con el prototipo experimental diseñado con una fuente tipo *sans-serif.* La información textual diseñada con una fuente tipo *sans-serif* demostró ser más efectiva debido a su atractivo y las preferencias de lectura de los usuarios

Los resultados de esta investigación tienen implicaciones significativas para el diseño de sitios web comerciales a fin de desarrollar actitudes positivas de los clientes y minimizar los sentimientos de irritación y rechazo por parte de éstos.

RESUMEN (en inglés)

Websites are an important method of buying and selling products conveniently. Website design is very important in achieving business success by attracting more customers. A visually appealing site with trustworthy content, which is easy to navigate will produce a sense of trust with the least irritation. In this study, we examine the user preferences and emotions about web design attributes in an online shopping environment in cultures with high uncertainty avoidance. Uncertainty avoidance expresses community avoidance from unknown situations, ambiguity, and personal risk.

The objective was to determine the relationship between web design attributes (i.e., content/information quality, interactivity, navigation, color, and typography) and individuals' loyalty via trust and satisfaction, and between web design attributes and irritation. Another subsequent part of this study was to explore the impact of Font personality on task completion time. In order to test the proposed hypotheses, three empirical studies were conducted.

Initially, a working e-commerce website prototype was designed to identify the implications of selected design attributes on loyalty via satisfaction and trust. A questionnaire was designed to collect data to corroborate the hypotheses, related to satisfaction, trust, and loyalty. The partial least squares method was used to analyze the collected data from the students who participated in the test n= 558. The results indicated that all of the web design attributes positively influence loyalty via trust and satisfaction for uncertainty avoidance cultures.

The same website prototype was further used to explore the relationship between design attributes and users' irritation. The data collected from participants (n= 515) via questionnaires were also analyzed using the partial least squares method. The results indicated that the adopted web design attributes had significant a negative relationship with irritation for uncertainty avoidance cultures.

Subsequently, the impact of font personality (i.e., serif, sans-serif, mono-spaced, and script) on users' preference, appeal, and ultimately on performance was determined. In order to examine this another working prototype was designed of an online shopping website. Initially, a subjective assessment was carried out with n= 445 participants. Results of this experiment demonstrated that the sans-serif typeface was the most preferred font type whereas serif was found to be the most appealing font personality, which led to a second experiment. In the second experiment n= 383 university students participated, and the results demonstrate that users had faster task completion time for the experimental prototype designed using a sans-serif typeface. Textual information designed using a sans-serif typeface proved to be more effective due to its appeal and the reading preferences of users.

The findings from this research have significant implications for online retailers andwebsite designers in the design of attractive websites that develop positive customer attitudes and minimize feelings of irritation.

Throughout my life few people have always been there during those difficult and trying times. I would like to dedicate this thesis and everything I do to my grandparents, parents, sisters, brothers, beloved wife, and my sweetheart children (Adan, Ibraheem, Fatima, and Mosa). Especial dedication to Nighat Saleem (late) miss you my sister.

Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award.

Tesis Doctoral
March 2017

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Abstract

Websites are an important method of buying and selling products conveniently. Website design is very important in achieving business success by attracting more customers. A visually appealing site with trustworthy content, which is easy to navigate will produce a sense of trust with the least irritation. In this study, we examine the user preferences and emotions about web design attributes in an online shopping environment in cultures with high uncertainty avoidance. Uncertainty avoidance expresses community avoidance from unknown situations, ambiguity, and personal risk.

The objective was to determine the relationship between web design attributes (i.e., content/information quality, interactivity, navigation, color, and typography) and individuals' loyalty via trust and satisfaction, and between web design attributes and irritation. Another subsequent part of this study was to explore the impact of font personality on task completion time.

In order to test the proposed hypotheses, three empirical studies were conducted. Initially, a working e-commerce website prototype was designed to identify the implications of selected design attributes on loyalty via satisfaction and trust. A questionnaire was designed to collect data to corroborate the hypotheses, related to satisfaction, trust, and loyalty. The partial least squares method was used to analyze the collected data from the students who participated in the test n= **558**. The results indicated that all of the web design attributes positively influence loyalty via trust and satisfaction for uncertainty avoidance cultures.

The same website prototype was further used to explore the relationship between design attributes and users' irritation. The data collected from participants (n= **515**) via questionnaires were also analyzed using the partial least squares method. The results indicated that the adopted web design attributes had significant a negative relationship with irritation for uncertainty avoidance cultures.

Subsequently, the impact of font personality (i.e., serif, sans-serif, mono-spaced, and script)

on users' preference, appeal, and ultimately on performance was determined. In order to examine this another working prototype was designed of an online shopping website. Initially, a subjective assessment was carried out with n= **445** participants. Results of this experiment demonstrated that the sans-serif typeface was the most preferred font type whereas serif was found to be the most appealing font personality, which led to a second experiment.

In the second experiment n= **383** university students participated, and the results demonstrate that users had faster task completion time for the experimental prototype designed using a sans-serif typeface. Textual information designed using a sans-serif typeface proved to be more effective due to its appeal and the reading preferences of users.

The findings from this research have significant implications for online retailers and website designers in the design of attractive websites that develop positive customer attitudes and minimize feelings of irritation.

Resumen

La web es una herramienta fundamental para comprar y vender productos. El diseño de sitios web es muy importante para lograr el éxito de un negocio al atraer más clientes. Un sitio visualmente atractivo, con contenido confiable, y que es fácil de navegar transmite sentimientos de confianza con la menor irritación. En este estudio se evalúan las preferencias del usuario y las emociones acerca de los atributos de diseño web en un entorno de compras en línea en culturas con alta evitación de la incertidumbre. La incertidumbre expresa la evitación de la comunidad de situaciones desconocidas, ambigüedad y riesgo personal.

El objetivo es determinar la relación entre los atributos de diseño web (es decir, la calidad del contenido / información, la interactividad, la navegación, el color y la tipografía) y la lealtad de los individuos a través de la confianza y la satisfacción, así como la que pueda existir entre los atributos de diseño web y la irritación. Otro objetivo de esta investigación ha sido el explorar el impacto de la personalidad de la fuente en el tiempo de finalización de la tarea.

Para probar las hipótesis propuestas, se realizaron tres estudios empíricos. Inicialmente se diseñó un prototipo de sitio web de comercio electrónico para identificar las implicaciones de los atributos de diseño seleccionados en la fidelidad del usuario hacia el mismo a través de la medición de su satisfacción y confianza. Se diseñó un cuestionario para recopilar datos para corroborar las hipótesis relacionadas con la satisfacción, la confianza y la fidelidad. Se utilizó el método de mínimos cuadrados parciales para analizar los datos recopilados de los sujetos que participaron en la prueba n = **558**. Los resultados indicaron que todos los atributos de diseño web influyen positivamente en la lealtad a través de la confianza y la satisfacción en culturas con alta evitación de la incertidumbre.

El mismo prototipo de sitio web se utilizó además para explorar la relación entre los atributos de diseño y la irritación de los usuarios. Los datos recogidos de los participantes (n = **515**) a través de cuestionarios también se analizaron utilizando el método de los mínimos cuadrados parciales. Los resultados indicaron que los atributos de diseño web adoptados tenían una relación negativa significativa con la irritación para culturas con alta evitación de la incertidumbre.

Posteriormente, se determinó el impacto que la personalidad de las distintas familias tipográficas (serif, sans-serif, mono-spaced y script) tienen sobre la preferencia de los usuarios, así como la influencia de la más popular sobre el rendimiento de éstos. Con el fin verificar/refutar las hipótesis de partida se diseñó otro prototipo de sitio web de compras online. Inicialmente se realizó una evaluación subjetiva con n = **445** participantes. Los resultados de este experimento demostraron que la familia sans-serif es el más popular, mientras que la familia serif presentaba la personalidad más atractiva, lo que llevó a un segundo experimento.

En el segundo experimento participaron n = **383** estudiantes universitarios y los resultados demostraron que los usuarios tuvieron un tiempo de ejecución más corto en tareas de compra con el prototipo experimental diseñado con una fuente tipo sans-serif. La información textual diseñada con una fuente tipo sans-serif demostró ser más efectiva debido a su atractivo y las preferencias de lectura de los usuarios.

Los resultados de esta investigación tienen implicaciones significativas para el diseño de sitios web comerciales a fin de desarrollar actitudes positivas de los clientes y minimizar los sentimientos de irritación y rechazo por parte de éstos.

Table of contents

List of figures xv

List of tables xvii

1 Introduction 1

2 Web usability 5

2.1 Usability and use of design attributes . . . 5

2.1.1 Culture and website design . . . 7

2.1.2 Uncertainty Avoidance and design . . . 11

2.2 Visual and aesthetic quality . . . 12

2.2.1 Typography . . . 14

2.2.2 Color . . . 17

2.3 Information architecture . . . 18

2.3.1 Content/information quality . . . 18

2.3.2 Navigation . . . 21

2.3.3 Interactivity . . . 23

3 Emotion, attitude and behavioral intention 27

3.1 Satisfaction . . . 28

3.2 Trust . . . 29

3.3 Loyalty . . . 31

3.4 Irritation . . . 32

4 Hypotheses 35

5 Empirical testing 43

5.1 Study-1 . . . 43

5.1.1 Measures and Data Collection . . . 45

5.1.2 Technique . . . 47
5.1.3 Results . . . 48
5.1.4 Discussion . . . 55
5.2 Study-2 . . . 58
5.2.1 Measures and Data Collection . . . 58
5.2.2 Technique . . . 59
5.2.3 Results . . . 59
5.2.4 Discussion . . . 61
5.3 Study-3 . . . 67
5.3.1 Measures and data collection for experiment 1 . . . 68
5.3.2 Technique . . . 69
5.3.3 Results . . . 70
5.3.4 Discussion . . . 72
5.3.5 Measures and data collection for experiment-2 . . . 73
5.3.6 Technique . . . 74
5.3.7 Results . . . 75
5.3.8 Discussion . . . 75

6 Summary **79**

7 Limitations **87**

8 Future scope **89**

References **91**

Appendix A (Survey items used for study-1) **119**

Appendix B (Survey items used for study 2) **121**

Appendix C (Experimental prototype web-pages and Google Statistics.) **123**

List of figures

2.1 Font personality 15

4.1 Research model and hypotheses to explored the influence of web design attributes on individuals' affective beliefs. 37

5.1 E-ticket bus website prototype. 44
5.2 Employed typefaces/font-families. 68
5.3 Experimental website prototype used in the second experiment to measure users' performance. 74

C.1 Google Statistics. 123
C.2 Ticket searching page. 124
C.3 Time and price selection 125
C.4 Booking and personal details. 126

List of tables

2.1 Overview of usability definitions 6
2.2 Website usability factors 9

5.1 Demographic characteristics of respondents (study-1) 46
5.2 Reliability, convergent, and discriminant validity (study-1) 49
5.3 Unidimensionality (study-1) 50
5.4 Combined loadings and cross-loadings (study-1) 51
5.5 Inter-correlations and $\sqrt{AVE}$ of latent variables (study-1) 52
5.6 Additional coefficients (study-1) 52
5.7 Additional model fit and quality indicators (study-1) 54
5.8 Path coefficients (study-1) 55
5.9 Demographic characteristics of respondents (study-2) 59
5.10 Reliability, convergent, and discriminant validity Path (study-2) 60
5.11 Unidimensionality (study-2) 62
5.12 Combined loadings and cross-loadings (study-2) 63
5.13 Inter-correlations and $\sqrt{AVE}$ of latent variables (study-2) 63
5.14 Additional coefficients (study-2) 63
5.15 Additional model fit and quality indicators (study-2) 64
5.16 Path coefficients (study-2) 64
5.17 Descriptive statistic of experiment 1 (study 3) 70
5.18 Inferential statistics t-test for equality of means and mann whitney u-test (experiment 1 of study 3) 71
5.19 Descriptive statistic of experiment 2 (study 3) 75
5.20 Inferential statistics t-test for equality of means and mann whitney u-test (experiment 2 of study 3) 76

Chapter 1

Introduction

The Internet is a channel for commercializing products and services that have conventionally been sold through traditional stores. Those markets had previously been considered out of reach for expansion but with the advent of the internet, that expansion became possible at a relatively low cost. Websites have become a corporate backbone and are considered a cheap means of communication to disseminate product and service-related information. Generally, e-commerce websites offer similar services, functions, and information. These similarities are the cause of competition among online service providers.

This competition drives the discovery of additional ways to retain customers by improving website usability. That is why design of commercial websites has become a crucial business concern in maximizing business sales by promoting products or services internationally. Moreover, the context of use, purpose, and the capabilities of target users are also important considerations that require consistent efforts. Therefore, engaging customers in e-commerce website for shopping poses new challenges for businesses [1]. Usability is an necessary condition for addressing those challenges related to website design and functional aspects. Nielsen [2], for example, argues that better usability is key to designing successful commercial websites.

Customers may feel happy if the design of a website is easy to use and provides them necessary and relevant information quickly; otherwise they feel bitter and annoyed, which ultimately leads to irritation, since customers are anxious to buy products a timely and efficient manner with little irritation [3]. It is easy for online customers to switch from one website to another. Several researchers have devoted their efforts to identifying additional website usability factors. The primary concerns of these factors are to assist in designing websites that are neither under nor over engineered. However, it is important to consider which factors should be used in design and evaluation and whether the selected measures give us a true picture of website usability.

Focus of research

A good, usable design may develop positive customer attitudes toward a website, increase profit, the number of customers, and the rate of revisits. However, it is still not easy to determine the success of a website due to variation in cultures of design preferences. Customers from different regions have different attitudes and adaptation behaviors. Website usability in a cultural context is an important concern, which may help to ensure the appropriateness of a website for all users. Therefore, improving usability means improving the website [4] and it is a clear indication towards an efficient interaction.

Several studies previously explained cultural variation in website design and its impact in terms of perceived usability, preference, positive attitude, and behavioral intention. Dinev et al. [5] mentioned that users from high uncertainty avoidance cultures value website security and they prefer to use trustworthy websites. However, design preference with respect to cultures with high uncertainty avoidance is rarely discussed in the literature. Uncertainty avoidance refers to those cultures that demonstrate a lack of tolerance for any personal risk or ambiguity. In high uncertainty avoidance cultures, people are more concerned about security and do not easily trust websites.

The identification of design-related aspects for developing websites which appear credible and trustworthy is also an emerging challenge in the domain of Human-computer interaction (HCI). These challenges demand the determination of design features which promote positive customer attitude s towards e-commerce website with minimum feelings of irritation. The aim of the research was to fill this gap by examining design considerations with respect to uncertainty avoidance cultures. The purpose was to classify design artifacts (i.e., content/information quality, interactivity, navigation, color, and typography) to develop individuals' positive attitudes through the satisfying nature of those artifacts as a positive attitude is a key aspect of behavioral intention to return.

Besides behavior, the aim was also to examine the relationship between website design characteristics and irritation in online shopping activities. In particular, the role of typography, which has been little discussed in the domain of e-commerce with respect to people's attitudes (i.e., satisfaction and trust), irritation, and performance.

In order to achieve the objectives of the current research, several empirical studies were

conducted. Initially, a working e-commerce prototype was designed by incorporating relevant design features to determine individuals' satisfaction, trust, and loyalty. That e-commerce website prototype was further used to explore the relationship of design features with irritation in another study. We found the potential role of design attributes to develop loyalty via satisfaction and trust. We also found that the design attributes used had a significant negative impact on irritation. Subsequently, another working prototype of an online shopping website was also developed to explore the influence of font personality on task completion time. The finding indicated that Sans-serif was a preferable, appealing typeface, which resultantly leads to lower task completion time. Thus, typefaces are important and complementary aspects of design and information quality which had previously been discussed with respect to high legibility [6], quick recognition [7] and attitude in a cultural context [8].

Overall, the finding of this research will be helpful for developers in designing websites that look attractive, credible and require less user effort to use as the alternative, a confused design, could make visitors leave.

This research is organized in the following chapters:

- **Chapter 1** is an introduction and outlines the focus of the research.
- **Chapter 2** presents existing studies related to website usability, culture and website design, and design attributes.
- **Chapter 3** is related to emotion, attitude and behavioral intention.
- **Chapter 4** is related to the research model and hypotheses of this research.
- **Chapter 5** is about empirical testing, measures and data collection, techniques, results, and discussion.
- **Chapter 6** presents the overall summary and implications of this research.
- **Chapter 7** describes the limitations of this research work.
- **Chapter 8** is related to future scope of this research work.

Chapter 2

Web usability

2.1 Usability and use of design attributes

Usability is a core term in HCI and is a critical factor for interactive technologies and considered to be an essential part of HCI expressing effective association between users and computer applications. How to measure usability is an important question in interaction design and end-user evaluation research. This is because website-based applications are diversified in nature and are rapidly increasing in number. Improving the usability of such diversified applications is critical because the users are familiar with a system or website only by its interface. Previously, usability was discussed under different headings or names such as ergonomics, ease of use, user-friendliness and finally usability [9]. The term ergonomics (human factor) refers to the design of the products, layouts and equipment fit according to human capabilities and safety of use [10, 11]. The term ease of use was defined by Davis [12] as "'**the degree to which a person believes that using a particular system would be free of effort**."' Hence, ease of use means free from difficulty and great efforts [12]. This is because difficulty of use could discourage the users from the adoption of a system or technology [12].

Finally, the term usability was coined to replace the term user friendly [13]. Later, Gould and Lewis in 1985 referred to usability indicating that "'**any system designed for people should be easy to learn, useful, that it contained function people really need in their work, and be easy and pleasant to use** [14]."' The component of usability was previously identified by Bennett and further practically operationalized by Shackel [15]. Nielsen [2] and Bevan [13] defined usability in terms of quality attributes. Whereas Rosson and Carroll [16] also defined usability in terms of software interaction quality and facilitation of ease of use, ease of learning, and user satisfaction. Lastly, the International standards organization (ISO) [17] defined usability in terms of efficiency, effectiveness, and satisfaction in a specified context.

[15]	[2]	[17]	[16]	[18]	[19]
[a]					
Learnability (Learn-Time) (Retain-Time)	Learnability		Ease of learning	Ease of learning	Learnability
Learnability Effectiveness (Error)	Memorability Error	Effectiveness			
Effectiveness (Speed)	Efficiency	Efficiency	Useful		
			Ease of Use	Ease of Use	Operability Understandability
Flexibility					
[b]					
Attitude	Satisfaction	Satisfaction	Satisfaction	Pleasant	Attractiveness

Table 2.1 **Overview of usability definitions**.

[a] = Performance.
[b] = Satisfaction.

- ***Efficiency****:* refers to the efforts and resources expended in relation to completeness and accuracy with which users can achieve their desired goals using a system or a website [17]. Thus, a user perceives efficiency if he or she can achieve his/her desired goal conveniently and quickly without investing much cognitive effort [20].

- ***Effectiveness****:* refers to completeness and accuracy with which users can achieve their desired goals through right functionality [17].

- ***Satisfaction****:* refers to positive attitudes, freedom from discomfort, and acceptability towards the use of a system or website [17].

In a website, usability reflects the ease of navigating the site [21]. According to Nielsen [2] website usability comprises the ease and convenience with which the users can; learn to operate the systems and easily memorize the design with function as well as error avoidance, efficiency in task, and satisfaction. Thus, it provides online users with high-quality services, understanding of, and sensitive to consumers' fears [22]. Table 2.1 shows an overview of usability definitions.

Previously, usability was evaluated through different methods and techniques by observing the actual users interacting with the websites. The purposes of these observational techniques are to collect information about the specific way of interaction to identify, whether the websites are easy or difficult to use, and whether the targeted users are satisfied or dissatisfied with it. Thus, usability is a multifaceted concept that further demands the exploration of its additional measures. For example, Hornbaek [9] argues that it necessary to explore new usability assessment measures/factors that adequately capture what is considered important in the specific context. Hence, proposals for new evaluation techniques and measures of usability are unceasingly emerging with respect to particular designs or user interfaces. These evaluation techniques and measures contain the assessment guidelines for both functional (utilitarian) and aesthetic

(hedonic) aspects [9, 23].

Moreover, some of these evolution methods focus on objective aspects while others try to obtain subjective measures, depending on the context of use. Utilitarian dimensions include functional and objective assessment methodologies (e.g., performance, task time, usefulness). Whereas hedonic dimensions are concerned with fun and entertainment and are mostly evaluated through a survey scale. Hassenzahl [11] argues that the ease of use and content depicts the ergonomic or functional quality of the interfaces whereas aesthetics reflects the hedonic quality of the interfaces. This is because both the hedonic and the functional aspect play very important roles in improving the quality of an interface, which leads to positive attitude, and behavioral intention. Likewise, Pallud and Straub [35] argue that aesthetics, ease of use, and content significantly influence the users' experiences, which intentions to return to a website. Moreover, the identification of additional usability factors for better experience. It is also important because users have different abilities and skills in internet use. In this regard, several studies have been conducted by various researchers proposing several usability factors to measure individuals' emotions, positive attitude, and behavioral intention (see table 2.2).

2.1.1 Culture and website design

Culture has been defined in different ways and is complex in definition. It shapes our behavior and refers to design of living [57]. According to Komin [58, 59] culture means and functions as the basis for a group of people's thoughts, behavior and feelings. It shares and impacts on the individual's attitude, behavior, values, and feelings [60]. For example, Hall [61] argues that culture controls the specific group of people's attitude and behavior, and is a form of communication. Thus, it is the distribution of preferences, cognitive styles, and needs [62]. Robbins and Stylianou [63] argue that culture is a set of shared values that affects attitudes, perceptions, societal preferences and responses. Doney et al [64] stated that culture is "**a system of values and norms that are shared between a group of people and that when taken together constitute a design for living**" [65].

The most adopted definition of culture is that from Hofstede [66]. According to Hofstede [66], culture is "**the collective mental programming of the human mind which distinguishes one group of people from another**." Furthermore he identified the following dimensions (variables) Power distance (PDI), collectivism (CL) vs. individualism (IDV), uncertainty avoidance (UA), Femininity vs. Masculinity (MAS) and Long-term orientation (LTO) [66].

Sr	**Web usability factors**	**Ref**
1	Content, download delay, interactivity, navigability, and responsiveness	[24]
2	Ease of use, sense of presence, and usefulness	[25]
3	Structure, navigation, personalization, searchability, layout, and performance	[26]
4	Mystery, variety, coherence, and legibility	[27]
5	Content, ease of use, made-for-the-medium, promotion, and emotion	[1]
6	Ease of use, aesthetic design, processing speed, and security	[28]
7	Content relevance, consistency, credibility, interactivity, learnability, navigability, simplicity, supportability, readability, and telepresence	[20]
8	Navigation efficiency, download time, task completion time, successful search rate, page loading, frequency of cursor movement, and error rates	[29]
9	Information, usability, site design	[30]
10	Personalization, interactivity, ubiquity, and presentation	[31]
11	Completeness, content quality, ease of use fun, readability, relevance, and productivity	[32]
12	Content, credibility, navigation, and response time	[33]
13	Consistent image, emotional appeal, ease of understanding, information/fit-to-task, intuitive operation, innovativeness, online completeness, response time, relative advantage, tailored information, visual appeal, and trust	[34]
14	aesthetic aspects	[35]
15	Content, visual organization, navigation, color, and typography	[36]
16	convenience, merchandising (product offerings and product information), website design, and security	[37]
17	convenience and website design (e.g., information and search path presentation, and appearance)	[38]
18	tailored information, visual appeal, intuitive operations, ease of understanding, response time	[39]
19	customization, cultivation, care, community, choice, convenience, and characte	[40]
20	convenient search function, flexible shopping hours, web page structure, and convenient contact related information access.	[41]
21	layout, information (i.e., relevancy, accuracy, comprehensibility and comprehensiveness), connection (i.e., ease of use, structure, entry guidance, speed, and hyperlink connotation)	[42]
22	informational fit-to-task, tailored communication, online completeness, relative advantage, visual appeal,innovativeness, emotional appeal, consistent image, ease of understanding, intuitive operations, response time, and trust	[43]

Sr	Web usability factors	Ref
23	Reliable/prompt responses, attentiveness, access, security, and credibility	[44]
24	Website appearance, content quality, specific content, and technical adequacy	[45]
25	System speed, ease of use/navigation, product and company information, customer and purchase services, security and privacy policy	[46]
26	Functionality (i.e., purchase information, service/products information, destination information, quality of information, contact information) and usability (i.e.,language, layout and graphics, information architecture, user interface and navigation, general)	[47]
27	Web page order and complexity	[48]
28	telepresence, ease of use, customization, connectedness, aesthetics, and perceived benefits	[49]
29	Content, navigation, visual design, and information design	[50]
30	Functionality, structure, and content	[51]
31	Accessibility, product-search, shopping-basket-handling, product overview, shop response time	[52]
32	Interactivity, effectiveness, and efficiency	[53]
33	Convenience (e.g., order processing, easy to navigate, search), firmness (e.g., privacy, security), and delight (e.g. visual and aesthetics aspects)	[54]
34	Usefulness, ease of use, enjoyment, website design, trust, content quality navigational challenge, and system availability.	[55]
35	Fulfillment, ease of use, security/privacy, information/content, responsiveness, and visual appeal.	[56]

Table 2.2 **Website usability factors**.

