Tallinn University

School of Digital Technologies

PERSUASIVE POWER ON MOTIVATING COMPUTER USER TO CHANGE BEHAVIOR

Mõjuv jõud arvutikasutaja harjumuste motiveerivaks muutmiseks

Master thesis

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Abstract

The research goal of the thesis is to to explore how to enhance persuasive power by applying persuasive technology to motivate computer users to change prolonged usage behavior. The literature review initiated the research to reveal the most relevant health issues caused by prolonged computer usage behavior and the related behavior change theories. Also the persuasive technology and Fogg behavior model were studied and emphasized to explore how to enhance the persuasive power to motivate computer user to perform behavior change. The practical study was conducted by applying the theories, which included two experiments with case study of Eyes Relax. It aimed to verify the persuasive design enhanced the persuasive power on motivating user to change behavior. There are seven valuable elements have been defined to enhance the persuasive power under the Fogg behavior model. Those are subjective norm and social norm, perceived threat, perceived benefits, companionship support, observation learning, reinforcements, and cues respectively.

The study was concluded based on theoretical and practical study to propose the design recommendation which has been proofed that has a great efficiency on behavior change. The interactivity of persuasive technology has many great values to deal with unhealthy behaviors. As we believe and expect, this study also can bring out many possibilities to contribute in the area of human health and computer usage.

Kokkuvõte

Käesoleva magistritöö eesmärgiks oli uurida mõjuva jõu täiendamist mõjuva tehnoloogia rakendamisel, mille kaudu saaks motiveerida arvutikasutajaid muutma oma käitumistavasid pikemaajaliselt. Ülevaade kirjandusest algatas uuringu, mis paljastas pikaajalisest arvutikasutusest tingitud terviseprobleeme ning sellega seotud käitumiste muutmise teooriaid. Samuti uuriti mõjuvat tehnoloogiat ning Fogg'i käitumismudelit ja nendele rõhku pandes uuriti, kuidas mõjuva jõu täiendamise kaudu saaks arvutikasutajaid motiveerida oma käitumist muutma. Praktiline uuring viidi läbi teooriate rakendamisel, mis sisaldasid endas kahte eksperimenti koos Eyes Relax'i juhtumiuuringuga. Selle sihiks oli tõestada, et mõjuv disain täiendab mõjuvat jõudu motiveerimaks kasutajaid muutma oma käitumistavasid. Fogg'i käitumismudeli all on defineeritud seitse väärtuslikku elementi, millega täiendada mõjuvat jõudu, milleks on subjektiivne ning sotsiaalne norm, tajutud oht, tajutud kasu, kaaskonna tugi, vaatluse õppimine, abiväed ja vihjed.

Põhinedes teoreetilisele ja praktilisele uuringule jõuti uurimuses disaini soovituse välja pakkumiseni, mille puhul on tõestatud kõrge efektiivsus nimelt käitumise muutmise osas. Mõjuva tehnoloogia interaktiivsusel on palju väärtuseid, mis tegelevad ebatervisliku käitumisega. Usutavasti ning loodetavasti käesolev uurimus suudab välja tuua palju võimalusi, mis soodustaksid inimtervise ja arvutikasutuse valdkonda.

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List of Abbreviation

AFSCME: American Federation of State, County and Municipal Employees

CTS: Carpal Tunnel Syndrome

CVS: Computer Vision Syndrome

HBM: Health Belief Model

HIV: Human Immunodeficiency Virus

IT: Information Technology

LBP: Low back Pain

NSP: Neck-Shoulder Pain

OSHA: Occupational Safety and Health Administration

SCT: Social Cognitive Theory

TPB: Theory of Planned Behavior

VDT: Video Display Terminal

1 INTRODUCTION

The explosion of technology development is rapidly changing our daily lives. Technology development facilitates our lives in various area to work faster and easier, but also made us dependent and surrounded by it. What brings a new challenge, is to be able to balance its convenience and its negative impact in society and health, which has leaded to our proposed research problem. Computer makes a part of our businesses, education, entertainment and many other areas. Lately, maintaining health and promoting healthy behavior, became a proposed subject in research. A question that is often proposed is how technologies can promote healthy behaviors, or how it can prevent improper usage behaviors.

Basically, there are many means from traditional method to promote healthy behavior, like making a paper sticker on the obvious position, or reminders from people around the object, which impacts in a certain extent. Technologies are highly correlated as a tool to facilitate in every field, also it is strongly effective on balancing the impacts of the use of technology. From recent study of Chatterjee, Samir, and Alan Price (2009), persuasive technology has been explored to be an efficient tool to facilitate human health and help to improve living quality. Captology (Computer as persuasive technology), as described by B.J. Fogg (2002), uses interactive computing system to change people's behavior and attitude, which is the main technique applied in our study.

1.1 RESEARCH PROBLEM AND SIGNIFICANCE

Besides the benefits of the use of computer technologies, the negative healthy impacts come to our concern. Staying with computer long hours or overloaded usage of computer are happening among computer users. Most users like students and employees are obligated to work long hours with computer, especially in IT company. The prolonged working with computer has become like normal routine to them. However, according to Ellahi, Khalil & Akram (2011) staying with technology long periods of time and exceeded a regular break, which is considered as prolonged usage, is an unhealthy behavior which is the root of many additional types of healthy problems. Such problems lead computer users to look for new techniques that can build up healthy inter-behavior between the user and computer. One of those techniques is the persuasive technique.

This technique is applied to help users to change prolonged computer usage behavior and create proper computer usage habits.

Additionally, persuasive technology has its own working principle featured as human-computer interaction. It brings a possible bridge to deal with the relationship between the human and computer. Persuasive technology is capable to interact with users and adjust the best solutions based on users' responses. This interactivity can be used to explore many possibilities to deal with human health issues related with computer.

1.2 RESEARCH GOAL AND MOTIVATION

The purpose of this study is to gain a deeper understanding of persuasive power on motivating computer user to perform behavior change. In detail, it is to explore how to enhance persuasive power by applying persuasive technology to motivate computer users to change prolonged usage behavior.

The main goal besides reviewing previous studies which is aimed to reveal the most related health issues affected by prolonged computer usage behavior, is to understand how behavior change is performed. Also, the persuasive technologies are studied to understand how to enhance the persuasive power to motivate user to perform behavior change.

According to Fogg (2002), persuasive technologies have many great beneficial potentials on applying it to increase human health and well-being. That is what motivates us to take it into account in our research. Persuasive technologies are what support the research goal to promote healthier lifestyle, such as exercise, stress management, diet and maintaining social relationship, or even prevent the onset of variety of medical problems. Some health issues have been being studied by using persuasive techniques. Many interventions are built and has the profound improvements in human health. Examples includes Fit4Life which is a design of persuasive technology and it promotes healthy behavior and ideal weight (Purpura, Stephen, et al., 2011). And, Playful Bottle is designed to motivate healthy water intake (Chiu, Meng-Chieh, et al., 2009). Also, health regimen habit can be built by task interruption of persuasion (Bickmore, Timothy, et al., 2007).

The persuasive technology is studied in literature review and applied in experiments which is done through the case study. Case study is conducted to understand the experience of the use of persuasive design, aimed to find out what prevents users to change behavior and how to enhance persuasive power in design to break the prevents. Two experiments are conducted using the current persuasive design application called Eyes Relax at working facilities. It is on purpose to see how is or in what way the use of persuasive techniques can influence user to perform behavior change. More specifically, the first experiment aimed to understand how users feel and react to it and to dig out the possibility for improvement. The second experiment is conducted using extra persuasive design techniques, which is based on what is fed from data of the first experiment. All the data is collected to analyze and compare the performance of behavior change between two experiments, which is to verify if the persuasive power has been enhanced on motivating computer user to change prolonged usage behavior.

1.3 RESEARCH QUESTION

The main research questions of this study are:

How users experience (feel and react to) the use of persuasive design to change prolonged computer usage behavior?

1.4 RESEARCH PROCEDURE

The research methodology builds to serve the research goals. A literature review was conducted:

- To have a clear reveal of what are the possible health issues correlated with prolonged computer usage behavior.
- To build a path for knowing most popular behavior change theories.
- To study persuasive technology and its applicability on behavior change.

Also, these methodological steps help us to reveal the most relevant healthy effects which are used to support the study and to guide us into possible directions on how to recommend proper instruction of healthy behavior to computer users.

After the literature review, a case study was conducted by four phases including two experiments:

- To find out possible persuasive design opportunities.
- To study the current persuasive design on motivating user to change prolonged computer usage behavior, as well as to find out the room for improving the persuasive power.
- To construct new persuasion design based on theoretical study and add it to the current persuasive design for the second experiment.
- To verify if the new design enhances the persuasive power on motivating user to change prolonged usage behavior.

In this section of the study, interview and observation are used as data collection techniques. Two experiments were implemented, which aim to reveal how users feel and react to the persuasive design and to compare the performance of their behavior change. It goes to verify that persuasive design can enhance the persuasive power on motivating computer user to change prolonged usage behavior.

Table below illustrates above described research procedures.

Steps of Research	Research objective	Research question	Method
Step One: Theoretical Background study	To have a clear view of what are the most popular and possible health effects of prolonged computer usage behavior.	What are the possible health effects caused by prolonged usage behavior?	Literature review
	To understand behavior change and most behavior change theories and models.	What is behavior change and most popular behavior change theories?	

		To study persuasive technology and its applicability on behavior change.	What and why is persuasive technology?	
Step Two: Design and Exploration Study	1. Design Opportunities	To find out possible persuasive design opportunities	What is the prolonged usage behavior in real context?	Case study; Experimental design; Observation; Interview; Multivariate analysis.
	2. First Exploration Case study (First experiment)	To find out the room to improve persuasion in current design. (What prevents users to change prolonged usage behavior)	How users experience (feel and react to) the use of persuasive design?	
	3. Solution design	To design new persuasion based on theoretical study and add it to the current persuasive design for second experiment.	How to enhance the persuasive power to break the preventions?	
	4. Iteration Case Study (Second Experiment)	To verify the new design enhances the persuasive power on motivating user to change prolonged usage behavior.	How users experience (feel and react to) the use of new persuasive design and do they improve the performance of behavior change?	

Step Three: Result Discussion and Proposal	To reveal the persuasive power on motivating computer users to perform behavior change and propose possible recommendations		

Table 1 Research Procedure

1.5 STRUCTURE OF THE THESIS

This thesis is divided into four sections.

The Introduction section, which focus on stating the whole research background. It describes research problem and significance, research goal and motivation, research question as well as the research procedure.

Further, section outlines the theoretical background. It goes to the possible effects of prolonged computer usage, theories of individual behavior and behavior change, also the persuasive technology.

This section is followed by the design and exploration study section, that provides the research strategy and the whole exploration study construction. The exploration study takes 4 phases to go through, including design opportunities, first exploration case study, making the solution tangible, and the second iteration case study.

The final section addresses the overall discussion, drafts the preliminary design recommendation and discusses future work.

The list of references and appendix are also provided in the end of the thesis.

