Smart Innovation, Systems and Technologies 134

Amaresh Chakrabarti *Editor*

Research into Design for a Connected World

Proceedings of ICoRD 2019 Volume 1

KES International

Springer

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Manufacturing
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Bangalore, India

ISSN 2190-3018 ISSN 2190-3026 (electronic)
Smart Innovation, Systems and Technologies
ISBN 978-981-13-5973-6 ISBN 978-981-13-5974-3 (eBook)
https://doi.org/10.1007/978-981-13-5974-3

Library of Congress Control Number: 2018966842

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

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Chapter 5
Assessing Designers' Perception, Analysis, and Reflective Using Verbal Protocol Analysis

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Abstract This paper examines designers' response toward the theory of unconscious interaction and cognitive of human behavior in the everyday product. During the Verbal Protocol Analysis (VPA) study, 30 designers were given four selected images which have been categorized into four attributes of unconscious interaction in everyday human behavior. At the same time, they were asked to verbally respond to following aspects: (1) their perception toward the attributes of the unconscious interaction of human behavior in everyday life; (2) their analysis on the given images; and (3) their reflection of those given images. The contribution of the study led to the identification of designers' abilities to perceive, understand, analyze, and reflect in enhancing the value of an existing product by interpreting the design needs from the four attributes of unconscious interaction in everyday human behavior.

5.1 Introduction

Ever since the aggressive expansion of technology features in design, one of the current approaches in finding a fit between technology and human values is to integrate the human interaction factor into product design by understanding the human behavior. Unfortunately, there are other realms of human behavior that might be overlooked: the unconscious interaction and cognitive of human behavior

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A. Chakrabarti (ed.), *Research into Design for a Connected World*,
Smart Innovation, Systems and Technologies 134,
https://doi.org/10.1007/978-981-13-5974-3_5

(hereafter referred as UICHB). In comparison with the conscious human behavior, unconscious human behavior in design has always been hard to identify, more so to quantify. However, for the past few years, the integration of varying and disparate literature regarding this theory has shown extraordinary potential in product design ideation (see [1–8]). Unfortunately, the applicability and the usefulness of understanding the theory may be questioned, as both the approaches and empirical evidence to clarify designers' response toward the attributes of the theory are not widely discussed. Therefore, the objective of this study is to assess designers' perception, analysis, and reflection toward the theory of UICHB in the everyday product. The contribution from the study will provide a better understanding on how designers perceive the attributes of UICHB in everyday product, how they analyzed the subtle interaction existed within the attributes, and how they be inspired by the attributes to create an innovative product design concepts.

5.2 Unconscious Interaction and Cognitive of Human Behavior (UICHB) in Everyday Product

In 1964, Alexander [9] introduced the theory of unselfconscious design; a form of cognitive interaction which is animated by incremental engagements leading to subjective and possibly unknown design improvements in relationships among everyday products, environment, and end users. According to Alexander, people unconsciously make a "good fit" from a "misfit" as soon as the "misfit" is recognized. The term "unselfconscious" used by Alexander is to describe the process that produces this fit and claimed that the unselfconscious designing culture passes on by imitation and correction leading to the coherence of the design. This is in line with Suri's [1] idea of "thoughtless acts"; an act that revolved around intuitive interaction in which human adapts, exploits, and reacts to things in our environment. According to Suri, the acts involved things human did without "actually thinking" and by observing such interactions, designers shall able to discover a lot about how human engage, make sense of surroundings, and be inspired with new design opportunities. Based on her study, Suri outlined seven attributes of unconscious interaction in everyday human behavior: (1) reacting, (2) co-opting, (3) exploiting, (4) adapting, (5) conforming, (6) signaling, and (7) responding. However, Sohn et al. [3] simplified Suri's attributes into four. The objective of reducing the number of Suri's attributes is to simplify the design process. Moreover, the exact distinction among the seven attributes was not that meaningful for designers. For instance, the term "reacting" and "responding" do not seem to be very different from each other. After the grouping up of similar categories, Sohn et al. finally developed the four attributes that can be differentiated from each other, as follows: (1) Reacting: human reacts automatically with the affordance of an object (e.g., physical properties) and spaces that they encounter, even without any purpose [2, 10]. Sohn et al. [3] justify this attribute as an individual reaction that

