제품 사용성과 감성에 관한 개념적 연구*

Conceptual Framework for Emotions in Usability of Products

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Abstract: With the advent of computer technology, the fundamental nature of products has shaped from physical forms towards product interactivity. The focus is now on usability of the product with ease and efficiency rather than conversing with just the looks of the product. However, most definitions of usability and contemporary usability-related researches, have focused on the performance-oriented functional aspects of usability (i.e., how well users perform tasks using a product). Today, user expectations are higher; products that bring not only functional benefits but also emotional satisfaction. So far, there have been many studies on human emotions and the emotional side of products in the field of emotional engineering. Contemporary emotion-related researches have focused mainly on the relationship between product aesthetics and the emotional responses elicited by the products, but little is known about emotions elicited from using the products. The main objective of our research is analyzing user's emotional changes while using a product, to reveal the influence of usability on human emotions. In this research, we suggested conceptual framework for the study on the relationship between usability of products, and human emotions with emphasis on mobile phones. We also extracted emotional words for measuring user's emotions expressed not from looking at the product's appearance, but from using the product. First, we assembled a set of emotions that is sufficiently extensive to represent a general overview of the full repertoire of Korean emotions from the literature study. Secondly, we found emotional words in the after note by the users on the websites. Finally, verbal protocols in which the user says out loud what he/she is feeling while he/she is carrying out a task were collected. And then, the appropriateness of extracted emotional words was verified by the members of the consumer panel of a company through web survey. It is expected that emotional words extracted in this research will be used to measure user's emotional changes while using a product. Based on the conceptual framework suggested in this research, basic guidelines on interface design

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methods that reflect user's emotions will be illustrated.

**Key words**: usability, user's emotions, using products, emotional words

1. Introduction

Since the application of computer technology in products, usability that concerns the ease and efficiency of use has become the key factor of success rather than its appearance [9]. However, most definitions of usability and contemporary usability-related researches are focused only on objective aspects that is directly related to the user's performance (i.e., how well the users perform tasks while using a product). Nowadays, people look for something more: products that bring not only functional benefits but also emotional satisfaction.

Although there have been many studies on human emotions from the field of emotional engineering, most were about product appearance and the human emotion in relation to it. The researches on emotion and product usability merely show that human emotion affects product usability. In relation, Norman [8] claimed that negative emotions can make a simple task difficult, and that positive emotions can make a difficult task easier. However, little is known about emotions elicited by using the products and how the usability of products has effects on human emotions. Does good usability of products elicit positive emotions?

On the other hand, does bad usability of products elicit negative emotions? These questions have not been clearly answered yet. The main goal of this study is to reveal the influence of
usability on human emotions by analyzing the user's emotional changes while using a product.

Before proceeding into the research, we suggested a conceptual framework for the study on the relationship between usability of products and human emotions with emphasis on mobile phones. We also extracted emotional words to measure the user's emotion that is expressed, not from the product's appearance, but from the product's use.

2. Research methodology

For a successful outcome, the research is composed of literature study and experimentation. First, through literature study, research on the following contents should be performed. (See Figure 1)

- Understand the concepts of usability from studies on its definitions and attributes.
- Benchmark various usability evaluation methods.
- Suggest the most effective method to measure usability of products.
- Understand the concept of user's emotions from studies on the definitions and attributes of emotions.
- Benchmark various measuring methods to measure user's emotion.
- Suggest the most effective method to measure user's emotions expressed while using a product.

The following aspects will be extracted and verified through experimentation.

- Comprehend the various types of user's emotions elicited while using a product.
- Measure the changes of user's emotions elicited while using a product.

Based on the result of this study, we can discover the relationship between product usability and the user's emotions. Furthermore, we hope to suggest basic interface design guidelines that reflect the users' emotions.

Study 1: Extracting Korean emotional words elicited from the use of products

Using the words collected from previous research results and other various methods, we aim to extract emotional words expressed while using a product through web surveys, and extract main emotions expressed while using a product after clustering through factor analysis.

Study 2: Benchmarking usability testing methods and human emotion measuring methods

Through various literature studies, select the most reliable method that can be used to make quantitative analysis of product usability, and the most appropriate method to measure emotions while using a product.