- **Power-distance (PD)** expresses the individual's beliefs that power is unequally distributed or centralized in the culture [67]. Thus, these cultures deal with inequalities, and organizations in these cultures follow a top-bottom hierarchy [67].

- **Individualism (ID)** expresses individuals' relationships with each other. Therefore, in individualistic culture, people are expected to consider personal interest over group interest and are considered as loosely integrated cultures [67]. Whereas, in **Collectivist (CL)** cultures, people are integrated into cohesive groups and preferably think towards common interests and are considered tightly integrated cultures [67].

- In **masculine cultures**, the focus is on achievement; material success and assertiveness are considered more masculine in orientation [67]. Cultures where the focus is on cooperation and caring, modesty and quality of life are considered more feminine in orientation [67]. Feminine cultures score highly in feminine traits such as quality of life

and interpersonal relationships. On the other hand masculine traits include assertiveness, competition, and material success [67].

- ***Long-Term Orientation (LTO)*** expresses the extent to which a culture retains or prefers long-term views [67].

- **Uncertainty avoidance** expresses community avoidance of unknown situations and ambiguity, and demonstrates lack of tolerance for any personal risk [67]. In these cultures, such situations are avoided by keeping strict codes of behavior and beliefs in absolute realities [67]. Thus, high UA cultures are aggressive, active, emotional, intolerant and are more concerned about security [67].

Furthermore, Barber and Badre [68] explained the relationship between culture and usability in terms of culturability. Culturability is the merging of usability and culture and represents an association between culture and websitee design features [68, 69]. They produced a list of cultural markers to distinguish cultural/genre specific design elements. These cultural markers (e.g. color, language, cultural icon and flag, font, link and shape) are the design elements which are possibly preferred in a specific culture.

Several other researchers [57, 70–76] also discussed culture with respect to website design and individual behavior. Initially, Marcus [70, 77] adopted these cultural variables to explain the influence of these variables on the user interface. Zaharias and Papargyris [71] and Isa et al. [72] also observed the quantitative relationship between website perceived usability and cultural variables. For example, Chu and Yang [57] found a higher error rate and task completion time on Chinese websites than on western websites due to language and information density. Jaramillo-Bernal et al. [73] conducted an empirical investigation between Panama, Colombia, and Spain. They observed significant differences between cultures with respect to website design preferences. Users from Panama preferred culturally specific elements on the website. Furthermore, they observed that users from Panama and Spain perceived more pleasantness due to aesthetics and appearance of the website. Haddad et al. [78] argue that East Asians preferred the enrich interface augmented with learning support and security and they felt less anxious with that than a minimal interface. In contrast, Caucasians preferred the interface with slight elements or had no preference. Kralisch et al. [62] argue that users' cultural backgrounds impact on navigation patterns in terms of time to access information. Frandsen-Thorlacius et al [79] employed several usability attributes to seek differences in design preferences between Chinese and Danes. They observed that the Chinese gave more importance to fun, visual appearance, and satisfaction whereas the Danes preferred efficiency, and effectiveness. However, equal presences were observed for ease of use between both

cultures.

Besides design, language is also an important aspect of a culture and has also been discussed with respect to website usability in several studies [75, 76]. For example, Nantel and Glaser [75, 76] observed the impact of language and culture on a website's perceived usability. Moreover, Ng [80] observed differences in culture between regions that significantly moderate the relationships between social interaction and the intention. Thus, people prefer websites that are designed using culturally specific elements with the highest usability [78, 81]. This is because the cultural variable affects the context and personal values of use [81].

Hofsteds' cultural dimensions were also frequently adopted in several technological studies [82–89] to explain the cultural variation with respect to website design. Shiu et al. [82] observed the impact of ID on trust for an informational website. Ganguly et al. [83] observed the moderating impact of masculinity on the relationship of design attitudes and trust and also between trust and purchase intention. Furthermore, they observed that customers from masculine cultures were more concerned about the presentation of information for quick decision-making. However, a negative moderating effect was observed in the relationship of trust and purchase intention in this study. Yoon [90] observed that in LTO cultures, trust is not only an important factor in determining an individual's behavior for e-commerce acceptance. Moreover, the moderation effect of both PD were seen for consumer e-commerce acceptance in this study. Cyr et al. [84] conducted an empirical study in Canada, Germany and Japan. They observed that color appeal was an important predictor of satisfaction and trust. In another study, Cyr and Head [91] observed individuals' preferences for web design in countries with higher (i.e., Mexico, Germany, and United States) and lower (i.e., Chile, China, and Canada) masculinity orientation. Sabiote et al. [87] conducted an empirical study on Spain and the United kingdom and observed high preferences for web service reliability in terms of commitment and trustworthiness from the British (individualistic culture).

2.1.2 Uncertainty Avoidance and design

As previously mentioned, UA cultures demonstrate a lack of tolerance for personal risk and prefer trustworthy websites [67, 92]. Thus, UA is related to trust and security [83, 93] and is a rarely adopted dimension in e-commerce research. Marcus [70] explains the theoretical implication of UA on design in several ways, which are, simplicity versus complexity, structured navigation versus less control navigation, and redundant cues (sound, color, typography, etc.) to reduce the risk. Moreover, Singh and Matsuo [85] and Marcus and Gould [86] argue that high UA cultures prefer simple, more structured websites. Thus, guided navigation is an important

design attribute to design websites for higher UA cultures [85]. Isa et al. [94] observed the positive influence of UA on user performance and preference. Cyr and Trevor-Smith [65] argue that user characteristics, cultural biases, and design preferences are important considerations with respect to multicultural audiences. Likewise, Yoon [90] employed cultural dimensions as moderator in a consumer e-commerce acceptance model and he observed the moderating affect of UA on the relationship between trust and intention to use and also between perceived usefulness and intention to use.

Thus, in high UA culture, people hesitate to adopt e-commerce or may decrease their online shopping [90]. Lee et al. [95] empirically observed that help and support available on a website and risk are more critical factors for Korean customers' satisfaction over US customers. Cyr [92] argues that cultures with low UA indexes score higher for perception of design whereas in higher UA cultures, there is a tendency to score lower on trust. Hwang and Lee [96] observed the moderating effect of UA on the relationship between subjective norms and cognitive based trust. Evers and Day [97] discussed the differences between Australians, Chinese and Indonesians with respect to design preferences and interface acceptance. They found that the Chinese prefer more useful systems even if they are hard to use. In contrast, Indonesians prefer easy to use systems due to UA. Furthermore, they argue that Indonesians' beliefs about the ease of use of a system directly affect the behavioral attitude to use the system whereas the Australians were observed to be satisfied if they found the interface design satisfactory even if the system was not useful or was hard to use. Singh and Matsuo [85] argue that country-specific websites reflect cultural values. They observed differences in design preferences between Japanese and U.S. companies websites with respect to Hofstede's cultural dimensions. Kralisch et al [62] observed an impact of UA on website navigational behavior. Likewise, Ford and Gelderblom [88] mentioned that high UA websites are superior compared to low UA website in terms of speed, accuracy, and satisfaction. Similarly, Shiu [82] discussed the potential role of UA in a website engagement that demands careful consideration. Furthermore, they observed the interrelationship moderation between trust, perceived value, and attitude. Therefore, different culture groups employ different development and usage behavior for website interfaces because of language, social contexts, symbols, and aesthetics.

2.2 Visual and aesthetic quality

In human-computer interaction, one focus of research is on visual design and aesthetic aspects to improve website quality. Jennings [98] considered aesthetic characteristics as important features to design the engaging environment for better user experiences. An engaging environment

is always designed using aesthetic elements to keep the users more engaged [98] and to attract new customers. Thus, aesthetic features play a very important role in the visual design of a website for attractiveness. Therefore, both attractiveness and appeal are important factors in developing positive user perception. The quality of website services could be improved through aesthetic quality [99] and is considered a distinct factor for a product success [100]. Moreover, the influence of aesthetics has also been discussed in previous studies [101]. Sonderegger and Sauer [101], in an empirical study, noticed the impact of aesthetics in terms of website appeal (attractiveness), perceived usability, user performance, and attractiveness. Furthermore, they observed that highly appealing artifacts were rated as more usable.

Consequently, appeal/attractive positively affects user performance and eventually reduces task completion time and error rate [101]. In addition, they empirically explained the importance of aesthetic aspects on user performance and website usability. According to Tractinsky et al. [102], what is beautiful is usable and they observed a significant relationship between aesthetic aspects and website usability. In contrast, Tuch et al. [103] observed no relationship between website interface aesthetics and perceived usability. Li and Yeh [104] observed a strong impact of website aesthetics on perceived usefulness, ease of use, and customization, which ultimately leads to both customers' cognitive and affective beliefs. Liao [45] argues that website appearance enhances customer's perception of perceived usefulness.

Aesthetic aspects of websites were also discussed in terms of user preferences, performance, and behavioral intention in several studies [84, 101, 103, 105–110] who categorized aesthetic aspects into color and layout of font/typographical elements. For example Liu et al [109] observed a direct impact of home page aesthetic design on users' emotional experience and an indirect effect on satisfaction. Tuch et at [108] discussed the impact of website visual complexity on emotions and recognition. They argue that users performed better on search and recognition tasks on start-pages with low visual complexity. Lee and Koubek [110] also observed users' preferences for aesthetic aspects such as such as color and typography. In addition, Fogg et al. [111] argue that consumers make their judgments about website credibility based on design elements such as typography, font size and color scheme.

Hence, aesthetics/visual richness addresses sophistication, creativity, and originality through typography, layout, and graphicss [112]. This is because these elements constitute the website contents in such a way as to provide better interactivity experiences due to structure and a good form of presentation [113]. For example, both Chu and Yang [57] and Fraternali and Tisi [114] empirically observed the influence of information density and length on user's performance

in the e-commerce context. Hence, information should be organized in the form of chunks where color and typography features are complementary aspects of this organization and significantly influence communication effectiveness [115]. Tufte [116] argues that "'**skillful visual design of computer screens with care given to color, typography, layout, icons, graphics and coherency substantially contributes to quality and usability**."' Likewise, Keyes argues that both color and typography play an important role in information and communication effectiveness [115] in forming graphics and content. Thus, the appropriate use of color and typographical features to design the layout of graphics and textual information, which support the users for fast and efficient information recognition and retrieval.

2.2.1 Typography

Typography is related to the appearance and attractiveness of text [110]. It is the set of notations [117] and the art of arranging the written language in a consistent [118], readable, appealing, and legible manner. According to Pimentel and Branco [119] it is a dynamic, artistic, and interactive feature offered by computer systems. Turgut [120] argues that typography is a source or instrument of communication. Thus, high-quality typography enhances the value of the website interactivity, the meaning of words, and how those words can be perceived by the users [121].

Typography influences the readers in terms of legibility, and aesthetics. Legibility refers to words and typography that affects the reader's ability to recognize them. This is because people quickly recognize and read the shape of the words rather than separate letters whereas readability can be a measure of how fast a reader can read the text. Thus, the outcome of legibility is perceived in terms of reading speed, comprehension, and eye fatigue [122]. Besides legibility, aesthetic aspects also affect comprehension and readers' emotional motivations which are pleasure and appeal [122]. Similarly, Kuzu and Ceylan [123] mentioned that aesthetic and color-related features enhance the readability of text. The use of color, contrast, and appropriate positioning may draw attention to the right place. In order for comprehension, it is necessary to focus on the interplay of text forms and balance on the page [124]. Legibility, however, can be achieved through precise selection of typeface, space, and contrast with the background for quick observation [124]. The consequences of all these aspects further occur in relation to structural and physiological features dues to type or style [122].

Thus, poor-quality typography negatively affects learnability, legibility and comprehension, and it visually confuses the readers [125] which in turn causes poor understanding. In this regard, Nielsen [126] argues that non-scannable text is painful and boring and requires excessive effort

or attentional resources and increases an individual's cognition load. Likewise, Walker [121] argues that non-expert typography influences visual communication. Therefore it is important to design graphics [127, 128] and information effectively. Because typography quality ensures readability, legibility, and comprehension [122, 129]. Moreover, the quality of typography enables the reader to experience with pleasure [130], positive mood/engagement [131] and decreases users' time and efforts to find [132], understand, and to access required information efficiently [123]. Accordingly, the selection of typographic (text) elements (i.e., typeface, sign, size, spacing, and color) for writing is very important as it facilitates effective communication and reading [122, 133, 134].

The features that affect reading and appropriateness of typography are spacing (i.e., Kerning, leading, and tracking), column, paragraph type, size, and typeface [123, 135]. Kerning refers to space between two characters, leading refers to the space between lines of types, and tracking refers the to space between letters [123, 136]. Moreover, column width also affects readability. Previous work suggested that 10 cm column width support the readability, however 18 cm column width is more convenient to read [135]. Paragraph type has an effect in terms of structure and alignment, such as right, left, or center justified where in western culture left alignment is common.

Font size or style/typeface is also an important consideration when designing effective

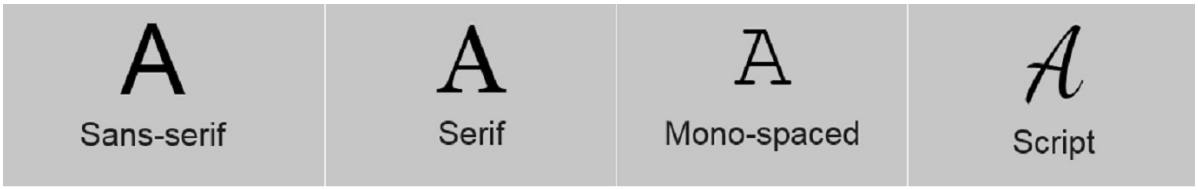

Fig. 2.1 Major categories of font-families/typeface

content. These attributes convey the emotions that a content includes. Typeface is a set of typographical symbols [137] or visually related shapes used to present characters [138]. Typeface also refers to font-families, with four major categories; sans-serif (no extending serifs or straight letter strokes), serif (serif or small lines at the end of letter strokes), mono-spaced (constant width throughout covering the same amount of space), script (cursive/fantasy and handwritten appearance) [135] (See Figure 2.1). Typographical preferences are also very important for e-commerce and the web environment to enhance customer satisfaction [124] and trust [8]. Nielsen [139] pointed out that as small font size with low-contrast is the cause of criticism in online reading. Users like the font they appreciate and complain about those they do not like [140].

Prior work discussed the influence of typographical features with respect to performance, preference, and reading speed [141–143]. In an empirical study Bernard et al. [144] compared the serif and sans serif typefaces 10-12-point size in a task in which the participants had to find the substituted word in a given text. The 12-point font was seen as more legible, and led to faster reading. They observed participants higher preference for sans-serif as typeface.

Beymer et al. [145] considered 12 point fonts preferable with respect to reading speed and preference. However, no difference was observed in this study between serif and sans-serif on speed through eye tracking or retention metrics. Ling and Schaik [146] also found sans-serif as the preferred font compared to serif but no effect of the font was observed on performance. Darroch et al. [147] suggested that the range of 8-12-point size maximizes reading speed for mobile based interfaces, while Dyson [148] argues that line-length increases in characters per line slows down reading speed. Rello et al. [149] argue that heavy-text or informational web-sites should use 18-point font or even larger with default line spacing for better comprehension and readability. Nafiseh and Balakrishnan [150] considered sans-serif typeface (Verdana) as a better choice for displaying long text on the screen compared to serif (Times New Roman).

Dyson and Haselgrove [151] argue that line length with 55 characters per line support effective reading at fast and normal speeds. Consequently, it produces the highest level of comprehension and also faster reading than short lines. Nielsen [139] argues that text line spacing at 1.5 facilitates better reading, speed, and comprehension, especially for readers with poor vision due to aging or other factors [139]. In all usage contexts problems can occur if the information is presented with inappropriate typographical features [7, 152]. Thus, information processing increases with suitable typeface selection [7, 152]. In television broadcasting, Pusnik et al. [152] compared the typeface Georgia, Verdana, Calibri, Trebuchet and Swiss and observed that Georgia had better legibility. In another study they observed Calibri typeface as a the better choice because it was recognized and processed faster compared to Georgia, Trebuchet and Verdana [7]. Myung [124] empirically observed users' preferences with regard to typography. The results from this study demonstrated the following: the importance of line spacing 56%, style 35%, and 12% for size, respectively [124]. Tullis [153] observed the differences caused by font/size in terms of reading time, accuracy and preferences in a Windows environment [153]. No differences were observed for text background on reading accuracy and preference. Besides preference and performance, other studies [8, 154, 155] additionally discussed the role of typefaces in the e-commerce domain. Thus, typographical features play an important role in supporting website content and functionality though appeal-able artifacts leading to positive attitude [156].

2.2.2 Color

Color is an element of light and associated with appeal. Besides, appeal, it is an important aesthetic attribute of, and visual stimulus to attract human attention [115, 157]. Marcus [158] considered color as an important, complicated aspect of visual design. Noiwan and Norcio [159] stated that color is one of the most prominent and powerful aspects of design. It influences human feelings and emotions. In a website design it is important to consider which emotions the design provokes in the viewers. Thus, strong colors result in strong reactions and its components (e.g., hue, lightness, and saturation) also evoke psychological effects [160].

- ***Hue****:* refers to main or simple color such as red, yellow, green, blue-green, etc [115]. "‘ **it is an arbitrary division which our culture makes in the continuous spectrum of light** [115]."’
- ***Value****:* refers to the value of darkness, lightness, or relative gray-value of color [115]. The value of darkness is increased by adding more black referred to as "‘**shade**"’ and lightened by adding more white color referred to as "‘**tint**. [115]"’
- ***Saturation****:* is also known as intensity, chroma, or purity. it refers to the relative dullness or brilliance of a color. A color of maximum saturation is pure and composed of one wavelength. Saturation can be lowered by adding the components of color [115].

Colors helps users to understand the meanings and functions of links, icons, and buttons on the website and has been consistently discussed with respect to information processing [157]. This is because it creates prominence and differences in order to draw the viewer's attention and support them for quick recognition of information and functions. It has been observed that the combination of colors and intensity on the screen influences individuals' preferences due to legibility [161] and positive emotions. Similarly Cyr et al. [84] also mentioned that color affects users' feelings and emotions. These emotions are associated with well-being and play a considerable role in determining the length of visit and the level of interaction [107]. Thus, color not only helps the users during navigational and functional tasks, but also during the whole interaction time for their better experiences. These experiences and length of visit may be due to appealing color and beautiful artifacts. A strong association has been observed between website usability, aesthetics, beauty, and color by various researchers [102, 107, 162]

Several other studies [8, 70, 84, 107, 160, 163, 164] also discussed the impact of color on website usability, beliefs, emotions, positive perception, and intention to purchase. Specifically, blue is a universally preferred cool color [70, 165] associated with wealth, trust, and security [84, 160], and endorsed to establish a polite, credible corporate image [84, 166]. In an

empirical study, Bonnardel et al. [107] examined the impact of color (i.e., blue, orange, and gray) on different website prototypes. They observed blue and orange as most appealing color. Furthermore, blue was seen to be the favorite and gray the least preferred color. They also observed a strong relationship between color and website usability. Hall and Hanna [164] also observed the improved readability and increased purchase intentions for the web-pages which were designed using blue. Therefore, aesthetic and visual elements such as color influence an individual's cognitive beliefs [50], performance [107, 159, 161], and preferences. These preferences are also associated with language and cultural cognition.

Internationalization refers to the elimination of culturally sensitive elements whereas localization refers to the process of adoption by adding local elements such as language, symbols and color. Color preferences have been observed in several cultural studies [68, 69, 85]. Cyr [84] conducted an empirical study into three countries (i.e., Canada, Germany, and Japanese) to examine the impact of color appeal (i.e., blue, yellow, and gray) on satisfaction, trust, and loyalty. The results of this study demonstrate that blue was the most preferred color and yellow was the least preferred in this study. Furthermore, they also observed the impact of color appeal on cognitive affective beliefs in this study. In another cultural study by Noiwan and Norcio [159], the researchers also observed blue as an effective color compared with other colors such as green, red, orange, yellow, and violet. This is because blue tends to retain the elements on the screen such as font color, words, and background.

2.3 Information architecture

Website features related to organizational structure and layout (i.e., content quality, interactivity, and navigation) are complementary aspects in e-commerce websites, and deal with presentation of information, navigational clues, and the nature of interaction [167]. In short, structure refers to how the information is presented or displayed on the web page, and furthermore, to how the website is generally organized [168].

2.3.1 Content/information quality

The content/informational quality specifies what information a website should present to the consumers and is considered an important website usability attribute [169, 170]. The website contents are empowered with functional, transactional, and informational capabilities [169] and describe the overall structure and presentation of information content that users need [83]. Thus, it is important to ensure that the available information or content on the websites

is accurate, relevant, complete, and useful [20, 45, 110, 171, 172]. Wang and Strong [173] discussed information in terms of fitness of use along with its following dimensions (i.e., accessibility, interpretability, relevancy, and accuracy). Accessibility means that the information must be easily accessible, for example, the user or consumer must know how to retrieve the desired information [173]. Interpretability means that available informational content must be understandable so the customers are able to interpret that information easily [173]. Relevancy refers to the appropriateness of information. Therefore, the use of appropriate and relevant information in timely manners helps consumers in quick decision-making [173]. Lastly, accuracy refers to the correctness and credibility of information that comes from a reputable source [173].

Thus, the design of informational content is an important concept and it applies to how the contents are generally organized on the websites [170]. All the content/information dimensions (e.g., clear, useful, current and accurate) were considered important to determine the quality of content [45]. Hence, these information aspects help to create a positive customer attitude and usage intention [174–176]. Nelson and Todd [177] and Kim et al. [178] also categorized content/information quality in terms of completeness, format, and accuracy. Likewise, Sun et al. [179] adopted these information quality dimensions (e.g., accuracy, conciseness, completeness, currency, format, precision, relevance, reliability, and timeliness) to explore customer satisfaction. Thus, content quality has become an important issue for companies who want to increase their profitability by promoting their products and services online [170]. This is because both content and customer satisfaction are closely related to each other [170]. Moreover, Proctor et al. [180] argue that content ensures the successful user interaction with a system, and its presentation should consider; (1) what information is required or need to be extracted, (2) how to organize and store it (3), the methods of information retrieval, and (4) presentation of information. In term of operational quality it is categorized into the following aspects accessibility, contextual, presentational, transactional, and ergonomic [181, 182]. Consequently, previous studies emphasized and discussed its heightened significance in the online shopping environment due to the extensive nature of information [183].

E-commerce websites are a particularly important source of information for customers. Content/information quality is essential for developing website effectiveness. Thus, it is crucial to organize information in a clear, structured, and logical way so customers can access and process it easily. Therefore, website developers must be aware what information is valuable for customers to meet their needs or to find for a particular product or a service. Besides being at the customer's fingertips, it must be available and organized in the form of chunks so customers can easily process and remember it. Accordingly, appropriate and precise informational content

makes it easy for consumers to compare the product or service features to reach a buying decision [184]. Eroglu et al. [185] argue that customers who are highly involved with the information learn the buying procedures quickly. Hence, content or information understanding reduces the risks, which translates into a higher comfort level and convenience [183]. Similarly, Yang et al. [186] discussed the customers' desire for complete, in-depth, and comprehensive information related to online purchasing process such as product information, after sales information, and payment policies. On the contrary, excessive and complex information may exceed customers' cognitive efforts and may influence or limit their information-processing capabilities.

Several other studies have discussed the role of content/information quality with respect to customers' emotions and affective attitude from the local and international perspective. Palmer [24] considered content/information quality of websites as an important factor in determining website success. Rahimnia and Hassanzadeh [170] observed the direct positive impact of website content (information and its design) quality on e-trust and its indirect impact on market effectiveness. Furthermore, they argue that market effectiveness is a success factor for the online environment and in order to achieve that a website must be well-designed with rich, essential information [170]. Besides market effectiveness, content quality also attracts customers and encourages them to browse leading them to purchase [170]. Chen et al. [187] observed the positive impact of information quality (i.e., informativeness, organization, and entertainment) on user satisfaction and attitude. Furthermore, they argue that apart from informativeness e-commerce success is also associated with entertainment (e.g., exciting, cool). Dedeke [182] argues that information fit for tasks also helps to determine the customers' purchase intention for online travel websites. Likewise, Udo et al [188] considered content as an important aspect of web related service that directly influence customer's satisfaction and ultimately behavioral intention to purchase.