happens unintentionally. For instance, some people shake their pen unconsciously while reading due to the element of stress. At the moment, the gesture happens with no specific intention or purpose but helps to reduce the stress; (2) Adapting: human tend to alter the purpose or properties of things to meet certain objectives [1]. The process is called adaptation, which happens through the process of changing and evolving the surrounding artifact and system. The adapting attribute triggers on an individual basis and transpires with interaction [4, 5]. The process can be instigated by stimuli (either unconsciously, or consciously but the stimuli were no longer present) [11]. For instance, people usually put their jacket on the back of their chair. At first, they may have an initial intention to exploit the chair physical properties (the back side of the chair) in order to meet their objective (of hanging the jacket). However, after continuous and repeated processes, they have adapted and are no longer conscious of their action; (3) Signaling: human convey messages through signals and prompts to other people [1]. It was triggered by the desire to inform rules and to make others adhere to them. The signaling attribute is usually triggered in a social context and happened with initial intention [3]. However, the choice of signaling approach was made by human unconsciously (or almost unconscious) [12]. For instance, people leave the door ajar or open in signaling for a potential visit. The action of "leaving the door open" was performed after nothing more than a fleeting moment of awareness; and (4) Conform to others: human learns patterns of behavior from others in both social and cultural contexts [1]. The process can be explained as conformity; where an individual's attributes, beliefs, and behaviors are influenced by others [3]. This expands Cleereman's [12] idea which indicates that to certain extent, human is unaware that they have learned anything, or what it is that they have learned, or unaware that their behavior is influenced by something they have previously learned. An individual behavior is important source of stimulation for another individual behavior [13]. Hence, conform to others falls under the category of social behavior; whereby the behavior of two or more people with respect to one another within a common environment [13]. For instance, the evolution of fashion happened through the way people utilize their dress, learned from and followed others.

5.3 Methodology

The integration of varying and disparate literature regarding the protocol studies has shown extraordinary potential to contribute to understanding designers' thought and response processes (see [14–16]). As a method for seeking insights into human-thought processes in complex cognitive tasks, Verbal Protocol Analysis (henceforth, referred to as VPA) was used in this study. The method has received the most attention in recent years and is regarded as the most likely method (perhaps the only method) to bring out the somewhat mysterious cognitive abilities of designers into the open. Before the VPA study was conducted, 30 photographs were captured by the researcher. Each photograph depicts the subtle and creative

ways in which people interact with a product. Using image-based research analysis [17] and Burri's [18] three visual dimensions of images, the photographs have been analyzed (see Fig. 5.1). As a result, each photograph has been categorized into four attributes of unconscious interaction in everyday human behavior, which is adapted from Suri [1] and Sohn et al. [3]. The reliability of analyzed images and its categories was obtained through survey study, which has been conducted by 30 respondents.

Specifically, for VPA study, four categorized images were selected as a stimulus (see Fig. 5.2). During the VPA study, two cameras were installed to capture different angles such as a whole angle of the designer when sitting on the table and a closer angle of the drawing pad. In order to ensure the designer's continuous verbalization, the researcher sat in front of the designer while the experiment is conducted (see Fig. 5.3). The VPA session began in earnest when designers started to conduct the experiment. At this point, designers began to verbalize and describe aloud what they are thinking as they generate a conceptual product ideation

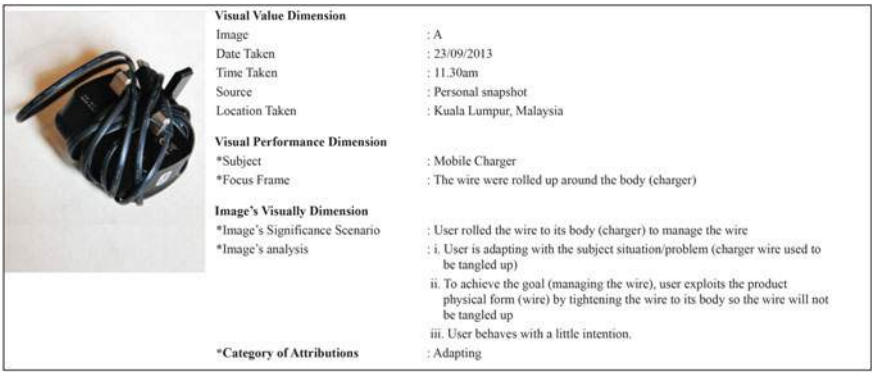

Fig. 5.1 Sample of image analysis

Fig. 5.2 Four polar images

Fig. 5.3 A three-dimensional illustration of designer and the researcher in actual VPA session