2 THEORETICAL BACKGROUND

In this section, we will define what we understand by prolonged usage behavior of computer, and elicit the possible effects of prolonged usage behavior. Secondly, we will discuss several behavior change theories. And it ends by the definition and point of our understanding of persuasion technology and discussion of Fogg behavior model.

2.1 POSSIBLE EFFECTS OF PROLONGED COMPUTER USAGE

According to Ellahi, Khalil & Akram (2011), prolonged usage behavior is defined as "*an experience of using computer systems extensively over a prolonged period of time*." It refers that staying with technology long period of time and exceeded a regular break, which is considered as prolonged computer usage, which leads to various physical and psychological health issues, such as Carpal Tunnel Syndrome (Mayo Clinic), back, neck and shoulder problem (van Deursen, Leo L., et al.1999), also eye and vision problem (Blehm, Clayton, et al 2005, Ellahi, A., Khalil, M. S., & Akram, F. 2011), and stress (AFSCME).

In the following subsection we will describe in more detail about possible health effects of prolonged computer usage.

2.1.1 CARPAL TUNNEL SYNDROME

Carpal tunnel syndrome(CTS), as defined by Mayo Clinic, "is a hand and arm condition that causes numbness, tingling and other symptoms. Carpal tunnel syndrome is caused by a pinched nerve in your wrist." Simply described, it is considered as the pains of the joint of hand and wrist (figure 1).

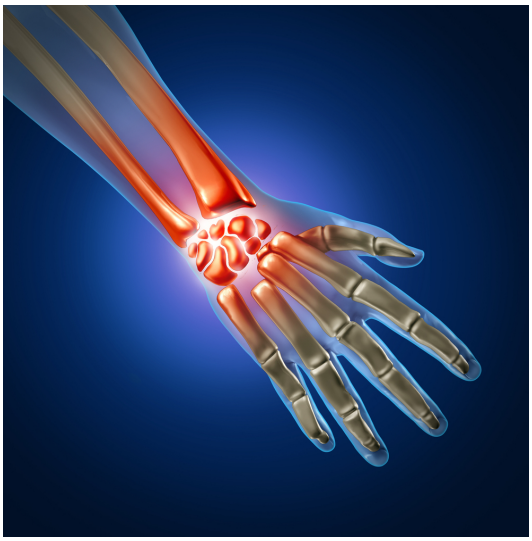


Figure 1 Carpal Tunnel Syndrome[1]

Carpal tunnel syndrome is a stress-related injury which is often caused by the repeating stress on joints. And it can lead to many muscular and skeletal problems. According to Thomsen, Gerr & Atroshi (2008), lack of joint recovery is one of the key factors, which happens when users concentrate on their work and forget to take time for hands to relax. The study from Szabo & Chidgey (1989), found out postponing recovery time is also one of the main issues on causing CTS, which describes a situation when users are staying on computer for their continuous works they often ignore the severity of overloaded usage of hands and postpone the time of recovery.

And according to the Occupational Safety and Health Administration (OSHA) the risk of getting CTS increases with factors like: repeating tasks, forcing wrist and awkward posturing. These factors are pervasive among prolonged working on computer. Because it is hard to move the attention out of their works to take rest when computer users are concentrating to continue the works. The study of Stetson et al. (1990) shows a strong relationship between prolonged working and CTS. In most industries like Information Technology (IT) companies, workers who stay in front of a computer over a long period of time are often diagnosed with CTS. They are considered to apply too much working force on wrist over a break time. That is the reason that the Occupational Safety and Health Administration (OSHA) has conducted the rules about to deal

[1] *Source: http://www.advancedhealthcareofthepalmbeaches.com/wp-content/uploads/2013/10/wrist.jpg*

with these type of disorders. Therefore, prolonged working on computer with the hands, it is easy to ignore or postpone the recovery time, which will most possibly result in the CTS to them.

2.1.2 BACK, NECK AND SHOULDER PROBLEMS

Another common health problem of prolonged computer usage behavior is about the pain of back, neck and shoulders (figure2). These prevalent musculoskeletal issues complaints in the general population are considered to be a significant public health concern.

Figure 2 Back and Neck Pain[2]

This is one of the results as often as not, of sitting and using computer for long period with an awkward posture without regular rest or recovery (AFSCME, van Deursen, Leo L., et al.1999). Based on a Finnish large-scale population surveys (Hakala et al, 2006), neck-shoulder pain (NSP) and low back pain (LBP) increased among computer users in the 1990s and the beginning of 2000. The study also reveals the neck-shoulder problem and low back problem are caused by lengthy computer usage. The stress is overloaded to muscle-bone while users stay with awkward posture long time. Since using computers more often for any purposes like surfing in the Internet, playing games, writing or keeping contacts via e-mail, computer users generally suffer the problems of back, neck or shoulders more often.

[2] *Source:http://doctorsaputo.com/upload/filemanager/uploads/back-neck.jpg*

According to Leboeuf-Yde & KyvikLow (1998), low-back pain as a common disease is estimated to be around 70% of lifetime prevalence rates. And it states that prolonged sitting is associated with low back pain. The awkward sitting posture without regular recovery is considered to be a strong risk factor for back pain. As described in the study from Dunk & Callaghan (2010), prolonged sitting without any low-back supports, which induces the lumbar (lower back region) to suffer most force and causes the musculoskeletal disorder. The study from Smith, L., et al. (2009), shows that sitting for lengthy periods in fixed postures for computer usage most probably results in user's neck pain. When the user is concentrating on the computer monitor, the awkward posture is easy to perform without any attentions to sit properly. The most of stress forces the joint of your muscle-bone and keeps it prolonged suffering. Most chronic neck-shoulder pains are from the long term prolonged awkward sitting. Therefore, for most computer users, neck, shoulders and back are easy to suffer most stress and be forced by the prolonged awkward sitting posture.

2.1.3 EYE AND VISION PROBLEMS

Eye and vision problems, which are the most common health complaints from the computer user. As well, it occurs easily to who has stayed with the computer over a long period of time. According to the study of Yan, Hu, Chen & Lu (2008), the common symptoms include eye fatigue or eye strain, blurred vision, burning, itching or tearing eyes and temporary change in ability to see colors. The umbrella term is so called Computer Vision Syndrome describe all the problems caused by extensively looking at a computer screen over long period of time (Blehm, Clayton, et al 2005; Ellahi, A., Khalil, M. S., & Akram, F. 2011).

About computer vision syndrome, some studies concern on safety and health of video display terminal (VDT) users. The study from Belhm et al. (2005) indicated that prolonged watching on VDT causes the removal of the near point of convergence, deviation of phoria for near vision as well as diminished power of accommodation. It's said that prolonged working on a video display terminal will result in a possibility of changes in both relative accommodation and vergence. As stated by Wimalasundera, S. (2009), these disorders of computer vision syndrome are basically caused by prolonged watching or overuse of eyes functions in a poor situation on VDT. That is

said the users watch on VDT over a recovery time in the situation like dark surrounding, close to screen or intense flashing, which will lead to some disorders of CVS.

Referring to the study of Bansal & Moudgil (2014), the National Institute of Occupational Safety and Health (U.S.) shows a high rate (almost 90%) of the computer users who work on a computer over three hours per day are affected by computer vision syndrome. Prolonged viewing on the computer over a regular recovery time, which most probably will end up different eyes symptoms to user. There is another study from Reddy, S. Chandrasekhara, et al. (2013) in Malaysia which was conducted on more than seven hundred college students to show the prevalence in the study. The students whose age ranged from 18 to 25, have headaches or eyestrain, and almost 90% of the students feel different types of symptom of computer vision syndrome in the survey. Therefore, prolonged usage of eyes to watch and work on the computer in a poor will most probably cause the eyes and vision problems.

2.1.4 STRESS

Finally, adding to that from AFSCME (U.S. 2006) describes a study of stress related with prolonged computer usage. The study of Selye (1973) has defined, *"stress is the nonspecific response of the body to any demand made upon it"*. Referring to Harvard Health Republication, stress is not only a feeling, which responds changes in body functions physiologically. The examples include the production of more stomach acid, quickened pulse, increased breathing and the release of a variety of hormones.

As AFSCME described in Health and Safety Handbook (U.S. 2006), lack of breaks and excessive overtime working with computer technology are the factors leading to induce stress condition. Suffering from continuous stress may include different experiences like the following health issues (AFSCM, 2006). Frequent headaches, previous studies found out it is one of the effects associated with prolonged computer usage like sitting for lengthy period in fixed postures at computer terminals (Palm, Peter, et al. 2007; Smith, L., et al. 2009). Also depression, was found out by the study from Subrahmanyam, Kaveri, et al. (2000). And it states that long-term overloaded usage of computer will affect the social ability and increases the effect of depression and loneliness. More, the high blood pressure, it happens during the prolonged computer usage

period (Hjortskov, Nis, et al. 2004). Overloaded computer usage will increase the effects on high blood pressure due to the incitation caused by the concentration.

Working under pressure for reaching the demands of tasks in workplaces, pushes employers and workers to strive for better efficiency which requires them to catch more time to work on computer. AFSCME has indicated that management in offices is looking forward to reach more work done but with less manpower and in less time. This kind of situations cause a lot of employees to work more time with computer and to recover less time. Therefore, prolonged computer usage, especially under compulsion, will most probably induce the stress situation.

2.2 THEORIES OF INDIVIDUAL BEHAVIOR AND BEHAVIOR CHANGE

In the following paragraphs, we will describe several behavior theories and behavior change models, including health belief model, theory of planned behavior, social cognitive theory and Theory of social support. This part of literature review helps us to get a deeper understanding of how behavior change is performed and what are the most important factors to lead computer users to change prolonged usage behavior. Also, it helps to build up more association in the following section of the design and exploration study.

2.2.1 HEALTH BELIEF MODEL

According to Janz & Becker (1984), the Health Belief Model (HBM) as one of the first theory of health behavior, was developed by the U.S. Public Health Service in the 1950s. And it stands as one of the most widely used behavior theories in health area. It's defined in the study of Janz & Becker (1984) as "*health belief model suggests that a person's belief in a personal threat of an illness or disease together with a person's belief in the effectiveness of the recommended health behavior or action will predict the likelihood the person will adopt the behavior.*"

As described by Wayne (2016) in Boston University School of Public Health, the health belief model originates from behavioral and psychological theory with the foundation which included two components of health-related behavior. The first one is the desire to avoid illness. And the second is the belief that a specific action can cure or prevent the illness. Ultimately, an

individual's action is depending on the perceptions of the benefits, barriers, and threat (Wayne, 2016).

