PHOTO-BASED RESEARCH: ANALYSING ATTRIBUTES OF UNINTENDED INTERACTION TOWARDS MAINSTREAM PRODUCT

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ABSTRACT

This paper intends to critically assess the attributes of unintended interaction patterns that influence human behaviour towards mainstream products. Several such studies focus on investigating the influence of human experience on users' and designers ' differing concepts of existing products. Furthermore, some problems are found in current practice regarding whether photo-based research can be used to support scientific design research. This paper introduces the study's methodological approach, which employs photo-based analysis to uncover designers' interpretations of people's perceptions of unintended use of products by evaluating the attributes. The four main dimensions that describe sources or aspects of human experience and interaction with products were evaluated by 30 designers based on photo representation as well as to assess the reliability of photo analysis. Photos were used as research subjects for a series of assessment criteria and thoroughly examined according to Pauwels' theoretical framework of visual analysis. Comparisons were made based on an agreement measure. The findings of the study revealed significant descriptive patterns across several dimensions, resulting in the identification of aspects of understanding, experiences, and perception between users and designers. This study suggests that the approach used is applicable to assist in the design of product usability and in the design thinking process by informing the association between the specific dimension of human experience that is valuable for conceptual product design and innovation.

Keywords: Design thinking, mainstream product, unintended human behaviour, user interaction, photo-based analysis

1 INTRODUCTION

Product design and behavioural research are topics of significant relevance for user interaction studies, as these are the main elements that connect people, products, and designers, providing intuitive, enjoyable, and satisfying design of user-products [1]. Research that promotes designers' involvement with users' experiences as a crucial part of the design process emerged in response to improving the design of user-product interactions. Previous studies reviewed the problem that intended use designs do not always translate into actual use and users' needs [2][3]. They conclude that designers directly translate user perceptions or needs based on their understanding. Indirectly, the situation causes the use of products beyond the designer's expectations. Designers' interpretations of the issues may differ due to knowledge and individual experience in understanding users' experiences and the reality of people's lives [1]. In dealing with the issue of using products out of context, understanding the factors that influence human experiences is crucial. In psychology studies, such a phenomenon is defined as "unintended human behaviour" (UHBe) when people unintentionally use a product in a way that deviates from the designer's intent [4][5][6]. The phenomenon of using a product in a novel way encompasses the interaction between the cognitive process and behaviour patterns that influence human perceptions and actions. According to Hassan et al. [6] UHBe exhibits inconsistency in action as a goal or objective without intentional intent and/or planning. In the context of user research, UHBe interactions occur regularly as users connect with diverse objects, resulting in unanticipated object use. Both conditions can happen if the object allows it, and the user believes in its efficiency. The statement aligns with the concept of "affordance," which holds that objects and human interactions inherently offer perceptual and ability-based opportunities for action. Norman [2] coined the concept of "design affordance" in

"Psychology of Everyday Things," which pertains to the way users perceive the capabilities of an object. As claimed by Gibson's theory of perception, human beings acquire information about objects through direct perception, which is intricately linked to the potential behaviour manifested by the environment. Several scholars on the notion of UHBe concur that unintentional occurrences often reveal insights into people's needs that designers can use to create design opportunities [5][7][8][9][10]. Referring to Sleeswijk et al., [11], diverse design methods and approaches have been developed to overcome this problem. These methods and approaches show an increasing interest in understanding user behaviour and interpretation [5][12], context-of-use issues [11], design concept [3], and everyday design [8][13]. Although these design approaches have aided designers in collecting information about user needs, they have not facilitated a deeper comprehension of how human perception aligns with the product's interaction experience. To address this shortfall, this paper introduces a study that investigates how designers interpret and assess the attributes of UHBe based on user perception, which followed the preceding study [14]. Further, a comparison between user-designer interpretations would be discussed based on an agreement measure. The approach provides an early-step evaluation of human perception that can benefit the early design process.

