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Using QUIS as a Measurement Tool for User Satisfaction Evaluation (Case Study: Vending Machine)

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Abstract Today, industrial designers believe that their products are not only designed to meet the needs of customers, but also to create a new experience in users. Since the physical performance of products have been solved by technological advances, investigating and providing the customer satisfaction and addressing customers' demands and requirements in long term design and manufacturing the products can lead to the increase of loyalty and success of companies. Designers have begun to find a sense of connection between people and products to satisfy the people. Regarding these issues, in this article, user satisfaction and experience of the use of vending machine were measured by satisfaction questionnaire (QUIS) which is a designed measurement tool to assess a computer user's subjective satisfaction by the human-computer interface. 32 students (19-35 years old) from Tehran's universities (Tehran Polytechnic, Iran University of science and technology, university of Tehran) were participated in this study. The results of the questionnaire were analyzed by SPSS. Finally, the results of this analysis are defined as the criteria which can be used in designing future spaces to create pleasant feeling in users.

Keywords Interaction design, User satisfaction, Vending machine, QUIS, User experience

1. Introduction

Until some decades before, products and services provided by organizations were considered as the result of creative minds of designing engineers than to comply with customer needs and wants. In other words, customer's role in most cases was limited only to a contented consumer and it was the engineers of organization who played customer's role in the process of product design. Competitiveness of markets, collapse of business borders, economic globalization and finally the increase of customers' level of expectations and needs had increased the needs. Considering specific economic conditions in which companies get involved, addresses customers' needs and wants and provide a tool to improve the quality of products. Customer satisfaction will have a considerable effect on the present and future life of an organization. A satisfied customer acts as advertising loudspeaker of company and attracts everybody towards products or services of the company.

The increase of the competition, accessibility to abundant information, availability of similar products and services, etc. reduce the competitive capability of the organizations. The only way for them to survive is to supply products and product design. Services with higher values and qualities require innovation and development in the field of products, services and exploration and evaluation of customers' needs and wants. Investigation and provision of customer attention and importance towards customers' needs, investigation and provision of customer satisfaction through addressing customers' needs and wants in the design and production of products in long term can lead to the increase of loyalty, an element which is considered as a vital key and relief cause for organizations in today's agitated economic and competitive conditions, which can in turn have a considerable role in increasing the contribution and profitability of organizations [1].

Essentially, there are two types of definition for the "customer (**user**) **satisfaction**" concept, based on different approaches. The process-oriented approach considers consumer **satisfaction** as the difference between expected **satisfaction** and achieved **satisfaction**, whereas the outcome-oriented approach regards **satisfaction** as an attribute extracted from a product or service after its consumption. [2]

1.1. Use Experience

1.1.1. User Pleasure in Interaction Design

In recent years, the field of human-computer interaction (HCI) has witnessed increasing interest in user interface design looking for a holistic perspective that includes emotions such as fun, joy, pleasure, and aesthetic value. A new movement in the study of emotions in the field of HCI has emerged. Previously, much of the effort expended in the

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field has focused on the usability of computer systems. Cognitive psychology has been the major influence in understanding users as human information processors to pursue the aim of HCI practitioners of making *usable* computer systems. [3] Emotion and 'pleasure engineering' is beginning to occupy a critical role in product design as the usability becomes more of a competitive differentiator in new device design. [4]

1.1.2. Perception of Pleasure

Emotions govern the *quality of interaction* with a product in the user's environment and relate directly to appraisal of the user experience. Jaasko and Mattelmaki (2003) presented a framework for user experience where pleasure must satisfy two levels. The first level involves appearance (aesthetics) and user interface (usability).The second level extends to user personality (socio-cultural context), product meaning (time/historic context), environment (physical context), interaction (use context) and product novelty (market context). Perception of pleasure encapsulates the experienced usability, the formed attitudes, and the emotions felt during product appraisal. In the WAP phone example, Exon's concerns before, during and after using product, illustrate this negative attitude formation. In short, lack of Satisfaction at any stage of the lifecycle can jeopardize the user experience. The user's evaluation about whether to keep a product or return it to the store; recommend the product to a friend; or generate an emotion of ownership, loyalty and commitment to the product are outcomes of perception of pleasure. The more closely a product can invite and deliver user expectations, while intensifying emotional response sets that form of favorable attitudes, the more pleasurable the product will be perceived by the user (Jordan 2002). Emotion plays a significant role in the actual and perceived experience with products. [4]