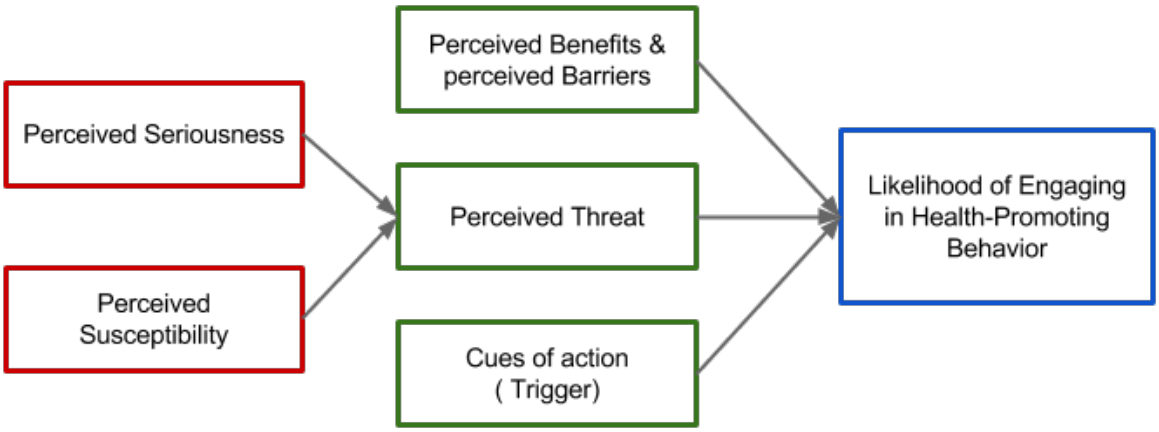


Figure 3 Health Belief Model

The health belief model is used in many different kinds of healthy behavior change. Referring to the study of Rosenstock, et al. (1994), the example of preventing HIV and promoting safe sex for young people by following the health belief model, strongly reflects the process and helps to understand the working principle. To enhance the threatening, it's easier to communicate information of how easy to get HIV and create a pregnancy, moreover to make youth believe it is significant enough to try to avoid. The benefits come from the suggested action of using condoms, which would protect them from getting HIV, or avoid creating a pregnancy. The benefits should outweigh the barriers which like using condoms will limit the feeling or feeling embarrassed to talk about it. Poster or printed package messages would be the useful cues, to make sure the youth receive training on using the condom correctly.

From last session studied, prolonged computer usage behavior is considered as an unhealthy behavior. The health belief model is a useful theory to change prolonged usage behavior, which can work on a way of enhancing the threat of performing prolonged usage behavior, as well to provide the path to users for changing this behavior to avoid that. Also, the self-efficacy from external support can be provided by useful cues to motivate users to perform recommended behavior.

Referring to the health belief model from Boston University School of Public Health[3] (Wayne, W. 2016), these six main constructs included perceived benefits, perceived barriers, perceived severity, perceived susceptibility, cue to action and self- efficacy, as presented below.

- Perceived susceptibility is an individual perception of getting the risk of health problem, which is a wide variation of an individual's feelings of personal fragility to an illness. According to Rosenstock & Irwin (1974), it suggests that an individual whose opinion of getting a health problem susceptibly will get engaged into a recommended behavior for reducing their risk. Regarding to prolonged usage behavior, the consideration of susceptibility will be aimed to communicate to computer users how easy to get the possible health effects from prolonged usage behavior and convince users to believe so.

- Perceived severity is an individual's feelings on the seriousness of contracting an illness, which is a wide variation of an individual's feelings of severity regarding to perform specific behavior. It refers a person considers the medical consequences and social consequences when evaluating the severity to perform the actions (Glanz, Rimer, & Viswanath. 2008). For computer users who perform prolonged usage behavior, the severity of getting a health problem which can be concerned about how serious is the consequence if the user continues to perform the behavior. Combining the susceptibility, provides computer user an idea of how easy to get the serious health problem like carpal tunnel syndrome etc.

- Perceived benefits is an individual's perception of the effectiveness of actions which are possible to weaken the risk or seriousness of health impacts, or to cure the illness. The action which the individual takes to prevent or cure illness is relying on the evaluation of perceived benefit and perceived susceptibility, so that the individual will accept the recommendation of health action if it was perceived as benefits. For computer users, after perceived susceptibility and severity of developing a health problem from prolonged computer usage, providing a path of performing recommended behavior and the idea of benefits after performing recommended behavior, will be easy to be followed. For instance, telling user how beneficial

[3] Source available online: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories2.html

is to perform behavior change in a regular recovery period, and providing an instruction to stretch shoulder and back muscle, which helps user to prevent the back pain problem.

- Perceived barriers is an individual's assessment of the obstacles to perform a suggested action, which is a wide variation of an individual's feelings of impediments which lead to the consideration of cost analysis. It refers to an individual to evaluate the benefits and cost of performing such actions. For computer user to perform the recommended behavior, the perceived benefits must over the perceived barriers in the evaluation process. The most obvious barrier is that the users will be affair of losing ideas from concentrating to stop prolonged computer usage. And another concern is the time cost. Therefore, the perceived benefits of changing prolonged computer usage behavior should surpass them to convince user to perform target action.

- Cue to action is the stimuli needed to activate the "readiness" (the decision-making process) to accept the suggested health action. As described by Carpenter, C. J. (2010), these cues can come from internal like chest pains and wheezing, or external like advices from others. Cue to action also can be referred in Fogg behavior model in which also emphasize it as trigger. To trigger user change behavior, the internal cues will be stronger (Fogg, 2007). But if user does not have internal cues, external cues will be provided to remind user to stop prolonged usage behavior. To trigger computer user to change prolonged usage behavior, the cues are diverse such as a sound, reminder, message, notification push etc.

- Self-efficacy is about the degree of an individual's confidence of his or her ability to success on performing a target action. The component of Self-efficacy is also emphasized importantly in other behavioral theories like the social cognitive theory Fogg behavior model. By building up personal confidence and enhancing the motivation, it leads computer users to gain the confidence to believe that they have the ability to change the prolonged computer usage behavior. To reach it, combining another behavior theory of social support together will increase the effects on building up self-efficacy and enhancing motivation.

2.2.2 THEORY OF PLANNED BEHAVIOR

The theory of planned behavior (TPB) originates from the theory of reasoned action (Ajzen, I. 1991), which stays as "*one of the most accurate theories to explain human behavior*". Referring to Boston University School of Public Health (2016), it is defined as "*The theory of planned behavior predicts an individual's intention to engage in a behavior at a specific time and place.*" Behavioral intentions have been pointed out as the key component to this model by Ajzen, I. (1991), which described as "*intentions are influenced by the attitude about the likelihood that the behavior will have the expected outcome and the subjective evaluation of the risks and benefits of that outcome.*" In this behavior theory behavioral achievement is indicated that is dependent on two key elements of intention and behavioral control, which is similar to the factors of motivation and ability in Fogg behavior model.

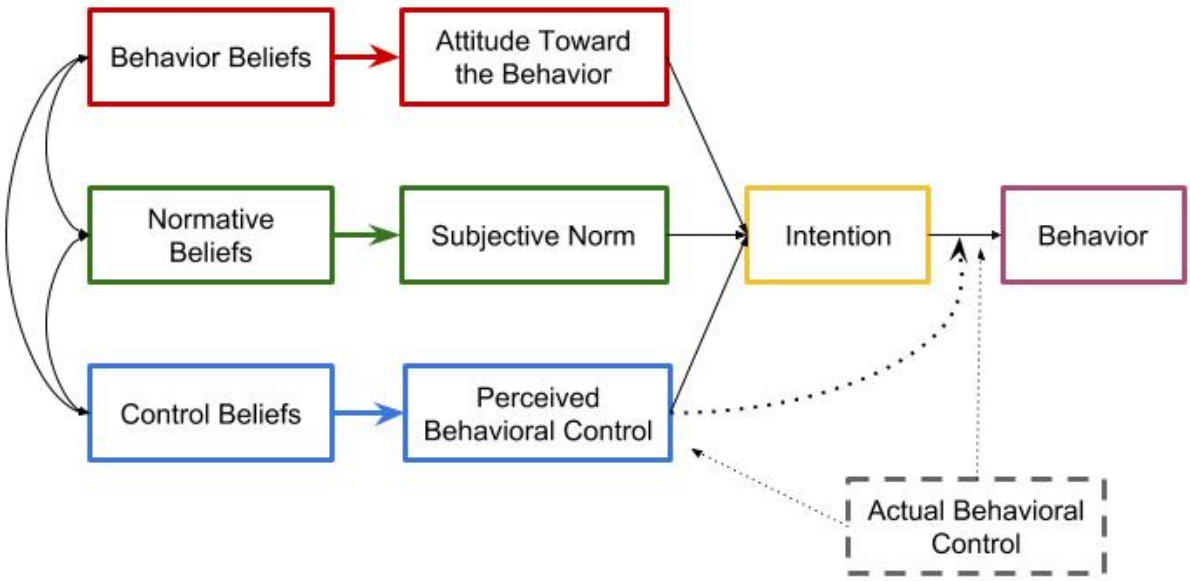


Figure 4 Theory of planned behavior

There is an example that has been studied about healthy eating amongst adolescents (Grønhøj, Alice, et al. 2012). The first stage is to measure the existing attitudes before attempting to change the adolescent behavior of diet. To establish the attitudes of healthy eating, the path is to communicate a common scenes of health eating is good for development. It's somehow similar

with perceived benefits from the health belief model. And then, for the normative beliefs, is to spread information that everybody should have healthy eating in different ways. In this case, they communicate the idea of everybody should have healthy eating by social norm which is a way that surrounded by the common point of view from people around like families, teachers, peers and roommates. And the last step is to offer many other diet options during the meal time. So, this way is to provide users an easy path to reach the target behavior. Finally, the result shows that most adolescents change the diet habit and start healthy eating. In this case, the key elements are to improve the motivation (intention) and provide the path to reach the behavior (behavioral control).

As one of the accurate theories explaining human behavior, the theory of planned behavior brings out the guidance from two main points to cope with prolonged computer usage behavior. The first is to improve the motivation to change prolonged usage behavior for increasing the likelihood of the successful performance. And the next step is to provide computer users possible paths to reach the behavior performance, which is about enhancing the ability or lower the difficulty of change behavior. To change prolonged usage behavior, one is to focus on improving motivation and another is to provide a path which can lead computer user to reach the goal easier.

Referring to the theory of planned behavior from Boston University School of Public Health[4] (Wayne, W. 2016), there are six main constructs include attitudes, subjective norms, social norms, perceived power, perceived behavioral control and behavioral intention, presented as below.

- Attitude is the level of interest. An individual has an assessment of preference to perform the target action, and it leads to concern about the result of evaluation of completing the target action, which could be positive or negative. Behavioral belief is behind the attitudes, which is a belief about consequences of particular behavior based on the subjective probability that behavior will produce a given outcome. To establish the attitudes of proper computer usage behavior, which could be communicating the risk of prolonged usage and the benefits of proper usage to computer users.

[4] Source available online: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories3.html

- Subjective norm is a belief on whether people normally will approve or not to perform the behavior. According to Amjad & Wood (2009) it is related to an individual's beliefs about whether other people think he or she should get engaged into the target behavior. Regarding to prolonged computer usage, first is to provide normative belief of how bad it is from wide ways like poster, banner, tips, desktop wallpaper etc. Secondly, it's to spread an idea that everybody has proper computer usage and also that you should have it since it is important to your healthy life.

- Social norm is the customary rules of behavior which are considered as standard in a social group of people or special cultural context. This is somehow similar to subjective norms, but it is up to a social group, like in an office, different departments have different customary of working status and requirement. For employees who have prolonged usage behavior, to spread the idea of proper computer usage, could be to communicate that the working culture is to reach healthy status and forbid prolonged usage computers or working without break. The next step is to convince them to follow rules because it's normative social behavior.

