Affective Technology, Affective Management, towards Affective Society

Hiroyuki Umemuro

Department of Industrial Engineering and Management, Tokyo Institute of Technology, Tokyo, 152-8552 Japan
umemuro.h.aa@m.titech.ac.jp

Abstract. In this paper, the term *affective* is defined as "being capable to evoke affects in people's mind" or "being capable to deliberate affects to be evoked in people's mind". This paper discusses potential impact of concept of *affectiveness* on development of technological products and services, management, and value systems of societies.

Keywords: Affect, emotion, feeling, management, mood, quality, usability.

1 Introduction: Beyond Usability

1.1 Contributions and Limits of Human Factors

In the later twentieth century, products and services using technologies continued to get complex, and thus, difficult to interact with. The more people have to adapt to technologies, the more errors they tend to make, and the more likely they tend to forget how to use.

One of the goals of human factors and ergonomics is to make products, systems, and/or environments safe and usable, in other words, to enhance *usability*. For this purpose, human factors researchers and practitioners have made efforts to understand characteristics of potential users and to reflect them on design. As pioneers including Norman [1] and Nielsen [2] had established and propagated the concept of usability and methodology of usability engineering, the concept and importance of usability had been widely recognized in design communities.

As the results of the efforts of industries during the last couple of decades of the twentieth century to enhance usability, most of the products and services that can be seen in markets today have high usability. Except for those targeted to special users and special purposes, products and services with low usability can never be successful in the market. That means, usability is now considered as one of the attributes that every product or service must have; usability alone no longer makes a product or a service attractive and distinguishable from other competitors any more [3].

Therefore from the end of the twentieth century to this century, a new idea has emerged across a broad range of fields that design is just not enough to be simple and usable, and that it is now essential to design products and services that users

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themselves want to use and to continue to use [4]. Thus researchers started to seek for what are necessary in addition to traditional usability.

1.2 Beyond Usability

In his recent book *Emotional Design* [5], Norman argued that design had too much emphasized on usability aspect of the products, i.e. to enable users to accomplish their own goals safely an efficiently. Norman also discussed significance of appeal of products to user's emotions.

Some researchers focused on factors such as fun and pleasure. Csikszentmihalyi [6] defined *flow* as a status where a person is completely absorbed in an activity, forgetting time. According to Csikszentmihalyi, *flow* is the happiest and most productive moment in people's life. In human factors field, Fulton [7] claimed the importance of introducing the concept of pleasure into human factors approach. Jordan [3] categorized pleasure into four categories: *physio-*, *psycho-*, *socio-*, and *ideo-pleasures*, and proposed approaches to design products to evoke these pleasure categories as *pleasure-based approach of human factors*. Hancock and colleagues [8] coined *hedonomics* as design and scientific studies that aim pleasurable interaction between human and technology. They categorized the goals of human factors into five hierarchical layers: safety, functionality, usability, pleasurable experience, and individualization. They argued that conventional ergonomics deals with safety to a part of usability, and usability, pleasurable experience, and individualization should be pursued by *hedonomics*. Furthermore, an emerging interdisciplinary field that studies fun is called *funology*, which attracts researchers from engineering, human factors, philosophy, history, education, psychology, as well as practitioners [9].

On the other hand, scientific studies on aesthetics have also attracted more attentions. There have been more evidences that products that were designed aesthetically beautiful can not only obtain higher subjective evaluation but also improve actual task performances and perceived usability [10], [11]. There are also new evidences that aesthetics is a major factor that determines users' engagements with technologies [12]. At the same time, as symbolized by media arts, boundary between technology and art has been blurred illimitably [13], [14]. Now aesthetic design and engineering design have been considered as one inseparable activity.

One common idea among the series of studies above is that providing emotionally or affectively good experiences such like pleasure, fun, and aesthetics might lead users to have affection and continue to use technological products and services.

2 Affect and Affection

2.1 Cognition and Affect: Rationality and Irrationality of Human

In the history of human evolution, affects had developed much earlier than rational thinking. In many situations, affect can be responsible to the information (stimulus) from neurosensory system and able to send signals (responses) to body system for appropriate reactions, much faster than rational thinking. This mechanism has been important for humans to survive.

However, modern Western philosophies have tended to recognize affects as primitive and irrational aspects of human, and thus, emphasized on rational and logical thinking as the characteristics that differentiate human from other animals. In the trend towards "globalization" in the last century, rationalism and market-based principles in which efficiency and cost reduction are measured in money became the fundamental rule to participate in competition in the global market.