Thus, a good website is one that delivers well-organized and logical information in an engaging manner [172]. On the contrary, inappropriate, irrelevant and over-dense informational content enhances the customers' cognitive load and requires too much attentional resource to process it. Consequently, they feel annoyed and irritated. That is why Hernandez et al [189] emphasized adopting information management techniques in order to avoid customer cognitive load, which may lead to irritation. In this regard, Hasan [190] empirically validated the argument that information and its design quality is essential to minimize the customer's irritation. In addition to these aspects, cultural preferences are also associated with information quality, especially in a cultural context. Cyr [191], Ghasemaghaei and Hassanein [192], Cyr [92], Cyr and Head

[91] empirically observed cultural variation with respect to website content/information design and its impact on customer attitude and loyalty.

2.3.2 Navigation

Navigation was defined as "'**a process of tracking one's position in a physical environment to arrive at a desired destination** [193, 194]."' Generally, it referred to a physical process to determine a path towards a destination [194, 195] and was considered a useful metaphor for information access [194, 196]. In the online context, website navigation refers to the ease of finding desired information appropriately and helps the users to move quickly around a website. According to Webster and Ahuja [194] "'**web navigation system is a system that is designed to aid users in the creation and interpretation of an internal mental model that helps them find and examine data on a Web site**."' Thus, navigation supports the users' determination of the path through a website [194]. Lack of navigational support in a website may be the cause of confusion with feeling lost or disorientated [24, 167, 194, 197]. Nielsen [126] considered lack of appropriate navigation structure as one of the top ten errors in website design.

Moreover, lack of navigational support in websites was previously discussed in terms of poor organization and non-obviousness of navigational links, paths simplicity, buttons, and poor organizational structure [167]. In terms of navigation design, if people do not understand the labels and tags associated with navigational items and the title/heading do not covey their meanings enabling the users to develop their mental model, that interface cannot compensate for the loss of the users efficiency [198]. As users differ in their capabilities and expertise using the Internet, the design of navigation should guide the users to achieve their final destination along with adding support by reminding them where they currently are in the web site [194].

Accordingly, the prime focus of companies should not only be on beautiful and attractive design but also on developing websites that are easy and convenient to navigate. This is because website navigation supports users in carrying out their tasks in an accurate and timely manner [199] and furnishes them with additional alternatives to retrieve the required information efficiently. Otherwise, users have difficulties in finding information and their desire for a strong sense of organization and structure makes them switch to other websites [194]. In a study Fang and Holsapple [200] observed the impact of navigational structure on website usability and they categorized website navigational structures into two major categories:

- ***Semantics:*** represents the meaning of the text or language. It is used in the navigational structure to manage or organize web based objects (e.g., multimedia presentation, a static graphic, text sentences) [200].

- ***Syntax:*** refers to organization and configuration of the provided links in order to allow navigation between web-based objects [200].

Despite a good amount of information, users may leave the website if they find it difficult and inconvenient to navigate when looking for desired data. In previous studies [85, 86], researchers emphasized the use of structured navigation to avoid errors. As precise navigational functionality not only enhances user performance but also influences their intent to use due to error avoidance. Similarly, Webster and Ahuja [194] empirically observed the impact of website navigation on user performance and intention to use a website [194]. Furthermore, they emphasized the need to deploy a good navigational strategy that enhances visitors' search efficiency and motivates them to stay and explore the other pages on the website.

In previous studies, various researchers [91, 194, 200–202] have observed the impact of website navigation on website usability, effectiveness, intention to use, and affective beliefs. Thus, navigation is a critical component to measure perceived website usability [203] and success. Lee and Kozar [20] found a strong, positive impact of website navigation on telepresence and on purchase intention. In another study, Lee and Koubek [110] found a higher level of users' preferences for website navigation compared to aesthetics and attractiveness in an online shopping environment. Childers et al. [3] identified both navigation and convenience as important determinants of cognitive belief to predict online shopping attitudes.

Other studies [37, 38, 41, 201, 204] have also noted a strong relationship between website navigation and positive attitude (i.e., satisfaction and trust). Kim and Eom [41] and Evanschitzky et al. [38] argue that convenient browsing is an important factor to satisfy online customers. Dewit and Aubert [205] claim that "'**ease of navigation, interface design, and user guidance affect customer establishment for trust.**"' As a good navigation strategy builds individual's positive attitudes by keeping them on track in order to avoid sense of disorientation or confusion, convenient design along with reversibility features are considered important aspects of navigation to avoid irritating experiences [171, 190]. Besides users' skill and design-related aspects, cultural differences also exist for website navigation design that influence the individual's positive and negative emotions, which are also consistently discussed in the literature [8, 83, 91, 92].

2.3.3 Interactivity

Interactivity determines how information that is presented is processed by users [206] on a website. It is related to improving the user's experiences during interaction [207] and is considered a critical attribute of website design [208]. It is categorized into several dimensions for better users experiences.

- ***User control*:** discussed in terms of user's ability to control or modify the content and information display on the website. Therefore, it refers to the extent to which a user feels in control during his or her interaction with a website or a system [209]. Furthermore, it is considered a central aspect of a website and was defined as a function of individual's perception of control [210, 211]. Likewise, Steuer [212, 213] defined interactivity in terms of controllability in which a user can modify the form and content of a mediated environment. Dholakia et al. [214] argue that user control refers to the extent to which a user feels control over time, content, and order of communication.

- ***Responsiveness*:** refers to the website as being able to respond to user queries [209]. Johnson et al. [215] argue that "'**the degree to which the responses in a communication are perceived to be appropriate and relevant and resolving the information need of the interaction episode or event**."' The user enjoys the interaction if they receive the appropriate, relevant response from the system. Likewise, Lee et al. [207] argue that responsiveness captures how a system responds to individual's input in timely and appropriate manner. It is related to a website's quick feedback to a customer query or question [215, 216]. Thus, the quicker the response, the better the user perception of website interactivity [215–217]. It is also discussed under the heading of synchronicity, which refers to the speed of communication or quick response, which facilitates communication between the system and users [213, 215]. Similarly, Palmer [24] observed the positive impact of responsiveness on website success. According to Dholakia et al. [214] responsiveness is related to response to earlier messages or mutual discourse. Furthermore, they argue that "'**users gauge responsiveness of a system from direct communication as in a reply to an email; or indirectly from actions taken as in changes in the website because of an expressed opinion**"'.

- ***Personalization/Customization*:** refers to the website that enables the purchase of products or services which are tailored to the individuals and to their exclusive desires [209]. Accordingly, Dholakia et al. [214] state that personalization/customization is the degree to which information is tailored or customized to meet the needs of the customers. Therefore, personalization/customization is distinct from responsiveness and user control as it

is incorporated in the ability of the system to use information provided by the customers or collected by the system to offer a tailored web experience [214].

Mahdi and Fattahi [218] discussed Personalization/customization as important aspects of user interfaces. Specifically, the term personalization refers to the extent to which the responses of websites are perceived personally and as relevant to the user's behavior [207]. Park [219] and Song and Zinkhan [220] observed the positive impact of personalization on people's perceptions of interactivity, satisfaction, and behavioral intention. Customization, however, refers to the capability that a website provides to the individuals for changing the products or services according to their preferences [40, 221]. This is why Haag and Cummings [222] considered both personalization and customization as important strategic factors for e-commerce websites. In addition, Haag and Cummings and several other researchers [223–226] discussed the importance of personalization/customization to enhance online business performance.

- ***Connectedness*:** refers to feeling of being able to be connected or linked to other participants/content in the outside world to enhance one's experience easily [214]. Cyr et al. [209] argue that connectedness is related to one's sharing of experience with other customers or visitors about the products or services. Likewise, Zhao and Lu [210] point out that it "'**refers to an individual's feeling of being connected to others through the sharing of experiences and feelings**."' According to Benyon [227] connectedness is important for social presence and relationship whereas Martin et al. [49] indicate that it is a customer experience about being able to link, connect, and share knowledge and perception with others in the virtual community. Thus, connectedness can be achieved through incorporating and developing the interactive design features of a website that enables customers to be engaged in conversation to share their perception and experiences [228].

- ***Playfulness*:** refers to the enjoyment or pleasure a user perceives during their interaction [210]. It is an important factor which motivates users toward system utilization and is derived from the concept of flow [229] and categorized into three important dimensions (e.g., curiosity, enjoyment, and concentration) [229]. Dholakia et al. [214] defined playfulness in terms of the enjoyment and entertainment value of a website. Furthermore, they argue that it is an important feature of interactivity that may include pleasureable aspects (e.g., humorous animations), where the final intent is to provoke an emotional or behavioral response. Ahn et al. [230] observed the positive impact of playfulness on behavioral intention to use via attitude. They argue that it is a short-term system specific

state or trait and considered important because customers wish to obtain entertainment and pleasure while shopping online. Katerattanakul [231] discussed playful design in terms of curiosity, intrinsic interest, attention focus, and control. Chung and Tan [232] considered website characteristics (e.g., navigation, usefulness, variety, feedback, content, experimentation, speed, ease of use), cognitive aspects (e.g., focused attention and control), and motivation for searching (e.g., experiential-directed type of task) as important aspects that influence the perception of playfulness of a website [229].

In several other studies, [49, 104, 183, 209, 210, 221], researchers found the positive impact of web site interactivity features on user attitude and purchase intention.

Chapter 3

Emotion, attitude and behavioral intention

Website design features affect user's feelings, emotions, and behavior. These emotions referring to "'affect"' are very critical in behavioral sciences and are consistently discussed in information and technological studies. Zhang [233] discussed affect in terms of emotions, feelings, and mood. These emotions are particularly arouse or stimulated due to situational events and generate subjective feelings and motivate appropriate actions [233, 234]. In psychology, emotions describe individuals' experience and plays an important role in the decision-marking process [234–237]. Thus, feelings or emotions can be positive (e.g., enjoyment, appeal, and satisfaction) or negative (e.g., contempt, anger, and irritation) [190, 192, 234, 238–242] which influence the individual's attitude. Attitude also refers to emotions, which in turn leads to the intention to perform a behavior (e.g., intention, action, usage, and performance) [242, 243]. Thus, a user may feel a sense of enjoyment or satisfaction if the design features of a website are attractive, functional, and appealing. Hence, if the design of an e-commerce website is according to preferences of target users, it will ultimately lead to a positive attitude and behavioral intention.

In this research, positive emotions and attitude (i.e., satisfaction and trust) were used to determine individuals' behavioral intention. Irritation was adopted as a negative emotion to explore design consideration in order to avoid anger or annoying experiences.

3.1 Satisfaction

In reality, it is difficult to design a product or website that satisfies all international and intercultural customers [244]. Therefore it is important to identify what makes it possible to satisfy customers. Satisfaction is a gauge for system success and is a commonly adopted construct in various technological studies [192]. It is the consumer's overall commitment to a product and is considered an important predictor of behavioral intention. Furthermore, it highlights the users' personal perception, fulfillment, and affective attitude [21, 192, 245]. In previous studies, satisfaction was discussed under different names and headings, for example, comfort, intent, and pleasure users feel after use. Thus, the greater the degree of satisfaction with a service the greater the intention to use or purchase that product [246].

Therefore, satisfaction is an individual's assessment and affective response to his or her performance and experience with a product/service [192, 247, 248] and was previously used as a major determinant of behavioral intention [247, 249]. According to expectancy disconfirmation theory [250] satisfaction is "**the summary psychological state resulting when the emotion surrounding disconfirmed expectations is coupled with the consumer's prior feelings of the consumption experience** [p.29]." However, the retention of consumers as well as the continuous use of a website is an important challenge for commercial website providers [45]. Because "'**web sites have different hidden subjective factors that stem from the process of user and system interaction and affect overall user satisfaction, and that they can serve the development and maintenance phases of Web site creation** [26]."'

Hence, it is a critical factor linked to the diverse nature of other related factors [26], and can be assessed by obtaining subjective data from users. Belanche et al. [22] and Lee et al. [251] observed a strong association between website usability and user satisfaction. In several technological studies it was determined through diversified nature of other measures.

End-user computing satisfaction is a frequently adopted model for measurement of satisfaction, proposed by Doll and Torkzadeh [252]. According to them, user satisfaction is used to evaluate design effectiveness and related activities. Furthermore, they considered five distinct validated factors to determine end user computing satisfaction (i.e., content, ease of use, accuracy, format, timeliness). In one study, Aggelidis and Chatzoglou [253] extended end-user computing satisfaction into an extensive end-user computing satisfaction model. In the model, they measure the satisfaction with sub factors of system quality (i.e., training, ease of use, documentation, interface, and system speed) and information quality (i.e., content, format, accuracy, and timeliness).

In terms of websites, Evanschitzkya et al. [254] define e-satisfaction as users' positive perceptions of a website design. Muylle et al. [42] consider website satisfaction as the final attitude towards a website. In addition, they argue that it is a measure of the utility of a website in the end user's decision-making process. Petrie and Bevan [255] define satisfaction as an optimistic attitude toward a product. Therefore, it is related to emotional reaction [192], stickiness and is a summary of website quality. These qualities fascinate and encourage visitor retention rather than moving to another website [256]. In the context of e-commerce Zviran et al. [26] considered website design and usability as distinct factors for predicting online customer satisfaction.

3.2 Trust

Like satisfaction, trust is also an affective attitude and has received considerable attention in marketing and technological research. It was defined in terms of terms of emotion; that individuals feel secure and comfortable [257, 258]. It also refers to the depth and assurance of customers' feelings based on inconclusive evidence [170]. Apart from being a feeling and emotion, it is one's faith and belief in another person's trustworthiness and honesty in a transaction [65, 259]. Gundlach and Murphy [260] argue that trust is a belief like honesty in which a person keeps his or her word in order to fulfill a promise. Likewise, Johnso and Grayson [261] discussed trust in terms of consumer sureness and readiness to faith on a service provider's competence and reliability.

It allows individuals to act in risky and uncertain situations [21]. Thus, uncertain situations and risk were considered important conditions in order to discern the value of trust, [21, 65, 262] which ultimately enhances company profit and performance [263]. Wang and Emurian [258] argue that trust plays a distinct role in the online context because of uncertainty and anonymity. Thus, consumers make their decision to trust e-retailing by considering perceptions (cognitive) such as reputation, information, similarity, and perceived control [264]. As more problems are associated with online business, such as, privacy and insecurity, it enforces website providers to develop trustworthy websites.

The term **online trust** or **e-trust** also refers to the customer's confidence in a website and reduction in risk and uncertainty [265, 266]. This is because financial risk and transaction security tends to reduce purchase intentions, especially in the online context, where consumers are unaware or not sure about the credibility of merchants or online vendors. They feel more scared about buying or transacting due to the loss of their privacy or money [267]. Moreover,

online transactions also does not involve the parallel exchange of money and goods [268]. The absence of credibility and trust was frequently discussed as one of the reasons why customers avoid purchasing from online vendors [268].

Accordingly, users' perception of presentation flaws on a website also influence trust and intention to purchase [269]. Website usability and related factors significantly influences online user trust [21]. That is why defining e-trust is still more difficult in online context due to its complex and abstract nature along with related concepts such as confidence, reliability, and credibility [258]. It is a multidimensional factor that incorporates cognitive, emotional, and behavioral dimensions [258] and depends on an individual's beliefs and perception in any kind of interaction [21].

Trust is an important determinant of participation in the online shopping environment in general. Hence, it is important to understand the element of trust in the online environment. According to Gefen [270] beliefs of integrity, benevolence, and ability are important predictors of overall trust. In addition, he discussed "'**integrity**"' as a belief in the merchant's promises, "'**ability**"' as a belief in the merchant's skills and capacity to provide good quality, and "'**benevolence**"' as a belief in the merchant's capacity to do good without regard to making a sale [270]. Ang et al. [271] also proposed three elements of trust such as the presence of a privacy policy on the web, delivering the products or services as promised, and the willingness of an online merchant to verify, should their purchased product meet the customer's satisfaction or not?

- ***Benevolence*** is associated with the individual's confidence that the other party is concerned for their well-being and interested in mutual benefits [21, 272]. In an online context, this refers to a website concerned with the desires, interests, and needs of individuals, which gives them useful recommendations about their services or products [272].
- ***Honesty*** is the confidence that other party will keep their word to fulfill promises and always act sincerely [272, 273]. In the online context, it refers to the fact that the provided information on the website is true and honest with no false statements [272].
- ***Competence*** refers to whether a website has the potential resources and ability required for the effective completion of transactions and motivation to proceed, a kind of continuing relationship or vender skills [21, 272, 274].

In order to attract new customers the trustworthy appearance of websites is very important in uncertain situations. Kubilus [275] argues that the development of trustworthy e-commerce

websites through credible design features is important for website usability and interface effectiveness. Consequently, a website with trust-inducing features and functions acts as a skillful company sales person. Wang and Emurian [258] categorized design features into content design, graphic design, structural design, and social-cue design in order to develop a trustworthy interface especially in the cultural context. A credible design with a trustworthy appearance creates positive feelings towards online transactions with retailers, which ultimately reduce behavioral uncertainty and fear. Seckler [272] observed a strong association of graphic and structural design with users' distrust and trust. Hence, website usability and content comprehension reduce errors, which improve the design credibility and ultimately customer trust. Thus, careful attention to design elements and elimination of design and presentation flaws has a positive influence on the customers of e-commerce websites.

3.3 Loyalty

User interface designs for globalization are becoming more important for business success and customer loyalty [244]. Customer loyalty is defined as strong feelings of allegiance or commitment [274]. So it is a psychological attachment of consumers towards a vendor or a service provider [276]. Griffin [277] argued that there are two important aspects that critically influence customer loyalty. The first aspect refers to the feelings and emotional attachment customers to have towards the service or product [278]. The second aspect refers to the intention to return or repeat purchase [278]. In addition, Griffin explained that there are four types of loyalties in terms of purchase intention or attachment; inertia loyalty, premium loyalty, latent loyalty, and no loyalty [277, 278]. Likewise, Brown [279] classified loyalty into four categories, (1) divided loyalty, (2) undivided loyalty, (3) unstable loyalty, and (4) no loyalty based on customers' purchases patterns.

Jacoby and Kyner [280] argue that loyalty is a biased attitude or unfair behavior buying processes that results from a psychosomatic process. Assael [281] and Keller [282] considered a positive and favorable attitude towards a specific brand as an important element to measure repeated buying behavior. Fornell [283] mentioned that loyalty should also be evaluated through price tolerance and repurchase intention. Thus, it is a degree to which the customers want to purchase services or products from website retailers in the future or a continuing favorable attitude. Loyalty happens once "'**the customer feels so strongly that you can best meet his or her relevant needs that your competition is virtually excluded from the consideration set and the customer buys almost exclusively from you** [284]."' Besides price and quality, design and a credible appearance also enhance customer loyalty. From a traditional perspective

Srinivasan et al. [40] mentioned that improving the appearance of a store front and positive presentation of sales and service personal increase customer loyalty. In general, consumer loyalty is demonstrated via certain behavior such as retention, reputation, revenue, and referrals:

- ***Retention:*** Loyal customers continue to do business and are not sensitive to competitive pressures [285].
- ***Reputation:*** Loyal customers always speak well of you [285].
- ***Revenue:*** Loyal customers always give you a larger share of their business that increases revenue, recognition, and success [285].
- ***Referrals:*** Loyal customers recommend and encourage others to choose a particular product via word of mouth, e-mail, and blogs [285].

Therefore loyal customers are found to have strong commitments and attachments towards retailers. Moreover, loyal customers are not easily distracted by slightly more attractive alternatives. Hence, true loyalty leads to purchase retention [286], resistance to switch, and willingness to pay more. Besides this, companies operating their businesses online are facing competition because of rapid growth in this sector. Therefore, trustworthiness, security, and ease of use are important aspects to keep the customer loyal to a website [287]. Srinivasan et al. [40] identified following factors (e.g., customization, community, care, cultivation, contact interactivity, character, convenience, and choice) that influence customer e-loyalty.

3.4 Irritation

Irritation can be defined as feelings of discomfort, infuriation, and momentary impatience [190, 288]. It is a kind of negative emotion [234, 240, 241] and displeasure due to frustrating or annoying stimuli such as messages, incidents, or interaction that may go against what a customer desires or expects in a particular situation [240, 241, 288]. Irritation can also be defined as negative incidents related to users' experiences with services that do not proceed normally and create dissatisfaction or friction [289]. Hornbaek [9] discussed annoyance in terms of irritation, arguing that it is the extent to which user's feelings or experiences go from extremely comfortable to extremely frustrated.

In terms of online shopping, it is defined as the degree to which a website appears irritating, frustrating, and messy to online customers [290]. Irritation is an unintended outcome of a website due to design-related features that customers find offensive, annoying [190, 288], or

confusing because of its poor organizational layout [172]. Hence, disorganized websites with inappropriate graphics, color, or broken links irritate online customers [171]. The consequences of irritation include excessive efforts or wastage of time that goes against customer value [53] along with a less favorable attitude towards the website [171].

According to Nielsen [126], web-based features that negatively affect user perception include non-scannable text, continuous running animation, outdated information, nonstandard link color, error messages, complex URLs, broken links, and pop-up adds. Poddar et al. [291] argue that an unpleasant website personality likely entails irritating, frustrating and annoying behavior due to poor design layout, themes, and product purchase processes. Dealing with such unpleasant websites seems irritating and offensive in nature [291]. However, customers are particularly concerned about purchasing products online in a timely manner with minimum irritation [292]. Several studies [9, 171, 190, 288, 293–296] in the literature have discussed design considerations with respect to customer irritation in both traditional and online environments.

Lim [293] argues that well-designed web atmospherics and entertainment gratification reduced customers' irritation during their interaction while shopping online. According to Azeem and Zia-ul-haq [294] it is important to understand customers' perceptions of commercial websites in order to explore the causes of irritation. They observed the negative impact of pop-ups on consumers' attitudes because pop-up messages cause irritation, which ultimately affects adoption behavior [294]. In the same vein, Aaeker and Bruzzone[295] explored consumer irritation with respect to advertising channels. They observed that commercials with useful information were less irritating, whereas irritation was higher with unattractive artifacts. Moreover, he argues that irritation reduces the credibility of an advertisement.

Hausman and Siekpe [171] studied the human factor (e.g., feedback, language, and humor) and the computer factor (e.g., contents/information, design consistency, and security) of perception related to informativeness, entertainment, usefulness, irritation, and purchase intention. They concluded that design features are important for developing a commercial website which as a result generates positive perception through informativeness and usefulness [171]. They further argue that positive perception performs a key role in developing customers' favorable attitudes through an understandable website layout and convenience in navigation while searching for desired products or information [171]. Chiu and Yang [297] observed a negative impact of the computer factor (e.g., contents/information, design consistency, and security) on irritation. According to Chakraborty et al. [296] website organization (e.g., arranged content and graphics) is an important design consideration in order to avoid irritation.

Chapter 4

Hypotheses

The prime objective of this research was to explore the web design artifacts and usability measures fit for individuals in a cultural context (see Figure. 4.1). These measures and design considerations are important to determine online users' emotions in terms of positive attitude (i.e., satisfaction and trust), and loyalty. Because a user may feel a sense of satisfaction if the design of a website looks attractive, appropriate, and trustworthy. These positive aspects lead to user loyalty and their strong association with that website. On the contrary, poor organization and unpleasant features arouse negative emotions in terms of annoyance or irritation. Particularly in the case of typography, which was rarely discussed in the domain of e-commerce with respect to an individual's trust, satisfaction, irritation, or performance. It is an important design feature in terms of visual representation of information. Thus, determining the role of typographical appropriateness with respect to the user's attitude and minimizing their irritation is also an important contribution of this research.

In order to explore individuals' emotions regarding design consideration in a high UA culture, five design attributes are suggested by the research community (i.e., [24, 36, 86, 91, 298]) they include:

1. **Typography**- an aesthetic aspect, related to appearance, attractiveness, and readability of text on the website to capture and hold user attention.

2. **Color**- also an aesthetic aspect, it appeals to users' emotions and feelings, and helps them to understand the text and the functions of buttons, icons, and boxes.

3. **Content/information quality**- the degree to which the provided information is sufficient, complete, and updated.

4. **Interactivity**- how information is presented and processed to consistently enhance user interaction consistently.

5. **Navigation**- the extent to which navigational clues and formats assist the user to access other sections of a website and a useful metaphor for information access.