- Perceived power is the presence of factors that are perceived as facilitated or impeded to perform a behavior. Perceived power will over other factors to result in an individual's perceived behavioral control. Computer users will assess based on all the factors, to make sure that facilitates, like social norm helps in the office where everybody performs the proper computer usage behavior, and as a colleague who would like to follow deal to it felt as a right way.

- Perceived behavioral control is an individual's perception of the degree of difficulty to perform the complete target action. It is changing based on different situations which in return will result in the perceptions whether the performance is easy or not. To make sure computer users' feeling of ease to reach the performance of behavior change, the situation is the key which provides a context which user will believe that it is easy to perform. The path could be asking the user to follow the video guidance, graphic instruction or something easy and low-cost.

- Behavioral intention is the motivational factor that affects an individual's readiness to perform a recommended behavior. According to Ajzen (2002) it is considered as an immediate

antecedent of behavior, which is based on other factors of subjective norm, attitude toward the behavior and perceived behavioral control. In sum, to enhance the computer user's motivation will increase the likelihood of changing prolonged usage behavior.

2.2.3 SOCIAL COGNITIVE THEORY

Social cognitive theory (SCT) originated from the theory of social learning by Albert Bandura in the 1960s. It is defined by Bandura (1977) as "*the social cognitive theory posits that learning occurs in a social context with a dynamic and reciprocal interaction of the person, environment, and behavior*." The triadic interaction model is described in this model, which states human behavior is a reciprocal result of behavior, environmental and personal factors. This theory has its unique feature which emphasizes on social influence and social reinforcement (external and internal). All the situational influences are represented as environmental factors. Also it represents the environment where the behavior is performed while personal factors and other motivational forces are functioning.

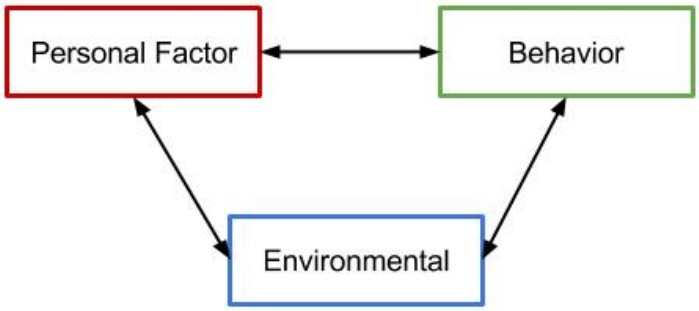


Figure 5 Social Cognitive Theory

In the social cognitive theory an individual's past experiences are considered as factors to whether the behavior will be performed. The expectation of performing the behavior will be influenced and reinforced, which collectively will lead to an individual to a decision of whether to engage in a target behavior and generate the reasons why the engagement happens in that behavior.

In social cognitive theory, to motivate computer users to change prolonged usage behavior, firstly is based on the personal factors like capability of performing the recommended behavior, and the trust of the ability to perform. Further, the user can learn from external presence, like consequences of performing the target behavior. Moreover, the user can also learn from social information. The expectation of outcome will reinforce the computer user's likelihood of performing the recommended behavior. So in this reciprocal model, all the factors affect each other. Thus, keeping the positive effects on all the elements will positively affect each other, vice versa.

Referring to the social cognitive theory from Boston University School of Public Health[5] (Wayne, W. 2016), there are six main constructs include reciprocal determinism, behavioral capability, observational learning, reinforcements, expectations and self-efficacy, presented as below.

- Reciprocal Determinism is the code of the concept in the social cognitive theory, which states a triadic and dynamic interaction between environment (external factors in social context), person (individual who keeps learned experiences), and behavior (responses to perform the target action). Keeping computer users has positive effects on performing recommended behavior, it will keep the mutual effects positively. Moreover, the positive results will reflect to reinforce the human factor and behavior.

- Behavioral Capability is an individual's ability to complete an action through skills and knowledge, which is similar to the component of behavioral control in the theory of planned behavior. In order to successfully perform the behavior change, the computer user must know what and how to take action for it. They learn from the outcome of behavior performed while also influences the social environment where they live. To make sure the user has real ability to perform a recommended behavior, which could be supported by external information. Combining with observational learning, it can make sure that computer user receives information which includes the structure of performing target behavior.

[5] Source available online: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories5.html

- Observational Learning assumes that the individual can witness a behavior performed by other people and it leads the individual to regenerate and perform those behaviors, which is also titled as behavioral modeling in other studies (Schwarzer, R. 2008). If people observe a successful demonstration of performing a specific behavior, they can also learn to reproduce this behavior successfully. Computer users can model other individual's behavior from different ways. Considering computer as a medium, associated with the theory of social support, the observational learning can happen between human and computer. The users can model the the given behavior by observing the process of performance on computer.

- Reinforcements states that an individual is influenced by internal responses or external responses on the likelihood to continue or discontinue the action. Reinforcements can come from individual' self who generates or from the social environment, which leads to being positive or not. Once the computer user performs the behavior change successfully, the outcome of the experience will reinforce both sides of personal factor and behavior. Especially, the first experience is very important to computer users. If the performance is successful, then it will be accessed to keep continuing. If else, then user will got a big chance to quit and discard the intention to perform it next time.

- Expectations state that an individual predicts the outcome of performing a specific action, which is similar to the component of perceived benefits and perceived threat in the health belief model, which leads both sides of health-related or not health-related. Computer users anticipate the consequences of behavior change before engaging into changing prolonged computer usage, and these predicted consequences can return to affect the successful behavior completion. Expectations derive largely from previous experience, but it focuses on the value placed on the consequences and is subjective to computer users. Thus, it is associated with reinforcement, if the user gets a consequence differed from the outcome of expectations, then the user won't put values on it, even most probably the user will quit and discontinuing to perform behavior change.

- Self-efficacy is about the level of an individual's confidence on the ability to success on performing a behavior, which is the same component in the health belief model. Building up

the confidence and enhancing the motivation, which can lead computer users to believe they have the ability to complete the behavior change.

2.2.4 THEORY OF SOCIAL SUPPORT

Social support was defined by House, J. S. (1981) as *"perception and actuality that one is cared for, has assistance available from other people, and that one is part of a supportive social network"*. The supports can come from many sources including emotional, like the provision of love, trust and empathy, tangible (instrumental), like financial assistance or goods, informational, like advice, or companionship, like the sense of belonging (Cohen & Syme, 1985; Krause, 1987; Weinert & Brandt, 1987; House,1981).

Social support is connected to many health benefits physically and psychologically. According to Uchino, B. (2004) the connection is significant between the social support and individual physical health. For example, people with low social support have a higher possibility of death from various illnesses, like cancer. Referring to the study of Holt-Lunstad, J., et al. in 2010, the survival percentage is more likely to increase on those people with high social support. According to Thoits, P. A. (1995) social support is also related with psychological well-being in the workplace and in response to important life events. The study of Lakey, B., & Cohen, S. in 2000 shows that, when people are under stress, social support helps people to reduce psychological distress like depression. The perception or actuality of being associated which is a strong motivated power. It can improve the user's motivation to influence the behavior change when the individual does not have enough intention to perform the health behavior.

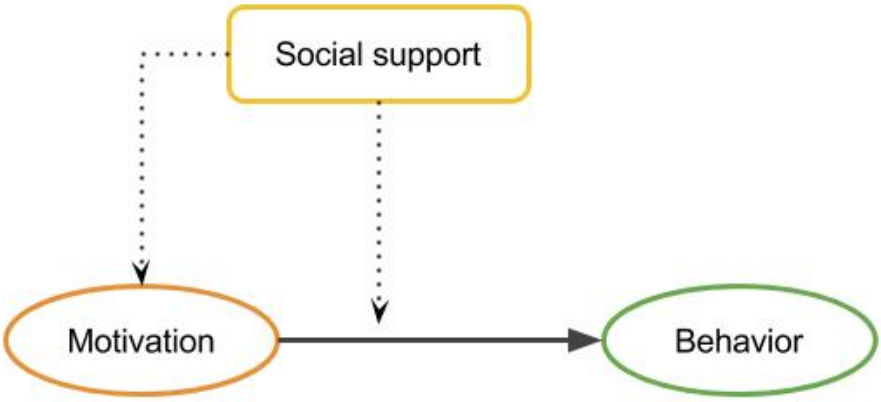


Figure 6 Social Support

Computers as social medium (Fogg, 2010) which could be an effective way to provide social support to computer users. Computers can be considered as a social actor, who can bring you support from various resources. When the user does not have enough motivation to make the decision to change prolonged usage behavior, supports can come from the computer itself to motivate users to perform the behavior change.

Referring to the study of Muñoz-Laboy, Severson, Perry & Guilamo-Ramos (2014), there are 4 main types of social support included instrumental support, emotional support, informational support and companionship support, as presented below.

- Instrumental support is the provision of material goods, finance, services, or assistance. This type of social support is called tangible support as well, which presents the concretes directly to assist other people (Langford, Catherine Penny Hinson, et al.1997). For computer users, it is more considered to be the personal benefit to change prolonged usage behavior. But it's possible to be the way of motivating user to pursue the goods in reality or fiction.

- Emotional support is the provision of encouragement, caring, love, concern, affection, trust, intimacy or empathy, referred in the study of Langford, et al. (1997). Emotional support is also titled as "appraisal support" or "esteem support" in other studies (Wills, T.A. 1991). This is also similar to the component of self-efficacy in other behavior theories. Providing emotional support is a good way to lead computer users to realize that

he or she is being cared or valued. Computer Users are easy to be motivated emotionally by this way to reach the likelihood of changing prolonged computer usage behavior, especially when the computer as a social actor is capable to support consistently by encouraging or affecting etc. (Fogg, B.J. 2010).

- Informational support is the offering of suggestions, guidance, advice or any useful information to other people, referred in the study of Wills, T.A. (1991). The informational support has the potential to help on persuading people on purpose (Langford, Catherine Penny Hinson, et al.1997). Informational support could be combined with other behavior change models to improve motivation, to communicate with computer users by offering benefits when computer user performs the recommended response. Informational support can offer computer users advice and suggestions on persuasive purpose, like "You had done a lot, please take a water and stretch your body". It could also suggest the user to listen to music or to go and have some fresh air a while. Regarding to physical health issues, to bring out a video guidance of stretch the neck and massage eyes and wrist, can be taken into account.

- Companionship support is also titled as social belonging, which is about presenting a sense of social belonging to an individual, referred in the study of Wills, T.A. (1991). According to Uchino (2004), this type of support can be considered as the appraisal to access him/herself to get engaged with companions into social events or activities. Social belonging is associated with social norms in the theory of planned behavior. Providing computer users information of the social context, which can affect getting engaged into the group. Another way is to get computer users involved in group activities of performing behavior change.