2   BACKGROUND STUDY

2.1 The Attributes of Unintended Interaction

Human behaviour reflects the interaction between humans and their environment, showcasing their mental, physical, and social capacities in response to internal and external factors across their lifespan, intentionally or unintentionally, consciously or unconsciously. Conforming to Freud [15], behaviours that demonstrate the achievement of an unconscious intention appear to be clumsy and interfere with unintentional acts. There is limited discussion on UHBe interaction in design studies to interpret the phenomena in the context of design thinking. For that reason, a comprehensive study has been conducted to investigates the value and prospect of UHBe for enhancing user-product design. The term unintended use of a product in user research refers to the innovative use of a product by individuals and have new sensory experiences. Ridgway and Price [16] concluded that UHBe as "unplanned behaviour" involves the introduction of new ideas, innovation, and solutions to issues. Hirschman [4] concurs with Ridgway and Price's statement and then creates a model of use innovativeness (UI) that includes two forms of behaviour when users creatively use existing products: inherent use innovativeness (IUI) and actualized use innovativeness (AUI). Later, they provided a theoretical framework by highlighting five dimensions in the Model of Use Innovativeness to evaluate such "unplanned behaviour": risk-taking, voluntary simplicity, creativity/curiosity, multiple use, and creative use. Menold et al. [17] condensed the dimensions into four categories for assessing creative attributes, actions, and cognition: creativity/curiosity, voluntary simplicity, risk-taking, and multiple uses/creativeness. In identifying a dominant characteristic that underlines UHBe interaction, 32 attributes were analysed through Visual Inventory Analysis (VIA) from a user perspective. The attributes were derived from research on unexpected behaviours, designing appropriation, unorthodox use, non-intentional design, design by use, and unselfconscious interaction [6]. Figure 1 reveal the attribution of UHBe extracted by the UI model for each dimension. The characteristic of the dimensions as portray in Figure 2.
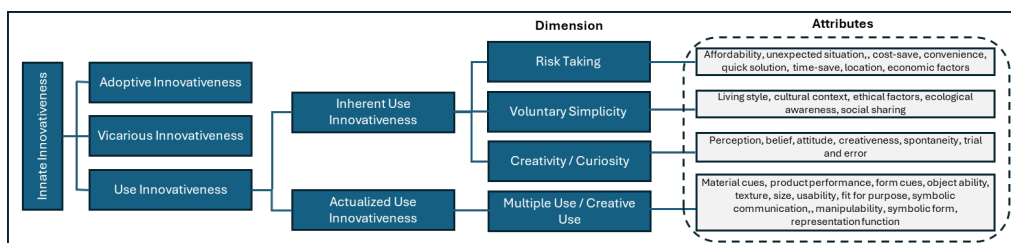

Figure 1. The attributes of UHBe adapted by UI model

Through VIA, the participants analysed the attributes via a visual that represent UHBe in everyday interaction with mainstream products. The results of the analysis found four dominant attributes that represented four dimensions of UI, as depict in Table 1. Based on the preceding study, 88.6% of respondents concurred that 'quick solution' (risk-taking dimension) was a dominant attribute that triggers UHBe interaction with existing products. They corroborate a statement that users unintendedly interact with a product to perform and streamline everyday tasks due to a lack of access to specific

