# Assessing and Managing Mobile Technostress

Jui-Chen Yu
National Science and Technology Museum
No. 720, Jiu-Ru 1st Rd., Kaohsiung City,
Taiwan
raisin@mail.nstm.gov.tw
&.
Lung-Hsing Kuo, Li-Min Chen, Hung-Jen Yang
National Kaohsiung Normal University
No. 116, Ho-Ping 1st Rd., Kaohsiung City,
Taiwan
admi@nknucc.nknu.edu.tw, chenlm02@yahoo.com.tw, hjyang@nknucc.nknu.edu.tw
&
Hsieh-Hua Yang
Department of Health Care Administration
Orient Institute of Technology
No. 58, Sec. 2, Sihchuan Rd., Pan-Chiao City, Taipei County 22061,
Taiwan
yansnow@gmail.com
&
Wen-Chen, Hu
Department of Computer Science
University of North Dakota
Grand Forks, ND 58202,
U.S.A
wenchen@cs.und.edu

*Abstract:* From time to time, new technology brings people impacts. Mobile information system provides new way for manipulating information in both directions, sending out and bringing in. Anywhere and anytime are both the characteristics of mobile technology that people could get rid of. The purpose of this study was to explore mobile technostress and bring up the discussion of assessing and managing. A balance theory was concluded and how to cope with mobile technostress was also discussed.

*Key-Words:* Mobile technostress, characteristics of mobile technology, balance scale

# 1. Introductions

From time to time, new technology brings people impacts. Mobile information systems provide new ways for manipulating information in both directions, sending out and bringing in. Anywhere and anytime are both the characteristics of mobile technology that people could get rid of.

# 2. Framework

In order to reveal mobile technostress, a research framework was designed. In Figure 1, the components of this study were listed. Those were technology, stress, technostress, and mobile technology. By reviewing these components, this study was conducted.

# 3. Technostress

## 3.1 Technology

Technology is the way which extends humans ability. It is very difficult to obtain a precise definition of technology. It is generally accepted that "technology" is more than just a collection of physical products of science. "Technology" is the link between society and its tools. Technology, as a practice, means not only that new tools change, but also that we can change the practice. If we have the political will to do so, we can set certain tools aside, just as the world has set slavery and other tools aside. It is also the nature of modern technology that it is a system. One cannot change one thing without changing or affecting many others.

For further discussion of technology, it is necessary to reveal the relations among engineering, science and technology. According to the involved science and engineering fields, there are many kinds of technologies. Generally, the following distinctions can be made:

- Science is the formal process of investigating natural phenomena. It produces information and knowledge about the world.
- Engineering is the goal-oriented process of designing and building tools and systems to exploit natural phenomena for a practical human means. Engineers work within the constraints of natural laws and societal needs to create technology.
- Technology is the consequence of these two processes and societal requests. Most commonly, the term “technology” is used as the name of all engineering products.