2.3 PERSUASIVE TECHNOLOGY

Persuasion is considered as part of human interaction. In our modern society, persuasive efforts teem with a continuous attempt to influence our attitudes and behaviors. According to Fogg (2002), it happens on convincing us to purchase on one product rather than another, to vote and donate for a particular political party, to exercise more, to fight for environmental conservation

and more. Fogg B.J. (2002) has stated in the book, "*technology is frequently designed to draw people's attention to specific information in an attempt to change what they do or think."* Commercial advertisements pop-up advertisements are used on websites for commercial purposes to draw audiences' attention into purchasing items. Warning text are displayed on the screen to lead user go through next action in the software operation. All the designs that mean to change user's behavior or attitude, which have been labeled by B.J. Fogg (2002) as "persuasive technology".

According to the study of Fogg (2002), the earliest application of persuasive technology occurred in the 1970s, when some systems were designed to improve the productivity and promote health. There is an example which is called Body Awareness Resource Network (Bosworth, Kris, et al. 1981). This design aimed to teach youth about health issues like smoking, exercise and drug for enhancing healthy behaviors ultimately. Gradually, other interactive designs were following to address some health issues and to treat mental disorders. Until the Internet has comes, more and more interactive designs were created by persuasive technology on web like *Amazon.com* or beyond web like smart toothbrushes. With the occurrence of embedded computing, the types of persuasive technology will become more diverse and better integrated into our daily lives.

Persuasive technology is considerably suggested by B.J. Fogg (2002), which can be applied to change people's behaviors in non-commercial area such as preventative healthcare and fitness. The concern of the study focuses on to apply this technology to enhance the persuasive power which is able to motivate computer user for changing prolonged usage behavior, and to promote healthy computer usage behavior.

2.3.1 ADVANTAGES OF PERSUASIVE TECHNOLOGY

"Computer as persuasive technologies" are coined as Captology by Fogg in 2002. Since its occurrence, the strong advantage has been studied and used to change what we do and think. The interactivity gives computing technology a strong advantage over other persuasive media.

Traditionally from stickers and printed advertisements to digital commercials, persuasion has long been applied in order to influence people to change what they think or what they do. This is one-way to influence audience's attitude and behavior, which has not interaction between. But

Captology is more effective because it's an interactive way which can receive feedback and adjust strategy. For instance, from Fogg (2002), a skilled salesman knows how to adjust their pitches to customer based on the feedback received. Persuasive technology is capable to modify information according to outcome from user side. That's why the cigarette package which includes warning texts like "Smoking Kills" and images, can motivate smoker to reduce or quit smoking in some extent. But, according to Schneider, S. J. (1986), a more effectual way to help people to quit or reduce smoking could be an interactive program which are able to tailor different approaches to physical addiction and address the psychological addiction that compel people to smoke.

Current computer technology is designed to imitate the traditional human techniques of interactive persuasion to reach as interactive persuaders (Woodward, J. P. Carnine, D., & Davis, L. G. 1986). According to Fogg (2002), computer as persuasive technology not only has advantages over traditional media, but also has other advantages over human persuaders. Specifically, computer is persistent. Human cannot be persistent like a machine. But computer can, because it doesn't get tired or frustrated. It can work all hours to persuade, or to wait and catch the exact moment to intervene. And human will get tired to resist, which is said that there is a moment of weakness when people will feel easier to comply than resist (B.J. Fogg 2002).

2.3.2 THE FOGG BEHAVIOR MODEL

Coming with the new term of Captology coined, is the Fogg behavior model which is originated by Fogg B.J. As Fogg described (2009) this behavior model is created based on many previous studies included those behavior theories we studied above. In this model, behavior is an outcome of three factors collectively working, included motivation, ability and triggers. For an individual to complete the recommended behavior, it's required to have sufficient motivation, sufficient ability of performing the behavior and effective trigger to cue the performing. These three factors should occur at the same moment for successfully performing a target behavior. These three factors are collaborating when a person performs a recommended behavior. Visualizing the behavior model is easier to understand the working relatives. As seen from figure 7, there are two axes which represent motivation and ability respectively. Thus, to perform the target behavior,

which requires both of high motivation and ability, also with the proper triggers together at the same moment.

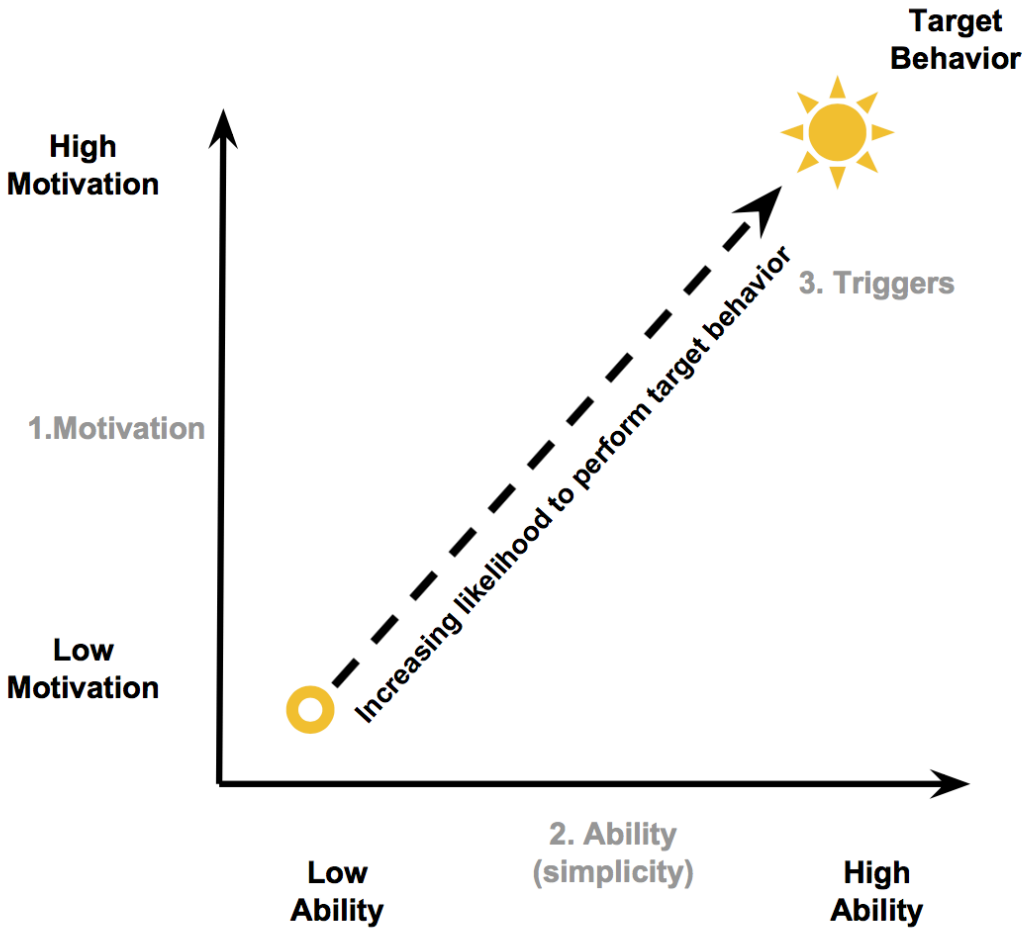


Figure 7 Fogg Behavior Model

For instance, the design of Instagram, which wants user to log in by Facebook account (figure 8). In this case, the target behavior is simply to click the button to login. So in general users have the ability to perform the target behavior. If user has enough motivation to login, then the target behavior is easy to occur. Or else, to enhance the motivation by text "Sign up to see photos and videos from your friends", user will be more likely to perform target behavior. The trigger of this case is the blue button embedded Facebook symbol inside. Moreover, the time is also one issue in behavior change. Because motivation is unstable, which is like a wave, always changing status. It is hard to keep high motivation when it comes. If the trigger comes up later, probably user won't

have enough motivation to make the behavior occurs. These three factors are collectively working at the same moment to contribute a specific behavior performed.

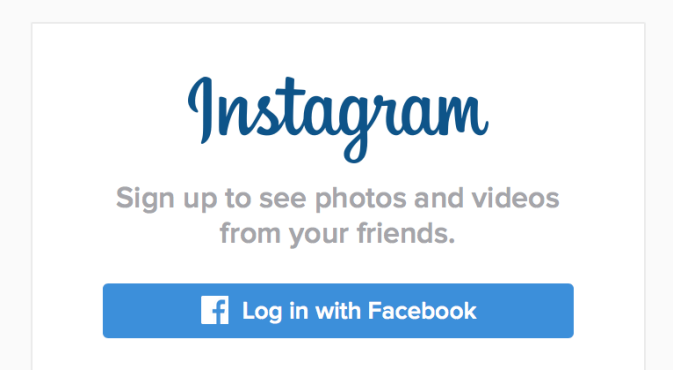


Figure 8 Log in with Facebook, Interface of Instagram

Persuasive technology is powerful for enhancing persuasive power which is represented on those three factors in Fogg behavior model. To motivate computer user to change prolonged usage behavior which requires to enhance motivation, to improve the simplicity and to bring out proper triggers. According to Fogg (2009), three factors are described as below.

Motivation is a widely used term in many areas to explain the behaviors. In Fogg behavior model, it has three core motivators with two sides on each, which are pleasure and pain, hope and fear and social acceptance and rejection. In persuasive design, to motivate people by going through these three motivators will enhance individuals' motivation of likelihood to perform behavior, like to improve the pleasure and reduce the pain will bring user more motivation.

Ability is about the skill to perform specific actions or tasks. In reality, it's not only about teaching people to improve skill or gain new skills. Because it is a dangerous way which requires efforts. Also, human is fundamentally lazy, who are generally resistant to spend effort. Another possibility can reach the same gold is to reduce the difficulty of things and make it easy (improve simplicity). According to Fogg (2010) simplicity in persuasive design includes six elements of money, social deviance, time, brain Cycles, physical effort and non-routine. In persuasive design, it is considerable to reduce the cost of those relevant elements to make a behavior easier to perform.

Trigger is considered as a cue to inform people that it is time to perform a specific behavior now. This is a general concept which goes by different names: Prompts, cues, call to action etc. According to Fogg (2009) triggers can come as many forms like a text message, an announcement, a printed post, a push notification that sounds and so on. Referred to the study of Fogg (2009), triggers have three different types: sparks, facilitators and signal, which are functioning in different way to power the persuasion. A spark is to motivate people. A facilitator is to make target behavior easier to perform. A signal indicates or reminds to action.

2.3.3 PERSUASIVE TECHNOLOGY ON BEHAVIOR CHANGE

Persuasive technology has been applied in various areas to achieve the change of attitudes or behaviors on purpose (Fogg, 2010). How it works on the way to change human behavior, which is the main study in this session.