products in urgent or emergency conditions that occur unexpectedly. For instance, some people cover their heads with a plastic bag instead of using an umbrella on a rainy day. They seek an alternative object (an existing product) that can effectively fulfil the intended objective, even if it involves some risk. As Norman [2] stated, user product design is affected by differences between designers' and users' concepts of product. The question arises: how different are their interpretations? Will the difference provide a point of meaningful insight in the early design process and create value for conceptual product design? Thus, this paper suggests an approach using photo-based analysis (P-BA) to assess designer interpretation and associate the differences to inform the value of UHBe interaction.
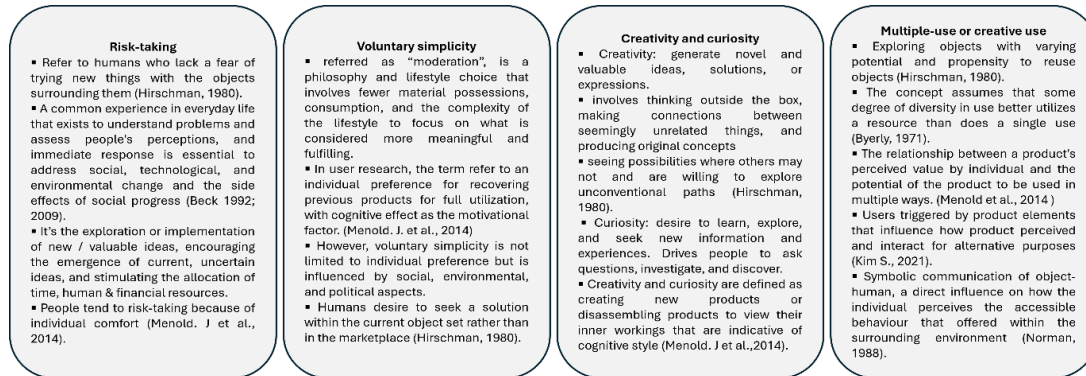

Figure 2. The characteristic of UHBe attribute [14]

Table 1. The result of user's perception towards UHBe

Visual Inventory Analysis	Scale Analysis	Dominant Attributes Analysis			
		Curiosity & Creativity: Trial & Error / Creativeness	Voluntary Simplicity: Social	Risk-Taking: Quick Solution	Multiple Use: Object Ability
	Strongly Disagree / Disagree [%]	1.4	0.0	0.0	1.4
	Moderately Agree [%]	17.1	12.9	11.4	14.3
	Strongly Agree / Agree [%]	81.5	87.2	88.6	84.3

2.2 Photo-Based Research

Visual media is having an increasingly significant impact on our society and culture as they depict human experiences, behaviours, and emotions in daily life. In recent decades, researchers in the social sciences have begun to pay serious attention to the use of images to enhance their understanding of the human condition [18] and use photos for the analysis and interpretation of images, focusing on the underlying meaning behind the images [19]. Recently, P-BA research has gained popularity as an important form of "social.". In a study by Copes and Davis [19], scholars enhance current approaches by introducing a new perspective, collecting detailed multi-dimensional information, and providing valuable understandings about participants' daily lives. Photo images are "active", performing the visual equivalent of speech acts; the audiences of an image participate in interpreting its meaning and responding to its particular "action." Burri [20] proposed the concept of "visual rationality," where images become vital parts of knowledge reasoning processes to be more visual based rather than just linguistic or textual, and how the visual leads to phenomena like "seeing with images," where insights come directly from engaging with visuals. In mainstream research, P-BA is considered a supplementary resource to text-based research. Thus, this paper employs an integrated framework for a visual research study [21] to provide a comprehensive understanding and critical analysis of the phenomenon.

3 METHODS

This study employs P-BA to assess the attributes of the UHBe interaction. The photo has been extracted through three different approaches: (i) natural observation (researchers' sources), (ii) voluntary images (participation sharing), and (iii) social media (public posts). There were four sections in this study that the respondents examined. The first section was the visual reference section (focus frame). The other three sections were Visual Data Resource (source and subject), Visual Research Focus and Design (analytical focus, content analysis, and visual dimension attributes), and Overall Analysis (adapted from Pauwel's integrated framework of visual research) [21]. According to Pauwel's framework, the visual analysis process continues by carefully presenting plates of photos illustrating the theoretical point. The survey provided a text description to support respondent perceptions in the photo analysis process. The

first section was the backbone for the three other sections to determine the response of the respondent in evaluating the attributes of UHBe. The photo was derived from social media and was classified as a "found image" (the highest scored image selected by respondents in the preceding paper) and was the most common interaction and context of use that has been seen, experienced, and practiced by society in unintended ways [14]. The image presented the context of "parents bathing their babies using a wash basin." This study used the Likert scale (1: "strongly disagree" to 5: "strongly agree"). Four different levels of product designers involved in the survey responded with a critical understanding of the phenomenon and confirmed that the photo analysis was accurate. 30 designers were involved, consisting of 10 junior, 8 novice, 7 senior, and 5 expert product designers. The designers were selected using a snowball approach from a clearly defined group, as well as to clarify the reliability of the photo analysis.