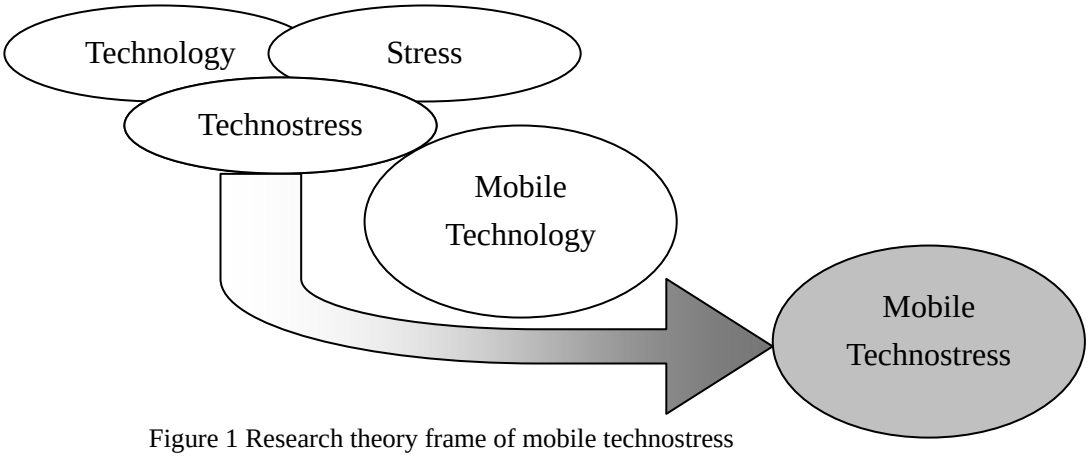


Figure 1 Research theory frame of mobile technostress

For scientists and engineers, technologies are: conceptual tools--as methods, methodologies, techniques; instruments--as machines, apparatus, and software programs; and different artificial materials which they normally use. Technology is the area of studying artificial world not natural world. Technologies are not direct products of science, because first they have to conform to such requirements as utility, usability, and safety; therefore, the application of scientific knowledge to concrete purposes requires the contribution of engineering research.

### 3.2 Stress

The term “stress” has multiple meanings. As Richard Lazarus stated in his 1966 book *Psychological Stress and the Coping Process*: "It seems wise to use 'stress' as a generic term for the whole area of problems that includes the stimuli producing stress reactions, the reactions themselves, and the various intervening processes[1]. Thus, it is possible for us to speak of the field of stress, and mean the physiological, sociological, and psychological phenomena and their respective concepts.

It could then include research and theory on group or individual disasters, physiological assault on tissues and the effects of this assault, disturbances or facilitation of adaptive functioning produced by conditions of deprivation, thwarting or the prospect of this, and the field of negatively toned emotions such as fear, anger, depression, despair, hopelessness, and guilt. Stress is not any one of these things; nor is it stimulus, response, or intervening variable, but rather a collective term for an area of study." [1]. Hans Selye[2] first introduced the term “stress” to medicine in 1926, as a result of conducting medical research to develop a new ovarian hormone. He termed it “the general adaptation syndrome or biologic stress syndrome". According to Selye, "stress is the nonspecific [common] response of the body to any demand made upon it". This definition views stress as a physiological response and stressor as the demand that evokes the response. Selye was primarily concerned with what is going on inside the skin when a person is stressed.

Research has shown that persons experience higher levels of adrenaline and noradrenaline during work periods with computers[3]. Adrenaline and noradrenaline are catecholamines secreted by the adrenal gland. Increased excretion rates of adrenaline and noradrenaline are associated with both underload and overload (stress) stimulation and emotional arousal [4]. Skin conductance level is an indicator of increased sympathetic nervous reaction (the more you sweat, the better the conductance).

This brief report suggests that using computers and dealing with computer technology may in principle cause stress reactions in individuals as evidenced by physiological changes.

### 3.3 Technostress

Craig Brod [5] defined “technostress” in his book *Technostress: the Human Cost of the Computer Revolution* as "a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner. It manifests itself in two distinct and related ways: in the struggle to accept computer technology, and in the more specialized form of over-identification with computer technology." Our focus on technostress will be with the first type described by Brod and labeled by researchers with various terms like: technophobia, cyberphobia, computerphobia, computer anxiety, computer stress, negative computer attitudes, and computer aversion.

Brod [5] further elaborates on the symptoms of technostress: "The primary symptom of those who are ambivalent, reluctant, or fearful of computers is anxiety. This anxiety is expressed in many ways: irritability, headaches, nightmares, resistance to learning about the computer or outright rejection of the technology. Technoanxiety most commonly afflicts those who feel pressured--by employers, peers, or the general culture--to accept and use computers".

# 4. Mobile Technostress

## 4.1 Mobile technology

It is estimated that there are 1.5 billion mobile phones in the world today [6, 7]. This is more than three times the number of personal computers (PCs), and today's most sophisticated phones have the processing power of a mid-1990s PC. These facts, as well as the range of computer-like functionality offered by top-of-the-range devices, are leading some observers to speculate that many people in the not-so-distant future will start to see the mobile phone as an alternative to a PC.