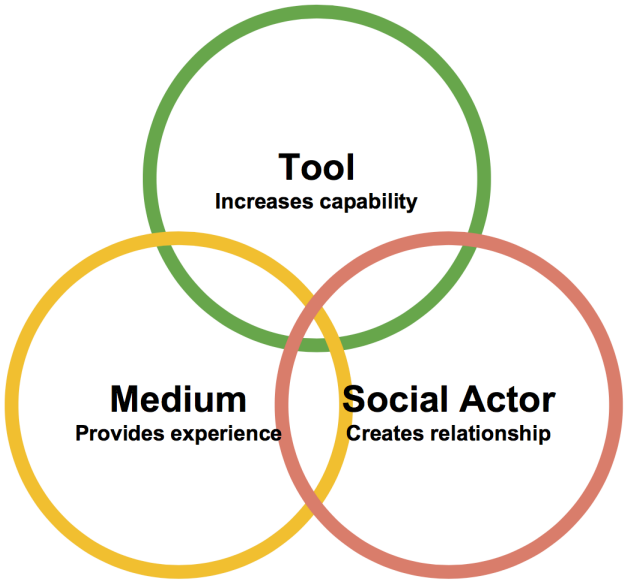


Figure 9 The Functional Triad_ Computers in Persuasive Roles

A functional triad was proposed by Fogg (2002), which described computer technologies play three roles in a framework. This framework makes explicit three computer functions as tools, media and social actors. The first comes as any computing systems or application which is

functioning as tools, are able to provide the users with new powers or easier path to low the difficulty. To use computer as tool which can empower the users to perform more difficult tasks or complete tasks more easily. The framework also suggests that computers function as media which has two categories of symbolic and sensory. Information like graphics, text and chart are conveyed to user when computers are functioning as symbolic media. Also, sensory information like video, audio, touch and smell are provided while computers are functioning as sensory media. The final, it's computer as social actors, which demonstrates that the interactive technologies play roles as living entities which are capable to convince user form social relationship.

This functional triad is not a theory but a framework for analysis and design, which helps to show how computer technologies can take various techniques to change human attitudes or behaviors. The Fogg behavior theory and its persuasive technology were created based on many other behavior change theories (Fogg, 2010). So that, many relative components are overlapped and similar with other behavior change theories which are described above. In our case, to motivate computer user to change behavior will apply this framework to move on the design.

2.3.3.1 COMPUTERS AS PERSUASIVE TOOLS

According to Tombari, Fitzpatrick, & Childress (1985) generally when computers are functioning as persuasive tools, it will go the way to empower individuals' abilities or to reduce the difficulty of the task to influence attitudes and behaviors.

Increasing self-efficacy, is to improve the effective benefactor to the process of behavior of attitude changes, which is described the increased beliefs in their own ability to perform the specific behavior successfully (Bandura, 1997; Bandura, Georgas, & Manthouli, 1996). It is also valued in other behavior change theories like the social cognitive theory and health belief model. The likelihood of the individual to take actions is increasing while the individuals perceive increased self-efficacy. And computer technology is able to improve or encourage individuals to perceive more efficient or productive (DeCharms, 1968; Kernal,1999; Pancer, George, & Gebotys, 1992). An effective persuasive system can increase computer users' self-efficacy to believe in their ability to change prolonged usage behavior successfully.

Providing tailored information, is to provide content to computer user that is relevant to their needs in the context. According to Strecher (1999) and Strecher, et al. (1994), compared with other general information it can enhance its potential to improve user's confidence to change attitude or behavior. Providing relevant information about dangerous effects of prolonged computer usage behavior, which helps and reinforces computer user to realize the needs to make behavior change and avoid it in a potential way.

Triggering decision-making, is the proper cue designed in order to tell people to make the decision in time. A well-designed cue is capable to "wake up" people and follow the procedure to make decision. For computer user, computer as medium to bring out cues which help user to realize the time issue and avoid prolonged usage.

Guiding people go through the process, is an available path to facilitate or simplify a process for users to perform behavior change easier. A well persuasive design aims to help people understand the content and achieve the target area easily. It is usually applied combined with social support, to make a clear path for user to move on and follow. Computer user can follow the simple guide to reach the target information, to get the correct information that helps user to avoid the effects due to prolonged usage behavior.

2.3.3.2 COMPUTERS AS PERSUASIVE MEDIA

As Fogg described in 2007, "media" means the possibility of computer simulations. Computer technology play this role to offer users with simulated experiences in order to change their attitudes and behaviors. Interactive technology is able to offer media that helps user to gain experiences which is powerful to impact on what people think and do.

Simulating cause and effect, which is a simulator that affords individual the possibility to modify the inputs and to observe the possible effects (Hennessy & O'Shea 1993). According to Alessi (1991) and Balci (1998), it is able to give evidences of the outcome of performing the behavior immediately and reliably. The simulations offer computer users first-hand knowledge of how the behavioral inputs influence an outcome. By showing what user does with prolonged computer usage behavior and the result comes from the behavior performed, this kind of computer simulator helps users to shape attitudes and behaviors toward prolonged computer usage.

Simulating the environment, which is the type of simulators which designed to offer computer user with new surroundings through images and sounds. According to Bullinger et al. (1998) The simulated surrounding can lead users to experience in order to change what they think and. The application of simulating the environment are mostly used with the virtual reality technology effectively. Providing a simulated environment with relax contents, such as the ocean view and relevant sounds, can lead computer user to change the behavior due to their experience, such as resting with sunshine bath on the beach.

Simulating objects, which is a way opposed to an environment. A computerized device simulate an object, which can leads user to understand the context and learn from mistakes. It helps user to change behavior when they meet the same situation and will try to avoid it happens again.

2.3.3.3 COMPUTERS AS PERSUASIVE SOCIAL ACTORS

Persuasive social actor comes to be a point of view of computers that has recently become widely recognized as social lively entities. According to Fogg (1997) and Parise, Kiesler, Sproull & Waters (1999), some researches have described that individuals construct the social relationships with technologies. For instance, referred to Nass, Moon, & Carney (1999), individuals who share reciprocal relationship with computers is able to be flattered by computers.

Providing social support, arcading to Jones described (1990), which is a form that aims to persuade people by a dynamic of human interactions. It is an effective way to influence user emotionally. Computer users can be flattered to be happy or proud emotional by a social character based on technology. Once computer users get motivated by social support, it's more likely to perform the recommended behavior.

Modeling attitudes and behaviors, which is the second type as social actor to persuade by showing the specific attitudes and actions. According to the study of Bandura in 1997, in the natural society, individuals learn through hands-on experience directly and through observation indirectly. In general, people are in most likelihood to enact and model a behavior if the behavior is performed by an attractive people and the result comes as positive outcome. A designed social actor could lead computer user to understand prolonged usage behavior, and by showing a proper behavior can avoid the health effects.

Leveraging social rules and dynamics, which is to to provide social rules of reciprocity that can lead people to change behavior by follow it. According to Reeves & Nass (1996) the social rules cover the politeness norms, being respectful, turn talking and so on. The rule of reciprocity as one of the the most powerful social rule states that people have to offer the favors as return to others. And this one is indicated to have force when individual is interacting with computers (Gouldner, 1960).

2.4 FINAL CONSIDERATIONS

Our literature review is conducted to find out the most correlate theoretical background. Regarding to our research question of how does persuasive design motivate computer user to change prolonged usage behavior, the first consideration is to figure out why prolonged computer usage is an improper behavior. Many relative effects are found out to answer what are the outputs caused by this behavior, which included physical and psychological healthy issues such as Carpal tunnel syndrome, Back, neck and shoulder problems, Eye and vision problems, and stress. After the most possible effects are defined, we turn to study behavior change theory aimed to understand how to approach a behavior change regarding to our research object. Many behavior theories are studied to guide how to change prolonged computer usage behavior, which included Health belief model, Theory of planned behavior, Social cognitive theory and Social support. Although these behavior theories provide wide techniques to help us to sort out most important elements which are useful to change behavior prolonged usage behavior, the persuasive technology comes to our study with Fogg behavior model because of its attributes of interactive mechanism. Fogg behavior model is a simple behavior change architecture with three elements, and this behavior theory is built based on many other behavior theories included all the theories that we have studied in this session. In our study, Fogg behavior model is considered as a significant combination of many behavior theories. Moreover, persuasive technology has many advantage over traditional persuasive techniques. Computer is valued as a tools, media and social actors, which means computer systems are capable to react to human feedback. This way of human computer interaction effectually enhances the possibility to change prolonged usage behavior over others. Therefore, persuasive technology with Fogg behavior model are taken to apply in our exploration study and design.

3 THE DESIGN AND EXPLORATION STUDY

This section of the study, is to conduct the experiments with the case study of Eyes Relax. The framework of the practical research procedure will be described as a circle process which is divided into four phases of design opportunities, first exploration case study, solution tangible design, and second iteration case study.

3.1 RESEARCH PROBLEM AND STRATEGY

According to Ellahi, Khalil & Akram (2011) staying with technology long period exceeded a regular break, which is considered as prolonged computer usage that is a pervasive behavior among computer users. Most users like students and employees are obligated to work long hours on computer, especially in information technology area. This unhealthy behavior is the root of many kinds of healthy problem (Ellahi, A., Khalil, M. S., & Akram, F. 2011).

The strategy is brought out to lead the research, which is divided into four main phases to lead the search. These four phases are described as below.

Phase 1

The first is to find out the design opportunities. Our study started from literature review to have a clear reveal of what health issues correlated with prolonged usage behavior. At the same time, it leads us to understand who, where and which situations are prolonged usage behavior happened in real context. This understanding helps to build up the personas and set up the scenarios of prolonged computer usage behavior. Also a path is brought out from it to guide and identify the prolonged usage behavior in real lives.

Phase 2

The second phase is to conduct the first experiment. In this case study, the application called Eyes Relax is applied to find out how does current persuasive design motivate computer user to change prolonged usage behavior. In details, the study focus on how users experience (feel and react to) the persuasive design. The experiment is aim to find out what prevents computer users to change prolonged usage behavior. This is considered as the room needs to be improved to

enhance persuasive power. This case study will be used to compare with the iterated case study of second experiment.

Phase 3

The following phase is about to construct the solution and make it tangible. In this process, behavior change theories are applied to improve the persuasion power on motivating user to change prolonged usage behavior. The study of possible health effects from literature review, will be used in the relevant behavior models, as well be used to prevent it happens and to promote proper usage behavior.

Phase 4

The forth phase will be the evaluation. The iterated case study will be conducted in this second experiment. It is to evaluate the performance of behavior change, which is to study how users experience (feel and react to) the new solution design. The data is collected to compare with the first experiment to reveal the difference. The aim is to verify if the new persuasive design has stronger persuasive power on motivating user to change prolonged usage behavior.