Study 3: Measuring users' emotional changes while using a product

We aim to measure the change in emotions expressed by approximately 30 participants while they perform several given tasks using mobile phones, 2 tasks that do not have any usability problems and 2 tasks that do have serious usability problems will be performed to measure
emotional changes in relation to the difficulty of the task. After each task, a subjective evaluation on the emotional changes expressed by the user is to be performed by the user him/herself using the emotional words extracted from study 1. Lastly, we aim to evaluate the satisfaction rate of the product's usability and compare it with the actual experiment results.

Due to their subjective and personal qualities, emotions are difficult to define and measure. Typically, there are two main human-emotion-measuring methods: psychological evaluation and physiological evaluation. The parameters in physiological evaluations that appear from autonomic nerve system are blood pressure, electrocardiogram (ECG), pulse, skin temperature, and one of the parameters that appear from the central nerve system is electroencephalogram (EEG). Out of these, EEG is often used for studying emotions because it contains the most information on brain activities [1].

Therefore we aim to measure the emotional changes by detecting the users' EEG while they perform tasks concerning several aspects, such as pleasantness-unpleasantness, excitement-relaxation, tension-release. This is based on the theory of Wilhelm Wundt who systematically studied the human emotion after establishing the Psychologisches Laboratorium at Leipzig in 1879. Wundt [10] saw the human emotion as a combined system of three dimensions, which are pleasantness-unpleasantness, excitement-relaxation, tension-
release. This can be seen as a classic of human emotion studies. Also, accurate data of the users' emotional changes can be measured by examining various physiological signs, such as electrocardiogram, electrodermal activity or galvanic skin response, electromyogram, blood pressure, pulse, FPG, and eye blinking.

The following issues will be analyzed through this experiment.

- Analyze the relationship between task duration and emotions,
- Analyze the relationship between errors and emotions,
- Analyze the relationship between satisfaction and emotions,
- Analyze the relationship between facial expression and emotions.

Study 4: Comparing users' emotions before and after the improvement of usability

After correcting the problems and improving the usability of the mobile phone used during study 3, we aim to measure the emotional changes by using the same methods as study 3 while performing identical tasks. From this experiment, difference in emotion between before and after the improvement of usability can be compared.

The following issues will be analyzed through this experiment.

- Compare performance time before and after the improvement of interface
- Compare the emotions before and after the improvement of interface
- Compare the emotions for the two tasks without problems
- Compare the emotions for the two tasks which had problems and thus were modified

3. Extraction of emotional words

In the field of emotional engineering, a measurement method that indirectly measures the user's emotions through adjectives, called emotional words, is used. However, most of the studies on emotional words are related to expressions of emotions felt from a product's appearance or studies on words that emotionally express a product's appearance itself. In relation, we have extracted some emotional words that can come up while people use a product and reveal emotional changes.

First, we assembled a set of emotions that were sufficiently extensive to represent a general overview of the full repertoire of Korean emotions from various literature studies. Secondly, we found emotional words from the after notes written by website. Lastly, emotional words were collected from verbal protocols in which the user says out loud what he/she is feeling while he/she is carrying out a task. (See Figure 2) After the collected words were deleted or integrated

![Extraction of emotion words for measuring user's emotions expressed in using products](image)

Figure 2. Extraction of emotional word
according to standards, they were applied on appropriateness evaluation surveys for identification of emotional expressions while using a product.

3.1. Extractions from previous research results and literature study

Researches on emotional words have been carried out actively in the fields of psychology, linguistics, emotional engineering, and etc. The following are some of the major research results.