4   FINDINGS

This section presents the results of the P-BA on 30 respondents to the research survey. Some photo analysis segments are reported in detail through explanation and discussion by relating the significant findings to the literature gathered in the research area. P-BA was designed based on Pauwel's framework [21] using the highest score image that was selected by the user as representing the significant UHBe interaction, which was extracted from the preceding paper. Due to ethical issues, the image was only revealed to the participants involved in the survey and was blurred for publishing purposes. Figure 3 illustrates a set of evaluation schemes for P-BA designed in the study.

Figure 3. Sample of Photo-based research Analysis

4.1 Photo Analysis finding

The respondent was requested to analyse and interpret four sections of the survey scheme, which depended on the photo in Section 1 accordingly. Section 1: Visual research reference (focus frame) indicated that the images were identified as "people bathing a baby using a wash basin." Section 2: Analysis of visual data resources required the respondent to give their opinion on whether the photo can be found on social media such as Facebook, a blog, or on other media platforms. They were also requested to make a validation on the photo's subject, consisting of (i) the first user (the parents); (ii) the second user (the child); and (iii) the product being interacted with (the washbasin). Section 3: For the analysis of visual research focus and design, the respondent interpreted the photo through (i) analytical focus; (ii) content analysis; and (iii) visual dimension. Analytical focus refers to the context of use often practiced by users. They assess the significance of the scenario and whether a wash basin is often used for bathing a baby instead of a baby bathtub due to the unavailability of the product in a daily context. Content analysis indicates that people achieve the goal (bathing a baby) by exploiting the physical properties of the object (wash basin: form, surface, height, water source). The analytical focus and content analysis were the analytical lenses through which the research subjects examined the visual stimuli, revealing any possible biases or focal orientations that might have influenced the interpretation of the data. Visual dimension analysis is the heart of this study. It reveals four main attributes that represent four dimensions of UHBe according to user perception, namely, creativity and curiosity, voluntary simplicity, risk-taking, and multiple use. Finally, the overall analysis represented a holistic overview of the predominant sources of analysis, shedding light on the primary reservoirs of insights leveraged throughout the study. The result of the analysis will be discussed in the next section.

4.2 Respondent Evaluation of the Photo-based Analysis

The table (Table 2) encapsulates the findings of a research endeavour aimed at elucidating the factors triggering UHBe in mainstream products, focusing particularly on the four dimensions: curiosity/creativity, voluntary simplicity, risk-taking, and multiple use. The study engaged four distinct

levels of product designers (junior, novice, senior, and expert) as respondents to provide a critical understanding of the phenomenon as well as confirm the reliability of the photo analysis. The table is structured into four main sections, delineating critical aspects of the research process and outcomes. Based on the result, the evaluation of the photo analysis gained a positive response from respondents, where all nine items are mostly rated as "good." The analysis went through section by section, except for Visual Reference. In the Visual Data Resource section, the source of the photo evaluation score is 73.3%. However, in the subject column, the score is good and rated at 80%. The respondents agreed that the photo reference was clearly representative of the first and second users using subject research. In the section on Visual Research Focus and Design, there are three components of evaluation: (1) "Analytical Focus" scored 70%, and (2) "Content Analysis" scored the highest at 90%. This means that the respondents strongly agreed with the description that the image portrayed the situation of the user's goal by exploiting the physical properties of the object unintendedly. As the focus of the study, (3) "Visual Dimension Attribution" has mutual agreement among the respondents. The multiple use dimension has the highest score as 93.3%, and respondents strongly agreed that the *object ability* (Oa) influences human cognition while interacting with the product. The second highest rate that portrays UHBe is the risk-taking dimension, with a score of 87.6% through the factor of *quick solutions* (Qs). However, *trial and error* (Tt) and the *social sharing* (Ss) attribute have a lower score than Oa and Qs, with 80% agreement. Meanwhile, there were respondents who strongly disagreed (3.3%) that trial and error and social sharing attributes may influence UHBe. Nevertheless, the overall analysis was rated according to different perceptions of evaluation, with scores of only 76.7% strongly agree or agree, 16.7% moderately agree, and 6.6% strongly disagree or disagree.