This rationalistic trend in modern thoughts is also apparent in emergence of *cognitivism* in psychology. Cognitivism is the approach to recognize human mental activity, or cognitive process, as information processing, and to try to model human mental activities as information processing models. Irrational behaviors of human are treated as exceptions from rational information processing and called heuristics or biases. This approach became a major stream called cognitive science, and has given significant influences on various fields even outside of psychology.

Psychological studies on affects, on the other hand, have long been laboratory studies and field studies on human emotional responses, understanding, and expressions. However, there were some major developments in this field in the end of the twentieth century. One was the emergence of the modeling approach that had been successful in cognitivism, which tried to model human affective processes to build *computational models of affects*. Another was the development of technologies for direct observation of brain activities such as positron-emission tomography (PET) and functional magnetic resonance imaging (fMRI). These technologies enabled high precision observations of brain cells, and resulted in significant advance in neuroscience. These two approaches, analytic approach with models and empirical approach based on direct observation of human brain, provided broader ways for scientific research on affects.

In addition, demand for affective studies was also claimed from the fields of social sciences. Goleman [15] pointed out that human emotion could be a significant factor for various modern social problems and argued the importance of people's ability to understand and control their own emotion. In the marketing field, consumer psychology is now establishing a new research paradigm called *neuro-marketing*, with the help of fMRI technology.

As discussed above, since the end of twentieth century to the beginning of this century, studies on affects have become a major multidisciplinary stream. Fujita and colleagues [16] coined *affective science* as a scientific research field on human affects, rather irrational aspects of human activities, contrasting to conventional cognitive science that studies human cognition, subjecting rational aspects of human. Fujita claimed that affective science is not to replace conventional cognitive science; affective science and cognitive science are to focus on two different aspects of human, and influence each other. Furthermore, as discussed above, emerging interdisciplinary studies on fun and pleasure are not limited within psychology field.

2.2 Affect and Affectiveness

In psychology, the term *affect* is used to represent human affects in general, including emotion, feeling, and mood. Affects include both positive and negative status. However, the English word *affection* is usually used only for positive meanings such as love and gentle care.

In this paper, the term *affective* is defined as "being capable to evoke affects in people's mind" or "being capable to deliberate affects to be evoked in people's mind". For example, *affective products* might mean "products that are capable to evoke appropriate affects in users" or "products that were designed carefully considering possible affects users might have." In the same way, the term *affectiveness* is used for the meanings of "how capable to evoke affect in people's mind," or "to what extent affects that people might have are thoroughly considered."

As stated above, affects include both positive and negative status. Thus an *affective product* may evoke positive or negative affects in users. What are desired in many situations in the world should be *positively affective products*, or products that evoke positive affects and avoid negative affects among users. In some specific situations, it might be necessary to be *negatively affective*. A good example can be roller coasters. By providing negative affect of fear, roller coasters may give riders higher positive affects such as exhilaration or accomplishment. In general, however, careless misuse of negative affects may result in serious damage in human relationships and social climate. Thus being negatively affective, at its heart, requires thorough understanding of human affects and advanced skills.

Affect is not a simple one-dimensional characteristic, such as rational-irrational or cognitive-affect. Firstly, it is necessary to understand the multi-layered nature of affects, which consists of at least two layers: basic emotion including fear and anger, and higher affective responses based on individual memories and value systems. Norman [5] proposed three-level model of human information processing; in addition to *behavioral level* in which rational cognitive information processing is conducted, there are also lower *visceral level* that is responsible to instinctive responses, and higher *reflective level* that is meta-cognition based on human individual strategies and value systems. These three levels are concurrently working, influencing each other. Basic emotions described above are corresponding to the visceral level, while higher affective responses are considered to be processed in the reflective level.

Secondly, it is also important to understand multi-dimensionality of affects. Many psychologists agree that there exist six basic emotions: anger, fear, disgust, sad, happiness, and surprise. Furthermore, it is also considered that these basic emotions can be mapped onto a two-dimensional space that is spanned by valence and arousal. There are at least five modalities of sensory stimulus that evoke basic emotions. Individual factors that may relate to higher affective responses may include value systems, memories, experiences, generations, cohorts, social groups, cultures, and religions. As seen above, affective responses and their causes should be perceived in a multi-dimensional way.