Kim et al. [2] analyzed the human inner system in the form of ‘pleasant/unpleasant’ through emotion related word analysis. Through free associations, 83 human inner system words were selected from emotion related words that were frequently used when expressing experience, and were analyzed through dimensional evaluation. Kim [4] organized the linguistic characteristics of Korean emotional expressions through an overall examination on the characteristics of body language, and on the concept and category of emotion revealed from idioms. Idiom cases related to ‘joy/happiness, sadness, anger, fear, love, and disgust/hate’ were studied to examine the core meanings of each emotion. Jang and Jang [6] categorized idioms of Korean emotion expressions into ones that reveal emotional experiences concerning the production, extinction, and continuation of emotions, and one that reveal emotion expression behaviors. 220 emotional idioms were suggested to set the category of emotions. Park et al. [5] analyzed the overall meaning structure of Korean adjectives by using the semantic differential method. After 46 representative nouns that fall under Korean category criterion were suggested, the associated adjectives and Yonsei University Korean dictionary editors used the Korean vocabulary frequency list to collect adjectives. 115 frequently used adjectives in relation to various concepts were extracted and a group of graduate students majoring psychology extracted 40 set of main opposite word sets in Korean adjectives. Kim et al. [3] collected adjective words that were used to express products. Applicable adjective were collected from the Korean dictionary and 265 emotional words were extracted through appropriateness evaluation survey of understanding human emotions. Out of the adjectives extracted, 40 main words excluding opposite words and similar words were organized. The 40 emotional words evaluated by scaling method were categorized into attractiveness, luxury, comfort, openness, pleasantness, intimate, and feel of use through factor analysis. Han et al. [7] used existing research results, reference literature, association methods on product advertisements, observations on a product's interface factor groups to extract 1,700 emotional words that are related to human emotions. These words were filtered according to overlapping meanings and elimination standards to come up with 163 final emotional words.

In our research, we collected 182 words by relating to these existing research results and literature studies. (See Appendix 1) Psychological research result on emotional words by Kim et al. [2] was set as the basis and other researches were added on to it. Words that clearly did not induce from the use of the product and that were induced simply from the appearance of a product was eliminated. Also, words that were derived
from one word and words of similar concepts were combined into one word group.

3.2. Extractions from product use afternotes on the website

From the afternotes, we can indirectly understand the psychological state, reactions, and opinions of users while they used the product. With the internet, we can access large numbers of afternotes from various websites. In this research, we used websites that are used by many users, such as shopping mall and mania sites, to extract emotional words from their afternotes.

- Shopping mall sites: 6 sites
  ① Daum shopping
    (http://dnshop.daum.net/)
  ② INTERPARK
    (http://www.interpark.com/malls/)
  ③ Auction
    (http://www.auction.co.kr/)
  ④ Cjmall
    (http://www.cjmall.com/index_tab1.jsp)
  ⑤ Buynjoy
    (http://www.buynjoy.com/)
  ⑥ Hansol CS Club
    (http://www.csclub.com/)

- Mania sites: 5 sites
  ① Cetizen.com
    (http://www.cetizen.com/)
  ② dcinside
    (http://www.dcinside.com/)
  ③ nbinside
    (http://nbinside.com/)
  ④ Clien
    (http://www.clien.net/)

⑤ K'-BENCH
   (http://www.kbench.com/)

A total of 247 emotional words were collected from 11 websites on mobile phones, camera/digital cameras, home appliances, electronic pocket books, computer peripherals, and softwares. (See Appendix 2) The emotional words collected from each website were eliminated and combined according to overlaps and similarities.

3.3. Extractions from Think Aloud method in experiments

The two methods above are indirect methods of extracting emotional words. Think Aloud methods was applied as a direct method to collect emotional changes expressed by users while they used a product. Users were asked to perform a set of tasks using a mobile phone (J-PHONE) and verbally express their emotion during use. The participant users were 8 graduate students (4 males, 4 females) who have never used the experimented mobile phone (See Figure 3).

It took an average of 20 minutes for the 8 participants to perform 5 tasks, and a total of 85 emotional words, including overlapping words, were extracted. A total of 53 emotional words were collected after the elimination of overlapping words. (See Appendix 3) From debriefs after the experiment, we found that the Think Aloud method was not easy because the users concentrated on performing the given tasks due to the pressure of having to complete the tasks.
3.4. Assortment results of emotional words that are expressed during product use

In this research, a total of 482 emotional words were collected from the following methods: 182 words from existing research results, 247 words from users' afternotes on websites, and 53 words from the Think Aloud method. After eliminating words with overlapping concepts, 363 words were used in appropriateness evaluation surveys to understand the emotions that can be expressed while using a product. (See Appendix 4)

Through the first appropriateness evaluation survey on graduate students who study user interface and workers in the field of interface related work, we eliminated words that did not clearly relate to the use of a product, words that were derived simply from the product's appearance, and words that were not clearly understandable. A total of 34 users participated in the web survey. 18 users were male and 16 users were female. 18 users were in their 20s, 14 users were in their 30s, and 2 users did not mention their age.