All of these design attributes incorporate both usability as well as aesthetic aspects. However, both typography and color are associated with aesthetic quality, whereas content, interactivity, and navigation are more related to organizational structure and the layout of the website. These design attributes are extensively discussed by various researchers in e-commerce-related studies (i.e., [20, 91, 110, 167, 190, 191, 224, 299]) to assess users' preferences. Likewise, in the cultural context, Cyr and Head [91] examined the implications of design attributes (i.e., content, navigation, and visual design) on trust and satisfaction in masculine versus feminine oriented cultures. Similarly, Hasan [190] also discussed design attributes (i.e., content, navigation, and visual design) in terms of customers' perceived irritation. Besides indirect design implications on loyalty, both trust and satisfaction were further used as key antecedents to determine loyalty. The goal was to examine the relative strength of the relationship of trust versus satisfaction to loyalty for UA culture. Casalo et al. [274] observed a strong relationship between user satisfaction and loyalty. However, Bilgihan and Bujisic [300] and Cyr et al. [209] noted a positive relationship between user trust and loyalty.

Typography is an aesthetic aspect which is consistently discussed with respect to information processing, design, and reading preferences [7, 124, 144, 146, 147, 150, 301]. These studies provide effective recommendations for typographical appropriateness. Pusnik [7] noted sans-serif as a better choice because of its quick recognition and processing. Bernard et al. [144] also considered sans-serif with 12-point or larger as appropriate and preferable typography. In the context of commerce, Myung [124] empirically observed users' preferences for typography. The results from this study demonstrated the following: the importance of line spacing 56%, style 35%, and 12% for size, respectively [124]. Sasidharan et al. [302] observed a positive relationship between typeface and trust but the results of this study were limited and only specific about the typeface. In the domain of e-commerce little substantial evidence exists that adresses the determining role of typography in building user trust and satisfaction. We believe that appropriate use of typographical elements enhances visual appeal, legibility, and comprehension of product/services and buying related information on the website. Thus, we hypothesize that the typographical features employed positively influence user trust and satisfaction and have a negative impact on irritation.

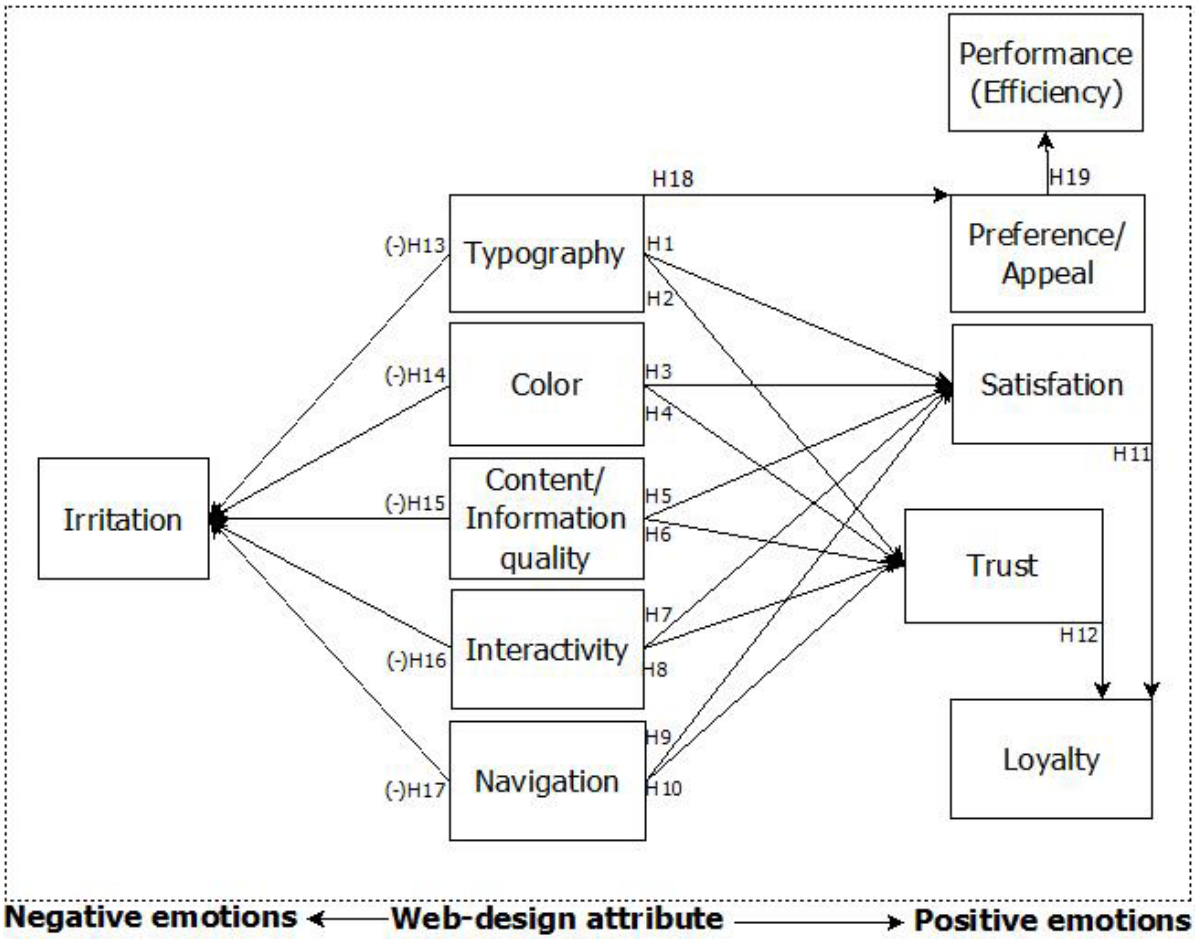

Fig. 4.1 Research model and hypotheses to explored the influence of web design attributes on individuals' affective beliefs.

H1: *Website typography positively influences user satisfaction.*
H2: *Website typography positively influences user trust.*
-H13: *Good website typography will have a negative effect on irritation in an online shopping environment.*

As previously mentioned, colors are also associated with appeal and attractiveness and help users to understand the functions of icons, buttons, and links. Color also plays a very prominent role by enhancing readability and drawing attention to important information [123]. In several studies, [8, 70, 84, 107, 160, 163–165] various researchers have discussed the role of color in terms of website usability, individuals' emotions, positive perception, and intention to purchase. Cyr et al. [84] observed the positive impact of color appeal on user satisfaction and trust for websites in a cultural context. Color appeal not only determines the level of interaction but also helps users to understand the navigational and functional aspects of a website. For example, blue is a universally preferred cool color [70, 84, 165] associated with wealth, trust, and security [84, 160], and used to establish a credible image of corporate entities [84]. Similarly, Hall and Hanna [164] found that the design of web-pages in blue improved readability and increased intentions to purchase. We assume that beside appeal, appropriate color schema also help the user to understand and to recognize functional and informational artifacts, which positively influences the trust and satisfaction and has a negative impact on irritation.

H3: *Website color leads to higher user satisfaction towards that same website.*
H4: *Website color leads to higher user trust towards that same website.*
-H14: *Appropriate use of color will have a negative effect on irritation in an online shopping environment.*

It was argued that information content reduces uncertainty and risks, which translates into a higher comfort level with a website [183]. Several studies [92, 92, 170, 188, 191, 262, 303] in the literature have looked at content/information quality with respect to customers' attitudes. Udo et al. [188] argued that website content positively influenced service quality, which translates into higher satisfaction. Ganguly et al. [83] examined the impact of information design (e.g., presented and organization) on trust. Where, Hasan [190] observed a negative impact of information design on customer perceived irritation. In this study, we assume that besides information design, concise and supportive content also help users to be efficient during the buying process through quick reading and comparison of product/service features in order to reach a buying decision. All these features of information reduce uncertainty and positively influence trust and satisfaction along with having a negative impact on irritation.

H5: *High quality website content leads to higher user satisfaction.*
H6: *High quality website content leads to higher user trust.*
-H15: *Content quality will have a negative effect on irritation in an online shopping environment.*

In several studies [210, 216, 304, 305], researchers have observed the impact of interactivity features on satisfaction, trust, and loyalty. Cyr et al. [209] argue that interactivity (i.e., user control, connectedness, and responsiveness) affect user trust and loyalty. Venkatesh and Ramesh [306] argue that website customization saves customer time by providing them with personalized information. Cyr and Head [91] discussed a positive impact of interaction and information tailoring features in terms visual design on trust and satisfaction between higher and low masculinity cultures. Haag and Cummings [222] considered both personalization and customization as important strategic factors for e-commerce websites. However, there is still insufficient evidence in the literature to determine the role of interactivity for e-commerce website in high UA cultural contexts. Consequently, we employed the following features of interactivity; responsiveness and personalization/customization to seek users' preferences. Personalization/customization helps the customers in tailoring product features. We theorize that personalization/customization includes important features, which help customers to tailor product features before buying. Similarly, we also assume that responsiveness positively influences customer satisfaction and trust through consistent feedback and support along with having a negative relationship with irritation.

H7: *An increased level of web interactivity leads to higher user satisfaction toward that same website.*
H8: *An increased level of web interactivity leads to higher user trust toward that same website.*
-H16: *More interactivity will have a negative effect on irritation in an online shopping environment.*

Website users have various capabilities and skills in the use of the Internet. Previously, several researchers emphasized the use of guided navigation in order to avoid uncertainty or error [85, 86]. Positive correlation exists between navigation design and satisfaction, and also between navigation and trust [91, 92, 191]. Consequently, we believe that besides ease of navigation and design, reversibility, navigational clues, and obvious buttons also help the users take appropriate action by eliminating ambiguity or error. All these navigational aspects positively influence trust and satisfaction and negatively affect irritation.

H9: *Guided navigation leads to higher user satisfaction toward that same website.*
110: *Guided navigation leads to higher user trust toward that same website.*
-H17: *Structured navigation will have a negative effect on irritation in an online shopping environment.*

Loyalty is defined as strong feelings of allegiance, commitment, and purchase return [274]. In previous studies, [21, 191, 224, 262, 278, 307], both satisfaction and trust were considered key factors for measuring user loyalty to a website. Thus, the greater the degree of satisfaction [274] and trust [209, 300] the greater the degree of website loyalty. We assume that satisfaction and trustworthiness of a website leads to loyalty in terms of repurchase and recommendation in high UA cultures.

H11: *Greater website user satisfaction leads to greater user loyalty to that same website.*
H12: *Greater website user trust leads to greater user loyalty to that same website.*

As previously mentioned, the subsequent part of this research work was also to explore the impact of font personality on individuals' performance. Besides emotion and attitude, the role of typography has also been neglected in terms of individuals' task completion in an e-commerce context. Various researchers [7, 8, 124, 153–155] previously adopted and discussed the implications of typefaces with respect to users' preferences, reading speed, and accuracy. Douglass et al. [155] and Sasidharan and Dhanesh [154] employed these font families (i.e., sans serif, serif, mono-space, and script) to discover their impact on customers' positive attitudes towards commercial websites. Therefor, a typographical feature (typefaces/font personality) was adopted in order to discover the impact of font personality on task completion time for an e-commerce website prototype. We assumed that users of preferred, appealing typefaces would take less time to complete a task in the buying process compared to those that used the less appealing, less preferred, and less suitable font. Accordingly, in the current study, different typefaces (font personality) were employed to determine the influence of font personality on users' preferences, appeal, and ultimately on performance (i.e., task completion time) for a developed e-commerce website prototype.

H18: *Sans-serif is preferable and appealing typeface compare to others (i.e., serif, mono-spaced, and script) in an e-commerce website.*

H19: *Higher the level typeface preference and appeal higher the level of user performance to that same website.*

Chapter 5

Empirical testing

5.1 Study-1

Initially, to refute/validate the hypotheses (i.e., H1 to H12) from the proposed model (see Figure. 4.1), a working e-commerce website prototype was developed after carefully considering the design features related to travel ticket booking to be tested by the participants (see figure 5.1). The website prototype was primarily designed by deploying the appropriate use of basic color (i.e., blue-white) to enhance users' understanding along with better recognition, retention, and to be aesthetically appealing as suggested in the literature [84, 159]. Blue was mainly used in the design of distinct areas (e.g., header, footer, navigation buttons and links) of the website whereas white was used as a native/background, logo, and graphics color. This is because both blue and white give high levels of contrast and were previously considered effective, popular colors. In a study, Noiwan and Norcio [159], empirically observed the combination of blue-white in terms of better usability (i.e., appeal, enjoyment, interest, and readability). Moreover, the blue hue is considered cool, well-appreciated, and is a favourite color [105, 107, 159] for all cultures or age groups. In terms of typography several empirical studies, [144, 146, 147, 150, 301] have suggested a font 12 px size or above, sans-serif typeface, and default spacing as appropriate and preferable typography features.

The typographical features used for the developed website prototype include; typeface sans-serif, default spacing, size from 12 px to 20 px, and colors that are more frequent (black, blue, and white) and less frequent (green, and pink). Furthermore, website navigation was supported through buttons and links along with navigational clues and a structured path for appropriate actions. To enhance website interactivity, for example ticket price, travel date and time, preferred destination, and seat location inside the bus were incorporated through customizable features. Furthermore, as shown in figure 5.1, in personalizing the seating plan,

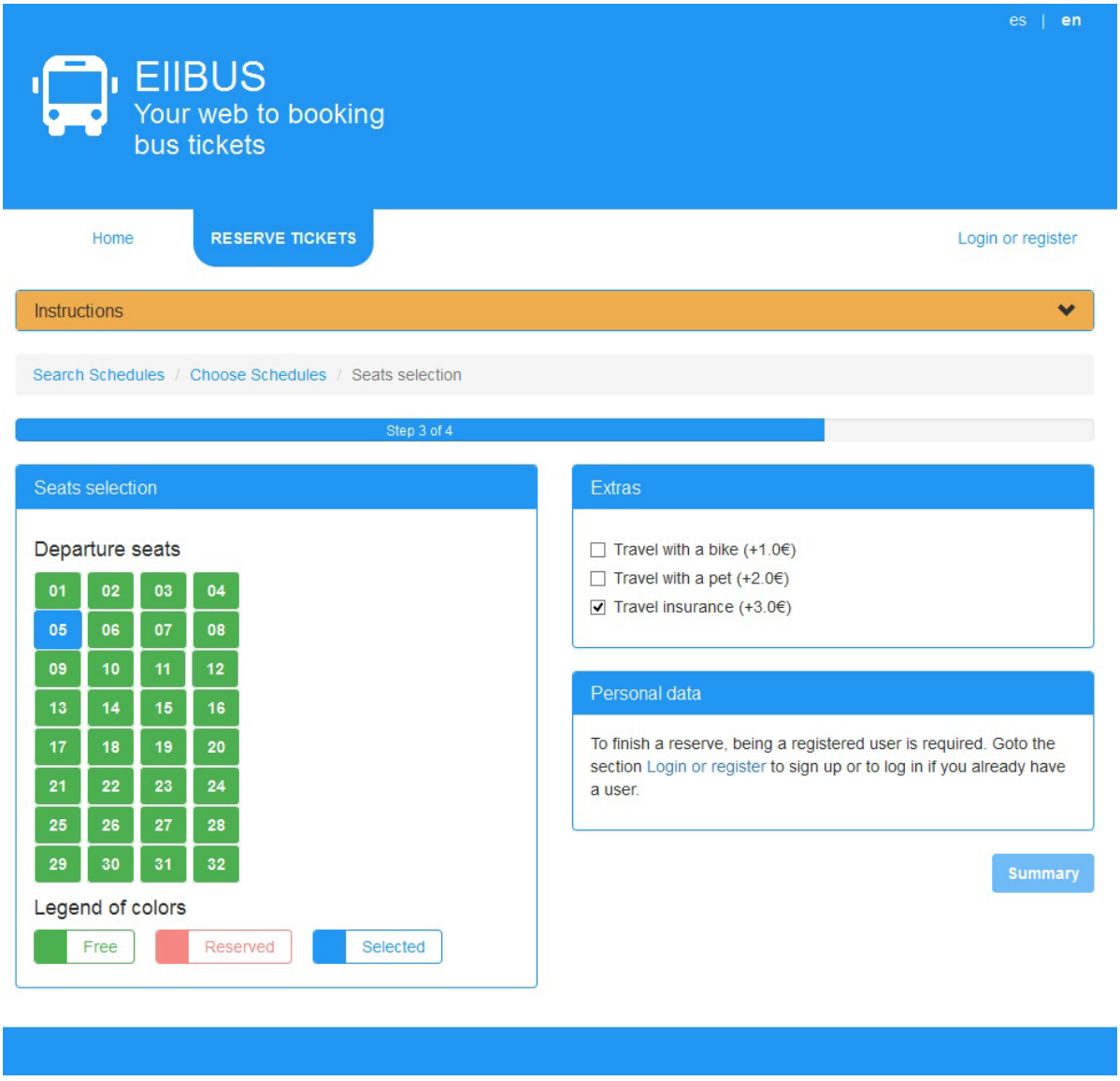

Fig. 5.1 E-ticket bus website prototype.

different colors were used for different buttons (i.e., green for “free”, pink for “reserved”, and blue for “selected”). Moreover, feedback, help and support were facilitated through pop-up messages and a progress bar.

Once the prototype had been developed, a series of user tests were conducted with university students to ensure a high usability level of the interactive elements. Thus, the prime objective of the pretest study was to validate the functional aspects of the developed prototype, that is, the searching and booking procedures. Suggestions and feedback were incorporated accordingly. We only kept relevant content/information related to booking and eliminated promotional information, banners, and graphics which were irrelevant to study 1. Removing irrelevant artifacts from the experimental website prototype helps to maintain the higher level of engagement during experiment. Lastly, an experimental website prototype was used instead of using a company website to avoid external factors such as users’ familiarity and company reputation. In several studies [20, 274, 308], researchers have observed the impact of customers’ familiarity and the service reputation on website usability.

5.1.1 Measures and Data Collection

In order evaluate the proposed hypotheses, a survey scale was designed and integrated with the website prototype to obtain subjective data from the participants (see Appendix A). The final survey questionnaire for study-1 consisted of 26 relevant items to assess the influence of adopted web design attributes on users’ satisfaction, trust, and ultimately on loyalty for the developed prototype with respect to high UA culture. The survey items for the hypothesized constructs (i.e., typography, color, content quality, interactivity, navigation, satisfaction, trust, and loyalty) were modified and developed from the literature (i.e., [22, 24, 26, 84, 91, 123–125, 167, 298, 302, 309, 310]) in the domain of e-commerce. The questionnaire items and source appear in Appendix A. The measurement scale was developed in English. A seven-point Likert-scale ranging from 1 (strongly disagree) to 7 (strongly agree) was used to measure each observed item. Lastly, the survey instrument tool validation is discussed in the data analysis section.

For the current study, students were recruited in Pakistan, the prototype used for this research supports multiple languages. As the culture of Pakistan, according to Hofstede’s cultural index, is rated high for UA = **70** (risk avoidance) [86], it is treated as a low trust culture. A culture that demonstrates a lack of tolerance for personal risk and prefers trustworthy websites. As for comparison,the minimum score of UA in Hofstede’s cultural index is 08 for Singapore, and maximum is 100 for Greece [86]. This difference renders Pakistan a substantial area of

Profile Category		Frequency	Percentage
Gender	Male	356	63.8
	Female	202	36.2
Age	<20	175	31.4
	20 - 30	365	65.4
	>30	18	3.2
Laterality	Left-Handed	136	24.4
	Right-Handed	422	75.6
Browsing Experience	Beginners	83	14.9
	Intermediate	125	22.4
	Advanced	211	37.8
	Expert	139	24.9
Buying Experience	No	245	43.9
	Infrequently	67	12.0
	frequently	246	44.0
Total		558	100.0

Table 5.1 **Demographic characteristics of respondents (study-1)**.

research in the domain of e-commerce.

Data were collected from graduate and postgraduate level students with the cooperation of several academic institutions. To recruit volunteers, the researchers sent an email to the students and also to colleagues in different universities, who further distributed the email to the students of their respective institutions along with a link to the prototype and study description. Approximately 1500 students from different universities responded with positive consent to participate in this research. A concise description of the research and buying scenarios was also included at the top of the home page of the prototype website (collapsible content) for review before starting the ticket booking process. newline
The participants were asked to use this prototype to search for bus tickets between two locations on a specified date see Figure c.2 (Appendix C). The next step was to choose a bus ticket with the minimum price from the schedule returned by the search see Figure c.3 (Appendix C). The participants were also asked to personalize the seating plan inside the bus see Figure 5.1. Lastly, the students were asked to login after the booking process through online registration to collect the their demographic data see Figure c.4 (Appendix C) followed by a survey. In the two-month data collection process, 662 surveys were obtained. Incomplete and invalid surveys were discarded from the original data set. Only **558** out of 662 surveys were considered valid and appropriate where the response rate was 44.1%. The students' brief demographic description is given in Table 5.1.

5.1.2 Technique

The proposed relationships were verified through partial least squares (PLS), a structural equation modeling (SEM) technique [311, 312]. This technique was also used in building extrapolative models, when the constructs are numerous with high collinearity and extensively applied in technological, social, and business sciences [311]. Besides predicting relationships between latent variables, its prime emphasis is to predict responses in a study. Basically, PLS is family of alternating least square algorithms that extends and emulates canonical correlation analysis and extends principal component analysis [311]. This method was proposed and invented by Herman for the computation of high dimensional data [311, 312]. PLS handles both composite and factorial models for construct measurement as well as estimating recursive and non-recursive structural models, and also conducting tests of model fit [311, 312]. PLS is normally defined through a set linear equations for the measurement model and the structure model [311, 312].

There are several reasons for using PLS rather than using other structural equation modeling software, such as covariance-based LISREL. It offers more flexibility in comparison with covariance-based standard error of means techniques [313]. It does not require data to be normally distributed and allows smaller sample sizes compared to other SEM techniques [313]. It avoids many of the restrictive assumptions underlying covariance-based techniques such as multivariate normality, and enables both reflective and formative constructs to be assessed together [314, 315]. It is a component based approach and is suitable for testing the hypothesis without having to alter the model [35].

PLS efficiently accomplishes the analysis of a model and has a sound reputation in analyzing quantitative data even if the sample size is small, there are missing values , or there is zero variance for same of the variables [316]. It is a comprehensive multivariate statistical analysis technique that can simultaneously examine relationships between all variables in a conceptual model in order to test theories. Its ability to model both composite and factors appreciated by the researchers and is considered an effective technique for new technological and information science research [311]. Factors can be employed to model latent variables of behavioral science such as personality traits and attitude [311]. newline
Consequently, PLS path modeling is a preferred statistical tool for successful factor studies due to its comprehensiveness and flexibility in analysis. For this reason it is a frequently adopted approach in empirical research to develop and to support theories.

The software package WarpPLS version 5.0 [312] was used to perform the PLS-SEM analysis.

We preferred WarpPLS over other PLS-SEM tools because it applies Wold's original PLS regression algorithm that reduces the levels of collinearity, thus providing no inflated coefficients and stable weights [312].

5.1.3 Results

A statistical tool (SPSS version 22.0) was also used to compute the descriptive statistics (i.e. frequency, mean, and standard deviation). The reliability of the constructs was examined through cronbach's alpha (α), which is based on the average inter-correlation of items [317–319]. Therefore, high inter-correlation between items results in a higher significance level of α . However, there is no strict cut-off point for α coefficients but a lower limit of alpha (α) is the generally agreed value of 0.70 [317, 318]. The values for α in this study-1 ranged from 0.838 to 0.898 (see Table 5.2). Furthermore, reliability was also assessed by analyzing the outer loadings or sample correlations of the observed items with the construct to which they are theoretically associated. The general rule is that the value of composite reliability (CR) should be equal to or greater than 0.70 [317, 318]. In this study, the value for CR ranged from 0.913 to 0.943 (see Table 5.2), which demonstrated good internal consistency.

Measurement model

The measurement model was examined through Unidimensionality, Standardized factor loadings, CR, Convergent Validity (CV), and Discriminant Validity (DV). Initially, unidimensionality was tested by employing a principal component (factor) analysis. According to Kaiser's criterion, unidimensionality holds if an eigenvalue higher than one is attained in the first principal component [320]. All the constructs used met the suggested criteria; moreover, the principal component accounts for the majority of the variances (see Table 5.3). CV was examined via WarpPLS by observing the outer loading pattern of the items [317]. The outer loadings for all observed items were greater than 0.70 and ranged from 0.776 to 0.945 (see Tables 5.2 and 5.4) along with significant p-values (Threshold ≤ 0.05), indicating good CV of all constructs [317].

