

Emotional Design on User Experience-based Development System

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Abstract— In UX, user as a center of the process has crucial role in determining the quality of a system. System has broad definition. In this study, system definition restricted to the outcome of information technology (IT) product. So far, there are so many approaches which are involving user as a center of process. Involving user in the UX process is not limited as evaluator in the measurement. Moreover, user research should be conducted deeply aims to excavate all about user deeper. Functionality and usability are two measurements methods which ensure user can experience using system intuitively. In order to excavate intuitive experience, it is required to figure out user deeper. Furthermore, physiological and psychological aspects are mandatory to be discussed. Psychology and physiology theories are related to the processes of designing system. This study aims to conduct argumentative literature review about the emotional design on the user experience (UX). Papers reviewed had been selected and limited related to the problems. Result of this study is proposed methodology. This methodology is proposed aims to gain deeper perspective on user research. Hopefully, this methodology can be considered to strengthen ideas about user mental model theories into system development.

Keywords—UX process, mental model, user-based development, psychology aspects, physiology aspects

I. INTRODUCTION

Recent days, creative development cannot be distinguished in system development. System has broad definition. In this study, system definition restricted to the outcome of information technology (IT) product which is involving user interaction. Related to this study, system can be defined as IT product which has user interface. Some indicators such as aesthetics, ergonomics, and marketable products are mandatory to be considered in system development processes. Ouden et al. had highlighted about the importance of fulfilling consumer's expectations. In their research, Ouden et al. state the condition when product function is already accordance to the specification but not meet the consumer's expectation. This condition causes failure in development [1]. Actually, user as the center of development, is mandatory to be involved in each development processes. But, the depth of the involvement is not deep enough. Human aspects were often ignored in almost all developments process. Even though, human aspects are crucial to gain intuitive system. Intuitive system has proven lures user when operating the system. User experience (UX) is emerging as a phenomenon to gain better usability by

considering users desire. Good interaction between user and system can be conducted better utilizing UX [2] on [3]. UX processes aim to figure out user as a human-being. Human aspects, such as emotion, beliefs, preferences, perceptions, behavior considered to be applied into design processes [4].

The study of system development has been expanded into new paradigms. It entangles user research which in order to explore every possibility to develop innovative and intuitive system [5]. To achieve ideal conditions, human behavior should be discussed. Users as human-being are reacting based on their circumstances utilizing conscious and unconscious minds. Human's emotional responses are various between generations, social groups, nationalities and cultures [26]. To produce emotional-based development, user's technological problems should be considered [22]. Unconscious mind is hard to be identified. In UX development process, human behavior may be accommodated, but still on the beneath of surface. The level of measurement still on the conscious minds level. Nielsen and Molich stated that good system has to facilitate user to recognize rather than recall utilizing their memory [6]. Better system accommodates user to minimize the load of memory. Specifically, study conducted by Hua and Fai (2009), stated that many designers had ignored unconscious mind on their development processes [7]. Even though, unconscious mind is dominating how human reacts daily.

In the book titled *How We Love (and Hate) Everyday Things*, Don Norman had formalized condition where unconscious mind was applied into development process [8]. Those condition had been used as a base of diverse studies associated to emotional design. The condition had formalized specifically into three sequences level, they are visceral, behavioral, and reflective. Visceral level reflects how user convinced on something he/she believe. Behavioral is the level when user actively using his/her conscious mind. Reflective is the cognitive level when user conclude about something after receive new information. Based on case study in the system development, user can conclude whether system has already fulfilled his desire or not. Izard (2013), stated that human behavior was directly affected by human emotions [9]. Human emotions as general and psychological aspect as specific had conducted by [23] on their research aims to meet user need. Moreover, emotion affects perception and cognition [9].