1.1.3. User Experience as Interaction

Usability experts know that while usability is important, it is not enough on its own to guarantee a product's success with customers. While helping people take advantage of a product's functionality, usability also needs to pave the road for pleasure. Usability techniques can be used to improve a given solution, but they do not reveal whether a different solution might deliver better and more enjoyable experiences. Consequently, designers have begun to apply hedonistic psychology to design for user experience. For example, Jordan takes a hedonistic perspective by proposing that pleasure with products is the sum of socio-pleasure, ideo-pleasure, physio-pleasure and psycho-pleasure. He defines pleasure with products as 'the emotional, hedonic and practical benefits associated with products'. Hassenzahl (2003) shows that satisfaction, a part of usability, is the sum of pragmatic and hedonic quality. However, as Desmet (2002) notes, the problem with focusing on pleasure is that it ignores the unpleasant emotional experiences related to product use. Perhaps to overcome this deficiency, user experience has become the new buzzword in design. User experience is subjective and holistic. It has both utilitarian and emotional aspects, which change over time. [5] Different approaches have been made to go beyond this understanding in considering other aspects of users' interaction with technical systems. Hassenzahl (2005) differentiates between approaches that focus on non-instrumental quality aspects and others that take the role of affect and emotions into account to better understand people's experience of technology.

1.1.4. Non-Instrumental Qualities

Different lines of research concerning non-instrumental quality aspects can be grouped under the three labels of hedonics, aesthetics and pleasure/fun. Examples taken from each area are described below.

Hedonics Batra & Ahtola (1990) differentiate hedonic and utilitarian sources of consumer choice and consider both to be important. Based on that Huang (2003) studied utilitarian and hedonic aspects of web performance. Hassenzahl defined the concept of Hedonic Quality in the context of HCI and studied the aspects such as Stimulation, Identification and Evocation. Helander & Tham (2003) coined the expression Hedonomics as the connection between ergonomics and hedonics. In the context of consumer electronic products, Han, Yun, Kwahk & Hong (2001) subdivide the usability into the two aspects of performance and image/impression.

-Aesthetics

Tractinsky, Katz & Ikar (2000) claimed that what is beautiful is usable. Based on that a lot of studies dealt with the influence of users' perceived visual aesthetics of an interactive system. Schenkman & Jönsson (2000) studied aesthetics and preferences of web pages. Van der Heijden (2003) investigated the influence of perceived visual attractiveness on the perceived usefulness and ease of use concerning an internet portal. The importance of aesthetic aspects for user satisfaction with websites was demonstrated by Lindgaard & Dudek (2003). Lavie & Tractinsky (2004) found two aesthetic dimensions to be relevant in the website context: classical vs. expressive aesthetics.

Aesthetic quality was also studied in other domains of interactive system design. Burmester, Platz, Rudolph & Wild (1999) questioned whether aesthetic design is only an odd on in the domain of medical systems, while Kleiss & Enke (1999) assessed visual appearance attributes of automotive audio systems regarding user reactions.

Liu (2003) defines two objectives for a new scientific and engineering discipline that can be called engineering aesthetics. The first intention is how to use engineering and scientific methods to study aesthetics concepts in general and design aesthetics in particular. Secondly, it is important to know how to incorporate engineering and scientific methods in the aesthetic design and evaluation process. Lindgaard & Whitfield (2004) integrate aesthetics within an

evolutionary and psychological framework to be considered in human factors research.

-Pleasure & Fun

Jordan (2000) argued for a hierarchical organization of user needs and claimed additional influential aspects to system interaction besides the instrumental qualities of the functionality and usability of a product. He assumes different aspects of pleasure to be of importance to enhance users' interaction with the product. In the study of Green & Jordans (2002), various topics are addressed that can be determinant conditions for pleasure with products. Already, Carrol & Thomas (1988) admonished not to confuse the concepts of *easy to use* and *fun to use* when talking about software quality. Draper (1999) analyzed fun as a software requirement candidate and Gaver and Martin (2000) presented a design approach for ludic products. Funology was defined as the move from standard usability concerns towards a wider set of problems to do with fun, enjoyment, aesthetics and the experience of use. [6] [7] [8]