(sketching) based on their perceptions, analysis, and reflection on each polar image. In this paper, the designers' response toward the UICHB in everyday product was identified based on three research questions, as follows: (1) an analogy of "how we see things" is claimed as a common way of defining perception [19]. Thus, what are designers' perceptions toward the attributes of unconscious interaction in everyday human behavior as depicted in given polar images? (2) an analysis is a careful study of something to learn about its parts, what they do, and how they are related to each other [20]. Thus, what are designers' analysis on given polar images? and (3) reflection is a conscious and rational action that can lead to making innovation [21]. Thus, what are designers' reflections based on their analysis on given polar images? In order to identify these elements, the researcher needs to derive the explicit explanation and construct the abstract thought, which was grounded in the views of designers. Therefore, coding analysis using grounded theory approach was conducted.

In this study, open coding is used to identify the elements of interest as mentioned in the three research questions. For instance (see Fig. 5.4), in a study of designers' perceptions toward the adaptation attribute, the researcher coded the selected emphases of respondent's utterance and extracted the utterance's properties. The open coding in this study begins with writing simple descriptive labels or properties of utterance's analysis. The "Open Codes" column provides an excerpt of open coding from one of those utterance analyses. Then, open codes that were introduced have been renamed and organized in relation to one another. Once a category or a dimension has been determined, the researcher may need to return to the data, and recode the data regarding the emergent concept that is summarized in the category or the dimension. The process of clustering open codes via axial

No.	Protocol Time	Transcriptions	Properties	Open Codes	Axial Codes	Selective Codes
1	2:08	The behaviour in image A is an unconscious behaviour or generally known as habits which applied to most of human being.	1. Unconscious human behaviour 2. Generally known as habits	Adaptation is an unconscious interaction which generally known as habit	Adaptation is an unconscious interaction	Adaptation is a natural and unconscious interaction behaviour
2	1:52	the scenario as a common action pursuit by most people.	1. common action pursuit by most people.	Adaptation is a common interaction	Adaptation is a normal/natural /common interaction	Adaptation is a natural and unconscious interaction behaviour
3	1:36	the scenario as an interaction between user and a product to gain control onto the wire management	1. as an interaction between user and a product 2. gain control onto the wire management	1. Adaptation is an interaction between user and product 2. Adaptation helps to gain control on product	Adaptation is an interaction between user and product physical properties	Adaptation is a process to gain control of product by exploiting the physical properties

Fig. 5.4 Sample of coding using grounded theory approach

coding, followed by re-coding may have to be followed multiple times, once for each axial code. Finally, the selective coding was generated by interpreting the interrelationships that emerge among categories formed in axial coding. The selective coding retains only relevant and applicable variables to the core variables, to yield explicit information. In order to ensure the results of the VPA study support the central proposition and obtained subsequently validate/disprove the theory, the researcher applied a statistical test to quantify the qualitative coding. Hence, the outcome of the coding analysis was further analyzed using frequency analysis in SPSS V16.

5.4 Results and Discussion

Figure 5.5 illustrates the participants' response toward adapting attribute depicted in Image A. Based on the result, we found that most designers perceived adaptation attribute as an immediate interaction that occurs as part of the problem-solving processes. As described by designers through the VPA study, adaptation spontaneously occurred and interacted when such "need" arises. This finding expands Suri's [1] idea that human tends to alter the purpose or properties of things to meet a certain objective. For instance, users need to tie up the messy cable to avoid further problems (e.g., broken and malfunction cable). Moreover, the design problem (mobile charger) is critical element analyzed by most designers. Based on the VPA data, the problem was being analyzed as follows: (1) disproportionate size of the original mobile charger design; and (2) a lack of additional features of mobile charger design to manage the cable. However, the majority of designers end up with a design that revolves around a "rolling up" solution. Based on the VPA data, there are eight design concepts generated to provide the "rolling up" solution, i.e., (1) a mobile charger with clip; (2) a mobile charger with rolling space outside the main