For example Jeff Hawkins, inventor of the Palm Pilot, was recently quoted [8, 9] as saying, 'One day, 2 or 3 billion people will have cell phones, and they are not all going to have PCs …. The mobile phone will become their digital life'. This view is likely to be completely objective, but the fact that the debate is happening is an indication of how powerful or sophisticated mobile devices are becoming.

### 4.1.1 Mobile-learning platform

A proposed mobile-learning platform consists of a series of mini web pages with navigation pointing to:

- simple help guides for the system
- learning materials
- mini web Page Builder tools
- peer-to-peer communication services (messages, chats, discussion and blogs)
- a collaborative activity tool
- the learning management system
- links to places on the Web that may be helpful or interesting for our target audience.

It is believed that the delivery of learning materials within a browser would give learners a great deal of platform independence, enabling learning materials to be easily ported between different existing and predicted devices[10, 11].

The platform should be designed for supporting both phone or PDA. Also, rather than developing one generic version of learning materials that can be used on all platforms, there is also a need to develop some materials, or versions of materials, specifically to take advantage of the strengths of particular platform types.

- hybrid PDA/phone devices running the Pocket PC operating system
- hybrid phone/PDA devices running the Symbian operating system.

The PDA/phone hybrids are typically a corporate rather than personal device and are increasingly being employed for business communication, data access and mobile training. They are also the kind of device that companies and institutions have started to purchase as a more convenient, though less powerful, alternative to a laptop computer. Symbian phones/PDAs, although currently rather expensive for many mobile phone owners, are perceived as a

phone rather than a PDA and therefore are more immediately attractive to the project's target age group. Emerging from e-learning, mobile learning is going to be a significant next wave of learning environments. This is an evolving research area and many issues regarding mobile learning have not yet been exhaustively covered.

This article focused on implementing m-learning modules using a simple case study. Most existing typical e-learning systems are tailored toward PC based web access and are not customized to be used through mobile devices such as Personal Digital Assistants (PDAs). In addition, the content developed in most of these systems is not standardized, making re-use rather difficult. It is need architecture and prototype of a mobile learning system for helping developers creating something reusable and helping users reusing their learning experiences.

The system performs adaptation based on the device and user profiles. The system therefore works on both PC and mobile platforms[12].

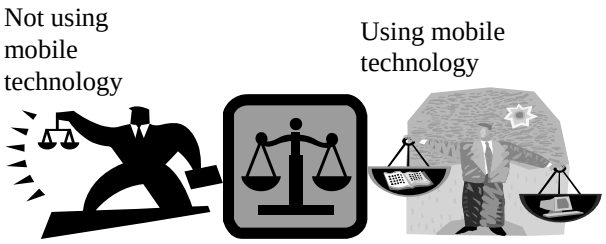


Figure 2 Technology balance model

### 4.2 Mobile technostress measurement

People use technology to gain control. There would be two sides of losing control on mobile technology. The first side is the experience of using mobile technology. The second side is the experience of not being able to use mobile technology. Both sides are pressure sources. Mobile technology becomes a stress whenever a user feels an imbalance between these two sides. This two sides' balance model could be a foundation for measuring mobile technostress.

In figure 2, the technology balance model was illustrated. Mobile stress caused mainly from imbalance situation. The measuring of balance would be the way to probe mobile technostress. In this study, functions of mobile technology and factors of technology acceptance are two dimensions for creating mobile technostress measurement.

#### 4.2.1 Functions of communication technology

There are three common functions of communication technology. Sending information is the first function. On contract of sending function, receiving information is the second function. The third function is the two-way communication of sending and receiving information.

In a general communication system, there are both roles of sender and receiver. Via communication technology, sender could send information and receiver could receive information. By using mobile technology, mobility of sending information, mobility of receiving information and mobility of two-way communication are accomplished.

#### 4.2.2 Technology acceptance

People use technology to expand their ability. Technology acceptance factors are usefulness of technology, easy of use of technology, accessibility of technology, and normality of technology.