Table 1. Measurement category and its type

Measurement category	Measurement type	Measure	Area measure
Anticipation Pre purchase	Anticipated use	The impact of expected UX to purchase decisions	UX lifestyle
Overall usability			
First use	Effectiveness	Success of taking the product into use	UX lifestyle
Product upgrade	Effectiveness	Success in transferring content from old device to the new device	UX lifestyle
Expectations vs. reality	satisfaction	Has the device met your expectation?	retention
long term experience	Satisfaction	Are you satisfied with the product quality	retention
Hedonic			
Engagement	Pleasure	Continuous excitement	retention
UX obstacles	frustration	Why and when the user experience frustration?	Break down
Detailed usability			
Use of device function	How used	What function are used, how often, why, how, when, where?	Use of function
Mal function	Technical problems	Amount of "reboots" and severe technical problems experienced	break downs
Usability problem	Usability problems	Top 10 usability problems experienced by the customers	Breakdowns
Effect of localization	Satisfaction with localization	How do user perceived content in their local language?	Breakdowns localization
Latencies	Satisfaction with device performance	Perceived latencies in key tasks	Device performance
Performance	Satisfaction with device performance	Perceived UX and device performance	Device performance
Received complexity	Satisfaction with task complexity	Actual and perceived complexity of task accomplishments	Device performance
User differences			
Previous devices	Previous user experience	Which devise you had previously?	retention
Differences in user groups	User difference	How different user group access features?	Use of function
Reliability of product planning	User difference	Comparison of target users vs actual buyers?	Use of function
support			
Customer experience in "touch points"	Satisfaction with support	How does customers think and feel about the interactions in the Touch point?	Customer care
Accuracy of support information innovation feedback	Consequences of poor support	Does inaccurate support information result in product return?	Customer care
	User wish list	New user ideas and innovations triggered by new experience?	New technologies
Impact of use			
Change in user behavior	How the device affects user behavior	How are usage patterns changing when new technologies are introduced	New technologies

Table 2. Factors contributing to system usability and UX

Quality characteristic	UX	functionality	User interface usability	learnability	accessibility	safty
Product attributes	Aesthetic attributes	Appropriate functions	Good UI design (easy to use)	Learnability attribute	Technical accessibility	Safe and secure design
UX pragmatic do goals	To be effective and efficient					
UX actual experience	Stimulation, identification and evocation					
Usability (=performance in use measures)	visceral	Experience and productivity in use: effective task completion and efficient use of time			Accessibility in use: effective and efficient with disabilities	Accessibility in use: effective and efficient with disabilities	Safty in use: occurrence of unintended consequences
Measures of UX consequences	Satisfaction in use: Satisfaction with achieving pragmatic and hedonic goals					
	pleasure	Likability and comfort				trust

1.1.5. Differences between Usability and User Experience

Although there is no fundamental difference between the measures of usability and measures of user experience at a particular point in time, the difference in emphasis between task performance and pleasure leads to different experiences which are shown in table (2):

1. Designing for and evaluating overall effectiveness and efficiency.
2. Designing for and evaluating user comfort and satisfaction.
3. Designing to make the product easy to use, and evaluating the product in order to identify and fix usability problems.
4. When relevant, the temporal aspect leads to a concern for learnability.

In the context of user centred design, typical user experience concerns include:

1. Understanding and designing the user's experience with a product: the way in which people interact with a product over time: what they do and why.
2. Maximizing the achievement of the hedonic goals of stimulation, identification and evocation and associated emotional responses.

Sometimes the two sets of issues are contrasted as usability and user experience. But some organisations would include both under the common umbrella of user experience. [10] [11]

1.2. Literature Review

1.2.1. Why Measure UX/Usability?

The most common reasons for measuring usability in product development are to obtain a more complete understanding of users' needs and to improve the product in order to provide a better user experience. But it is also important to establish criteria for UX/usability goals at an early stage of design, and to use summative measures to evaluate whether these have been achieved during development.

1.2.2. What Measures should be Used?

There are two types of UX/usability measures: those that measure the result of using the whole system (usability in use) and measures of the quality of the user interface (interface usability).

1.2.2.1. System Usability

ISO 9241 -11 (1998) defines usability as: the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use and ISO 9241 -171 (2008) defines accessibility as: usability of a product, service, environment or facility by people with the widest range of capabilities. These definitions mean that for a product to be usable and accessible, users should be able to use a product or web site to achieve their goals in an acceptable amount of time, and be satisfied with the results. ISO/IEC standards for software quality refer to this broad view of usability as "quality in use", as it is the user's overall experience of the quality of the product (Bevan, 1999). This is a blackbox view of usability: what is achieved, rather than how. The new draft of ISO standard ISO/IEC CD 25010.2 (2008) proposes a more comprehensive breakdown of quality in use into usability in use (which corresponds to the ISO 9241 -11 definition of usability as effectiveness, efficiency and satisfaction); flexibility in use (which is a measure of the extent to which the product is usable in all potential contexts of use, including accessibility); and safety (which is concerned with minimizing undesirable consequences):