This study aims to review some literatures and propose idea about the urgency of emotional design in the system development process. So far, there is no existence formal

process had been proposed to measure mental model-based development [10] [26]. Usability method is useful to identify usability-technical problems. Despite, Quinones et al (2018), stated that there is no specific theory or model that is appropriate to identify heuristic usability problems [3]. Furthermore, user desire is not being identified deeply. Hopefully, emotional science can be simplified in order to be implemented in UX-based software development. Although it is difficult to identify human unconscious mind perfectly, it still can be considered as a useful idea to expand the quality of the observation on system development [5]. Human behavior is reacting based on direct consequence of indicators such as emotions, perception, cognition, personality system, body language, and mind. Hopefully, it will be improved in future works [30].

In the rest of papers, we divide into several sections. First section, we provide research methodology. Second, we provide literature reviews about UX theories. Third, we provide a discussion about the human emotion model and its relevance to the UX process. Forth, we provide a discussion about the usability issues related to UX and human emotional aspects. Fifth, we propose methodology which is combining between UX process and human emotional model. Last, we provide conclusion and future works.

II. RESEARCH METHODOLOGY

Generally, this study is conducted based on literature review. This study aims to generate idea about the emotional design being involved into system development. Emotional design is used as a theoretical base, specifically using Norman's emotional design. UX is used as a systematic way to gain intuitive system development. Literature review specifically divided by two discussions, emotional design and the experience of users. Papers reviewed had been collected from various journal, using these keywords '*emotional design*', '*psychological aspect in UX*', '*physiological aspect in UX*', and '*user experience mental model*'. Moreover, this study aims to strengthen UX processes. User research is conducted deeper than before. Research methodology can be simplified into these sections.

- a. Framing topics and limitations
- b. Conceptualization
- c. Literature review
- d. Propose idea

USER EXPERIENCE

User experience (UX) trend is emerging in recent system development. User-centered development is becoming the advantages in UX processes. UX measurement aims to determine how user feels on targeted system [11]. Based on several studies, UX processes aims to develop system efficiently and effectively. It is quietly relevant to the definition of the usability which is aims to develop efficient, effective, and satisfaction system in order to achieve specific goals [4] [12]. Efficient system means user need less effort when finishing their jobs. Effective means system is intuitively fulfilling user desire. Moreover, system not only

good developed but better understanding user's desire. To develop system which relevant to those indicators, need more understanding about users. Understanding users is mandatory in UX Process, reflected by user research. Understanding users is helpful in order to achieve desired system [13]. In user-centered design (UCD) theories, result of user research reflected by personas. Personas is collected users who are chosen as a result which is assumed to represent the end-users. Different characters of human emotion are used as a base to pick each persona. Hopefully, each persona is observed deeply based on their emotional (conscious and unconscious) minds. UX was affected by these indicators, they are usefulness, need fulfillment, and negative emotions in order to achieve better result [24]. Next section, we discuss about human emotional model, which is relevant to the purpose of the study. Finally, [25] on [24] had shown that emotions are integral to the experiences and actions.

III. HUMAN EMOTIONAL DESIGN

There are some papers discussed about emotional design had found. But, only several papers are selected because of their relevancy to the UX domain. The papers which selected are chosen based on specific keywords '*emotional design*' on '*UX*'. Some of those papers are presented. Brief of literature review shown in Table I. Summary that is presented reflects the brief of discussion about emotional design on the papers.

TABLE I. BRIEF OF LITERATURE REVIEW RELEVANT TO EMOTIONAL DESIGN

Study	Summary
Cherry (2010) [15]	Emotional design can be classified into three levels, physiological, neurological, and cognitive. According to physiological theories, emotions are generated by reactions inside the body. Neurological theories on the other hand advise that emotions are engendered by activity inside the brain. Cognitive theories claim that emotions are mainly created by thoughts. Those three levels can be used as emotional base theory in order to develop system.
Buxton (1994) [28]	Human nature and abilities can be distinguished into three levels: physical, cognitive, and social. Physical level involves human senses, such as look, geometry, color, proportion, material, texture, and color. Cognitive level discusses about the user perception when interacting with system. Social level discusses about the interaction and social environment. Those three levels can be used as practical guidelines to develop UX-based