Table 1 Item lists of using mobile technology scale

| **Sub-dimensions** | **Item** |
|---|---|
| Sending | U1. Need levels of usefulness in sending information. |
| | U2. Need levels of easiness in |

| | |
|---|---|
| | sending information. |
| | U3. Need levels of accessibility in sending information. |
| | U4. Need levels of normality in sending information. |
| Receiving | U5. Need levels of usefulness in getting information. |
| | U6. Need levels of easiness in getting information. |
| | U7. Need levels of accessibility in getting information. |
| | U8. Need levels of normality in getting information. |
| two-way communication.( Sending and Receiving) | U9. Need levels of usefulness in two-way communication. |
| | U10. Need levels of easiness in two-way communication. |
| | U11. Need levels of accessibility in two-way communication. |
| | U12. Need levels of normality in two-way communication. |

Whenever people evaluate technology as an useful tool, there exist high possibility to adopt that certain technology. Easy of use is another factor affect people adopting technology. People expect technology trouble-free. Technology should be easy to be accessed. Without accessing, technology can not be used. Communication technology must be used by sender and receiver at the same time. Normality of communication technology is a serious factor in adopting technology.

Table 2 Item lists of not using mobile technology scale

| **Sub-dimensions** | **Item** |
|---|---|
| Sending | N1. Controlled levels of usefulness to send information. |
| | N2. Controlled levels of easiness to send information. |
| | N3. Controlled levels of accessibility to send information. |
| | N4. Controlled levels of normality to send information. |
| Receiving | N5. Controlled levels of usefulness to receive information. |
| | N6. Controlled levels of easiness to receive information. |
| | N7. Controlled levels of accessibility to receive information. |
| | N8. Controlled levels of normality to receive information. |
| two-way communication.( Sending and Receiving) | N9. Controlled levels of usefulness for two-way communication. |
| | N10. Controlled levels of easiness for two-way communication. |
| | N11. Controlled levels of accessibility for two-way communication. |
| | N12. Controlled levels of normality for two-way communication. |

### 4.3 Scale of mobile technostress

There are two parts of balance scale. Those are using technology and not able to use technology. Not able to use technology means lack of control of technology. Technostress is the level of difference

between need of using technology and control of using technology.

If the need level equal to the controlled level, there is no technostress. If need level was higher than the controlled level, the technostress is raised by not enough controlling ability to use technology. If need level was lower than the controlled level, the technostress is raised by not necessary technology behavior.

Mobile Technostress =

$$|\text{Need level} - \text{Controlled level}| \ldots\ldots (1)$$

In equation (1), the difference between need and controlled levels is the source of mobile technostress.

### 4.4 Measurement of variables

The variables included in the mobile technostress framework are developed from mobile technostress equation listed in 4.3. The mobile technostress framework is illustreated in figure 3.

The measurement items of these variables are described in detail in table 1, and table 2.