-Quality in use
-Usability in use
-Effectiveness in use
-Productivity in use
-Satisfaction in use
-Likability (satisfaction with pragmatic goals)

-Pleasure (satisfaction with hedonic goals)
-Comfort (physical satisfaction)
-Trust (satisfaction with security)
-Flexibility in use
-Context conformity in use
-Context extendibility in use
-Accessibility in use
-Safety
-Operator health and safety
-Public health and safety
-Environmental harm in use
-Commercial damage in use

Usability in use is similar to the ISO 9241 -11 definition of usability:

- Effectiveness: "accuracy and completeness." Error free completion of tasks is important in both business and consumer applications.
- Efficiency: "resources expended." How quickly a user can perform work is critical for business productivity.
- Satisfaction: the extent to which expectations are met. Satisfaction is a success factor for any products with discretionary use; it's essential for maintaining workforce motivation. Usability in use also explicitly identifies the need for a product to be usable in the specified contexts of use:
- Context conformity: the extent to which usability in use meets requirements in all the required contexts of use. Flexibility in use: the extent to which the product is usable in all potential contexts of use:
- Context conformity in use: the degree to which usability in use meets requirements in all the intended contexts of use.
- Context extendibility in use: the degree of usability in use in contexts beyond those initially intended.
- Accessibility in use: the degree of usability in use for users with specified disabilities.
- Safety: acceptable levels of risk of harm to people, business, data, software, property or the environment in the intended contexts of use.

Table (2) shows how measures of system usability and UX are dependent on product attributes that support different aspects of user experience. In Table (2) the columns are the quality characteristics that contribute to the overall user experience, with the associated product attributes needed to achieve these qualities [9]

1.3. Why Vending Machine?

Vending machines are a $7B industry in the United States, and there is now one vending machine for every 55 people. Globally, the installed base is expected to reach 35.2 Million units by 2015. Customers are hungry for convenience coupled with healthy food options, which has increased the demand for smart vending machines that display calorie counts, provide hot or cold delivery, and offer several payment options [13]. It is only natural that they should affect urban scene by their sheer quantity. The first vending machine made its appearance in 1905. It sold stamps. In 1957, after the World-War 2, the vending machines of juice with paper-cup made their appearance, subsequently followed by that of coke. Then, full-fledged age of vending machine got under way. With the addition of technological and design improvement, their number increased to one million in 1970 and to 4.3million in 1980. They reached the saturation level with 5.0 in number in 1985. [12] In the case of beverage, they can drink it on the spot, making vending machines is more convenient than convenient stores. For the manufacturers of merchandises and the owners of the locations, when the use of vending machines attended by no men leads to the reduction of labor cost. For the former, the machines serve as advertising columns as well. On the other hand, demerits of the machines have been pointed out by many.

1.3.1. Advantages and Disadvantages

Why did vending machines get so popularized? First, they have made it possible for people to purchase the certain kinds of the goods wherever and whenever they want them, in the context of rising trend of eating out, eating late and eating alone. A psychological explanation could also be given in that they want to and can buy things without meeting and talking with sellers. They have been afraid of the uncontrolled purchase of cigarettes and alcoholic beverage by the young that could lead to the increase of juvenile delinquency. In addition to the occurrences of traffic accidents due to the obstruction of view, environmental problems have been also pointed out. For example, the annual consumption of electricity by a vending machine is said to be about 70% as much as the amount consumed by an average household. The scattered wastes such as empty cans and the release of fluorocarbon in the air are also problematic. Despite of these disadvantages, there is nowhere to go but to the step by step improvement of present state of things. This is because vending machines are now so much incorporated into our life system that no one could avoid or escape from them. [12]

1.3.2. Digital Malls

Today, all the players in the U.S. retail ecosystem —mall developers, retailers, vending operators, and consumer product manufacturers—are facing with the key demographic, economic, and technological changes: 12% of consumers are moving to urban areas annually; 1% of high unemployment continues to depress consumer spending; 8 percent of retail sales has moved to e-commerce channels; 2% of mobile phones have become the new retail showrooms; and the Millennial generation expects an engaging, personalized digital shopping experience. This "new normal" world of retailing is challenging the retail players to reverse vacancy rates and sales declines, create enhanced customer experiences, reduce labor and construction costs, deepen brand differentiation, optimize small urban formats, and justify investment in innovation. [14]