	system.
Demirbilek and Sener (2003) [26]	Design elements are included in the physical layer. Design elements can trigger positive emotions and sensory pleasure, such as fun, cuteness, and familiarity. Design elements as discussed above tell about the importance of emotional aspects in order to produce intuitive system.
Scupelli and Hanington (2014) [27], Norman (2004) [8]	Design the emotional-based system concerns on visceral, behavioral, reflective. Visceral related to design qualities and appearance, such as color and aesthetics. Behavioral related to effectiveness and ease of use, such as function and usability. Reflective related to interpretation understanding, such as personal experience and story. This conclusion tells about the emotional-base guidelines in order to develop intuitive system.
Yan and Cheng (2008) [29]	User experience approach is related to some aspects, such as psychological process, perception of the outside world, cognition of the product utilization, and product reflection. This conclusion tells about the relevancy between UX and emotional aspects.
Partala and Saari (2015) [24]	Emotions are highly involved in user experiences (UX). The successful of UX product is affected by usefulness, need fulfillment, and negative emotions in successful adoptions. This result tells about the relevancy between UX and emotion. Moreover, some aspects indicate the importance of emotional aspects in order to develop system.
Pucillo and Cascini (2014) [23]	Psychological aspects are relevant to discuss in order to meet user needs. In this study, framework had been developed with some aspects involved, such as experience of use, effect, and manipulation affordance. This result show about how relevant psychological aspects, as a part of emotional theory, in system development.
Jokinen (2015) [22]	Emotional aspect and UX is dependent. Their dependence is related on the behavior. Human behavior are related on user technological problem-solving tendency, frustration tendency, pre-task

	self-confidence, and task performance while interacting with system. Human behaviors which discussed are related to the domain of emotional design, such as frustration tendencies and self-confidence.
Kamil and Abidin (2017) [5]	Unconscious mind is useful to establish idea and understanding human needs in order to develop system. This result show about how relevant unconscious mind, as a part of emotional design theory, in order to develop system.

The brief of summary which presented above are following the discussion about the summary of the selected papers and the relevancy with this study. Human try solve problem by themselves, before expressing to anyone else. Moreover, they immediately use their intuition and creativity to solve problems, instead of following instructions [16]. Human is act dominantly based on unconscious minds reactions. Unconscious minds as a pool of thoughts, memories, and feelings beyond conscious minds [17] on [5]. Unconscious minds affect how human behave on current existence condition. Unconscious mind is useful to establish idea and generate innovative design [5]. Don Norman, formalized design processes into three levels, they are visceral, behavioral, and reflective. In his book *Why We Love (or Hate) Everyday Things*, he was called his concept as Norman's Emotional Model [8].

A. Visceral phase

This is the human nature, their instinct regarding to something new. Human has their own perspective created by experiences. Furthermore, their experience captivated by human senses, such as seeing, hearing, and touching [5]. Based on [14] and [28], this phase can be called as physical action, which related to fun, cuteness, and familiarity of user when operating system [26]. In other study, Yan and Cheng call this condition as perception of the outside world [29]. Visceral phase related to color and aesthetics [8] [15]. Accordance to the UX process, visceral level can be used to conduct user research which is aims to gain more effective result. This is urge to gain user's need based on their human sensory, instead of their current behavior. Based on Kamil and Abidin, interaction on visceral level has proven able to please user's sensory [5].

B. Behavioral phase

Behavioral phase can be defined as outer activity that is controlled by psychological aspects [7]. In this phase, user acts using conscious mind. Conscious mind is used to determine jobs given. Behavioral acts related to functionality and usability of the system [8] [15]. Yan and Cheng called this phase as cognition of the product utilization. A medium used to bridge between user's cognitive mind and product/system is prototyping. Prototyping is used as a medium by designer to

communicate with users. So, users could imagine sensation like interacting with real system. There is guideline to determine jobs such as hierarchical task analysis (HTA). To determine user's feeling while interacting with the system, cognitive walkthrough (CW) can be used as approach. CW was adopted from cognitive science in psychology theory.