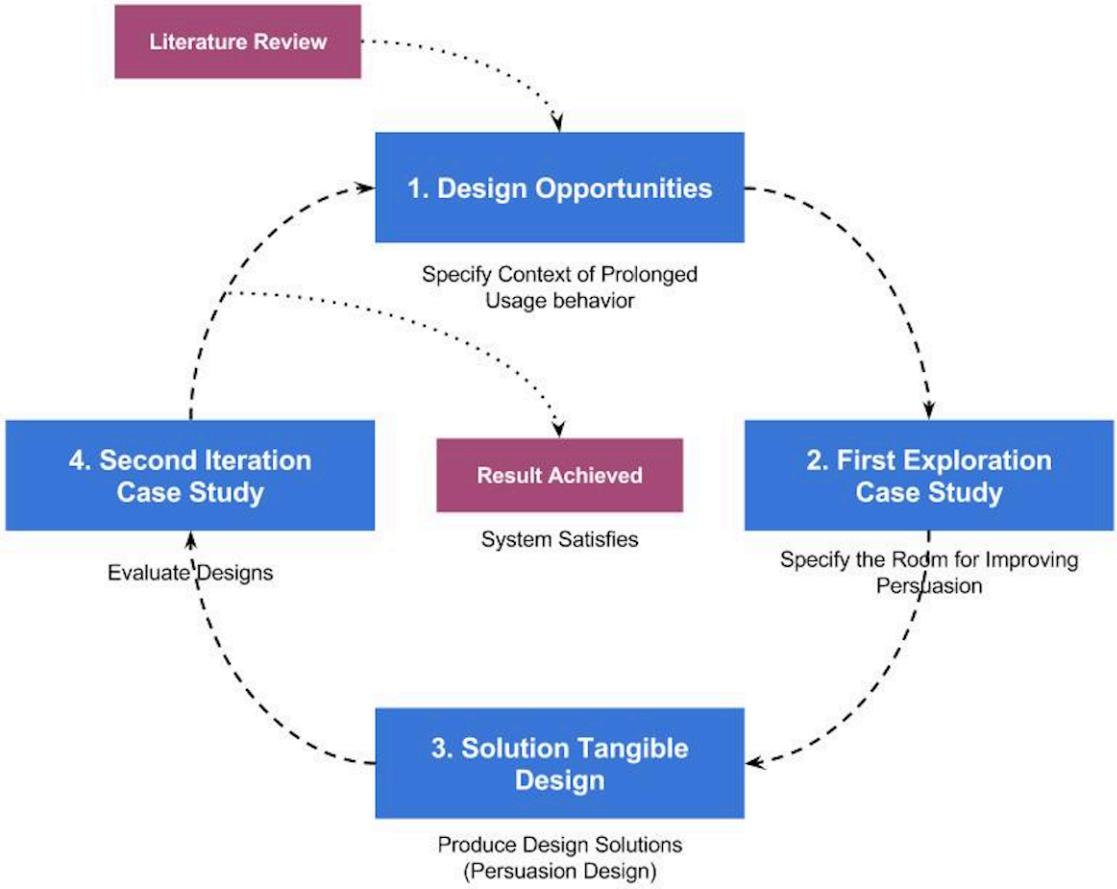


Figure 10 The Procedure of Design and Exploration Study

3.2 PHASE 1 – DESIGN OPPORTUNITIES

This phase is to find out the design opportunities. The literature review leads us to understand what health issues correlated with prolonged usage behavior, meanwhile it guides us to seek out who at where and in what context they prolonged usage behavior. The personas and scenarios are build up based on this understanding, which also help us to identify the prolonged usage behavior happened in real life and finally set up the simple and venue.

3.2.1 PERSONAS

From literature review, there are three possible personas built to get better understanding and shape our design, which are based on our research problem. Three different personas present

different skills and expectations. The standard of building the personas is based on the concern about the performance of changing prolonged usage behavior when motivation comes. Persona A is advance; persona B is intermediate and persona C is novice. They are represented as below.

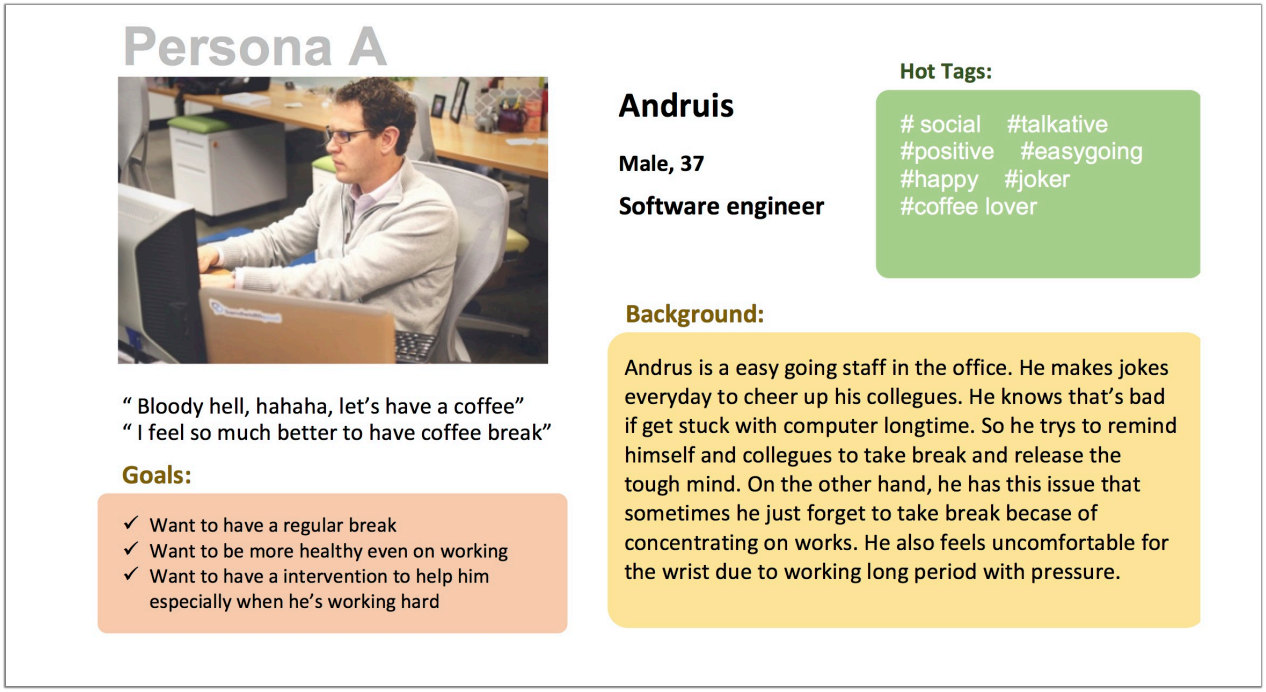


Figure 11 Persona A

Persona B

" Why I'm still working in this hell. I need to buy lottery and take a beer "

Goals:

- ✓ Want to have more motivation to get off the computer
- ✓ Want to deal with the back pain

Rauno

Male, 41

Software Engineer

Hot Tags:

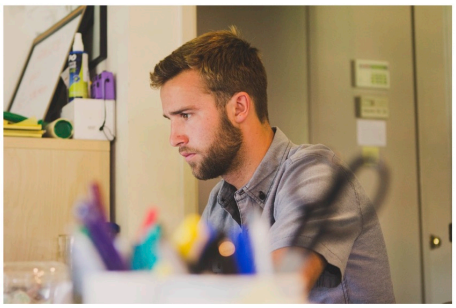
Mr. knowledge #funny #positive #jokemaker #workhard #greatheart #tealover

Background:

Rauno is joke maker in the office. He is always on his computer until someone to call him up for a talk or coffee. He feels stressful if working long hours in front of computer. So most time, he will watch Youtube to relase the mind, but it's still on computer. He also had feeling of pain on his back after a long day working. He feels so hard to leave the computer.

Figure 12 Persona B

Persona C



" Stupid"----- he is blaming the computer

Goals:

- ✓ Want to have a better working style
- ✓ Want to be more healthy and social

Pedro

Male, 27

Software engineer

Hot Tags:

hardworking #productive #quite #lion #pokeface #geek #IT guy #coffeelover

Background:

Pedro is really productive employee. He performs very well on his work. He is not a talkative guys. Sometimes he even want to quite in the social activity. Basically he is like a geek, facing the screen and concentrating on it. He can sit on computer for more than 3 hours. He eats chip and drink coca cola when he is hungry. He is listening music all th time while working. He has 'panda eyes' all the time and looks very tired.

Figure 13 Persona C

3.2.2 SCENARIOS

The scenarios are crated to pitch personas down with more concretes, which and help us to get the design close to real context aimed to seek out the sample and venue. They are represented as below.

Scenario A

Andrus works as software engineer. He is working with computer so hard more than 1 hours. He is tired but he even didn't notice because he is completely concentrating on his work. Suddenly he just receives a notification from computer to remind him to take a break. He realizes he has worked for long period already. Then he accepts that, and stops to keep continuing. He also follow the instruction to stretch his neck and shake his hand. And then he gets off the table and goes to take a coffee. He starts to talk to other colleagues and makes some jokes. He feels so much better for releasing his mind and pressure after the break. And then he goes back to work with a little bit relax, also he gets many new ideas of the project he is working on.

Figure 14 Scenario A

Scenario B

Rauno is a happy software engineer. He is working for 1 hour already, and then he receives a notification from computer to remind him to take a break. He accepts that and stop to continuing his work. And then he follows the instruction to do the stretching. He feels better for his back because he has a problem of back pain before. He is getting better for this problem since he is taking break and stretching his body. And then he turns to the next table to his colleague and ask his colleague to have a tea break. After 10 mins break, he comes back to computer to watch a funny video for 10 mins, then starts working again. He is happy to have a break to get off the computer for a while, and he feels his eyes isn't dry as before.

Figure 15 Scenario B

Scenario C

Pedro is hard working software engineer. He is listening music and concentrating on his screen for more than one hour already. And now he receives a notification from computer, but he feels he needs to continuing the work in case he will lose the idea in mind. He postpone the reminder to 10 mins later. And then he continues on computer. When the second notification comes, he take off the headphone and accepts to take a break. He feels tired and then he gets off the table and go and take coffee. In the coffee corner, he starts to talks to new people and release mind. After talking he goes back to computer and feels relax.

Figure 16 Scenario C

3.2.3 Sample and Venue

The possible personas and scenarios are set up based on literature review. From that, we started to observe our colleagues in the workplace. There are three of them are close to the profiler defined above. They are invited to get involved in the experiments as from our workplace. For

privacy issues, we named them as participant A, B and C. Before we start everything, a coffee chat is conducted to get them understand the experiment and our goal. Meanwhile, it is also a way to get to understand what they think about it, and to know their ideas. Particularly it is to make sure their wills to improve their health lives while working. The venue is the workplace which is an open office with around 100 staff working together. Participants are sitting in the area of software department which located in the corner of the office area where is comparatively quiet.

Participant	Gender	Age	Position	Experience (years)	Behavior of Computer Usage
A	male	35	Software Design Engineer	10	He works hard but usually he notices to take break regularly. But most time when he is totally concentrating on his work, he just stays on computer for more than2 hours. And he feels so tired and uncomfortable of his wrist if without break.
B	male	47	Software Design Engineer	11	He notices working long hour in front of computer is bad, so he doesn't change his behavior. So most time he will browse other website or go social media to release the stress. Basically he is always on computer.
C	male	28	Software Architect Designer	6	He feels tired with long hour working on computer. But he doesn't make any change. And he already have eyes and vison problem.

Table 2 Samples of Participants

3.3 PHASE 2 – FIRST EXPLORATION CASE STUDY

The first case study is conducted in this phase aimed to understand the behavior change in the real context. It is to study how users experience (feel and react to) the persuasive design and what

prevents users to perform behavior change, which aims to find out the room for improving the persuasion design. For this objective, the application which called *Eyes relax* is applied in this empirical study. In practice, the semi-structured interviews were conducted with implementation and observation.