1.3.3. Innovative Vending Machines

From $40 billion to $50 billion, vending industry has faced slowing sales since 2007, hit hard by the impact of the recession on workplace traffic and consumer spending. Traditionally, vending machines have been "dumb" analog devices: put in a dollar, get a soda. However, vending is now at a technology and sales tipping point as machines become smart, networked devices. Innovative vending which are shown in figure (1) is changing the consumer experience in three important ways:

1. Technology is enabling more convenient, engaging interactions. Suddenly, all the consumers of the retail technologies that are commonplace in-store or online are possible in vending, including:

– Cashless payment
– Networked location data
– Video and touchscreen communication
– Mobile and facial recognition
– Remote experts

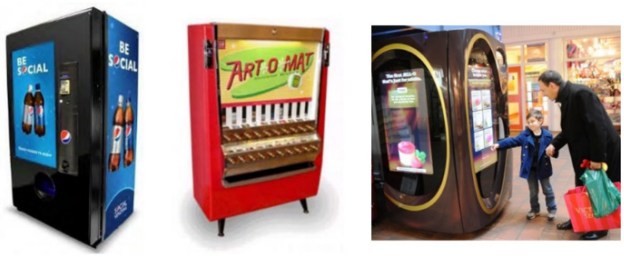

Figure 1. Vending machine kinds

2. Consumers are now buying higher-priced goods from vending. Consumers are showing a willingness to buy a wide range of goods and services from vending machines or remotely attended retail, including general merchandise, electronics, fashion, beauty, flowers, gifts, prescriptions, investments, even gold bars and kitchens. Millennial generation shoppers, in particular, are often more comfortable buying from machines than from humans, who may be perceived as slower and less accurate.

3. Vending is becoming a point-of-purchase marketing opportunity. Networked machines are providing opportunities for marketers to connect with consumers at the point of purchase and to control brand messaging in a way not possible at a typical retail shelf. LCD screens and glass doors enabled by video, mobile, social media, and augmented reality can offer product information, advertising, promotions, games, and samples to bring brands and new products to life.

The second trend reinvigorating self-service retailing is micro-markets, which are driving growth in large workplaces. Micro-markets are essentially unattended, networked convenience stores with open shelves for snacks, coolers for drinks and fresh foods, and freezers. Consumers select, scan, and pay for their own purchases at video-enabled kiosks with cash, payment cards, or mobile devices. Micro-market shrinkage is managed by security cameras and placement in venues with a known or controlled population.

In today's first incarnation, micro-markets are being installed by vending operators in workplaces with 250 or more employees, replacing vending machine banks. Micro-markets are proving very popular with company human resources departments because they provide a wider, healthier variety of products than vending machines, without the cost of cafeteria labor.

1.3.3.1. Virtual Stores

Virtual stores are the final emerging retail trend supporting the development of Digital Malls. Following Tesco's innovation in the Seoul subway in 2010, there are numerous virtual store pilots around the world today where consumers click on product pictures by using touchscreen or mobile technology and place orders for later home delivery. The confluence of e-commerce operations, high-resolution and interactive surfaces, mobile QR codes, and even gesture technology has created shopper convenience, stores without inventory or sales labor costs, and tremendous branding buzz. [14]

2. Material and Method

In this research, with the aims of expanding pleasure practical implication in products, 2 stages were followed: library survey & reference extraction of the related articles from the definition of research review & previous reports, second stage that was done in a cross-sectional and case study. In this research, home appliances of Iranian companies were analyzed. Three types of 3 distinct products were selected as case studies that are presented in Fig. 2, Fig. 3. After that a questionnaire was designed that was filled by 15 women with 20-60 years old. Interviewee's perceptions through presenting product sampling were evaluated by content analysis and semantic differences scale. In this way, housewives evaluated each product separately. The aim was to gather housewife comments about products (mixer, iron, rice cooker) and evaluate their pleasure in using products.