Subject	Value Lable	Descriptions	Frequency	(%)
Image A	Perception on Adaptation Attribute in Image A	Adaptation is a process to gain control of product by exploiting the physical properties	4	13.3
		Adaptation is an immediate interaction which occurred to solve the problem and manage things	14	46.7
		Adaptation is a natural and unconscious interaction behaviour	11	36.7
		Adaptation was resulted from the repetition process of everyday life	1	3.3
		Total	30	100
	Designers' Analysis Based on Image A	Analyse the problem of mobile charger design in Image A	18	60.0
		Analyse the inappropriate interaction and behaviour as depicted in Image A	11	36.7
		Analyse the human issues in interaction as depicted in Image A	1	3.3
		Total	30	100.0
	Designers' Reflection Based on Their Analysis in Image A	Reflect to design a rolling solution	24	80.0
		Reflect to protect the cable	4	13.3
		Reflect to design an abstract form inspired by the messy cable	1	3.3
		Reflect to build a design service	1	3.3
		Total	30	100.0

Fig. 5.5 The result of participants' response toward adapting attribute depicted in Image A

body; (3) a mobile charger with a hook; (4) a mobile charger with an automatic rolling system inside the main body; (5) a mobile charger with a manual rolling system inside the main body; (6) universal cap to tie the cable; (7) a mobile charger as a fashioned accessory; and (8) a mobile charger with a built-in compartment.

Figure 5.6 illustrates the results of participants' response toward signaling attribute depicted in Image B. Based on the result, we found that most designers perceived signaling as an attribute that has various and proper approaches which results in a different level of communication efficiency. As described by designers in the VPA study, there are many ways of signaling. However, each approach requires a significant element to make it communicable at certain level of efficiencies. Meanwhile, the issues of inappropriate signaling approach are the critical element analyzed by most designers. For instance, according to the participants, sticking the paper notes is not a suitable medium for signaling. The writing on the sticky notes could be washed out by heavy rain or the notes itself can be blown away by the wind. Moreover, the participants mostly reflect to design signaling features. The data also generated six design concepts, which aims to provide signaling solutions, i.e., (1) a parking meter with a slotting indicator card; (2) a parking meter with slide down indicator cap cover; (3) a parking meter with screen indicator; (4) a parking meter with light-emitting diode (LED) indicator; (5) a parking meter with a writing space; and (6) a parking meter with foldable indicator bag.

Figure 5.7 illustrates the results of participants' response toward reacting attribute depicted in Image C. We found that reacting attribute is perceived by most participants as a common form of interaction. The participants described reacting as

Subject	Value Lable	Descriptions	Frequency	(%)
Image B	Perception on Signaling Attribute in Image B	Signalling required an appropriate approach	9	30.0
		Signalling has a various and proper approach which result a different level of communication efficiencies	13	43.3
		Signalling has a significance relationship with human nature, morality, and values	6	20.0
		Visual is an essential key for signalling to provide a good notification	2	6.7
		Total	30	100.0
	Designers' Analysis Based on Image B	Analyse the inappropriate signalling approach in Image B	12	40.0
		Analyse the negative impact of having non-signalling features in parking metre	5	16.7
		Analyse the issues of responsibility in using public property	6	20.0
		Analyse the design problem of parking metre in Image B	7	23.3
		Total	30	100.0
	Designers' Reflection Based on Their Analysis in Image B	Reflect to design signalling features	24	80.0
		Reflect to develop the aesthetic element of parking metre	1	3.3
		Reflect to enhance parking system efficiencies	3	10.0
		Reflect to design an abstract form inspired by depression expression from the malfunction parking metre	1	3.3
		Reflect to provide a public service announcement (PSA) on responsibility issues	1	3.3
		Total	30	100.0

Fig. 5.6 The result of participants' response toward signaling attribute depicted in Image B