Secondly, DV was evaluated according to the criterion suggested in previous research. DV indicates the extent to which a given construct differs from other constructs [321]. Therefore, the DV criterion relies on two important elements. The first element is that the observed items should be weakly correlated with all constructs except the one to which they are hypothetically associated [321]. Gefen and Straub [322] in their study stated that "correlation of the latent variable scores on the measurement items needs to show an appropriate pattern of loadings, one in which the measurement items load highly on their speculatively assigned factor and

Constructs	Standard Deviation	(α) [a]	CR [b]	AVE [c]	Loadings [d]
Typography		0.871	.921	0.795	
1	1.602				0.886
2	1.707				0.881
3	1.616				0.907
Colors		0.867	0.938	0.882	
1	1.608				0.939
2	1.598				0.939
Content Quality		0.875	0.923	0.800	
1	1.574				0.878
2	1.559				0.915
3	1.562				0.891
Interactivity		0.881	0.913	0.678	
1	0.796				0.776
2	0.835				0.821
3	0.855				0.845
4	0.849				0.843
5	1.634				0.829
Navigation		0.882	0.914	0.681	
1	1.678				0.814
2	1.695				0.835
3	1.670				0.860
4	1.650				0.808
5	1.655				0.808
Satisfaction		0.898	0.929	0.766	
1	1.616				0.878
2	1.596				0.895
3	1.647				0.857
4	1.600				0.871
Trust		0.838	0.925	0.860	
1	1.612				0.928
2	1.645				0.928
Loyalty		0.880	0.943	0.893	
1	1.789				0.945
2	1.811				0.945

Table 5.2 **Reliability, convergent, and discriminant validity**.

[a] = Cronbach's Alpha
[b] = Composite Reliability
[c] = Average Variance Extracted
[d] = Factor Loadings

Constructs	Eigenvalues		Variance explained	
	1st Comp	2nd Comp	1st Comp (%)	2nd Comp (%)
Typography	2.384	.345	79.471	11.511
1				
2				
3				
Colors	1.765	.235	88.247	11.753
1				
2				
Content	2.401	.352	80.032	11.741
1				
2				
3				
Interactivity	3.390	.486	67.799	9.729
1				
2				
3				
4				
4				
Navigation	3.403	.495	68.060	9.894
1				
2				
3				
4				
5				
Satisfaction	3.066	.434	76.645	10.862
1				
2				
3				
3				
Trust	1.721	.279	86.030	13.970
1				
2				
Loyalty	1.786	.214	89.294	10.706
1				
2				

Table 5.3 **Unidimensionality**.

	Constructs	1	2	3	4	5	6	7	8	P-value
1	Typography	**0.88**	-0.19	0.08	-0.02	0.03	-0.07	0.06	-0.00	<0.001
		0.88	0.24	-0.07	-0.04	0.01	-0.05	0.12	-0.11	<0.001
		0.90	-0.04	-0.01	0.06	-0.04	0.13	-0.19	0.11	<0.001
2	Colors	-0.01	**0.93**	0.01	-0.05	0.01	0.00	0.00	-0.03	<0.001
		0.01	**0.93**	-0.01	0.05	-0.01	-0.00	-0.00	0.03	<0.001
3	Content	-0.04	-0.06	**0.87**	0.09	0.02	-0.04	0.01	-0.05	<0.001
	Quality	-0.06	0.01	**0.91**	-0.00	0.04	0.00	-0.06	0.11	<0.001
		0.10	0.05	**0.89**	-0.08	-0.06	0.04	0.05	-0.06	<0.001
4	Interactivity	0.14	0.03	-0.16	**0.77**	0.20	0.14	0.01	-0.15	<0.001
		-0.03	0.04	-0.02	**0.82**	-0.17	0.04	-0.23	0.16	<0.001
		-0.06	0.08	-0.04	**0.84**	-0.07	0.07	-0.02	0.03	<0.001
		-0.17	0.01	0.08	**0.84**	0.01	-0.13	0.15	-0.06	<0.001
		0.14	-0.17	0.13	**0.82**	0.04	-0.13	0.08	-0.00	<0.001
5	Navigation	-0.23	0.15	0.06	-0.10	**0.81**	-0.02	0.09	-0.08	<0.001
		0.03	-0.09	-0.18	0.01	**0.83**	0.11	0.14	-0.18	<0.001
		0.09	0.09	0.10	-0.10	**0.86**	-0.17	-0.00	0.01	<0.001
		0.10	-0.04	0.20	-0.07	**0.80**	0.00	-0.17	0.12	<0.001
		-0.00	-0.10	-0.18	0.27	**0.80**	0.08	-0.06	0.13	<0.001
6	Satisfaction	-0.01	0.11	-0.04	0.02	0.08	**0.87**	-0.18	0.02	<0.001
		-0.03	-0.09	-0.01	-0.04	0.14	**0.89**	-0.15	0.09	<0.001
		0.12	-0.13	0.00	-0.03	-0.09	**0.85**	0.05	-0.01	<0.001
		-0.07	0.113	0.05	0.05	-0.13	**0.87**	0.29	-0.09	<0.001
7	Trust	0.02	-0.01	0.04	-0.04	-0.00	0.00	**0.92**	-0.08	<0.001
		-0.02	0.01	-0.04	0.04	0.00	-0.00	**0.92**	0.08	<0.001
8	Loyalty	0.00	-0.05	0.00	-0.06	0.03	-0.00	0.07	**0.94**	<0.001
		-0.00	0.05	-0.00	0.06	-0.03	0.00	-0.07	**0.94**	<0.001

Table 5.4 **Combined loadings and cross-loadings**.

not highly on other factors." Table 5.4 shows the cross loadings for all adopted constructs. The second criterion of DV assessment is related to average variance extracted (AVE) as AVE presents the percentage of variance taken by a construct. Thus, to ensure DV, the AVE value of all constructs should be greater than 0.50 (see Table 5.2), and the $\sqrt{AVE}$ for each construct (off the diagonal value) should be greater than the correlation value (on diagonal) between constructs [317, 318, 321]. All constructs exhibited a sufficiently high DV index in this study, as shown in Table 5.5. We also evaluated multicollinearity through variance inflation factors (VIF). VIF assessed multicollinearity between the constructs. A higher VIF index between two latent variables indicating that these variables measure similar things. In this particular case, it was necessary to remove a latent variable from the developed model. It was also suggested that the VIF value for variables should be less than 5, although a more relaxed criteria has been

	Constructs	1	2	3	4	5	6	7	8
1	Typography	**0.89**							
2	Color	0.76	**0.93**						
3	Content-quality	0.74	0.62	**0.89**					
4	Interactivity	0.73	0.63	0.74	**0.82**				
5	Navigation	0.69	0.61	0.71	0.81	**0.82**			
6	Satisfaction	0.75	0.74	0.73	0.72	0.70	**0.87**		
7	Trust	0.66	0.63	0.68	0.65	0.65	0.79	**0.92**	
8	Loyalty	0.61	0.59	0.57	0.58	0.54	0.72	0.73	**0.94**

Table 5.5 **Inter-correlations and $\sqrt{AVE}$ of latent variables**.

suggested in previous research, which is to set the threshold at 10 [323]. In the current study, VIFs are far below 5 (see Table 5.6). Therefore, no latent variables measure the same thing. Even the computed values of both average variation inflation factor $\overline{VIF}$ = 3.1 and average full collinearity variance inflation factor $\overline{FVIF}$ = 3.4 were also observed to be far below the threshold value of 5. The ideal suggested value for both $\overline{VIF}$ and $\overline{FVIF}$ is 3.3 in previous research [312].

WarpPLS also reported other model fit indicators such as average R-squared (ARS) ($\overline{R^2}$)

	Constructs	Variance Inflation Factor	R-squared	Adjusted R-squared
1	Typography	3.799		
2	Color	2.870		
3	Content quality	3.155		
4	Interactivity	3.915		
5	Navigation	3.414		
6	Satisfaction	4.617	0.707	0.704
7	Trust	3.454	0.580	0.576
8	Loyalty	2.523	0.600	0.599

Table 5.6 **Additional coefficients**.

with p-value ($\beta = 0.629, P \leq 0.001$), average adjusted R-squared (AARS) ($\beta = 0.626$) with P-value ≤ 0.001), average path coefficient (APC) ($\overline{\beta}$) with p-value ($\beta = 0.221, P \leq 0.001$), and $\overline{VIF}$ = 3.1, respectively. Goodness of Fit was also measured through Tenenhaus [324] GoF = $\sqrt{\overline{(AVE)}X\overline{(ARS)}}$ or $\sqrt{\overline{(Communality)}X\overline{(ARS)}}$ = $\sqrt{(0.794)X(0.629)}$ = 0.707 and sufficient according to the suggested criteria [312, 325].

WarpPLS also reported other model fit indicators. Thus, the interpretation of the model

fit and quality indicators depends on the goal of the SEM analysis. Assessing the model fit depends on several criteria (see Table 5.7 and 5.6) discussed below.

1. **ARS, APC, and AARS:** normally, adding a latent variable into a model increases the ARS but decreases the APC [312]. Thus, both APC and ARS counterbalance each other. Hence, AARS is generally lower than ARS for a hypothesized model. It also is recommended that the P-values of APC, ARS and AARS must be equal to or lower than 0.05 [312] or at least the P-values of APC and ARS should be equal to or lower than 0.05 [312]. In the current study, the value of ARS, APC, and AARS were observed to be lower than 0.05 (see section 5.1.3).

2. **VIF and AFVIF** It is ideally recommended that both AVIF and AFVIF should be equal to or lower than 3.3 [312], specifically in models in which constructs are measured with two or more indicators. An acceptable or more relaxed criterion is that they should be equal to or lower than 5 [312]. In the current study, the value of FIV and AFVIF were observed to be lower than 5 (see section 5.1.3).

3. **GoF:** Like ARS, GoF refers to "'Tenenhaus GoF"' is a measure of a model's explanatory power. Tenenhaus et al. [324] defined it as the square root of the product between average communality and ARS. Thus, communality for a latent factor refers to the sum of the squared loadings for a specific latent variable divided by the number of indicators [312]. According to Wetzels et al. [325] AVE against each latent variable should be equal to the communality index. Furthermore, he proposed the following range of GoF; equal to or greater than 0.1 = small, equal to or greater than 0.25 = medium, and equal to or greater than 0.36 = large [312]. In this study, the value of GoF was found to be greater than 0.36 (see section 5.1.3).

4. **Sympson's paradox ratio (SPR):** The extent to which a model is free from instances of Simpson's paradox [312, 326, 327]. This occurs when a path coefficient, and a correlation linked with a pair of associated variables have different signs and demonstrate the problem of causality along with the reversed or implausible path [312]. The ideal value of SPR is 1 which indicates that there are no instances of Simpson's paradox in the hypothesized model [312]. The acceptable range of SPR is that it should be equal to or greater than 0.7 [312]. In this study, the value of SPR was found to be greater than 0.7 (see Table 5.7).

5. **R-squared contribution ratio (RSCR):** The extent to which a model is free from negative R-squared contributions. It occurs when the predictor variable makes a negative contribution to R-squared along with Simpson's paradox [326, 327]. Consequently, the

predictor latent variable reduces the percentage of variance explained. Generally, RSCR should be equal to 1. However, a more relaxed criteria is that it could be equal or greater than 0.9 [312]. In this study, the value of RSCR was observed to be greater than 0.9 (see Table 5.7).

6. **Statistical suppression ratio (SSR):** The extent to which a model is free from statistical suppression [312, 328]. It occurs when a path coefficient is higher than the corresponding correlation linked with a pair of associated variables [312]. Its acceptable range should be equal to or greater than 0.7 [312]. In this study, the value of SSR was found to be greater than 0.7 (see Table 5.7).

7. **Nonlinear bivariate causality direction ratio (NLBCDR):** refers to the extent to which coefficients (bivariate-nonlinear) support the hypothesized directions of the causal links in a model [312]. Its acceptable range is equal to or greater than 0.7 [312]. In this study, the value of NLBCDR was seen to be greater than 0.7 (see Table 5.7).

Finally, as all values indicated good fit, this study fulfills all the above-mentioned conditions to support the analysis. For additional model, fit, and quality indicators, see Tables 5.6 and 5.7.

Indicators	Value	Acceptable	-	Ideal
Sympson's paradox ratio	1.000	> 0.7		1
R-squared contribution ratio	1.000	> 0.9		1
Statistical suppression ratio	1.000	> 0.7		
Nonlinear bivariate causality direction ratio	1.000	> 0.7		

Table 5.7 **Additional model fit and quality indicators**.

Structure model

After confirming the unidimensionality, reliability, and validity of the measurement model, the next step was to analyze the structural model. We examined the comprehensive explanatory power (EP) of the structural model, path coefficients, (β) and amount of variance (R^2) [321, 329] of dependent variables explained by independent variables. Simply put, R^2 was used to explain the model EP. The results after executing the structural model explained 70% of the variation in satisfaction, 58% variation in trust, and 60% in loyalty (see Table 5.8). It demonstrated that the model provided good explanatory power. All path coefficients were observed to be significant in this study to support the hypotheses (see Fig. 4.1).

	Path	Coefficients	P-value	Significance
H1:	Typography → Satisfaction	$\beta = 0.138$	$P \leq 0.001$	**Supported**
H2:	Typography → trust	$\beta = 0.091$	$P \leq 0.015$	**Supported**
H3:	Color → Satisfaction	$\beta = 0.320$	$P \leq 0.001$	**Supported**
H4:	Color → Trust	$\beta = 0.202$	$P \leq 0.001$	**Supported**
H5:	Content quality → Satisfaction	$\beta = 0.219$	$P \leq 0.001$	**Supported**
H6:	Content quality → Trust	$\beta = 0.304$	$P \leq 0.001$	**Supported**
H7:	Interactivity → Satisfaction	$\beta = 0.153$	$P \leq 0.001$	**Supported**
H8:	Interactivity → Trust	$\beta = 0.086$	$P \leq 0.020$	**Supported**
H9:	Navigation → Satisfaction	$\beta = 0.131$	$P \leq 0.001$	**Supported**
H10:	Navigation → Trust	$\beta = 0.185$	$P \leq 0.001$	**Supported**
H11:	Satisfaction → Loyalty	$\beta = 0.393$	$P \leq 0.001$	**Supported**
H12:	Trust → Loyalty	$\beta = 0.424$	$P \leq 0.001$	**Supported**

Table 5.8 **Path** - Coefficients.

$p \leq 0.050$ = *
$p \leq 0.010$ = **
$p \leq 0.001$ = ***

5.1.4 Discussion

The result of this study provides support for a part of the model (see Fig. 4.1) and proposed hypotheses (i.e., H1 to H12). The results revealed that web design attributes positively influence user trust and satisfaction, which in turn leads to loyalty. This analysis section outlines some interesting findings related to user trust (see Table 5.8).

Hypotheses (**H1** *Website typography positively influences user satisfaction.* **H2** *Website typography positively influences user trust*): In previous literature, typography was neglected or rarely discussed with respect to strengthening user relationships with web interfaces. In this study, typography positively influenced user trust and satisfaction. Therefore, proper spacing between lines and between words, font color and style (typeface) with readable font sizes leads to loyalty because of its satisfying and trustworthy appearance. However, the relationship between typography and satisfaction ($\beta = 0.138, P \leq 0.001$) was found to be stronger than the relationship between typography and trust ($\beta = 0.091, P \leq 0.015$) (see Table 5.8). In a study, Sasidharanet et al. [302] argues that the typeface influences the user's trust-related perceptions.

Hypotheses (**H3** *Website color leads to higher user satisfaction towards that same website.* **H4** *Website color leads to higher user trust towards that same website*): The website color and graphics were seen to be influencing features for determining satisfaction and trust (see Table 5.8). Furthermore, the use of basic colors with fair contrast not only enhances the users'

reading capabilities but also guides them in website navigation. Therefore, choosing a suitable color scheme and graphics for a website ensures its attractiveness, supportiveness, and trustworthiness. A significant and positive relationship was found between color and satisfaction ($\beta = 0.320, P \leq 0.001$) and also between color and trust ($\beta = 0.202, P \leq 0.001$). Similarly, in an empirical investigation, Cyr et al. [84] also observed a strong relationship between color appeal and satisfaction and also between color appeal and trust.

Hypotheses (**H5** *High quality website content leads to higher user satisfaction.* **H6** *High quality website content leads to higher user satisfaction*): Website content quality is also seen to be an important factor in determining user trust and satisfaction in UA culture. A positive relationship was observed between content quality and trust ($\beta = 0.304, P \leq 0.001$) and also between content quality and satisfaction ($\beta = 0.219, P \leq 0.001$) (see Table 5.8). The precise presentation of information not only helps user recognition but also facilitates quick comparison between product/service features to help reach a buying decision. In several other studies [91, 92, 170, 224, 262], results demonstrate the positive relationship between content (relevant information) and customer satisfaction [91, 224, 262], and also between content and trust [91, 92, 170, 262]. In contrast, Eid [224] observed a positive relationship between information quality and satisfaction but not than between information quality and trust for a high UA (Saudi Arabia) culture. In the current study, we observed that for high UA or low trust cultures, content/information quality is an important aspect to explore and to enhance customers' trust and satisfaction. As appropriate, well-presented information reduces uncertainty and risk it leads to a higher comfort level with the website.

Hypotheses (**H7** *An increased level of web interactivity leads to higher user satisfaction toward that same website.* **H8** *An increased level of web interactivity leads to higher user trust toward that same website*): Website interactivity is an important design attribute that consists of several dimensions. However, these dimensions were rarely discussed in previous studies with respect to culture context. In this study, we include personalization/customization and responsiveness to explain the strength of the relationship between interactivity and trust and satisfaction. The results of this study demonstrated the participants' preferences for interactive features that helped them to personalize the service and product through customization. Moreover, versatility in the booking process, responsiveness (timeliness of information)/ feedback, and consistency also enhanced website interactivity. The relationship between interactivity and satisfaction ($\beta = 0.153, P \leq 0.001$) was observed to be stronger than interactivity and trust ($\beta = 0.086, P \leq 0.020$) (see Table 5.8). In support of our findings, Cyr et at. [209] observed a direct, positive impact of interactivity (user control, connectedness, and responsiveness) on

user cognitive affective perceptions (trust and loyalty). Likewise, Lee [216] also observed that perceived interactivity (user control, responsiveness, personalization, and connectedness) directly influences user trust and indirectly influences behavioral intention to use mobile commerce. Palmer [24] observed the positive impact of responsiveness on website success. In short, website interactivity induces favorable attitudes toward acceptability along with trust and satisfaction.

Hypotheses (**H9** *Guided navigation leads to higher user satisfaction toward that same website.* **H10** *Guided navigation leads to higher user trust toward that same website*): In addition to other factors, navigational support was also observed to be an important factor in developing user trust and satisfaction and a positive relationship was demonstrated between navigation and trust ($\beta = 0.185, P \leq 0.001$) and also between navigation and satisfaction ($\beta = 0.131, P \leq 0.001$) (see Table 5.8). Besides ease of navigation, the participants also preferred clear buttons, simple navigational aids, and reversibility features that enabled them to avoid any form of risk and to recover from mistakes. As navigational clues and aids serve as a logical road-map that not only help customers during purchasing but also help avoid any ambiguity. Similarly, Yoon [330] and Lim and Dubinsky [331] stated that website navigation is a strong factor in determining customer trust and a positive attitude. In several other studies [85, 86], researchers emphasize the use of guided navigation to reduce uncertainty/error. A positive relationship, therefore, exists between navigation and user satisfaction and between navigation and user trust in a cultural context [65, 91, 191].

Hypothesis (**H11** *Greater website user satisfaction leads to greater user loyalty to that same website.* **H12** *Greater website user trust leads to greater user loyalty to that same website*): In the current study, both satisfaction and trust significantly influence loyalty with a positive relationship between trust and loyalty ($\beta = 0.424, P \leq 0.001$) and between satisfaction and loyalty ($\beta = 0.393, P \leq 0.001$) (see Table 5.8). So, to design a website for a high UA culture, the presentation and arrangement of information and design features should be in a credible manner because culturally adopted web design attributes reduce the negative impact of risk. In several studies [84, 191, 209, 224, 274, 278, 300], both satisfaction and trust were seen to be strong determinants of loyalty in the domain of e-commerce. For example, Lee et al. [207], Brilliant and Achyar [307], and Cyr [191] observed user trust to be an important determinant of loyalty, whereas Moriuchi and Takahashi [278] and Flavia et al. [21] considered satisfaction as a more important factor in determining customers' loyalty. However, Eid [224] observed customer trust as a weak (unsupported) determinant of loyalty in a high UA culture. Apart from design attributes, a positive and influencing effect of UA on online customer trust has also been

seen in various technological studies [82, 90, 96].

All the adopted design attributes in the present study showed positive relationships with trust and satisfaction and ultimately wi loyalty (behavioral intention to return).

5.2 Study-2

The second experiment was designed to refute the hypotheses (i.e., -H13 to -H17) for the proposed model (see Fig. 4.1). The purpose of this study was to explore the relationship between adopted design artifacts and individuals' irritation. Determining the relationship of irritation with design attribute is important because it influences the decision making process and negatively influence the individuals' purchase behavior [171, 190, 234, 332]. The e-commerce website prototype and design artifacts were the same as used in the study 1 (see figure 5.1).

5.2.1 Measures and Data Collection

To evaluate the proposed hypotheses, the survey methodology was used in this study-2 consisted of 21 items to observe the relationship between employed design attributes and irritation for the developed e-commerce website prototype. The items for design-related constructs (i.e., typography, color, content quality, interactivity, and navigation) were the same as used in study-1 with minor changes (see Appendix B). The items of irritation were adopted from the literature (i.e., [171]) (see Appendix B).

For this study, the participants were recruited in Spain and Pakistan. Like Pakistan, the culture of Spain is also rated high for UA = 86 (risk avoidance) according to Hofstede's cultural index [86]. To collect the data, the researchers shared the link to the prototype and study description with university colleagues and students, who further distributed it to other friends working in different institutions. As in study-1, the participants of this study were also asked to use this prototype to search for bus tickets between two locations on a specified date see Figure c.2 (Appendix C). The next step was to choose a bus ticket with the minimum price from the returned schedule see Figure c.3 (Appendix C). The participants were also asked to personalize the seating plan inside the bus see Figure 5.1. Lastly, the participants were asked to login after the booking process through online registration to collect their demographic data see Figure c.4 (Appendix C) followed by a survey. In the two-month data collection process **515** surveys were obtained. A brief demographic description of the participants is given (see Table 5.9).

Profile Category		Frequency	Percentage
Gender	Male	281	54.6
	Female	234	45.4
Age	<25	292	56.7
	25 - 35	128	24.9
	>35	95	18.4
Browsing Experience	Beginners	55	10.7
	Intermediate	64	12.4
	Advance	190	36.9
	Expert	206	40.0
Buying Experience	Infrequently	318	61.7
	frequently	197	38.3
Total		515	100.0

Table 5.9 **Demographic characteristics of respondents (study-2)**.

5.2.2 Technique

The proposed relationships were also verified through PLS as the nature of the data and analysis were similar to study-1. A detailed description and outline of the benefits of the PLS technique is given section 5.1.2.

5.2.3 Results

Initially, descriptive statistics were computed using the SPSS tool, the values for Alpha α in the current study ranged from 0.714 to 0.895 (see Table 5.10) and values for CR ranged from 0.859 to 0.923 (see Table 5.10) and for Unidimensionality (see Table 5.11).

Measurement model

The outer loadings for all observed items ranged from 0.708 to 0.889 (see Tables 5.10 and 5.12) with significant p-value (Threshold ≤ 0.05) indicating good CV of all constructs. In terms of DV, the results (see Table 5.12) show the cross loadings for all adopted constructs load highly on their speculatively assigned factor. Secondly, the AVE for all constructs ranged from 0.616 to 0.777 (see Tables 5.10) and the $\sqrt{AVE}$ for each construct (off the diagonal value) were observed to be greater than the correlation value (on diagonal) between constructs (see Tables 5.13).

In the current study, VIFs are far below 5 (see Table 5.14) and the computed values of both average variation inflation factor $\overline{VIF}$ = 2.492 and average full collinearity variance

Constructs	Standard deviation	(α) [a]	CR [b]	AVE [c]	Loadings [d]
Typography		0.751	0.859	0.671	
1	0.998				0.867
2	1.022				0.862
3	1.086				0.719
Colors		0.714	0.875	0.777	
1	1.061				0.882
2	1.138				0.882
Content Quality		0.866	0.909	0.714	
1	1.047				0.825
2	1.036				0.873
3	1.098				0.872
4	1.174				0.807
Navigation		0.790	0.865	0.616	
1	1.083				0.820
2	1.116				0.841
3	1.069				0.765
4	1.107				0.708
Interactivity		0.895	0.923	0.707	
1	1.035				0.857
2	0.993				0.889
3	0.976				0.878
4	1.087				0.794
5	1.002				0.780
Irritation		0.828	0.897	0.745	
1	1.380				0.837
2	1.381				0.882
3	1.376				0.869

Table 5.10 **Reliability, convergent, and discriminant validity**.