Figure 2. Sample types

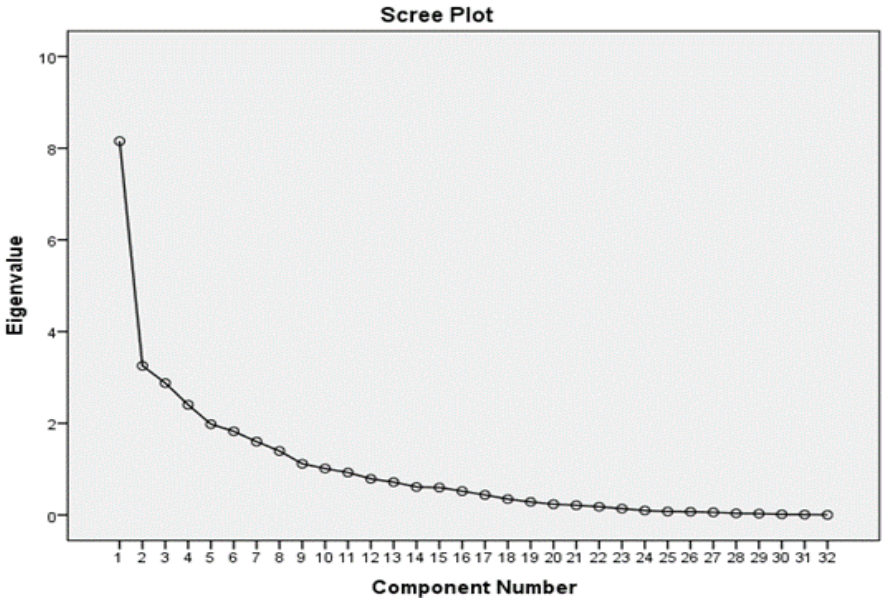

Figure 3. Scree plot

2.1. Participants

In total, 35 participants were interviewed from the four selected universities of Tehran (Iran). We want users to use the machine and after that we ask them to fill in the questionnaire. In earlier studies, it is found that men and women do not differ in their level of positive affectivity (Watson, 2000). Therefore, responses were not categorized according to the gender.

2.2. Questionnaire

The questionnaire which was used for this study was QUIS. (The Questionnaire for User Interaction Satisfaction). It is a tool developed by a multi-disciplinary team of researchers in the Human-Computer Interaction Lab (HCIL) at the University of Maryland at College Park. The QUIS was designed to assess users' subjective satisfaction with specific aspects of the human-computer interface. The QUIS team successfully addressed the reliability and validity problems found in other satisfaction measures, creating a measure that is highly reliable across many types of interfaces.

3. Results and Discussion

In this study, to reveal the reliability and effectiveness of the questionnaire survey, reliability analysis is conducted. A high value of the reliability coefficient means that the questionnaire survey is stable, namely, the consistency of survey results are conducted in different durations. The Cronbach's alpha of the kansei checklist was calculated to measure the internal consistency. The analysis yielded an overall Cronbach's alpha value of .867, which is higher than the common benchmark value of 0.7. This confirms the reliability of the questionnaire. The participants' responses were then computed to determine the average response and the range of each samples. The number of semantic adjectives is reduced and also categorized by using factor analysis. To confirm whether exploratory factor analysis is a suitable statistical technique to analyze our data, the Kaiser-Meyer-Olkin (KMO) measure of sample adequacy and Bartlett's Test have been used (Table.3), (table. 4) and (table. 4). The value of KMO statistic was .298, which means that the sample size is suitable for factor analysis. Sheskin (2007) refers that KMO statistic should be 0.5 or greater. Bartlett's Test has a p-value less than 0, 0001 showing that there are significant bivariate correlations between some of the variables.

Table 3. Case Processing Summary

		N	%
Cases	Valid	35	100.0
	Excluded	0	.0
	Total	35	100.0

a. List wise deletion based on all variables in the procedure.

Table 4. Reliability Statistics

Cronbach's Alpha	N of Items
.867	32

Table 4. KMO and Bartlett's Test

The QUIS 7.0 contains a demographic questionnaire, a measure of overall system satisfaction along six scales, and hierarchically organized measures of eleven specific interface factors (screen factors, terminology and system feedback, learning factors, system capabilities, technical manuals, on-line tutorials, multimedia, voice recognition, virtual environments, internet access, and software installation). Each area measures the users' overall satisfaction with that facet of the interface, as well as the factors which make up that facet, on a 9-point scale. The questionnaire is designed to be configured according to the

needs of each interface analysis by including only the sections that are of interest to the user Questionnaire for User Interaction Satisfaction

Table 5. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.153	25.477	25.477	8.153	25.477	25.477	3.251	10.161	10.161
2	3.254	10.167	35.644	3.254	10.167	35.644	3.164	9.888	20.049
3	2.877	8.990	44.634	2.877	8.990	44.634	3.094	9.669	29.717
4	2.403	7.508	52.143	2.403	7.508	52.143	3.087	9.646	39.363
5	1.981	6.189	58.332	1.981	6.189	58.332	2.960	9.249	48.612
6	1.824	5.700	64.031	1.824	5.700	64.031	2.391	7.472	56.084
7	1.600	4.999	69.030	1.600	4.999	69.030	2.172	6.789	62.873
8	1.395	4.359	73.389	1.395	4.359	73.389	2.005	6.266	69.139
9	1.116	3.486	76.875	1.116	3.486	76.875	1.767	5.521	74.659
10	1.013	3.164	80.040	1.013	3.164	80.040	1.722	5.380	80.040

Extraction Method: Principal Component Analysis.