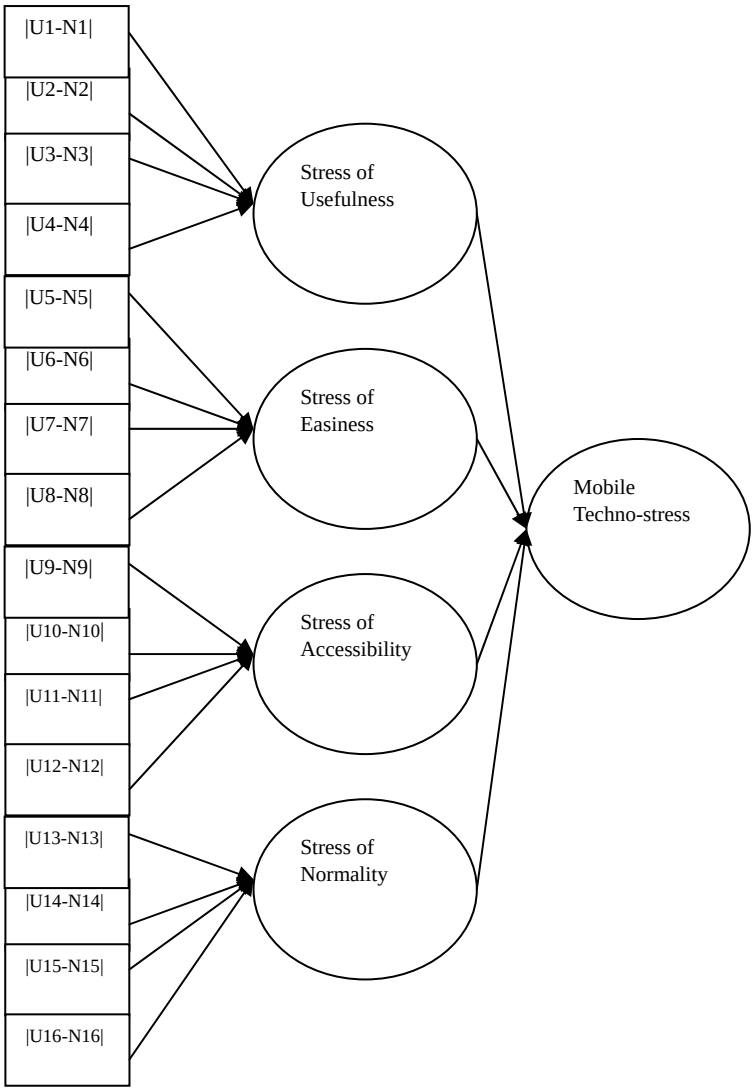


Figure 3 measurement framework of mobile technostress

## 5. Conclusion and Discussion

Based upon consideration of the opening scenario, Brod's description of technostress, and the general background to the concept of stress, the mobile technostress would be discussed. When humans interact with mobile technology devices, there may be several potentially negative outcomes.

Various terms have been employed to describe these outcomes: mobile stress, mobile anxiety, negative mobile technology attitudes, mobile phobia, and mobile aversion. These terms have appeared in the research literature of interaction between humans and mobile devices. Technology provides humans extended capability to deal with problems. If a technology user could not gain the balance of controlling mobile technology, the feeling of mobile technostress will rise.

Are these terms describing different reactions? From a descriptive (ideographic) perspective, they seem to describe the same symptoms that Brod described in his book. The systematic approach of research in psychology is to define what it is you are measuring, develop a way to measure it, and validate the measure by relating it to other types of similar reactions and differentiating it from dissimilar reactions. This is the systematic, empirical approach.

The use of the Balance Scale is but one of the ways to identify a person who is experiencing mobile technostress. It has the advantage of being objectively derived and objectively measured. Many persons who experience stress are reflecting on their personal experience and may have little use for an objectively derived measure. The benefits of using the mobile technology balance scale is that a collective assessment of technostress could be determined for an individual or group. This research focuses on the experiences of the individual dealing with mobile technology and does not focus on issues related to occupational or job stress. Detailed treatment of that topic is beyond the scope of this study.

In Richard Lazarus' psychological theory of stress[1], people are appraising potential stressors. The appraisal process includes primary and secondary appraisals. The secondary appraisal process will determine whether the person has the necessary resources to cope with the primarily appraised stressor. Coping is the process of managing external and internal demands that are perceived as taxing or exceeding a person's resources.

Coping may consist of behavior or cognitive responses that are designed to reduce, overcome, or tolerate the demands placed on the individual, known as coping strategies. Coping strategies have been classified into two major categories: emotion-focused strategies and problem-focused strategies.

According to Monat and Lazarus [1, 13], "Problem-focused coping refers to efforts to improve the troubled person--environment relationship by changing things, for example, by seeking information about what to do, by holding back from impulsive and premature actions, and by confronting the person or persons responsible for one's difficulty.