C. Reflective phase

Psychological perspective said that human is reacting based on their recent circumstances. In reflective phase, user is comparing their belief by reflecting condition before and after interacting with the system. Yan and Cheng also call this condition as product reflection. User asked to tell about their experiences while interacting with system. Reflective related to personal experiences and stories [8] [15].

Heuristic evaluation (HE) is proposed to confirm current result. This is the most popular inspection method [18]. Quinones et al. comprehensively review HE method [3]. Despite there is still contradiction about the relevancy HE included in emotional model that is proposed. They recommend some aspects, such as playability, communicability, learnability, security and adaptability. In other research, Nielsen and Molich recommend ten design principles to be used [6]. We need some evaluator to conduct heuristic measurement based on usability principles [19]. Finally, HE should be well-designed, easy to use, and related to problems domain.

IV. HOW TO GAIN USABILITY?

Without good usability, concept that is proposed becomes useless. Good usability aims to ensure system will run effectively, efficiently, easily to use, easily to learn, and so on. Both usability measurements and UX processes are essential to gain good interaction design and produce good experience obtained by user. By utilizing cognitive walkthrough (CW), we can manifest physiology and psychology based development. In UX processes, personas can be used to figure out user deeply. In CW, user as personas will be supervised to measure prototypes. Prototypes are measured by following guidelines aims to finish jobs.

Heuristic is one of methods that is used to identify usability problems conducted by some experts [20]. As heuristics measurement stated by Nielsen, system must meet ten principles to fulfill usability's indicators [6]. Those ten principles are

- Visibility of system status
- Match between system and the real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetics and minimalist design
- Help users, recognize, diagnose and recover from errors
- Help and documentation. Another substantial thing in UX process is user research.

User research is one of the most important process regarding to UX process. By conducting user research, it has advantages to identify user need comprehensively. So, it is useful to reduce usability problems earlier. Comprehensive understanding between designer and user affects quality of system. Both CW and HE are considered to be combined in order to improve result. Finally, discussion in this study is systematically written based on Norman's emotional design phases.

V. METHODOLOGY PROPOSED

After literature review and discussion are conducted on the UX and human emotional design, we recommend alternative methodology as follows:

A. Visceral phase (Physiological)

In UX process, user research is often reflected by utilizing personas. Observing personas is mandatory in whole of development process, especially in the beginning. According to human emotional perspective, user's preferences must be understood. To gain good result, user's beliefs and experiences about design qualities and appearances (color and aesthetics) should be asked [15]. These questions are conducted based on physiological aspects which is often physically visible to human sensory such as color, proportion, material, and texture [28]. The examples of questions such as color preferences, gadget size, previous experience using system. It is relevant to the study conducted by Cherry in 2010 [14].

B. Behavioral phase (Psychological)

- Hierarchical task analysis (HTA) is designed as guidelines given by evaluator to personas to conduct jobs. HTA designed to measure both functionality and usability of system. HTA designed based on the interaction design. Interaction design is produced by conducting user research and needs analysis.
- After HTA designed, evaluator should produce some prototypes give to personas. Prototypes used as medium by evaluator to communicate ideas to personas. Sequence of prototypes used to evaluate interaction based on HTA and identify usability problems on design elements. Cherry (2010) was identify this action as neurological action [14]. In this phase, psychological aspects would be figured out. This phase will end after usability problems are repaired and user's desires are accommodated. Prototypes, iteratively produce until the condition is ideal (based on previous indicators).