[a] = Cronbach's Alpha
[b] = Composite Reliability
[c] = Average Variance Extracted
[d] = Factor Loadings

inflation factor $\overline{FVIF}$ = 2.932 were also observed to be far below the threshold value of 5. The ideal suggested value for both $\overline{VIF}$ and $\overline{FVIF}$ is 3.3 in previous research [312]. WarpPLS also reported other model fit indicators such as average R-squared ($\overline{R^2}$) with p-value ($\beta = 0.153, P \leq 0.001$), average adjusted R-squared (AARS) ($\beta = 0.144$) with P-value $\leq$ 0.001), average path coefficient ($\overline{\beta}$) with p-value ($\beta = 0.117, P \leq 0.001$), and $\overline{VIF}$ = 2.492. Goodness of Fit was also measured through Tenenhaus [324] GoF = $\sqrt{\overline{(AVE)}X\overline{(ARS)}}$ or $\sqrt{\overline{(Communality)}X\overline{(ARS)}} = \sqrt{(0.705)X(0.153)} = 0.328$ and was sufficient according to the suggested criteria (see section 5.1.3) [312, 325]. Finally, as all values indicated good fit, this study fulfilled all the above-mentioned conditions supporting the analysis. For additional model fit and quality indicators (see Tables 5.14 and 5.15).

Structure model

After confirmation of the unidimensionality, reliability, and validity of the measurement model, the next step was to analyze the structural model. The results after executing the structural model explained 15% of the variation in irritation. It is demonstrated that the model provided good explanatory power. All path coefficients were observed to be significant in this study to support the hypotheses (see Figure 4.1).

5.2.4 Discussion

The result of this study provides support for a part of the proposed model (see Fig. 4.1) and proposed hypotheses (i.e., -H13 to -H17). The results revealed that adopted web design attributes had significant negative effects on irritation. This analysis section outlines some interesting findings related to typography, color, and interactivity decreasing irritation that were not discussed previously (see Table 5.16).

Hypothesis (**-H13** *Good website typography will have a negative relationship with irritation in online shopping environment*): In the current study, the relationship between typography and irritation was observed to be negative with ($\beta = -0.161, P \leq 0.001$) (see Table 5.16). Thus, proper spacing between words and lines, font color and appropriate typeface (sans-serif) with readable font size (12 px), alignment and layout leads to a higher comfort level because of its legibility, attractiveness, and satisfying appearance, whereas poor-quality typography is the cause of criticism, and negatively influences comprehension, learnability and consequently, visually confuses the readers [125, 139] or may cause irritation. Similarly, in a study Elling et al. [333] noticed users concerns with respect to arrangement and poor legibility due to font and size. Users criticize the fonts they do not like and appreciate fonts that visually appeal

Constructs	Eigenvalues		Variance explained	
	1st Comp	2nd Comp	1st Comp (%)	2nd Comp (%)
Typography	2.013	.650	67.084	88.764
1				
2				
3				
Colors	1.555	.45	77.373	22.263
1				
2				
Content	2.854	.486	71.361	12.157
1				
2				
3				
Interactivity	3.534	.592	70.671	11.846
1				
2				
3				
4				
5				
Navigation	2.464	.662	61.602	16.549
1				
2				
3				
4				
Irritation	2.235	.439	74.489	14.636
1				
2				
3				

Table 5.11 **Unidimensionality**.

	Constructs	1	2	3	4	5	6	*P-value*
1	Typography	**0.867**	-0.299	-0.090	0.092	-0.035	0.019	<0.001
		0.862	-0.348	-0.005	-0.038	0.128	0.010	<0.001
		0.719	0.077	0.115	-0.066	-0.112	-0.034	<0.001
2	Colors	0.008	**0.882**	0.030	-0.143	0.046	-0.061	<0.001
		-0.008	**0.882**	-0.030	0.143	-0.046	0.061	<0.001
3	Content	-0.050	-0.006	**0.825**	0.170	0.291	-0.015	<0.001
	Quality	-0.071	0.020	**0.873**	-0.037	0.159	0.000	<0.001
		0.021	0.029	**0.872**	-0.131	-0.000	-0.035	<0.001
		0.106	-0.047	**0.807**	0.008	-0.469	0.053	<0.001
4	Navigation	-0.104	-0.070	-0.112	**0.820**	0.031	0.075	<0.001
		-0.020	-0.125	-0.065	**0.841**	-0.162	0.012	<0.001
		0.146	0.050	0.236	**0.765**	0.301	-0.026	<0.001
		-0.014	0.176	-0.049	**0.708**	-0.169	-0.074	<0.001
5	Interactivity	-0.035	-0.072	-0.208	-0.104	**0.857**	0.021	<0.001
		0.039	-0.043	-0.225	-0.117	**0.889**	0.038	<0.001
		0.071	-0.091	-0.203	-0.075	**0.878**	-0.031	<0.001
		-0.131	0.135	0.289	0.172	**0.794**	-0.004	<0.001
		0.047	0.093	0.419	0.157	**0.780**	-0.027	<0.001
6	Irritation	-0.141	-0.019	0.140	0.033	0.008	**0.837**	<0.001
		0.091	0.011	-0.151	0.073	-0.074	**0.882**	<0.001
		0.043	0.007	0.018	-0.106	0.068	**0.869**	<0.001

Table 5.12 **Combined loadings and cross-loadings**.

	Constructs	1	2	3	4	5	6
1	Typography	**0.819**					
2	Color	0.709	**0.882**				
3	Content-quality	0.723	0.549	**0.845**			
4	Navigation	0.703	0.544	0.735	**0.785**		
5	Interactivity	0.785	0.592	0.826	0.750	**0.841**	
6	Irritation	-0.221	-0.237	-0.087	-0.092	-0.187	**0.863**

Table 5.13 **Inter-correlations and $\sqrt{AVE}$ of latent variables**.

	Constructs	Variance Inflation Factor	R-squared	Adjusted R-squared
1	Typography	2.865		
2	Color	1.991		
3	Content quality	2.659		
4	Interactivity	2.830		
5	Navigation	2.115		
6	Irritation		0.153	0.144

Table 5.14 **Additional coefficients**.

Indicators	Value	Acceptable -	Ideal
Sympson's paradox ratio	1.000	> 0.7	1
R-squared contribution ratio	1.000	> 0.9	1
Statistical suppression ratio	0.800	> 0.7	
Nonlinear bivariate causality direction ratio	0.700	> 0.7	

Table 5.15 **Additional model fit and quality indicators**.

	Path	Coefficients	P-value	Significance
H13:	Typography $\rightarrow$ Irritation	β= -0.161	P $\leq$ 0.001	**Supported**
H14:	Color $\rightarrow$ Irritation	β= -0.168	P $\leq$ 0.001	**Supported**
H15:	Content quality $\rightarrow$ Irritation	β= -0.194	P $\leq$ 0.001	**Supported**
H16:	Interactivity $\rightarrow$ Irritation	β= -0.219	P $\leq$ 0.005	**Supported**
H17:	Navigation $\rightarrow$ Irritation	β= -0.112	P $\leq$ 0.001	**Supported**

Table 5.16 **Path** - Coefficients.

p $\leq$ 0.050 = *
p $\leq$ 0.010 = **
p $\leq$ 0.001 = ***

to them [140]. Ngraham and Bradburn [334] argue that readability can be achieved through appropriate use of typeface and size. So typography is an important website design feature and is a visual representation of informational content on commercial websites. Several studies [8, 110, 302] in the literature have discussed the role of typographical features in developing positive emotions and attitudes. Hasan [190] observed a negative relationship between visual design (e.g., font, colors, and layout) and customers' perceived irritation for an e-commerce website.

Hypothesis (**-H14** *Appropriate use of color will have a negative effect on irritation in online shopping environment*): In the current study, the relationship between color and irritation was observed to be negative with $(\beta = -0.168, P \leq 0.001)$ (see Table 5.16). Website color and graphics were observed to be influencing features in determining customers' preferences (see Table 5). Cyr et al. [84] argue that the appeal and attractiveness users feel towards a particular color scheme significantly influence their experience in future interactions with the website. We observed that choosing a suitable color scheme (blue) and graphics for a website ensures supportiveness and attractiveness, and enhances the users' reading capabilities due to high contrast with native/background. Furthermore, this appropriateness also helps users to understand website functions and guides them in website navigation. newline

Similarly, Bonnardel et al. [107] argue that website colors as perceived by users constitute an

influential feature to assess their interaction level and experiences with websites. Furthermore, they explained that website colors not only have an influence during website navigation but also during the execution of complex activities. This is because the aesthetic and attraction-related features of websites enhance users' perception of usefulness [45]. Hence, appropriate use of graphics and colors minimizes user's irritation by helping them to deal with complex tasks and navigation. Besides functionality, several studies [8, 84] have also discussed the impact of color appeal on motivational and behavioral intentions to use a website. In line with our results, Hasan [190] observed a negative relationship between visual design (e.g., images, colors, and shapes) and customers' perceived irritation in an e-commerce context

Hypothesis (**-H15** *Content quality will have a negative effect on irritation in an online shopping environment*): The relationship between content quality and irritation was observed to be negative with ($\beta = -0.194, P \leq 0.001$) (see Table 5.16). Content/information quality was seen to be influencing factor for online shopping to save the users from irritation through effective and useful information. This is because the buying decision process requires quick scanning and filtering of product/service-related information for quick comparisons to select the final products. So the product selection process is irritating and time consuming where information is not presented appropriately. Similarly, Teo et al. [53] argue that an efficient website helps users access required information easily and in a timely manner with the least irritation. This is because irritation arising from irrelevant information consumes seeking time and efforts.

Nielsen [126] argues that extra information or a wall of text is deadly for an interactive experience, causes boredom, and is painful to read. Besides accuracy and usefulness, information-related content should be arranged in a more structured way because precise presentation of information not only helps users in recognition but also facilitates quick comparisons to reach the final goal easily. Thus, appropriate and well-presented information minimizes risk, which leads to a higher comfort level with the website. Lee and Kozar [335] considered information quality as an important factor in enhancing business performance by attracting more customers. In line with our work, Hasan [190] also observed the negative impact of information design on perceived irritation. Likewise, Hausman and Siekpe [171] also observed a direct negative impact of computer related factors (i.e., page contents, up-to-date information, and logical web page information) on irritation in an on-line shopping context.

Hypothesis (**-H16** *Higher interactivity will have a negative effect on irritation in online shopping environment*): Interactivity is an important web design attribute that consists of several dimensions and can be defined as how information is presented to enhance the user interaction

consistently. Sicilia et al. [336] argue that an interactive website leads to rapid information processing, positive emotions towards product and website, and greater flow state. Likewise typography, interactivity-related features were also rarely discussed with respect to irritation in the domain of e-commerce. The relationship between interactivity and irritation was observed to be negative with ($\beta = -0.219, P \leq 0.005$) (see Table 5.16). Chung and Zhao [337] observed a positive impact of interactivity on user perception and memory. Similarly, Cyr et at. [209] also observed a direct and positive impact of interactivity on user cognitive affective perceptions. This positive perception comes up with better experience, involvement and ultimately leads to success and purchase intention [24, 338].

Accordingly, Anderson [203, 339] argues that users expect a certain level of interactivity from a company website besides the nature of company and its services. Further, it leads to positive effect on performance, effectiveness, control, and cognitive relation with the website [20, 340, 341]. Thus, a higher level of interactivity leads to higher control with minimum irritation. In this study 2, we employed personalization/customization and responsiveness and the results demonstrated the participants' preferences for the interactive features that facilitated them to personalize the services and products through customizable facilities. Moreover, the versatility in the booking process, responsiveness (timeliness of information/feedback), and consistency also enhanced the website interactivity and favorable attitudes towards acceptability with reduced irritation. Responsiveness features facilitate the users with instant guidelines and feedback about their buying related activities or confirmation. In a study, Hausman and Siekpe [171] considered purchase tracking services and offers order confirmation as important feature of computer aspects and observed its negative impact on irritation.

Hypothesis (**-H17** *Structured navigation will have a negative effect on irritation in online shopping environment*): In this study, the relationship between navigation and irritation was observed to be negative with ($\beta = -0.112, P \leq 0.001$) (see Table 5.16). Thus, navigational support and convenience to use are important features for enhancing user interaction with a website. Ducoffe [288] considered ease or use convenience as an important factor to avoid irritation due to excessive effort to use a website and as something that ultimately goes against the customers' values. In a recent study, Webster and Ahuja [194] observed the impact of navigational design on user's performance due to disorientation. Poor design of navigation upsets and distracts users and they feel disorientated by losing their location/direction while searching for the information they want from a website. Besides design, the participants also prefer navigational support such as clear buttons, links, and aids that provide sufficient clues to smoothly move around the website.

Furthermore, we also observed that reversibility-related features are also important to avoid ambiguity or error. Similarly, several other studies [85, 86] have demonstrated that the use of structured and guided navigation reduces errors. Yoon [330] and Lim and Dubinsky [331] considered navigation as an important factor in building users' positive attitudes towards a website. Hasan [190] also observed a negative relationship between navigation design and perceived irritation. He argues that a website with an ambiguous, confusing navigation scheme is more likely to frustrate and irritate customers and dissuades them from further interaction or using the site again [190]. Hausman and Siekpe [171] considered the undo button (reversibility) an important aspect of the computer factor and they observed its direct negative impact on irritation in an on-line shopping environment.

So, websites should be designed using artifacts that encourage users' positive impressions and decrease feelings of anger or annoyance, especially in a culture where people are more concerned about uncertainty. Website developers should be aware of the appropriate use of functional, aesthetic, and informational aspects with respect to users' capabilities and preferences. These aspects are the necessary and effective prerequisites of design, which help the users to achieve their goals with minimum irritation. Monsuwe et al [342] argue that the customers main concern is to purchase products or services in an efficient and timely manner with a minimum of irritation. On the contrary, irrelevant information, inconvenient navigation, poor aesthetic and interactivity features provoke negative emotions and feelings of anger. Hausman and Siekpe [171] noted that website design generates positive perceptions of usefulness and informativeness to avoid irritation. They argue that irritation has several negative effects such as a worse attitude, and fewer purchases and revisits [171].

5.3 Study-3

To assess the hypotheses (i.e., H18-H19) of study-3 as described in section 4.0.1 (see Fig. 4.1), another working e-commerce prototype was developed using search functionality and product description pages. The website prototype was designed by deploying interactive elements (i.e., color, graphics, information content, and navigation/links) (see figure 5.3). With the exception of typefaces (i.e., sans-serif, serif, mono-spaced, and script) (see figure 5.2), all design elements/features such as structure/layout, content, color, size, and space were the same for all four experimental prototype versions. This study consisted of two phases. The first part consisted of identifying and assessing users' preferences and appeal for the typefaces used. We assume that typeface appearance and appeal are associated with each other and that this

association ultimately leads to better performance. The results of the first experiment (part 1) led to the design of the second experiment (part 2) in order to measure user performance when faced with prototypes having a highly appealing, preferred typeface and a less preferred, less appealing typeface.

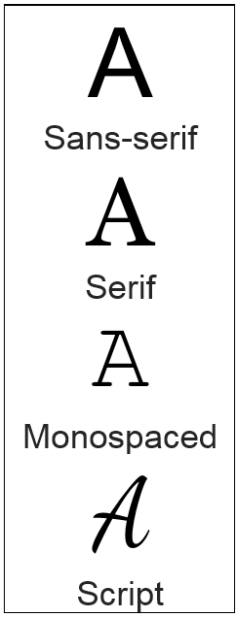

Fig. 5.2 Employed typefaces/font-families.

5.3.1 Measures and data collection for experiment-1

The measures employed in study-3 were preference, appeal, and performance. User preference can be defined as a choice from alternatives, that is, an individual's belief based on his/her experiences that one thing is more useable than another [110]. It reflects an individual's feelings and attitudes towards the interface and the functional aspects of a website [110]. This is because a positive attitude towards an interface and functional design that a user prefers influences their decision for adoption [110]. Generally, user preference is measured through interviews or questionnaires [110]. In the current investigation, preference is related to motivational aspects in terms of aesthetics, reading and a kind of pleasure. Typeface/font personality is also related to aesthetic and reading preference that refers to pleasurable emotions emerging from an affective appraisal of the stimulu's properties and was evaluated with a single statement "'**It is easy and preferable to read the text on this website with the used font type/style**."'

Appeal is an attractive, emotional aspect and is important for boosting the user's excitement leading to heightened engagement [84] with a positive impression. It is also considered in

terms of visual appearance of text in a clear and readable format on websites [343]. Appeal aims to make users feel better about the product [344]. Thus, it is an immediate emotion evoked by a stimulus that, as a result, influences the website's usability due the nature of its appearance. Andreu et al. [345] suggested that emotional appeal targets the experiential facet of consumption. Moreover, Albers-Miller and Royne [344] argue that design influences the visual appeal of a web site [346, 347]. So, the visual appeal of a website makes it entertaining, increases visitor likelihood and positive experiences to get more business [346]. Various researchers [163, 345, 348] have previously discussed appeal in terms of cognitive processing. It was also assessed with a single statement, "'**the font type on this website is appealing**."' The statements to assess both subjective measures, preference, and appeal, were developed and modified from the literature.

Initially, to find preferences for font personality and typeface, as well as appeal through subjective measures, the researchers sent links to all four developed prototypes along with a description to colleagues and to students at different institutions in Spain and Pakistan individually. All prototypes were identical in all respects of design, excepts for the typefaces used for presenting textual information. In the description, the volunteers were asked to look at the typeface given on the e-commerce prototype website and rate the typeface according to the criteria (i.e., ranging from 1 to 5) given on the assessment Likert-scale. Finally, 445 complete surveys were received online for all four prototypes separately (see table 5.17). The description of participants for all four prototypes gathered through self assessment questions included; web-browsing experience (22.9% beginner level, 63.8% intermediate level, and 13.3% expert level), online-buying experience (no experience 53.9%, rare 39.6% experience, and frequent 6.5% experience), and education (bachelor's degree level 96.0%, master's degree level 4.0%).

5.3.2 Technique

The Independent t-test (Independent-samples t-test) was used for this experiment-1 of current study-3 because the sample used was made up of four unrelated groups. The Independent t-test is a useful technique to compare the means of unrelated and unpaired groups [88, 294, 349]. In addition, the Mann-Whitney U test was also used to verify the results computed through the Independent t-test. Mann-Whitney U is a non-parametric test, similar to the t-test. It is also used to compare the mean score differences between the groups [350, 351] and is considered an alternative approach to the independent sample t-test.

5.3.3 Results

SPSS software package version 22.0 was used to analyze both the descriptive and inferential statistics for the first experiment. The differences were observed through inferential statistics such as the t-test for independent samples and the Mann-Whitney U test for both preference and appeal. Initially, the results after applying the independent t-test indicated significant differences between experiential prototypes with respect to preference (see Table 5.18). Similarly, differences were also observed between all experiential prototypes with respect to appeal (see Table 5.18).

However, no differences were observed between prototypes which were designed using serif and mono-spaced with respect to preference and between sans-serif and serif in terms of appeal (see Table 5.18). The Mann-Whitney U test was used to verify that, and indicated that the results are approximately the same (see Table 5.18). The descriptive statistics of preference revealed that the highest value (*mean*= 4.40 and *SD*= 0.891) is for the prototype having sans-serif typeface (see Table 5.17). For appeal the highest value was (*mean*= 4.28 and *SD*= 0.698) for the prototype with a serif typeface (see Table 5.17). However, the mean value of sans-serif was observed to be very close to the serif with respect to appeal (see Table 5.17). Finally, the statistical analysis showed sans-serif to be the most preferred and appealing typeface whereas script was the least preferred and least appealing.

	Measures	Typeface	N [a]	Mean	Standard Deviation
	Preference				
1		Sans-serif	117	4.40	0.891
2		Serif	107	4.15	0.684
3		Mono-spaced	112	4.03	0.895
4		Script	109	3.71	1.10
	Appeal				
1		Sans-serif	117	4.17	0.686
2		Serif	107	4.28	0.698
3		Mono-spaced	112	3.88	0.846
4		Script	109	3.60	1.14

Table 5.17 **Descriptive statistic** - of experiment 1 (study 3).

[a] = Sample size.

	t	df	Sig	MD[a]	SD [b]	95% [c]	95% [d]	U [e]	Z	Sig
f										
1-2	2.359	222	.019	.252	.107	.042	.463	4656.5	-3.633	.000
1-3	3.176	227	.002	.375	.118	.142	.608	4735.0	-3.961	.000
1-4	5.215	224	.000	.695	.133	.433	.958	3820.5	-5.598	.000
2-3	1.136	217	.257	.123	.108	-.090	.336	5776.5	-.507	.612
2-4	3.529	214	.001	.443	.126	.196	.691	4710.5	-2.663	.008
3-4	2.367	219	.019	.320	.135	.054	.587	5180.5	-2.108	.035
g										
1-2	-1.183	222	.238	-.109	.093	-.292	.073	5709.0	-1.305	.192
1-3	2.825	227	.005	.287	.102	.087	.487	5307.5	-2.873	.004
1-4	4.605	224	.000	.575	.125	.329	.821	4694.0	-3.930	.000
2-3	3.773	217	.000	.396	.105	.189	.604	4447.5	-3.634	.000
2-4	5.282	214	.001	.684	.130	.429	.939	3894.0	-4.615	.000
3-4	2.124	219	.035	.288	.135	.021	.554	5500.5	-1.401	.161

Table 5.18 **Inferential statistics** - t-test for equality of means and mann whitney u-test.

[a] = Mean Difference.
[b] = Std. Error Difference.
[c] = 95 Percent Confidence Interval of the Difference - Lower.
[d] = 95 Percent Confidence Interval of the Difference - Upper.
[e] = Mann-Whitney U.
[f] = Preference.
[g] = Appeal.

5.3.4 Discussion

Hypothesis (**H18** *Sans-serif is a preferable and appealing typeface compared to others (i.e., serif, mono-spaced, and script) in an e-commerce website*): Initially, to assess the first hypothesis an experiment (experiment-1) was carried out with 445 participants. Significant differences were observed between the typefaces used with the exception being the prototypes designed using serif and mono-spaced typeface with respect to preference (see table 5.18). The sans-serif typeface was seen to be the most preferred font personality for the developed prototype. Similarly, Nafiseh and Balakrishnan [150] considered sans-serif typeface as a better choice in displaying long text for on-screen display compared to other typefaces. Ling and Schaik [146] also found sans-serif to be the preferred font style compared to serif. In contrast, Beymer et al. [145] did not see any differences between serif and sans-serif typefaces for reading preferences.

Tullis [153] observed users' equal preferences for both sans-serif and serif typefaces. Banerjee et al. [6] noted sans-serif as the most preferred and legible typeface compared to serif. They argue that legibility in sans-serif typefaces is due to more spacing between letters. The legibility and letter spacing in sans-serif helps users to easily identify letters which in turn reduces mental effort or load. In another empirical study, Bernard and Mills [352] found that a sans-serif (Arial) typeface is the most preferred font on the web. However, users took longer to read sans-serif compared to serif (Times New Roman).

In terms of appeal, the results also revealed significant differences between all experimental prototypes except between sans-serif and serif (see Table 5.18). Both serif and sans-serif were found to be the most appealing typefaces. However, the mean value of serif was a little higher than that of sans-serif (see Table 5.17), but this difference was not statistically significant when we applied inferential statistical tests (see Table 5.18). The appeal and preference level of the mono-spaced typeface was found to be lower than that of sans-serif and serif. Lastly, the script typeface was found to be the least preferred and least appealing typeface in this study.

The participants preferred a sans-serif typeface while reading product and function related information. Finally, sans-serif was not only found to be the preferred font personality or typeface but also engaged the users through attractiveness and appeal in the same way as serif, which led to better interaction experiences along with emotional attachments. In addition, we hypothesized that the typeface that users preferred for reading and which had the highest appeal to them would take less task completion time in the buying process compared to those that appear less appealing, less preferred, and less suitable. Therefore, to determine the user performance with respect to typeface appearance a "second experiment" was conducted.

5.3.5 Measures and data collection for experiment-2

User performance is generally analyzed in terms of accuracy, speed and time [88, 353]. It refers to the consequence of users' actions in a given time-frame along with success rate. Consequently, interfaces should be supportive along with having up-to-date information in order to improve users' accuracy in decision-making [32, 88]. The International Organization for Standardization (ISO) [354], briefly defines usability with respect to performance with two important measures, effectiveness and efficiency (see section 2.1). In this experiment in study 3, performance was measured in terms of user task-completion-time with the developed experimental prototypes.