Table 2. The result of respondent evaluation on photo analysis

Visual Research Reference	Scale Analysis	Visual Data Resource		Visual Rersearch Focus & Design						Overall Analysis
				Analytical Focus	Content Analysis	Visual Dimension: Attribution				
		Source	Subject			Curiosity & Creativity: Trial & Error / Creativeness	Voluntary Simplicity: Social	Risk-Taking: Quick Solution	Multiple Use: Object Ability	
	Strongly Disagree / Disagree [%]	6.7	3.3	6.7	3.3	3.3	0.0	3.3	0.0	6.6
	Moderately Agree [%]	20.0	16.7	23.3	6.7	16.7	20.0	10.0	6.7	16.7
	Strongly Agree / Agree [%]	73.3	80.0	70.0	90.0	80.0	80.0	86.7	93.3	76.7

4.3 Associating the Differences

The contradiction between the designers' interpretation and the users' perception reveals a slight discrepancy in Oa and Qs attributes. Numerous designers agree that UHBe is influenced by Oa. They make a judgement based on their understanding, knowledge, and experience about design affordance, as emphasised by Norman [2]. Later, the designers agree that Qs attribution is the second-highest attribute that influences UHBe interaction. They perceive that the actions are linked to the context of the use of everyday objects. Contrary to the users' perception, they conclude that Qs and Ss are the most important attributes that trigger UHBe interaction among users. The users believe that such behaviour is influenced by social context and life experiences such as open access to social media, internet of thing, or cultural factors, nowadays. However, the difference in the level of knowledge about the value and objective of the product causes the users to slightly disagree on the Oa of the product, which triggers UHBe compared to the designers' perception. Thus, the design team should consider these differences in early product design activity because users are the buyers of the products. Throughout the literature on UHBe research, scholars have posited that user actions and interactions give an important 'signal' to design team [1][2][5][6][8][15][22]. They believe users would maximise the use of the product function, whether intended or unintended. However, both user-designer interpretations of UHBe have an almost parallel view of the "quick solution" attribution based on the percentage of agreement obtained. In summary, each attribute proposed and discussed in this study has a value that could be considered appropriately in different contexts.

5 CONCLUSIONS AND FUTURE WORK

Principally, designers should be more sensitive to factors that can inspire and innovate ideas, such as sharing on social media and the life context of users. The user's insistence on the nature of instant solutions reflects the real situation of human life today, which is faced with time constraints, emergencies, and economic status. These differences should be celebrated to find a unification that can benefit all parties. Although UHBe faces certain risks, designers should look at the meaningful side by understanding human behaviour more realistically. The implications of this study allow designers to

expand their design thinking parameters based on the potential of UHBe interactions and create motivation for new product design concepts. We believe that P-BA approach used in this study can be used as a guideline to improve the parameters of design thinking for designers in conceptual design and does not depend on the interpretation of the designers' experience alone. We can conclude that the objective of this study has been fulfilled: to observe creative ways in which people unintendedly interact with the product, as well as to assess the factors and attributes of interaction and obtain validation of reliability. Despite the limited number of respondents, the study consistently found a cohesive pattern of perceptions. To enhance in-depth understanding of the phenomenon, verbal protocol analysis will be conducted to investigate designer interpretations and reflections through the design activity.

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