3 Affective Technology

3.1 Perspectives on Affectiveness Research

Idea of designing technological products and services to be affective is not very new. In Europe, there has been a long tradition of affective design, or designing artifacts to evoke specific affects, in many cases positive ones, especially in industrial design field.

One of pioneering works of research about relationship between technology and affect might be a series of work called as affective computing [17]. In 1990s, however, major focuses of affective computing research had been how to let computers to understand, express, and *have* affects. It was not until this century that research focus started to shift to the affective responses computers might evoke among users.

This section tries to organize various researches that have the common viewpoint of how technological products and services might evoke affects among people, both ongoing and supposed to be pursued in near future, including the new trends in affective computing noted above. Research topics are categorized into five groups and discussed on their research significance and research questions. However, these five categories are neither definitive nor exclusive; some of research topics may be categorized into more than one category.

3.2 Affective Technology

Today, as discussed above, products should not only be excellent in the conventional aspects of multi-functionality and usability any more, but also be those that users themselves want to use and continue to use: products to make owners pleased and proud of their owning, products that are comfortable and enjoyable in use, and/or products that provide remarkable affective experience such as excitement and deep satisfaction. Such technological products and services can be *affective technologies*.

There are a number of questions to be answered in order to create such affective technologies. Firstly, in what situations or conditions do people experience affective experiences such as fun or pleasure in the context of technology usage? Secondly, what factors of technological products and services might evoke affects? Furthermore, as discussed in section 2, some of affective responses, especially higher ones, are expected to vary across individuals significantly. Thus individual differences in affective responses and its consideration in design should also be studied.

3.3 Affective Quality

What are the factors to make technological products and services affective? Various qualities built into products and services as a whole provide affective experiences: color and shape, material and finish, weight and balance, softness, torque and click of movement, sound, lightness and readability, latency, information provided to users, efficiency and comfort of task, temperature and smell, and so on. Various operational activities throughout whole organizations may contribute to customer's affective experiences: not only aesthetic design, but also production technology, acquisition, information design, usability engineering, marketing and advertisement that form anticipation among users before they actually see and get products and services, and various services to enhance satisfaction after customers have obtained them. All of these kinds of *qualities* of products or services that contribute to people's affective experiences are called *affective quality* [18].

As it is generally not easy to provide objective standards to these affective qualities, they are difficult to be numerically measured, and thus methodologies to design these qualities are often empirical in practice and still not systematically

established. In addition, as discussed above, affective qualities are created not only by design but also as results of various operations of whole organizations, thus it is not easy to understand affective quality comprehensively. The constructions of affective quality, as well as organizational activities and methodologies to produce affective quality, should be investigated.

3.4 Affective Design

There has been a long tradition of researches on aesthetic and attractive design, particularly in Europe. Those designs, including not only ones aesthetically beautiful, but also those to give a sense of wonder, sensual or vibrant ones, and those make their owners proud of them, may give a variation of affective experiences to people who own or see them. People irresistibly pay much money accidentally for these excellent designs, or become tolerant even if they have poor usability [5].

Such affective designs are not limited only within the category of *fine arts*, but also seen in everyday things such as kitchen ware and stationary. What are essences of such affective designs? For a long time, they have been considered as the territory of arts, or based on quite personal attributes of product designers such as their own sensitivity, skills or talents. However, now that the boundary between aesthetic design and engineering design is blurred, there are emerging researches to systematically investigate the fundamental elements of those *fine arts*.

3.5 Affective Communication

Researches on communication technology have mainly focused on how to transmit as much information as possible to remote sites reliably. In other words, their efforts have been made towards conveying as realistic and as high-quality information as possible to remote counterparts. As a result, in today's workplaces, videoconference systems using high-speed lines and high-definition imaging technology are conveying realistic vision of your colleagues on the other side of the earth. However, when you look at home settings, is the communication technology today connecting our minds with our loved ones? For example, are cell phones and e-mails nowadays connecting hearts of family members living far apart? If you introduce a high-definition videoconference system between households of you and your remote family members, can you feel stronger bond?

Communication systems that connect hearts of people far apart and make them warm-hearted feeling emotional bonds with counterparts can be called *affective communication*. Those kinds of communication might not be those that convey true and accurate information of users, such as videoconference systems in workplaces. Then what is the difference between communication systems that can make people smile and those in workplaces? Factors essential for affective communication should be clarified in future study, and actual systems realizing those factors should also be proposed in order to demonstrate the significance of this idea in our life.