Based on the analysis of the first experiment this second experimental study was designed to assess the impact of typefaces on task completion time. Consequently, all four prototypes with different typefaces were further used to investigate the impact of typeface (font personality) on user performance in terms of task completion time (see figure 5.3). To recruit volunteers, formal invitation letters and emails were sent to different institutions with the help of teachers. A total of 383 university students voluntarily participated in the second experimental study. This experiment was conducted in four different sessions, in each session the participants were requested to perform 2 simple tasks; (1) type the given **URL** to access the experimental prototype and select the "'**cell phone and accessories**"' category from the available 14 different categories in a drop-down list and then use the keyword "'**phone**"' or "'**mobile**"' with a specified brand name and press the search button, (2) the next step was to locate the mobile as per specification given on the task list from the returned list of products and order it by clicking on the "'**order now**"' button, followed by a registration process to get the participants' personal/demographic information.

In the first session sans-serif (highly preferred and appealing) was used as font type for the developed experimental e-commerce website prototype; 103 students took part in this experiment (see Table 5.19). In the second, serif (highly appealing) was used as font type; 83 students took part in this experimental session (see Table 5.19). In the third session, monospaced was used a typeface; 92 students participated in this experiment. Lastly, the script was used (the least preferred and appealing) as the font personalty, with 105 participants (see Table 5.19). Task completion time was considered as a measure of performance to discover the impact of typeface on user performance for the experimental prototype. Performance-related measures were gathered using Google analytics (see Figure c.1 Appendix C) or by incorporating the necessary code to measure each page view time. The description of participants for both experimental prototypes was gathered through self assessment questions include;

web-browsing experience (17% beginner level, 62.4% intermediate level, and 20.6% expert level), online-buying experience (no experience 42.3%, rare experience 40.2%, and frequent experience 17.5%), and education (bachelor level 81.7%, master level 18.3%).

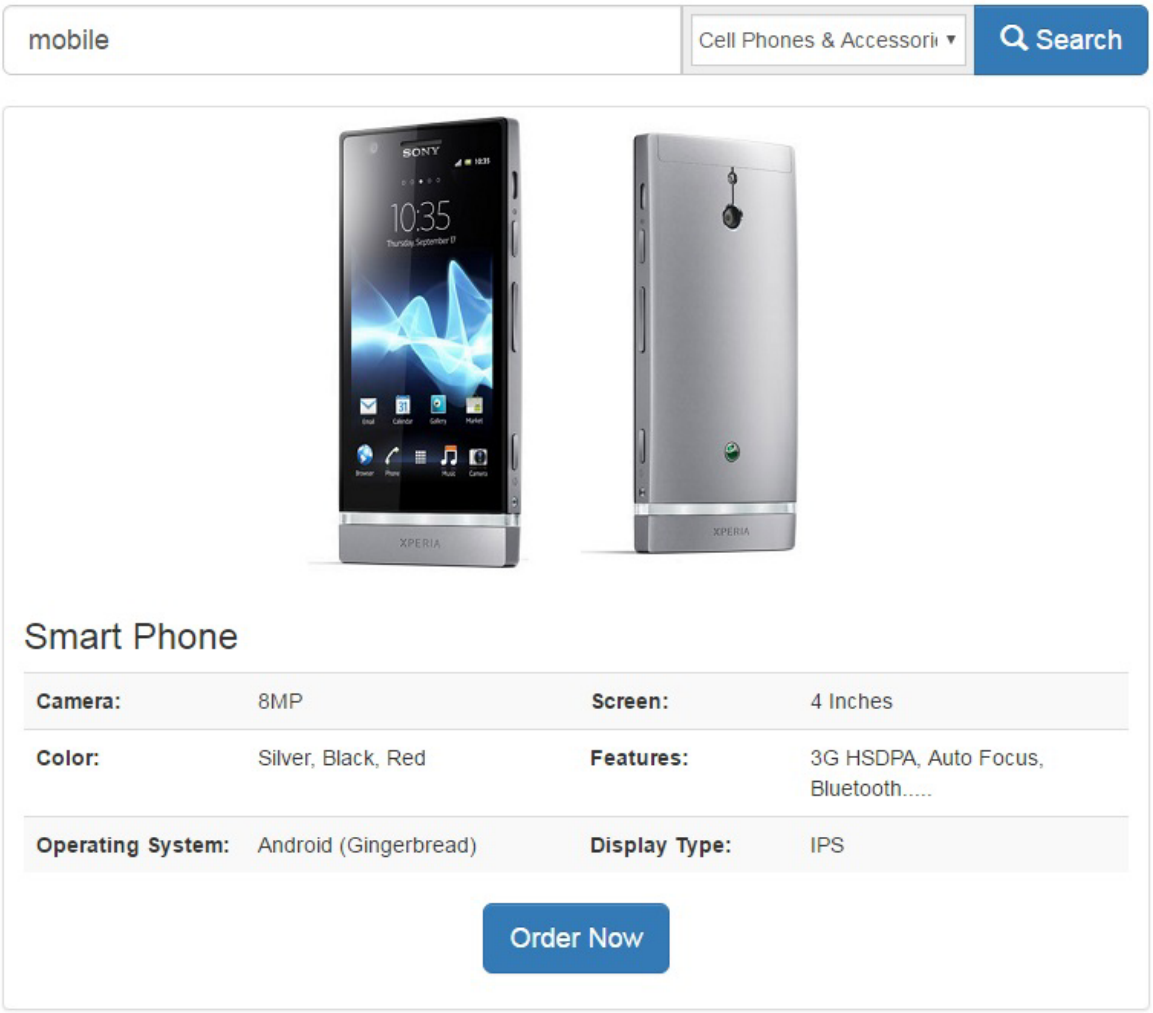

Fig. 5.3 Experimental website prototype used in the second experiment to measure users' performance.

5.3.6 Technique

In the same way as in experiment-1 in this study, both the Independent t-test and the Mann-Whitney U test (see section 5.3.2) were also used in experiment-2 due to unrelated sample used.

5.3.7 Results

As in the first experiment, significant differences were observed for task completion time. These differences were after applying the independent t-test and the Mann-Whitney U test for both experimental prototypes (see Table 5.20). Descriptive statistics for each task demonstrated notable differences with respect to time. In terms of task completion time, a value of *mean*= 27.02 seconds was observed for the prototype with a sans-serif typeface, *mean*= 28.13 for serif, *mean*= 29.68 for mono-spaced, and *mean*= 32.05 for the prototype with the script typeface for task one (see Table 5.19). Similarly, for task two a value of *mean*= 30.17 seconds was found for the experimental prototype with the sans-serif typeface, *mean*= 31.51 for serif, *mean*= 31.70 for mono-spaced and *mean*= 33.36 seconds for the prototype with the script typeface (see Table 5.19).

	Measures	Typeface	N [a]	Mean	Standard Deviation
	Task1				
1		Sans-serif	103	27.02	3.278
2		Serif	083	28.13	3.885
3		Mono-spaced	092	29.68	4.211
4		Script	105	32.05	4.793
	Task2				
1		Sans-serif	103	30.17	4.501
2		Serif	083	31.51	4.449
3		Mono-spaced	092	31.70	4.344
4		Script	105	33.36	5.400

Table 5.19 **Descriptive statistic** - of experiment 2 (study 3).

[a] = Sample size.

5.3.8 Discussion

Hypothesis (**H19** *The higher the typeface preference and appeal, the higher the level of user performance on that same website*): The second experiment was carried out with 383 participants, the results also revealed significant differences between typefaces with respect to task completion time. However, no differences were observed between prototypes designed using serif and mono-spaced typefaces for task-2 (see table 5.20). Participants took less time to complete the task with the experimental prototype using a sans-serif typeface followed by serif (see table 5.20). This may be because sans-serif's higher appeal, greater attractiveness, and preferability in reading encourages the users through their understanding of and heightened engagement with the website. Users easily and conveniently scan the product and function

	t	df	Sig	MD[a]	SD [b]	95% [c]	95% [d]	U [e]	Z	Sig
T[f]										
1-2	-2.119	184	.035	-1.113	.525	-2.149	-.077	3539.5	-2.025	.043
1-3	-4.959	193	.000	-2.665	.538	-3.726	-1.605	2883.0	-4.733	.000
1-4	-8.815	206	.000	-5.028	.570	-6.153	-3.904	2034.5	-7.794	.000
2-3	-2.526	173	.012	-1.552	.615	-2.765	-.339	2892.5	-2.774	.006
2-4	-6.037	186	.000	-3.915	.649	-5.194	-2.636	2219.5	-5.785	.000
3-4	-3.652	195	.000	-2.363	.647	-3.639	-1.087	3550.5	-3.215	.001
T[g]										
1-2	-2.030	184	.044	-1.341	.660	-2.644	-.038	3475.5	-2.200	.028
1-3	-2.410	193	.017	-1.531	.635	-2.783	-.778	3645.0	-2.787	.005
1-4	-4.634	206	.000	-3.197	.690	-4.557	-1.837	3536.5	-4.324	.000
2-3	-.285	173	.776	-.190	.665	-1.503	1.123	3609.0	-.627	.531
2-4	-2.526	186	.012	-1.856	.735	-3.305	-.406	3545.5	-2.198	.028
3-4	-2.364	206	.019	-1.666	.705	-3.056	-.276	4078.5	-1.888	.050

Table 5.20 **Inferential statistics** - t-test for Equality of means Mann whitney u-test.

[a] = Mean Difference.
[b] = Std. Error Difference.
[c] = 95 Percent Confidence Interval of the Difference - Lower.
[d] = 95 Percent Confidence Interval of the Difference - Upper.
[e] = Mann-Whitney U.
[f] = Task2.
[g] = Task2

related information with the website that was designed using a sans-serif typeface due to its appealing and engaging aspects. This is because the attractive and appealing typeface that users prefer to read can bring favorable experiences along with focused attention towards the tasks. Whereas non-scannable and less appealing text is painful and boring and requires excessive effort due to cognitive load [126]. Tullis [153] also observed differences between font styles in terms of reading time, accuracy and preferences in windows environments. In a recent study, Pusnik [7] observed sans-serif as a better choice because of its quick recognition and processing in a television and broadcasting context.

On the contrary, Bernard and Mills [352] compared serif and sans serif typefaces in a task where participants had to search for a substituted word in given textual information. They observed serif as fastest font to read but overall participants preferred sans-serif for reading and consider it more legible. In a study Banerjee et al. [6].found better readability with serif compared to sans-serif. Whereas Beymer et al. [145] and Ling and Schaik [146] do not find an impact of typeface or font on reading speed and performance.

Finally, the results revealed practical implications and individual involvement with visual information through determining the impact of the presentation of textual information on user behavior. Users' experience with typography is the major determinant of attention and pleasing design. Therefore, the appropriate use of typefaces not only helps users' quick recognition but also helps them to efficiently complete the tasks.

Chapter 6

Summary

Websites are an effective source of communication for developing better understanding. Understanding is associated with clarity of information and precise use of artifacts to design a website. Website design elements are important for arousing feelings in individuals to build their final attitude towards adoption, enticing them to return or revisit. They may feel irritated if these elements are inappropriate or poorly organized, especially in a cultural context, where individuals differ with respect to their preferences for website design. The impact of cultural variables on website design are an important consideration in e-commerce research. This is because some design employs text, color, contents, and other elements which could be unacceptable for some cultures. E-commerce service providers and developers need to understand regional and culture variations and incorporate these differences during website design and development. Moreover, users have diverse technical and cognitive capabilities, and design considerations reveal conflicts due to well-established cultural differences.

Variations in design preferences are strongly associated with and depend on cultural norms and values. Apart from other cultural values, UA is an important cultural dimension, rarely discussed in terms of e-commerce website design. It is important because people from high UA cultures are more concerned about design artifacts in order to avoid any ambiguity or error.

In this research, we employed several design artifacts to explore individuals' cultural cognition in high UA cultures. The identification of cultural cognition with respect to design artifacts will be helpful for the design community in developing culturally specific design that arouse positive emotions. Poor and disorganized design provokes negative feelings in terms of irritation, which resultantly distract the users. So, design artifacts can have either a positive or negative influence on individuals' attitudes and behavioral intentions when shopping online. These elements not only affect behavioral intention in terms of final outcome, they also impact

the users' performance if the artifacts used are not appropriate.

This empirical investigation was conducted to assess the cultural preferences for design artifacts, which constitute drivers of satisfaction and trust, and eventually contribute to loyalty or intent to revisit. These design artifacts -typography, color, content/information quality, interactivity, and navigation- act as marketing tools to enhance website revisit rates through satisfying and trustworthy functional design. These attributes play an important role in decision making to trust and encourage the customers to do business, particularly in high UA cultures where individuals are more concerned about trust in online shopping websites due to security. Moreover, this investigation also incorporated an exploration of the effects of selected design artifacts on irritation for the e-commerce website prototype.

All of the adopted design attributes were found to be important artifacts that significantly influence individuals' satisfaction and trust, which ultimately leads to loyalty, with a negative impact on irritation. With to respect information architecture, content/information quality was found to be an influencing factor in determining an individual's trust and satisfaction. Thus, the arrangement of content and information on the website should be enough to meet individual's need. Moreover, it should be formatted so that it is easy to learn and read, so that users can easily compare, understand, and process the available information for their own purposes. In line with our findings, various researchers also seen a strong relationship between content/information quality and a positive attitude. Zheng et al. [355] observed the positive impact of information quality on satisfaction. Hsu et al. [356] also noted the direct impact of website quality (information and service quality) on playfulness and indirect impact on satisfaction, which in turn leads to intention to purchase. Furthermore, in a cultural investigation, Cyr [92] categorized information quality into information content and information design and observed a positive relationship between information quality (information content and information design), satisfaction and trust. The researchers argued that online information should be complete, up-to-date, detailed, and organized in a logical way to meet an individual's needs. Particularly in high UA cultures, the information provided should use local terminologies, testimonials, and company details to get more information [92]. Appropriate (i.e., accurate, useful, and structured), concise, credible, and relevant information helps users in quick reading, understanding, and comparing product features, benefits, and prices. Better understanding is specifically concerned with clarity and goodness of information to satisfy online customers [201].

All these aspects of information quality not only help the visitors to reach buying decisions

but also keep them from having to read excessive, irrelevant information. We also observed a negative relationship between content/ information quality and irritation. Therefore, irrelevant, useless and poorly organized information could distract the users which leads to feelings of annoyance or irritation. Information quality in terms of relevancy and understanding plays a vital role in order to attract more customers [335]. In line with our findings, several other studies [190, 293] have also noted the negative impact of information design and its quality on individuals' irritation. Hausman and Siekpe [171] also observed a direct negative impact of computer related factors (i.e., page contents, up-to-date information, and logical web page information) on irritation in an on-line shopping context.

Interactivity is also an important structural attribute and plays a significant role in organizing a website that consistently enhances users' interaction via positive experiences. In this study, we found interactivity to be an important, usable aspect of the interface in developing users' positive attitudes (i.e. satisfaction and trust) and negatively influencing irritation. Websites, therefore, should be designed in a way that provide customizable features to users, so they can personalize products and services. In addition to customization/personalization, responsiveness through consistent feedback also arouses the feeling of guidance and being connected, which leads to positive attitudes and experiences with that website. Yoo et al. [213] stated that quick response or speed of communication, increases perceived value, which ultimately satisfies on-line customers. Consequently, better user experiences lead to a higher level of interactivity that not only develops a positive attitude, but also gives them a feeling of having more control over website contents. Cyr et al. [209] argue that website interactivity leads to positive experiences along with a significant impact on trust and indirect impact on behavioral intention to return.

Thus, positive interactivity experiences, and control over website contents engage the users consistently and minimize feelings of annoyance or irritation. Similarly, Teo et al. [53] argue that the level of interactivity that appears on a website significantly influences satisfaction and value via effectiveness to help in the decision-making process. Lee et al. [251] argue that interactivity is an important predictor of a better user experience and translates well into brand loyalty through trust and satisfaction. In line with our results, several studies have also noted the direct positive impact of interactivity or better user experiences on satisfaction [357], trust [209, 216], and indirect impact on loyalty and purchase intention [209, 216, 358, 359]. In conclusion, an interface with appropriate interactive features helps the customer to tailor product features and along with consistent responses are the most important features in retaining customers. Hausman and Siekpe [171] considered purchase tracking services and suggests order confirmation (interactivity) as an important feature of computer aspects that negatively

influence irritation.

Navigation was also seen to be an important predictor of a positive attitude (i.e., satisfaction and trust) and ultimately intent to revisit. The structure of navigation helps the user to conveniently access the desired functionality and informational aspects. In addition to being convenient, navigational links and buttons should be obvious and provide a logical road map along with supporting a search for products for buying in a useful way. In addition, a available path related to buying should also be supportive and help the users to personalize or narrow down product filtering and selection processes. Reversibility-related features in navigation make it easier to recover from mistakes or errors. Cyr et al. [92] argue that navigational features in terms of page layout consistency, and quick search are universally desirable features for online shopping websites. Structured navigation design (i.e., obvious buttons and links) allows users to navigate a website quickly and easily. Moreover, providing understandable navigation mechanisms with a logical road map and reversibility features also minimizes consumers' efforts and time required to complete purchase-related tasks. Structured navigation with guiding clues is especially important for UA cultures where individuals are more concerned about errors or risk avoidance. Cyr et al. [91] observed a positive relationship between navigation design and satisfaction and between navigation design and trust. Therefore, it is more related to trust in high UA culture. Similarly, in another study Cyr [91] found that navigation is highly related to trust for high UA cultures, which suggests that users from these cultures expect websites to be transparent and clear. In addition to a positive attitude, clear and convenient navigation and cue also provokes positive, pleasurable feelings and gratification [360].

We also observed a negative association between navigational aspects used and irritation. Therefore, poor navigation arouses feelings of anger, annoyance, and irritation due to increased effort. In line with our findings, Hasan [190] also observed a negative association between navigation design and perceived irritation. Furthermore, he argues that websites with confusing, cumbersome navigation design are more likely to irritate customers and discourage them from shopping or returning to the site in the future. This is because customers have differing technical skills and cultural backgrounds that influence their navigation patterns in terms of time and the amount of accessed information [62]. Hausman and Siekpe [171] suggested that an undo button (reversibility) is as important aspect of the computer factor and a vital feature in avoiding an irritating experience.

Color is a visual aspect, it helps the user to understand the meaning of functions, text, buttons, and graphics on websites. Attractive and appealing color is used to arouse feelings of well-being

and positive emotions, which in turn leads to favorable attitudes and visit lengths. In this study, we found color to be an important design attribute that positively and significantly influences users' satisfaction and trust. In order to develop customers' positive attitudes developers must be aware how to apply appropriate color schemes in website design. This is because the appropriate use of basic color helps maintain simplicity, attention, and understanding of specific website functions and information. Moreover, color has an impact on individuals' attentional resources in terms of navigation/search and reading [159]. In a cultural study, Cyr et al. [84] observed color appeal to be an important determinant of loyalty via trust and satisfaction. Furthermore, they also observed the pronounced preference for blue color schemes in all cultural contexts. Consequently, it has proven to be a universal favorite, corporate, credible [84, 105, 160, 165] and easily visualized color [70, 158]. In another study, Cyr [50] found that visual website design (which includes color) resulted in trust, satisfaction, and loyalty. Besides a positive attitude, we also observed the negative impact of a deployed color scheme on irritation in the prototype. In line with our results, Hasan [190] argues that attractiveness enhances customers' beliefs about the website that negatively influence irritation. Likewise, Wells et al, [361] claim that attractiveness in website design sends positive messages to consumers about the quality of a product.

On the other hand, unpleasant and ugly combinations of colors, could arouse feelings of annoyance in online customers due to complexity. It is important to avoid those ugly combinations when using multiple colors in a design. Lin and Lo [362] Seckler et al. [105] argue that the use of more graphics and colors in a website increases complexity, which in turn affects the individual perception. Noiwan and Norcio [159] argue that color that is perceived as more annoying, less visually interesting, and less pleasing could reduce individuals' attention and thereby cause higher error rates and longer search times. Similarly, Keyes [115] suggested that color is an effective visual communication aspect that may decrease time and efforts to access or understand informational aspects. In conclusion, a website that is professionally designed using simple and attractive colors such as blue promote positive attitudes and behavioral intention to revisit. Moreover, the appealing and appropriate use of a color scheme ensures understating and clarity of functional and information aspects, which minimizes feelings of irritation.

Typography is also a visual aspect. It is the art of laying out text on screen or a website and is seen as an important design and communication aspect that arouses individuals' emotions. It has been neglected in terms of trust, satisfaction, and irritation in the literature in the context of e-commerce. In this study, we found a direct positive relationship between typography and satisfaction, and also between typography and trust, and an indirect relationship

with loyalty. Typographical features (i.e., typeface/font personality, size, aesthetic, spacing, and alignment) enhance legibility and the comprehension of text on a website. Therefore, the use of appropriate typographical features leads to users' loyalty or intent to revisit because of the satisfying and trustworthy appearance. Sasidharan and Dhanesh [154] argue that e-commerce websites could influence users' perceptions of trust. They observed a positive relationship between font personality (serif and sans serif) and e-commerce trust. Likewise, Douglass et al. [155] argue that typeface and product context can influence users' trust in business with customers' e-commerce websites. However, the results of both studies were specific and only discussed the impact of a single typographical aspect on trust using small sample size. Accordingly, we also saw a negative relationship between the typographical features used and irritation at the e-commerce website prototype.

The use of typographical features in a precise manner, promotes a positive attitude and reduces users' excessive efforts and time to read and understand the product and buying-related information, which in turn minimizes their feelings of annoyance or irritation. Similarly, Keyes [115] argued that typography is an effective aspect that decreases individuals' efforts and time to access required information. Along similar lines to the current study, Bernard et al. [144] also considered sans-serif with 12 or above size as appropriate typography. Poor information structure due to inappropriate typographical features requires excessive efforts to read, which resultantly distract and irritate the user. Nielsen [126] argues that non-scannable text is painful, boring and requires excessive efforts or attentional resources, and increases the individual's cognition load. Hence, visual elements such as poor layout, small font, and glaring color should be avoided as they could increase a feeling of irritation [190, 290]. In line with our findings, Hasan [190] also observed a negative relationship between visual elements (i.e., fonts, shapes, and layout) and irritation. Furthermore, he argues that a website with an unpleasant visual design may upset its audience and produce feelings of irritation [190]. Thus, non-expert typography influences visual communication [121].

The transition from printed to electronic media demands the precise selection of typefaces to improve reading and understanding of information. The typeface or font personality plays a very important role in users recognizing and understanding the complexities of visual information. Therefor, visual appearance and aesthetic aspects are important design features helping in terms of performance through appealing and engaging artifacts. These artifacts enhance users' interaction and engagement consistently due to attractive and appropriate design elements. Sonderegger and Sauer [101] noticed that participants using an appealing prototype needed less time to complete their tasks than participants using an unappealing prototype in a mobile

phone environment. In addition to individuals' emotions, several other studies have discussed the role of typography features in terms of preference, reading, and learning speed in different contexts [124, 144–146, 148].

However,there is a lack of evidence in the literature about the role of typographical features in terms of task completion time for e-commerce websites. Thus, as an additional objective, we found sans-serif to be most appealing, preferable font personality, which significantly influenced individuals' performance with respect to task completion time. Several other studies, [7, 150] have also noted the sans-serif typeface as a better choice due to quick recognition and fast processing, and legibility because letter spacing in sans-serif helps users to easily and quickly identify letters, which in turn reduces the mental efforts or cognitive load. Several other studies have also found that sans serif and line length lead to improved performance [146, 363].

Website design for globalization are becoming more important for online business success and customer loyalty. A professionally designed website has competitive advantages by building customer loyalty. Loyalty is a favorable factor for winning market share along with sustainable growth. It contributes to the ongoing process of continuing purchase behavior and maintaining customer relationships with the website. In this research, both satisfaction and trust were adopted as determinants of loyalty and employed as mediators between web design attributes and loyalty. The results after statistical analysis demonstrated a positive relationship between satisfaction and loyalty and also between trust and loyalty. Therefore, both trust and satisfaction were observed as important predictors of loyalty in a high UA culture. Moriuchi and Takahashi [278] and Flavia et al. [21] also noted both satisfaction and trust as important factors in determining customers' loyalty.