Emotion-focused (or palliative) coping refers to thoughts or actions whose goal is to relieve the emotional impact of stress. These are apt to be mainly palliative in the sense that such strategies of coping do not actually alter the threatening or damaging conditions but make the person feel better. Examples are avoiding thinking about the trouble, denying that anything is wrong, distancing or detaching oneself as joking about what makes one feel distressed, or taking tranquilizers or attempting to relax." [13]. Problem-focused coping strategies have sometimes been referred to as direct approaches, while emotion-focused coping strategies are indirect approaches. Another issue concerns the general effectiveness of these two general types of coping strategies. Planning for change when it will come is a common technostressor portrayed by the announcement that a mobile system will be implemented but which one is not known. When the system is installed and up and running, you are expected to "know" how to use and teach everything about the new technology already. The first and primary way to cope is through education and learning (a problem-focused coping strategy). Educating oneself to new developments is an ongoing process. In one way, there will be less mobile technostress because technologies will be increasingly available and there will be ample opportunities for providers and users to become familiar with them.

In another way, there will always be the problem of information overload with increasing availability of information sources and ways to access the source, as well as continuous and ever swifter upgrades, enhancements, and totally new hardware and software. How to limit one's search of information will become the primary source of future mobile technostress. Using query language on CD-ROMs might yield ten to a hundred sources but using the Internet might yield hundreds to thousands of such information sources. Mobile technostress is here to stay but we will continue to develop effective ways to cope with it.

Further study in field data collection is required for establishing the reliability and constructing validity of this mobile technostress measurement scale. The balance scale of this study provided not only a measuring structure, but also a stress managing base line.

***References***

[1] Lazarus, R.S., *Psychological stress and the coping process*. 1966, New York: McGraw-Hill.

[2] Selye, H., *History and present status of the stress concept*. 1991, New York: Columbia University Press. 21-35.

[3] Arnetz, B.B. and M. Berg, *Techno-Stress. Psycho-physiological consequences of poor man-machine interface*, in *Human-Computer Interaction: applications and case studies*, M.J. Smith and G. Salvendy, Editors. 1993, Elsevier: Amsterdam. p. 891-896.

[4] Frankenhaeuser, M., *Psychoneuroendocrine approaches to the study of emotion as related to stress and coping.* Nebraska Symposium on Motivation, 1978. **26**: p. 123-161.

[5] Brod, C., *Technostress:the human cost of the computer revolution*. 1984, Reading, MA: Addison-Wesley.

[6] Prensky, M., *What Can You Learn from a Cell Phone? - Almost Anything*. 2004.

[7] Gourlay, C.M. and A.K. Dahle, *Dilatant shear bands in solidifying metals.* Nature, 2007. **445**(7123): p. 70-73.

[8] B, S., *The next frontiers: way cool phones*, in *Newsweek*. 2004.

[9] Isiklar, G. and G. Buyukozkan, *Using a multi-criteria decision making approach to evaluate mobile phone alternatives.* Computer Standards & Interfaces, 2007. **29**(2): p. 265-274.

[10] Peltokorpi, V., I. Nonaka, and M. Kodama, *NTT DoCoMo's launch of i-mode in the Japanese mobile phone market: A knowledge creation perspective.* Journal of Management Studies, 2007. **44**(1): p. 50-72.

[11] Wang, W.B., P.W. Tse, and J. Lee, *Remote machine maintenance system through Internet and mobile communication.* International Journal of Advanced Manufacturing Technology, 2007. **31**(7-8): p. 783-789.

[12] Goh, T.K., *Getting Ready for Mobile Learning--Adaptation Perspective.* Journal of Educational Multimedia and Hypermedia, 2006. **15**(2): p. 24 p175-198

[13] Monat, A. and R.S. Lazarus, *Stress and coping--some current issues and controversies*. 3rd Ed ed. 1991, New York: Columbia Univ. Press. 1-15.

[9] Yang, H.J., Kuo, L.H., Che-Chern Lin, & Wei H.M. Integrating Databases for Compiling Statistical Yearbook of Teacher Education, April 2006, *WSEAS Transactions on Engineering Education,* **3**(4),

[10]Yang, H.H., & Yang, H.J. Investigating the Opinions of University Students on

E-learning, May 2006,*WSEAS Transactions on Communications*, **5**(5)**.**

[11] Yang, H.J., Yu, J.C., & Yang H.H. A Study of On-line Problem-based Learning Framework, May 2006,*WSEAS Transactions on Computers*, **5**(5)**.**