Table 6. Component Matrix[a]

	Component									
	1	2	3	4	5	6	7	8	9	10
vakonesh e koli b narmafzar	.534	.262	-.197	-.053	.514	.001	-.207	.144	-.237	-.081
v2	.586	.100	.191	-.275	.136	.470	-.127	.146	-.036	-.028
v3	.579	.099	-.235	.075	.341	.336	.216	-.280	.042	.066
v4	.500	.405	-.370	.333	.117	.091	.275	-.103	-.291	.050
v5	.502	-.263	-.478	-.103	.112	.143	.289	.323	.328	-.121
v6	.353	.058	-.302	.442	.252	.387	-.134	-.221	.245	-.031
vizhegihayesafhenamayesh	.739	.285	.013	.195	.117	-.233	-.263	.157	-.179	-.003
n2	.173	.575	-.343	.168	-.276	-.052	.037	.335	.111	.097
n3	.727	.031	.390	-.188	-.156	.016	-.104	-.097	-.004	-.273
n4	.701	-.307	-.138	-.006	.046	.027	.231	.298	-.126	.108
information and information systems	.489	-.452	.149	.379	.065	.126	-.216	.221	.298	-.268
e2	.257	-.251	.450	.508	-.126	.160	.230	-.392	-.141	-.084
e3	.613	.167	.474	.074	-.381	.094	-.146	-.151	-.031	-.172
e4	.586	-.056	.149	.265	-.342	-.241	.299	-.004	.275	-.032
e5	.566	.070	.091	.102	.240	-.441	.198	.017	-.191	-.289
e6	.425	.289	.066	-.286	-.408	.425	.286	.159	.109	.052
Education	.641	-.428	.310	.046	.064	-.039	.134	.056	-.055	.325
edu2	.687	-.228	-.042	.181	.259	-.176	.017	-.362	-.009	.297
edu3	.390	-.596	.278	-.034	-.087	-.132	.084	.274	-.272	.285
edu4	.756	-.174	-.201	-.112	-.042	-.376	.162	-.086	.275	.078
edu5	.521	.188	-.286	-.539	-.028	-.120	-.048	-.135	-.087	-.198
edu6	.579	-.028	-.077	-.409	-.193	-.316	.177	-.092	-.011	-.335
Ability of systems	-.142	.377	.419	-.161	.114	.168	.409	.047	-.287	-.052
sys2	-.145	.533	.507	.337	.221	-.230	.103	-.066	.236	-.027
sys3	.028	.280	.508	-.031	.362	-.394	-.210	.328	.247	.157
sys4	-.008	.530	.512	-.017	.317	.193	.320	.163	.151	-.022
sys5	-.052	.478	-.058	-.171	-.345	-.191	.199	-.239	.151	.355
The relations of applications	.356	.133	.007	.517	-.468	.171	-.279	.193	-.055	-.010
r2	.477	.420	-.180	.122	-.270	-.180	-.409	-.091	-.152	.089
r3	.486	.032	.142	-.483	.195	.084	-.316	-.353	.278	.117
r4	.527	-.066	.390	-.361	-.085	.290	-.240	.037	-.045	.229
r5	.561	.403	-.228	.094	-.001	.049	-.020	.110	-.003	.172

Extraction Method: Principal Component Analysis.
a. 10 components extracted.

3.1. Who Uses the QUIS?

The QUIS is used at both academic and industrial sites to evaluate systems and software. What makes the QUIS such a good tool?...It has been proven both reliable and valid by J. P Chin, V. A. Diehl, and K. L. Norman (1988). It is one of the few available quantitative measures of user satisfaction that doesn't require expensive performance testing. The QUIS can also be used to test before and after changes which made for a system in order to quantify the magnitude of improvements. [15], [16], [17]

Using factor analysis in order to find important factors in vending machine, the detail of vending machine criteria were investigated with the average value of evaluation results. (Table.5) just shows the first five component of factor analysis after varimax rotation. Varimax, which was developed by Kaiser [1958], is the most popular rotation method that simplifies the interpretation of variables. This is because, after a varimax rotation, each original variable tends to be associated with one of factors, and each factor represents only a small number of variables. In addition, the factors can often be interpreted from the opposition of few variables with positive loadings to few variables with negative loadings.