However, in a high UA culture, people are more concerned about a website's trustworthy appearance. Trustworthy artifacts may reduce complexity and transaction uncertainties, which untimely leads to loyalty. Kaluscha and Grabner-Kraute [268] argue that website content/information and design are the main predictors for users' initial trust in the vendor. Accordingly, Wang and Emurian [258] considered website design (i.e., structure design, social cue design, and graphic design) as important artifacts in developing online trust. Similarly, Cyr [65] also observed the positive impact of website design artifacts on loyalty via trust and satisfaction. Previously, several studies have also noted that the satisfying and trustworthy appearance of a website ultimately leads to loyalty and intention to purchase [83, 84, 287, 356, 364]. Thus, to design a website for a high UA culture, presentation and arrangement of information and design features should be look trustworthy, because culturally adopted design attributes reduce the

negative impact of risk and produce a positive attitude, which leads to loyalty. Consequently, website elements and design artifacts have a significant impact on a customer's positive perception and willingness to return to that website [37].

Chapter 7

Limitations

A large sample population is a reliable and positive feature of this study. The volunteers were from several institutions with different academic backgrounds. The participants were also unfamiliar with the designed website prototype, which helps to avoid bias due to website reputation and familiarity. Some interesting findings related to implications of web design attributes in high UA culture were obtained.

However, the current study suffers some limitations. First, the sample employed only the young and most were students, which may not be illustrative of the overall population of e-retail consumers. Although students often have free access to Internet resources, so besides academic activities, they also regularly use e-retailing services for searching and buying products online such as, books, software, and e-tickets at low cost. Walczuch and Lundgren [264] and Pelling and White [365] considered students to be an important sample for e-commerce research because they frequently use the Internet for communication and online transactions. Moreover, it has been observed that most online customers tend to be young [106], and considered an appropriate sample because they are more interested in design and aesthetic aspects [366], which may reduce the concern over the use of students as a sample.

According to Ha and Stoel [367], students constitute a fit sample to observe online shopping behavior of young adults. However, the use of university students in an educational setting may impact the external validity of the current study and restrict the applicability of the result to other settings or customer group.

Second, both prototypes were used for online ticket booking and mobile search only, with no real purchase transactions. Although this procedure is consistent with previous e-commerce research (i.e., [84, 106, 190]), it may also limit the transferability of the findings to actual

e-commerce situations.

Third, in study 1 and 2, we did not include other background variables, which are, download delay, speed, interactivity features (i.e., user control, connectedness, and playfulness), and aesthetic aspects (i.e., value, saturation, other typefaces) to identify additional implications. Furthermore, only a questionnaire approach was used to collect subjective data, rather than a multiple methods approach to gather additional objective measures.

Fourth in this study, we only included the single Hofstedes' UA dimension and excluded other cultural dimensions (i.e. collectivism/ individualism, power distance, long-term orientation, and masculinity/femininity). Using a single Hofstede's UA dimension may also limit the transferability of the findings because UA only does not represent entire cultures.

Chapter 8

Future scope

In terms of future scope, in the proposed model we did not include the relationship between satisfaction and trust and between irritation and loyalty. However, there does not seem to be a clear consensus among scholars about the nature of the relationship between satisfaction and trust. Some authors [368, 369] consider satisfaction to be a determinant of trust. Their tests in the context of online business show that previous positive shopping experiences result in high customer trust. However, other authors [370, 371] report just the opposite: trust influences satisfaction. For them, the strong image that customers have about a company helps them to perceive a high level of satisfaction. However, several other relevant demographic studies [84, 91, 191, 224, 278, 307] represent both satisfaction and trust as unrelated variables in their research models. These research efforts are closely focused on the study of cultural differences, and they consider the impact of different design approaches on trust and satisfaction and, in turn, evaluate the relationship of these variables to online loyalty. As our research questions are closer to these studies, we decided to exclude the relationship between satisfaction and trust from our model.

However, the consideration of the relationship between satisfaction and trust in the context of different national cultures is an interesting avenue for future research. Similarly, few studies exist in the literature that discuss the relationship between irritation and loyalty in an e commerce context. Previous studies have noted a direct negative relationship between irritation and positive attitude [171, 240, 290, 294, 332, 372–375] and an indirect relationship with behavioral intention [171, 290, 332, 372]. However, Mccoy et al. [376] observed a direct negative relationship between irritation and intention to return but the result of this study was only specific to online advertising research. Thus, the consideration of the relationship between satisfaction and trust and between irritation and loyalty in the context of different national cultures is also an interesting avenue for future research.

In the additional work in study 3, we did not include other performance-related measures such as error rate, success rate, or accuracy. Nor did we include other typography variables (i.e., layout, line length, size, spacing, alignment, and color) with respect to the individual's performance. Considering individual performance using these color and other typographical artifacts would also be an interesting avenue for future research.

Finally, in the future, we plan to extend this investigation into several countries to examine differences and similarities in design preferences. These cultural preferences will further help us to verify and generalize the results. We also plan to extend the current research to more accurately observe the cultural impact of typography (i.e., typeface, size, spacing, alignment, and color) on trust, satisfaction, and loyalty.

Chapter 9

Conclusion

9.1 Conclusion (English)

One key focus of an e-commerce website is to enhance the customers' online shopping behavior via positive emotions, attitude and considered as an effective source of communication. The appropriate use of design features enhances the individuals' understanding, which in turn leads to quick buying decision and behavioral intention towards adoption. It is important to explore the design implications on individuals' emotions, especially for the cultures, where people are more concerned for security and website credibility. In this research, we examined the user preferences and emotions for web design attributes in online shopping context for high uncertainty avoidance cultures. This is because, in high uncertainty avoidance cultures, people are more concerned about security and do not easily trust websites. The key objective was to determine the relationship between the web-design attributes and individuals' loyalty via trust and satisfaction and also between design attributes and irritation. Because irritation is a feeling of anger that also negatively influence the customers' online shopping behavior.

A working e-commerce website prototype was developed to examine the design implications on positive attitude. The developed prototype was further used to seek the relationship between design attributes and irritation. The results indicated that all the used web design attributes positively influence the loyalty via trust and satisfaction and had a negative relationship with irritation for uncertainty avoidance cultures (Spain and Pakistan).

A subsequent part of research, was also to determine the impact of font personality on users' preference, appeal, and ultimately on performance. Accordingly, another online shopping website prototype was design to observe the impact of typeface on individuals' performance. The results showed that the textual information was designed using a sans-serif typeface proved

to be more effective due to its appeal and the reading preferences of users. We found sans-serif to be most appealing, preferable font personality, which significantly influenced individuals' performance with respect to task completion time.

The findings from this research work offer valuable implications for online retailers and website designers in designing websites that look attractive, well-organized, trustworthy and require less user effort to use as the alternative, a confused and messy design, could make visitors leave.

9.2 Conclusión (Castellano)

Una clave para el éxito de sitios de comercio electrónico es la mejora del comportamiento de compra de sus clientes a través de fuentes de comunicación efectivas que transmitan emociones positivas. El uso adecuado de determinadas características del diseño mejora la comprensión de los individuos sobre el entorno, lo que conduce a decisiones de compra rápida y a estrategias de comportamiento que facilitan la adopción de las herramientas proporcionadas por éste. Es importante explorar las implicaciones del diseño en las emociones de los individuos, especialmente en los entornos culturales donde la gente es más proclive a preocuparse por la seguridad y la credibilidad del sitio web.

En esta investigación examinamos las preferencias del usuario y las emociones de los atributos de diseño web en el contexto de compras en línea para las culturas de alta evitación de la incertidumbre. Esto se debe a que en las culturas de alto riesgo de incertidumbre las personas están más preocupadas por la seguridad y no confían fácilmente en los sitios web. El objetivo principal ha sido determinar la relación entre los atributos de diseño web y la lealtad de los individuos a los mismos examinando su confianza y la satisfacción. También se evaluó la relación existente entre los atributos de diseño y la irritación puesto que la irritación es un sentimiento de ira que también influye negativamente en el comportamiento de las compras en línea de los clientes. Se desarrolló un prototipo de comercio electrónico funcional para examinar las implicaciones de diseño en la actitud positive de los usuarios. El prototipo fue utilizado más tarde para analizar las relaciones entre los atributos del diseño y la irritación. Los resultados indican que todos los atributos de diseño web utilizados tienen una influencia positiva en la lealtad de compra por vía de la confianza y la satisfacción y presentan una relación negativa con respecto a la irritación en las culturas con alta evitación de la incertidumbre que fueron analizadas en el estudio (España y Pakistán).

Una parte posterior de la investigación reveló el impacto de la personalidad de la tipografía en las preferencias del usuario, así como en el atractivo del sitio web. Para ello se diseñó otro prototipo de sitio web de comercio electrónico en el que se midió el impacto de la tipografía en el rendimiento de los usuarios. Los resultados mostraron que la información textual diseñada empleando una tipografía sans-serif demostró ser más eficaz debido a su atractivo y a las preferencias de lectura de los usuarios. El estudio encontró la tipografía sans-serif como la más atractiva y preferible lo cual influenció significativamente al rendimiento de los voluntarios con respecto al tiempo de ejecución requerido para efectuar sus procesos de compra.

Los resultados de este trabajo de investigación ofrecen implicaciones valiosas para los sitios de comercio electrónico y diseñadores web a la hora de crear sitios web atractivos, bien organizados, confiables y que requieren un menor esfuerzo cognitivo por parte del usuario, presentándolos como alternativa a diseños confusos y desordenados.

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Appendix A

(Survey items used for study-1)

Typography

1- It is easy to read the text on this website with the used font type and size.

2- The font color is appealing on this website.

3- The text alignment and spacing on this website make the text easy to read.

Color (i.e.,)

1- The color scheme of this website is appealing.

2. The use of color or graphics enhances navigation.

C**ontent/information quality**

1. The information content helps in buying decisions by comparing the information about products or services.

2. The information content provided by this website meets my needs.

3. Contents and information support for reading and learning about buying process.

Interactivity

1- This website provides adequate feedback to assess my progression when I perform a task.

2- This website offers customization.

3- This website offers versatility of ordering process.

4- This website provides content tailored to the individual.

5- In this website, every thing is consistent.

Navigation

1- Navigation aids serve as a logical road map for buying.

2- Obviousness of buying button and links in this website.

3- It is easy to personalize or to narrow buying process.

4- It is easy to learn to use the website.

5- This website supports reversibility of action.

Satisfaction

1- Over all, I am satisfied with the interface of this website.
2- My current experience with this website is satisfactory.
3- Overall, I am satisfied with the amount of time it took to complete the tasks for booking a ticket.
4- Overall, I am satisfied with accuracy for this website related to the buying process.

Trust

1- I trust the information presented on this website.
2- This website is credible for me.

Loyalty

I would visit this website again.
I would recommend this website to my friend.

Appendix B

(Survey items used for study 2)

Typography. - (Same items see Appendix A).
Color. - (Same items see Appendix A).
Content/information quality.
1. Appendix A.
2. Appendix A.
3. Appendix A.
4- The information provided at this site is accurate, useful, and structured **(new item)**.
Interactivity. - (Same items see Appendix A).
Navigation.
1- Appendix A.
2- Appendix A.
3- Appendix A.
4- This website is easy to use and supports reversibility of actions **(new item)**.
Irritation.
1- The website is annoying.
2- The website is frustrating.
3- This website is irritating.

Appendix C

(Experimental prototype web-pages and Google Statistics.)

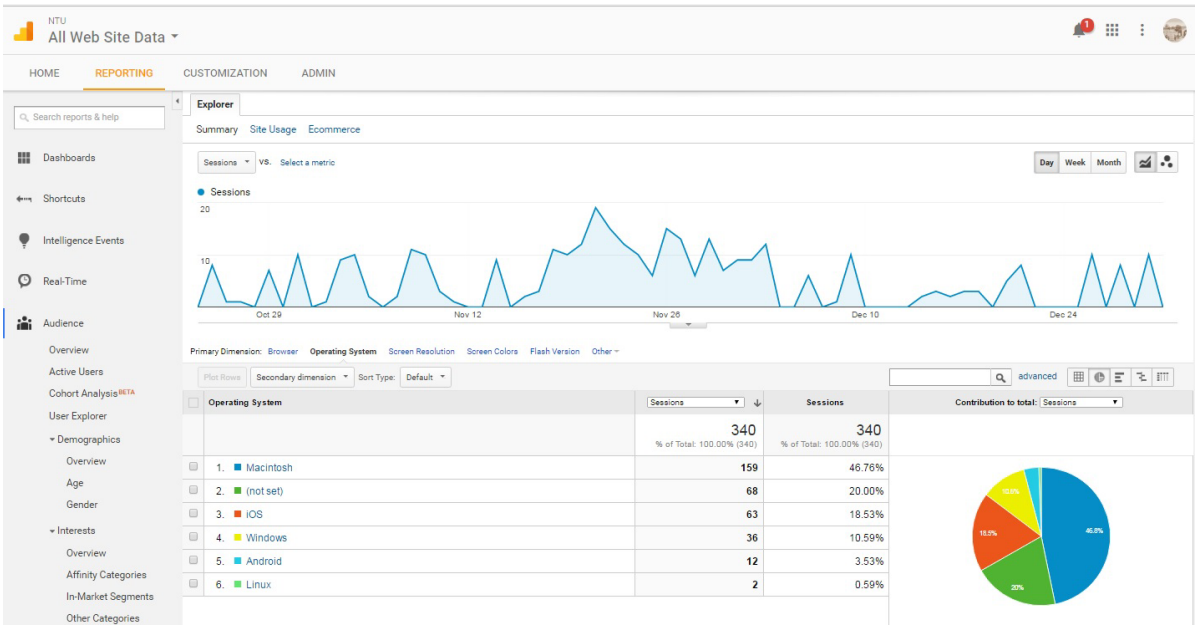

Fig. C.1 Google Statistics.

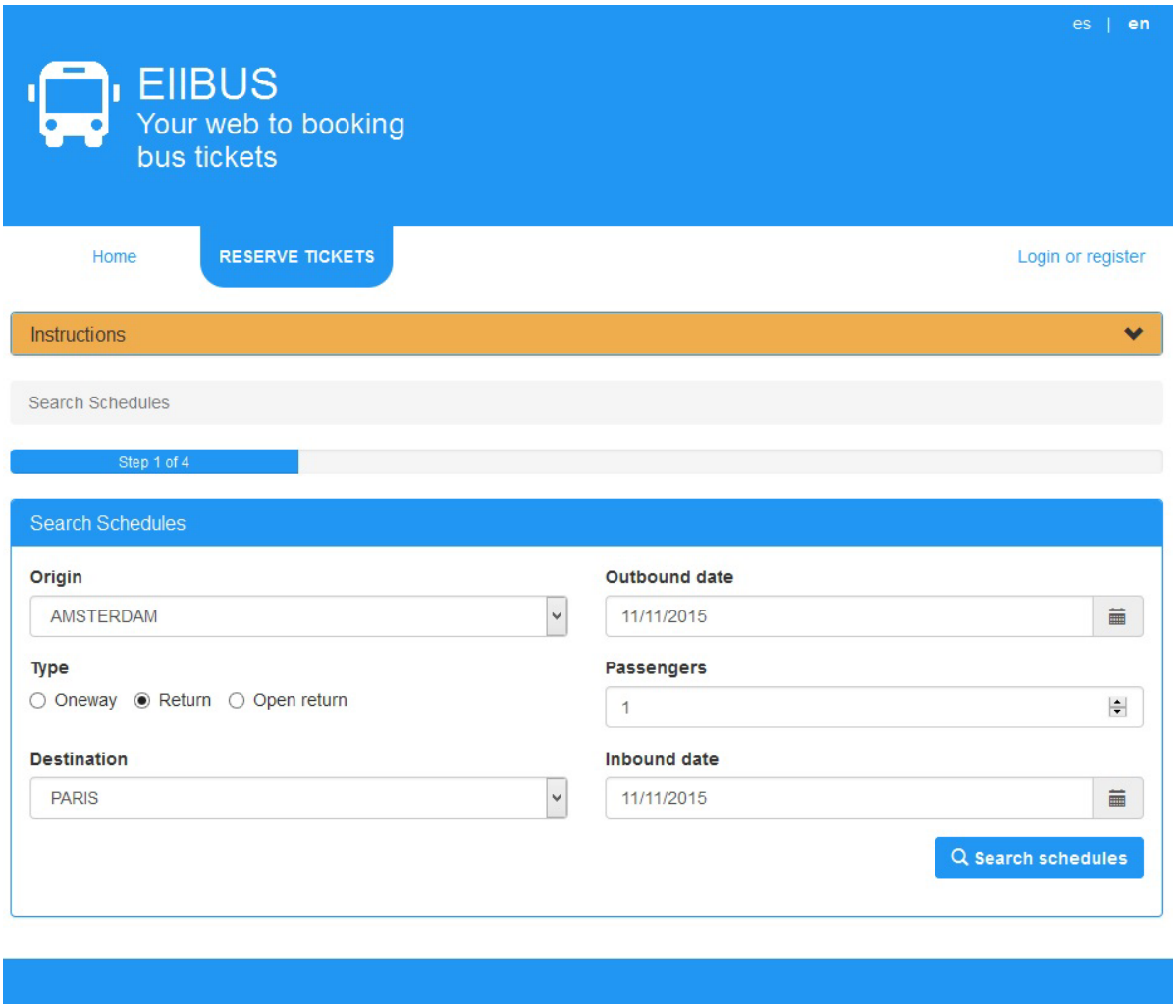

Fig. C.2 Ticket searching page.

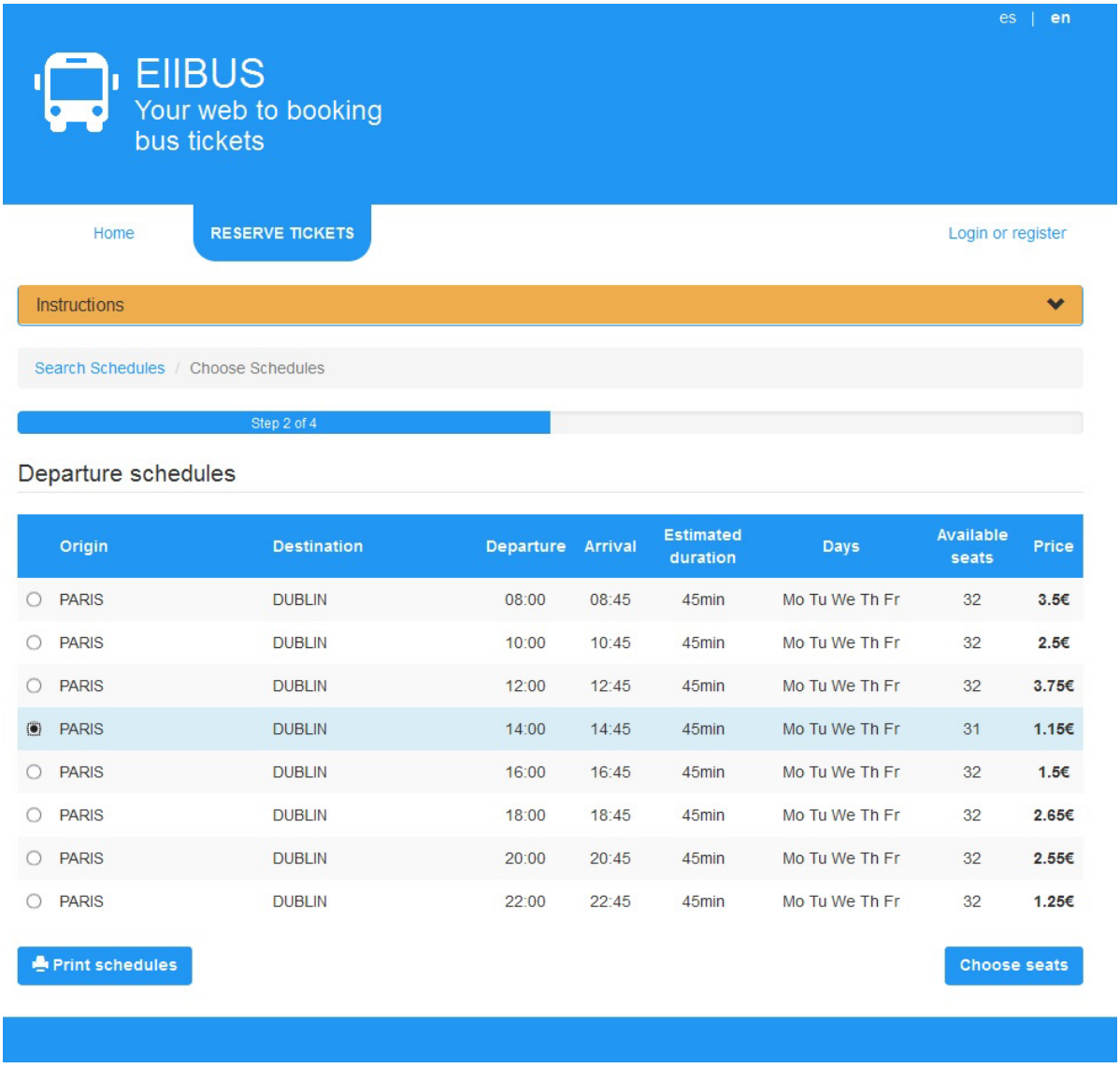

Fig. C.3 Time and price selection

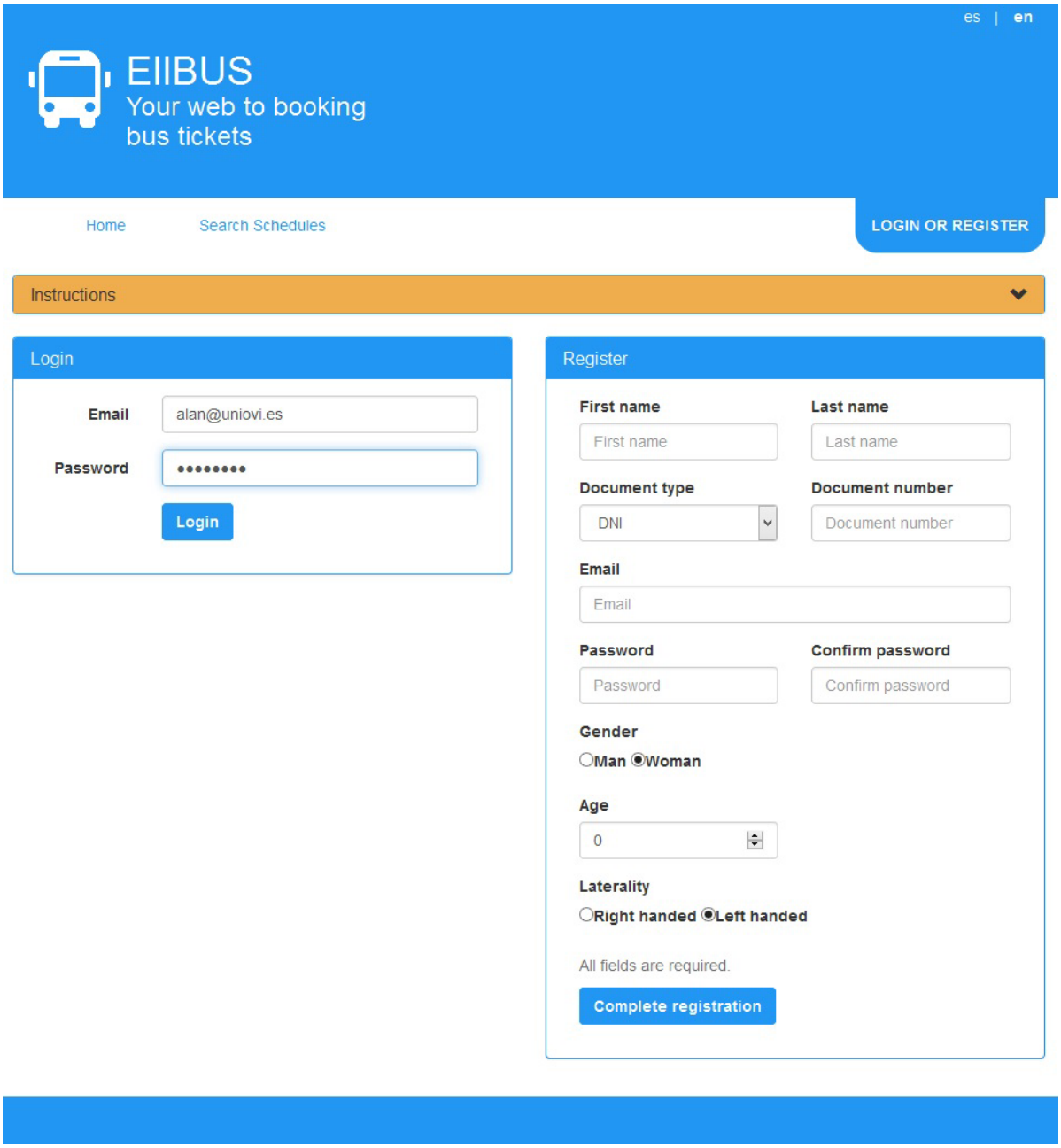

Fig. C.4 Booking and personal details.