C. Reflective phase (Ideology and Social/Emotion)

At the end, personas decide either use or ignore system. Personas will cognitively compare between their previous beliefs and recent beliefs by experiencing with prototypes. Personas could be asked to tell stories about their experiences. Cognitive walkthrough (CW) used as an approach. There are two goals in CW, interaction aspects and usability aspects.

Evaluator should pay attention on how personas behave. Measurement conducted based on physiology and psychology theories, such as memory load, eyes movement, and level of confusion while accessing system. Goal of CW measurement is help user to increase ease of learning. It is relevant to the study conducted by Cherry (2010) [14]. This phase is the most complex. Result of the measurement are abstract and ambiguous. There are so many condition, requiring evaluator to measure user psychologically than physiologically. The understanding of psychological theories and practices are mandatory to be mastered.

D. Confirming phase (Heuristic Measurement)

Heuristic measurement (HM) is optionally conducted to strengthen and improve the usability. HM is conducted by some evaluator those are chosen based on experiences and/or capabilities/expert in the domain of usability or user experience. Evaluator knowledge may be subjectively affects the results. HM should be well-designed, easy to use, and possible to identify usability problems [10]. There are some heuristic principles can be used as indicators given to evaluator, such as Nielsen's ten design principles [6]. Comprehensive HM research was conducted by Quinones et al [10].

Summary of discussion is presented on Figure 1. As shown in Figure 1, levels are conceptualized into three circles. The intersection of circles indicates the association between levels.

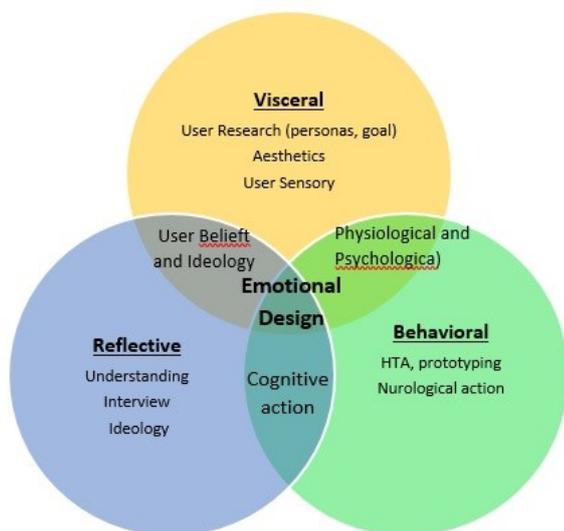


Figure 1 Circles of Proposed Methodology

Based on Figure 1, we can see three circles and three intersections. Each circle consists of some aspects inside, which related to the process required. Each circle is intersecting another circle. The intersection area produces the philosophy aspects in emotional design, such as psychological, cognitive action, and user belief.

VI. CONCLUSION AND FUTURE WORKS

Emotional design that is collaborated to UX process is irresistible. Good system/intuitive system should be developed

considering user's desire, not only functionality. User's desire only can be figured out by understanding user deeper in user research. Emotional design can be divided into three processes, they are physiological, psychological, and ideology. Each step requires deeply analysis on user's as human being.

So far, UX process has been involved user in the development. But, strongly deep analysis on user's emotional design could be better. Norman, had formalized emotional design method into three processes, they are visceral, behavioral, and reflective. Those three levels can be used as a theoretical base in UX development based on emotional aspects. So far, heuristic evaluation (HE) is used to measure quality of system. But, it is only fulfilling usability-technical problems. The combination of emotional design and HE hopefully can strengthen the UX-based development. Finally, proposed methodology can be considered as an alternative way to develop intuitive-based system. It is relevant because user as human-being is using emotional in daily action.

Recommendation of future works as follows. It is just the beginning study of potentially broader. In order to conduct more comprehensive result, literature review about cognitive science could be added. Furthermore, argumentative result in this study can be challenged by another study to strengthen the result. Moreover, psychological aspects are not discussed in more detail yet. Comprehensive methodology on psychological aspect is required in order to produce *ready to be implemented* methodology.

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