In (Table 5), it is clear that the first factor explains 25.477% of the data which represents the majority of the main factor's contribution and has dominant effect on the important factors. The second, third, fourth, and fifth, sixth, seventh, eighths factor explains 10.167, 8.990, 7.508, 6.189, 5.700, 4.999 and 4.359of the data, respectively. The first factor represents 25.477 of the variability alone while four factors explain 32.854% of the variability. Inclusion of the forth factor is deemed considerable, and therefore the first five factors could explain most of the data. The proportion of variability explained by the sixth factor and above is minimal (5.700, 4.999, 3.486, etc., respectively) and they can be eliminated as being insignificant. The following table (5) shows the partial result of factor analysis in ascending order.

The structure of the main factors are observable in the result of analysis. In Table (6), it is clear that the important factor in vending machine interaction are structured by 10 factors. The first factor in overall reactions to the software part: (easy), in screen part: organization of information on screen (clear). The second factor in terminology and system information part: computer keeps you informed about what it is doing (always); in learning part: tasks can be performed in a straight-forward manner (always), help messages on the screen (helpful), supplemental reference materials (clear). The third factor in screen part: characters on the computer screen(easy to read), highlighting on the screen simplifies task(very much), in usability and user interaction part: the use of colors and sounds(good), system feedback(good), system clutter and user interaction "noise"(good). The fourth factor in overall reactions to the software part: (wonderful), (satisfying), (adequate power), (simultaneously); in education part: exploring new features by trial and error (easy). The fifth factor in screen part: sequence of screens (easy), in education part: learning to operate the system (easy), remembering names and use of commands (easy), in screen part: sequence of screens (clear). The sixth factor in terminology and system information part: position of messages on screen (consistent), computer terminology is related to the task you are doing (always), messages on screen which prompt user for input (clear). The seventh factor consists of in system capabilities part: system reliability (reliable), system tends to be (quite). The eighth factor in system capabilities part: system speed (high), experienced and inexperienced users' needs are taken into consideration (always). The ninth factor in terminology and system information part: use of terms throughout system (consistent), in system capabilities part: experienced and inexperienced users' needs are taken into consideration (always). The tenth factors in overall reactions to the software part (flexible), in terminology and system information part: error messages (helpful). The result demonstrates that vending machine criteria are structured by ten factors. These ten factors altogether explain 80.040% of the total data. As a result from the present case studies, it has been shown that it is possible to have a mechanism to identify, among various object designs, a design proposal which is closer to satisfy the subjective requirements wanted to externally be shown by the object. The purpose of this study is to examine the relationship between properties of vending machine and user satisfaction. With QUIS, it is possible to determine what the vending machine properties obtained from existing samples. The main advantages of using QUIS in studies is revealing the users feelings or affectivities towards the design. Analyzing and generalizing these affective interactions, can get a better idea about the user's impression towards the design of vending machine and any interaction product.

Scree plot graphs the eigenvalue against the factor number. You can see these values in the first two columns of the table immediately above. From the third factor on, you can see that the line is almost flat, meaning the each successive factor is accounting for smaller and smaller amounts of the total variance.

4. Conclusions

This paper presents an exploratory extension of using QUIS as a user satisfaction questionnaire which includes an in depth study of the customer experience. Also, the current study has highlighted the need for instructional designer to refocus on the often neglected affective aspects of a design. It is noted from the literature [Wilson, 2005] that instructional designer has often put affective factors into secondary position and overlooked its role in promoting effective and engaging learning. The research explores the implementation of user experience in the effort of embedding user satisfaction signature in our product design. Factor analysis was performed to identify factors, important criteria, associated user responses and design elements.

Factor Analysis demonstrates that the first factor explains the most of data, i.e. 43.672% of the data. This means that the first factor is very important in user satisfaction area. It suggests that all vending machine samples should have this factor in order to attract people's attention and acquire user satisfaction. However the second, third, fourth, and fifth factors, are also important but have low influences. Therefore, these ten factors are suggested to be used as background/supporting features in good vending machine samples design. Finally, the results from this study have made it possible for the study to produce a guideline to experience the interface design of the vending machine. Since the interaction design is highly dependent on the specific characteristics of software, machine level, user knowledge, the results of this study may not produce universally accepted features.

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