From the survey, there were 39 words that none of the 34 participants chose, such as frustrated, disappointed, satisfied, delighted, and etc. By analogy, these words can be understood as appropriate words to express the emotions felt while using a product. In this survey, based on the average word selection frequency (average 3,887, standard deviation 4,219), the words that were selected by over 4 users were firstly eliminated. According to this, 231 emotional words were finally chosen out of the 363 words that were surveyed. (See Figure 4 and Appendix 5)

4. Conclusion & Expected outcomes

In this research, the research matter and methods to be progressed were organized by presenting the conceptual framework for the study of product usability and human emotion research. Also, we extracted the emotional words that are expressed from the use of a product and not its appearance. The finalized words that were collected form this research will be used in the 2nd set of appropriateness evaluation to extract emotional words that are even more suitable. The emotional words extracted from these evaluations will be used as subjective evaluation
data that is required to measure human emotion. The following are several anticipated results of future researches based on the conceptual framework presented in this research,

Expected Outcomes are:
- Suggesting effective methods of measuring usability
- Categorizing user's emotions revealed during use of a product
- Providing effective methods of measuring user's emotions
- Measuring emotional changes that users undergo during use of a product
- Extracting the relationship between usability and emotions
- Setting guidelines for interface design that reflect users' emotion

Through continuous studies based on these researches, we hope to supply a basic framework for the development of interface with consideration to the user's emotion.

References


Appendix

Appendix 1. Extractions from previous research results and literature study : 182 words

속상함, 피로움, 미워함, 자존감, 삶이함, 분노, 역울함, 불안, 경멸, 절망, 근심, 초조, 불쾌함, 혼란, 당황, 안타까움, 두려움, 미치겠음, 눈물, 슬픔, 실망, 간절함, 질투, 한스러움, 부끄러움, 긴장, 키릴침함, 혼란함, 귀찮음, 암담함, 울고 싶음, 만족스러움, 서려움, 웃음, 답담함, 우울함, 심란함, 미안함, 이상함, 행복, 부러움, 자신감, 고마움, 착잡함, 사랑, 사랑, 나훈함, 놀라움, 충격, 슬픔, 어지러움, 공허함, 허탈함, 피곤함, 기본, 좋음, 황홀함, 기쁨, 희망, 홍분, 무거움, 희미로움, 황기함, 감동직림, 그리움, 품은함, 웃음, 놀람, 놀람, 아픔, 충격, 화, 격분, 성가심, 즐오, 언짢음, 아닙고움, 원한, 가해, 관심, 의복, 욕심, 신명난, 고통, 공포, 수줍음, 착무, 죄책감, 예정, 미움, 무서움, 재미있음, 어둠다운, 따뜻함, 재미없는, 험한, 화려한, 빈곤, 도와, 친근한, 짜증나는, 조용한, 시끄러운, 급격한, 간단한, 단순한, 불편한, 불안한, 심한, 심각한, 어려운, 원인, 우수한, 적절한, 진지한, 풍요로운, 특별한, 평범한, 수수한, 느린, 손스러운, 낳은, 추천, 방해, 참수한, 독특한, 신선한, 생생한, 호감 있는, 친숙한, 실용적인, 강인한, 이용가능한, 건강한, 편리한, 평가한, 건강한, 체조, 단조로운, 마음에 드는, 사고 싶은, 생동감 있는, 생소한, 어설프, 어수선한, 위암감, 조장한, 동일성 있어 보이는, 혁신적인, 보수적인, 호기심을 자극하는, 귀여운, 귀여운, 무난한, 밀모한, 믿음직한, 백백한, 백백한, 섬세한, 아늑한, 안락한, 양주담은, 요란스러운, 유치한, 정교한, 정돈되어 있는, 취향에 맞는, 자기자기한, 돋보인
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음상한, 미일 짝한, 까마득한, 역울한, 죄수는, 완전한, 무서운, 감각한, 너무한, 참신한, 불만인, 슬픈, 예쁘지 않은, 심_FRAGMENT_END
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강력한, 간편한, 후회 없는, 부담스러운, 풍부한, 필요한, 개운한, 자질한, 버거운, 근사한, 감각적인, 비슷비슷한, 충동적인, 옷기는, 시원한, 점점한, 살벌한, 걱정스러운, 헤전한, 홉한, 경쾌한, 마음상한, 미칠 듯한, 가까운, 갈수 없는, 완전한, 감각한, 남무한, 불만이, 예쁘지 않은, 실증나는, 인삼이 되는, 감격스런, 어처구니운