3.6 Affective Service

Services, especially that human provides to human, are different in nature from the cases discussed above where human interacts with technology. The difference is that

both provider and receiver of a service are human, and that affects of the people on the both sides should be considered.

It would be ideal if both providers and receivers of a service feel happiness from the time they started a service until the end of it. Such ideal form of services can be called *affective services*. However in reality, in broad types of jobs centered in customer-care, it is often required for workers to *play* or pretend particular emotions that may be different from their own but are necessary to do the job. Hochschild [19] called this kind of jobs as *emotional labor*. This type of selling one's emotions off in pieces often demands heavily on workers' mental health. They may feel stressed, and if they failed to cope with it, they may suffer from serious mental illness such as burnout syndrome. In order to realize the ideal form of services described above, it is necessary to study on multiple issues including how services should be designed, what kinds of customer experiences should be provided, as well as how providers should attend customers and what kind of management is necessary to protect workers from hard feelings.

4 Affective Management

4.1 Affective Management

It has been widely believed, and actually practiced, that decision-making in management should be done in principle based on objective measurements such as sales, costs, benefits, and efficiency. In recent years, however, there emerged a new idea that such numerical indices may not be sufficient as a basis of decision. For example, if a company wants to develop a new product that evokes deep affective experiences among users, it is necessary to deliberately build high design, quality materials, skilled finish and tuned movement into the product, usually resulting in additional costs. If the management board emphasized reduction of costs, these elaborations of quality might be replaced with easier and cheaper ways. On the other hand, if the management board recognized that the affective experiences these qualities might bring to users would add much value to the product, these elaborations would never be the target of cost-reduction, and could even be given higher priorities.

The example above illustrates the difference in *affectiveness* of management, or whether the management takes into considerations "what affect this decision may result in customer's mind," and if it gives higher priority to this value system. In other words, a management may clearly recognize the importance of factors that appeal to people's affect such as aesthetics and pleasure, give higher priority to them, and do not allow sacrificing them. Such management that emphasize the criteria that "if this decision affective or not" in addition to the conventional numerical indices may be called as *affective management*.

The concept of affective management is neither neglecting nor thinking little of conventional numerical and rational indices. This concept is to value affectiveness equally to them. In practice, however, it is very difficult to provide common numerical measure of affectiveness that can be directly compared with the conventional numerical indices. As shown in the example above, it is not easy to convert affectiveness into money amount. If there were already precedent products of

competitors in the market, such as the case of luxury automobiles, it may be possible to estimate the money amount of affective quality value of your product that is planned to get into the market in the future. However, the more innovative the new product is, the harder it is to estimate its affective value in advance. In order to promote the concept of affective management, it is urgently needed to research and develop these quantitative measurements of affectiveness.

It is not limited to affects of customers that management board has to deliberate. For all stakeholders including shareholders, employers, business partners, and society, managements need to consider on what affective experience their managerial decisions may give those people, what affective experience they should provide, and what priority they should give to these issues comparing with other criteria. This is not a very new idea. A number of excellent managements have known, based on their sensibility and experiences, what affective effect of their decisions and behaviors might have on whom, and whether they should dare to do them or not. However, in many times this skill existed as implicit knowledge of excellent managements, and never be the one everyone can own. Affective management is one of the important values that have firmly existed among Japanese managements, which have not been explicitly claimed and thus might have remained in the shadows of "rational" decision making.

4.2 Affective Organization

Affective management is not the issue only for the top managements. In order to practice the organization's philosophy, principles, and strategies effectively, they should be shared among all members of the organization, including middle managements and employees in the fields. If the top managements emphasize affectiveness in their operations, this value system should be shared throughout the organization.

In affective management, as discussed above, potential affective responses on all stakeholders should be taken into considerations. Among them, the people who are considered to be more important comparable to customers are employees. Most of the managerial issues inside organizations have been discussed focusing on productivity and efficiency. On the other hand, issues such as climate of workplaces have generally got little attention in such a way that it is always better to maintain a good climate in workplace, though it was actually given lower priority than productivity.

Recent researches, however, have shown a number of new evidences suggesting that affective factors in workplaces have influence on productivity and creativity (e.g. [20], [21]). In the near future when this fact is widely recognized, whether workers in the workplace can have positive affect may be another important criteria to evaluate workplaces in addition to quantitative efficiency and productivity. Then managers would be required to maintain good affective climate in their workplace as one of their management skills.