Subject	Value Lable	Descriptions	Frequency	(%)
Image C	Perception on Reacting Attribute in Image C	Reacting is a common interaction	9	30.0
		Reacting is an unconscious interaction	7	23.3
		Reacting is a manifestation of habit	7	23.3
		Reaction occurred under certain circumstances and surrounding	3	10.0
		Reacting occurred from the interaction between human and product physical properties	3	10.0
		Reacting may cause a negative implication	1	3.3
		Total	30	100.0
	Designers' Analysis Based on Image C	Analyse the factor of biting pen	19	63.3
		Analyse the negative impact of biting pen	11	36.7
		Total	30	100.0
	Designers' Reflection Based on Their Analysis in Image C	Reflect to provoking interaction between user and the pen	19	63.3
		Reflect to prevent user from biting the pen	9	30.3
		Reflect to enhance the pen features	1	3.3
		Reflect to design a pen with curly handgrip	1	3.3
		Total	30	100.0

Fig. 5.7 The result of participants' response toward reacting attribute depicted in Image C

a common form of interaction, especially when the person is reading alone but still depends on the situation, venue, or even the types of book. This is in agreement with Suri [1], which indicates that humans are reacting automatically with the affordance of an object (e.g., physical properties) and spaces that they encounter, even without any purpose. Meanwhile, most participants analyze the rationale behind the pen-biting habit. It includes, among others, (1) users might get bored and start to chew the pen and (2) biting a pen helps users to manage the stress. The participants also mostly reflected to provoking interaction between the user and the pen. The data generated six design concepts, which aims to provoke interaction between user and the pen, i.e., (1) a pen with a candy on top; (2) a pen with paper bullet trigger; (3) a pen with a special hole for swinging; (4) a pen with a comfort biting spot; (5) a pen with health indicator; and (6) a pen that emits music sound whenever knocked.

Figure 5.8 illustrates the results of participants' response toward confirming to others attribute depicted in Image D. We found that conforming to others attribute as perceived by most participants can be justified as following the style and trend. This style and trend of behavior arise because one organism is important to another as part of its evolving environment [14]. Meanwhile, most designers analyzed that the glasses may fall if it is hanged to the collar. For instance, when a Muslim user with his glasses hanged at his collar bent a little forward for ablution, the glasses

Subject	Value Lable	Descriptions	Frequency	(%)
Image D	Perception on Conforming to Others Attribute in Image D	Conforming to others can be justified as following the style and trend	10	33.3
		Humans are conforming to others because they were adapted to what others did	4	13.3
		Humans are conforming to others in order to simplify and managing their things	7	23.3
		Conforming to others is a common interaction and behaviour	5	16.7
		Conforming to others is an unconscious behaviour interaction	1	3.3
		Human was influenced by environment when conforming to others	1	3.3
		Conforming to others can be justified as habit	1	3.3
		Conforming to others can be done in various ways	1	3.3
		Total	30	100.0
	Designers' Analysis Based on Image D	Analyse that the glassed may fall if hanged to the collar	14	46.7
		Analyse that the glasses' lens may get scratched if hanged to the collar	2	6.7
		Analyse that hanging a glasses to the collar is a trend and fashion	14	46.7
		Total	30	100.0
	Designers' Reflection Based on Their Analysis in Image D	Reflect to provide a hanging solution	17	56.7
		Reflect to protect the lens	10	33.3
		Reflect to add hi-tech values on glasses.	2	6.7
		Reflect to design an abstract form inspired by glasses material	1	3.3
		Total	30	100.0

Fig. 5.8 The result of participants' response toward confirming to others attribute in Image D

may slip and fall. The data generated three categories of design concept, which includes (1) glasses with supporting hanging cable and a built-in MP3 player; (2) glasses with special frame features that enable safe hanging solution; and (3) a shirt design with special holes for safe hanging solution.

5.5 Summary

Based on the results, we can conclude that our aims of this study have been met; to assess designers' perception, analysis, and reflective toward the theory UICHB using VPA. Through the study, we found that designers were able to perceive, understand, analyze, and reflect to enhance the value of an existing product by interpreting the design needs from the four attributes of unconscious interaction in everyday human behavior. This study contributes to provide a good insight of understanding designers' design thinking on conceptual ideation level based on their response toward the attributes of UICHB, which lead to new interpretation and present opportunities for new design solutions. Moreover, the study provides an alternative technique of using VPA as a comprehensive approach to look at the positive possibilities in the realms of unconsciousness and embodied human interaction for product design ideation.

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