서운한, 나쁘지 않은, 잘된, 믿망한, 신중한은, 화사한, 거친, 간편적인, 들뜬, 사포한, 발랄한

최강인, 정신없는, 장난 아닌, 죽을 지경인, 알 수 없는, 통쾌한, 바보 된 듯한, 신나는, 막막한, 골때리는, 의숙한, 이해할 수 없는

Appendix 5. Extracted emotional words : 231 words

전남도, 실망, 만족스러운, 즐거운, 좋아하, 피곤하, 성가심, 제미없는, 친근한, 불편한, 친숙한, 편안한, 마음에 든다는, 어설프, 미흡한, 요란스러운, 정교한, 고급스러운, 불안정해 보이는, 목적인, 아쉬운, 경쾌한, 임상하지 않은, 머리가 고인다, 아담한, 세심한, 자연스러운, 확실한, 심플한, 편한, 부드러운, 대단한, 알맞은, 적합한, 약해보이는, 근사한, 시원한, 심장난, 분노, 당황, 놀라움, 혼란함, 괴롭힘, 담당한, 이상할, 뛰어하다, 호흡함, 편안함, 지급함, 지투함, 기분 좋음, 조바심, 화, 재미있는, 시끄러운, 어려운, 평범한, 복잡한, 참신한, 신선한, 갈ируем, 단조로운, 생소한, 어수선한, 조잡한, 호기심을 자극하는, 섬세한, 아늑한, 양쪽맞은, 유치한, 취향에 맞는, 예쁘다, 좋은, 신기한, 특이한, 어울리는, 깨끗한, 세련된, 완벽한, 가벼운, 지저분한, 적당한, 특이 없는, 형편없는, 투박한, 눈을 확 사로잡는, 그저 그런, 허접한, 기대에 부담하는, 개성 있는, 밤에 들지 않는, 못약의, 신뢰할 만한, 영망인, 산뜻한, 쓰레한, 부담 없는, 단정한, 새로운, 예의한, 어색한, 떨리는, 예매한, 쓸만한, 부족한, 최고인, 인상적인, 영상한, 독보이는, 탁월한, 간편한, 옷기는, 완전한, 예쁘지 않은, 나쁘지 않은, 신중한은, 화사한, 알 수 없는, 신나는, 막막한, 의숙한, 꽃피운, 심장한, 불안한, 불쾌한, 호감 있는, 간단한, 단순한, 적절한, 특별한, 느린, 손스러운, 낙선, 독특한, 호감 있는, 갖고 싶은, 거주장스러운, 기발한, 조화감, 귀여운, 균형 있는, 무엇인가 빠르고, 안락한, 정돈되어 있는, 아기자기한, 돼지전, 열 받는, 매력 있는, 편리한, 무리 없는, 충분한, 잘못된, 불필요한, 감격한, 뭐야, 난, 거북스러운, 쌍박한, 기본 나쁘다, 헛갈리는, 용이한, 다양한, 실감나는, 즐길만한, 최상의, 강력한, 부담스러운, 풍부한, 원하는, 감각적인, 비슷비슷한, 헤전한, 경쾌한, 불만이, 어처구니운, 잘 된, 믿만한, 사포한, 정신없는, 통쾌한, 속상한, 초조, 두려움, 긴장, 자신감, 상쾌함, 어이없음, 인터뷰, 관심, 힘든, 빠른, 조용한, 쉬운, 우수한, 훌륭한, 평창한, 통일성 있어 보이는, 절이 털려서 싸운, 속은 좋음, 감각한, 황당한, 참을만한, 명쾌한, 별로인, 나쁘다, 허술한, 효율적인, 유용한, 적절한, 어처구니없는, 난감한, 신경 쓰이는, 덜컥한, 후회 없는, 자잘한, 홍한, 너무한, 인상이 되는, 거친

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