It is the emotional labor discussed in section 3 that managers have to pay particular attention to positive affects of employees. The emotional labor often demands heavily on workers' mental health, and occasionally they may suffer from serious mental illness. In addition to mental cares such as coping, managerial supports in the workplace is said to be particularly important in order to take care of these issues.

5 Towards Affective Society

In the new era when the concept of affectiveness have penetrated among managements as discussed in section 4, affectiveness will also be called into question as a qualification of a manager as a person; ability to deliberate possible emotional responses in other's mind. It would also be true for individuals in general. Affectiveness may also be one of the evaluation criteria at recruiting or personnel evaluations.

In that era, it will be quite usual for people to think about their own affectiveness. That means, idea of "to think about other's affect" or "to behave with deliberating possible impacts on other's emotion" are widely accepted as an essential value system in the society. Such a society can be called as an *affective society*. Again, this idea is not really new. This can be a reflection on an old issue that Goleman [15] warned more than a decade ago, but has been buried in the shadows of the trends of market fundamentalism and cost-reductionism and has not well reflected by people.

In an affective society, people will be required to grow out of the over-simplified codes of conduct such as they can do anything as long as it is not regulated by law or berated by others, or they should pay efforts for visible results objectively evaluated but not for elusive matters such as human minds. However, it goes without saying that such affective society is the society that is gentle to people, with much less stress, and comfortable and peaceful place to live.

References

1. Norman, D.A.: Psychology of Everyday Things. Basic Books, New York (1988)
2. Nielsen, J.: Usability Engineering. Moragan Kaufamann, San Diego (1993)
3. Jordan, P.W.: Designing Pleasurable Products: An Introduction to the New Human Factors. Taylor and Francis, London (2000)
4. Carroll, J.M.: Beyond Fun. Interactions 11(5), 38–40 (2004)
5. Norman, D.A.: Emotional Design: Why We Love (Or Hate) Everyday Things. Basic Books, New York (2004)
6. Csikszentmihalyi, M.: Flow: The psychology of optimal experience. Harper & Row, New York (1990)
7. Fulton, J.: Physiology and Design. American Center for Design Journal 7(1), 7–15 (1993)
8. Hancock, P.A., Pepe, A.A., Murphy, L.L.: Hedonomics: The Power of Positive and Pleasurable Ergonomics. Ergonomics in Design 13(1), 8–14 (2005)
9. Blythe, M.A., Overbeeke, K., Monk, A.F., Wright, P.C. (eds.): Funology: From Usability to Enjoyment. Kluwer, Dordrecht (2004)
10. Kurosu, M., Kashimura, K.: Apparent Usability vs. Inherent Usability: Experimental Analysis on the Determinants of the Apparent Usability. In: Conference Companion on Human Factors in Computing Systems, Denver, CO, pp. 292–293 (1995)
11. Tractinsky, N., Katz, A.S., Ikar, D.: What is Beautiful is Usable. Interacting with Computers 13(2), 127–145 (2000)
12. Solves Pujol, R.: Personal Factors Influencing People's ICT Interaction: A Study of Engagement, Quality of Experience, Creativity and Emotion. Unpublished master thesis. Department of Industrial Engineering and Management, Tokyo Institute of Technology, Tokyo, Japan (2007)

13. Dunne, A.: Hertzian Tales. MIT Press, Cambridge (2005)
14. Fishwick, P.A. (ed.): Aesthetic Computing. MIT Press, Cambridge (2006)
15. Goleman, D.: Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Dell, New York (1995)
16. Fujita, K. (ed.): Affective Science. Kyoto University Press, Kyoto (2007)
17. Picard, P.W.: Affective Computing. MIT Press, Cambridge (1997)
18. Zhang, P., Li, N.: The Importance of Affective Quality. Communications of the ACM 48(9), 105–108 (2005)
19. Hochschild, A.R.: The Managed Heart: Commercialization of Human Feeling. University of California Press, Berkeley (1983)
20. Grawitch, M.J., Munz, D.C.: Individual and Group Affect in Problem-Solving Workgroups. In: Hartel, C.E.J., Zerbe, W.J., Ashkanasy, N.M. (eds.) Emotions in Organizational Behavior, pp. 119–142. Lawrence Erlbaum Associates, Mahwah (2005)
21. Meisiek, S., Yao, X.: Nonsense Makes Sense: Humor in Social Sharing. In: Hartel, C.E.J., Zerbe, W.J., Ashkanasy, N.M. (eds.) Emotions in Organizational Behavior, pp. 143–165. Lawrence Erlbaum Associates, Mahwah (2005)