3.3.1 THE EXPERIMENT PROCEDURE

Before we start the experiment three participants are invited to have a coffee chat. It aims to declare our purpose of this experiment and the study goals. Meanwhile, it brings out a room to share different ideas about this topic, which helps us to understand what the participants think about it, as well to make sure that all the participants realize that they have this prolonged usage behavior while they are working. Also it's important for us to confirm 3 participants keep the positive attitude and have the will to continue the following experiments. After that, interviews are conducted to define the requirement of our participants, which leads us to select the correct case for the experiment.

The experiment included 3 parts of interview, implementation and observation. The empirical study in this part of research is conducted by applied the application called *Eyes Relax.* Eyes Relax is recommended to use as a case in this experiment, which is an application that helps computer user to avoid eyes-related problems when they working for long hours at a computer. Users can use it to prevent prolonged computer usage by taking regular breaks. Eyes Relax as a tool applied persuasive technology that reminds user to take those breaks, which allows user to customize the work periods, break length and types, and other settings.

Eyes Relax is suggested to run in background with customized setting by their own. Participants are asked to specify the working length of computer usage and breaking length by their personal will. Then the application starts running in background. When the time of working length runs out, users are able to follow the instruction to take break or postpone the break. The process of the experiment is under tracking in 3 days (plus the fourth day which is unvalued) by the observer. And short interviews are conducted every day mixed some short talks during their break time. The data are only collected by 3 rounds per day due to their working schedule and

personal plan, except the fourth day. The fourth day in the experiment is a simple test which is not counted.

3.3.1.1 INTERVIEW PROCEDURE

Before we start the experiment, the interview is conducted to define the requirement of our participants, which leads us to select the right application for the following experiments. Interviews are carried out by one to one, to dig out what our participants expect to have and what is the main function they need.

Interviews steps performed included:

	Interview questions
1	Do you realize that prolonged usage behavior happens to you? (If yes, please talk about that)
2	Do you know any effects caused by this (prolonged usage) behavior? (If yes, please talk about that)
3	What leads you to perform this (prolonged usage) behavior? Or what stops you to have an idea to take break.
4	Do you know any things or applications which can help you to take break and relax?
5	Anything that you think is powerful to stop you always staying on computer?

Table 3 Interview Questions (before first experiment)

After the day experiment, interviews conducted aimed to understand how do participants feel about the persuasion when the time is up. The responses are collected to analyze the motivation when persuasion comes to change prolonged usage behavior. Those quick interviews happen in

the end of day experiment to each of them respectively interview questions are rather open to bring out the room for our participants to talk more but narrow on the persuasion to motivate behavior change in this application. The interviewer and observer are the same person, to organize the process and collected the data of the experiment. Some interview questions performed as below.

	Interview questions	Measurement Scale and aim
1	How do you feel about this application?	To know what is the idea about this application for their usage if they feel it's likeable or unfriendly.
2	How do you feel when the time is up and reminder comes up to you?	To know the feeling and motivation when the persuasion comes to user. And to know if the persuasion design is to rough or is acceptable, or even great.
3	How do you feel when you accept the reminder to take break?	To know the feeling of performing the behavior change if it's well or not.
4	How do you feel when the reminder comes when you are concentrating on your work? Score the annoyance from 1 up to 5 of supper annoying.	To understand the scope of annoyance.
5	How do you feel after this experiment today?	To know if the experiment too long or too easy for modification.
6	What makes you to postpone the reminder?	To understand their feeling while they don't want to perform the behavior change.

7	(If they quitted the application) Why you quit the application?	To know what causes this strong emotion of aversion to quit.

Table 4 Interview Questions (after first experiment)

Also, short talks happen during the break time, to know the immediate feeling and motivation, because feeling and motivation are instant and fleeting, sometimes even ineffably. For the sake of being more easy and relax, the talks go to the way of not serious but funny mixed jokes, and some questions included as blow.

	Interview questions
1	How do you feel right now?
2	Do you feel relax?
3	Feeling good uhmmm? Get off so many crap
4	Coffee break helps, right?

Table 5 Interview Questions (during breaks in first experiment)

3.3.1.2 IMPLEMENTATION PROCEDURE

The implementation is carried out to see how do participants feel and react while they are experiencing the persuasion design in this case. It helps to find out the room for improving persuasion power design. After the requirement defined, application Eyes Relax is recommended to use as a case in this experiment. Participants are asked to use Eyes Relax during the experiment, which is to run it on background with customized setting by their own. Also, participants are suggested to specify the working periods of computer usage and breaking length by their personal wills. Then the application starts running in background. When the time is up,

the reminders comes and the user are able to follow the instruction to take break or postpone the break.

Experiment steps performed included:

Step	Experiment design	Measurement
1	Launch the application Eyes Relax	Launch succeed
2	Customize setting: specify the working periods of computer usage	Working Period set up
3	Customize setting: specify the breaking length	Breaking length set up
4	Confirm to run in the background	Program runs on background
5	Time is up and reminder comes to persuade user take break	• Accept to take break (Done) • Postpone the break time
6	Second reminder comes to persuade user to take break	• Accept to take break (Done) • Postpone the break time
7	Third reminder comes to persuade user to take break	• Accept to take break (Done) • Postpone the break time

8	Forth reminder comes to persuade user to take break	• Accept to take break (Done) • System rejects to postpone (Only allow to postpone 3times)

Table 6 Implementation Steps (first experiment)

3.3.1.3 OBSERVATION PROCEDURE

Observation is carried out by our observer to understand the users' behavior change when persuasion comes, but also to collect the data of the performance from the implementation process. The process of the experiment is under tracking in 3 days (plus the fourth day) by the observer. The data are only collected by 3 rounds per day due to their working schedule and personal plan, except the fourth day.

The observation steps performed included:

	What was observed	Measurement Scale and aim
1	Participants' expression and behavior in general	To see how they behave when persuasion comes
2	How long the working period is set	
3	How long the breaking length is set	
4	Performance of behavior change: Take break when persuasion comes	• Accept • Postpone

5	How long the postponed time length	
6	The next performance of behavior change: Take break when persuasion comes	• Accept • Postpone

Table 7 Observation Steps (first experiment)

3.3.2 THE RESULTS AND DISCUSSION

The result is described from interviews and observation to understand how participants experienced the persuasion design and how they performed the behavior change.

3.3.2.1 INTERVIEWS

Our interviews are conducted before the experiment, during the experiment, and after everyday experiment. Before we start the experiment, we conducted the interviews for knowing what our participants think about it, and to dig out what they expect to deal with the prolonged usage behavior. Also it leads to select the correct application for the experiments. Most responses are rather valued. Regarding to the prolonged usage behavior, all of our participants realized that they have this prolonged usage behavior while working, and knew that many health problems are caused by it. And what makes them to keep working longer time, mainly is the concentration, because of nothing to interrupt it when they are concentrating on work. Thus, they think that it could help if an application can do the job and remind them to take break. From the response received to analyze, the application called Eyes Relax is selected to be applied in the experiment. This application meets most needs of our participants and which is a light design but mixed typical persuasion techniques.

During the experiment and after the day experiment, interviews are carried out to understand how participants feel about the persuasion design on motivating them to change prolonged usage

behavior. They all agreed that this application somehow helps them to take break, and this persuasion design works at the beginning very well. And the breaks do make them feel so much better and more productive after that. However, the situation is changing due to the time is passing. They feel more annoying when they are busy or really concentrating on their work, because the reminder pops up on the screen which is disturbing somehow. Regarding to this situation, the parent mode is applied to prevent that participants postpone the break and to force them to take break. This model is about to set up the password first and then when the time is up the screen will be blocked if without entering the correct password (figure 17). The fourth day we conduct the experiment with parent mode and only the observer knows the password. Participants are forced to take break because the monitor will be blocked when the time is up. Unfortunately, they all quit the application and feel to detest it. They all come out the same idea of they don't like to be forced to perform the behavior change and parent mode actually does to interrupt their working process.

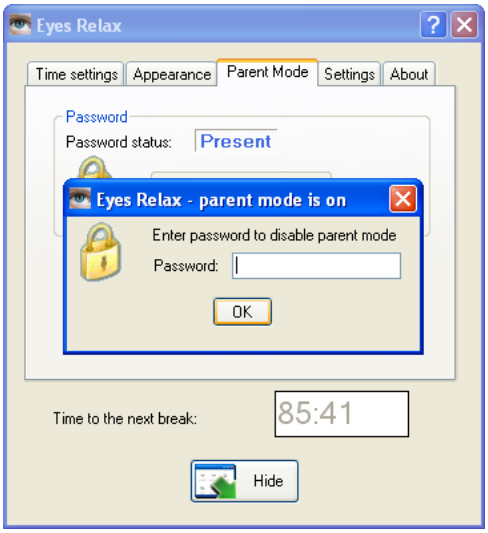


Figure 17 Parent Mode, Interface of Eyes Relax

3.3.2.2 OBSERVATION

The observation includes to observe the expression and behavior of participants, as well to observe the performance of behavior change. Data of the performance are collected by observer. The result from our observation is presented as below (table 8, table 9 and table 10), showing that

the performance of behavior change is declining in general by the time passing. Because the motivation is getting lower following the time passing. At beginning the participants keep high curiosity and confidence, so that the motivation to change prolonged usage behavior is high. But when the time is passing they get used to it and the motivation is getting lower and lower, so the performance is getter low. The first round at the first day, all of them got successful performance on behavior change. Interviews also reveal that at the beginning, participants have a high motivation to perform the task and feel that is interesting. But, the breaks are postponed in the following rounds gradually, especially in second day and third day. After the first day experience, the motivation lowers. Mostly in the situation which participants are concentrating on their work, they don't want to get rid of the idea in their mind at the moment and it is huge cost for them to take break in a risk of forgetting the idea. So the breaks are postponed once and once again. There is also one thing that reveals the social persuasion on motivating behavior change. When other colleagues come to our participants for asking to take a coffee break together and they succeed to change behavior to take break. Three of them all consider that the most powerful persuasion is a people comes to you and ask you to take a break together. That is considered as a friendly invitation which is not good to reject without any good excuses. So the social persuasion is valued by them. At the third day, participant C have quit the application in the second round. Because the reminder comes again and again makes him feeling disturbed and annoyed to this application.

Day 1							
Participant A	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	✖			
	2	1 hr	5 min	✖			
	3	1 hr	3 min	5 min	5 min	✖	
Participant B	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	40 min	5 min	✖			
	2	1 hr	10 min	5 min	✖		
	3	45 min	5 min	5 min	5 min	✖	
Participant C	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	✖			
	2	1 hr	3 min	5 min	✖		
	3	45 min	5 min	10 min	✖		

Table 8 Data of Performance, Day 1 of First Experiment

Day 2							
Participant A	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	✖			
	2	1 hr	5 min	5 min	5 min	✖	
	3	1 hr	3 min	5 min	5 min	✖	
Participant B	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	40 min	5 min	5 min	✖		
	2	40 min	5 min	5 min	✖		
	3	40 min	3 min	5 min	10 min	10 min	✖
Participant C	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	✖			
	2	1 hr	3 min	5 min	5 min	✖	
	3	45 min	5 min	10 min	10 min	✖	

Table 9 Data of Performance, Day 2 of First Experiment

Day 3							
Participant A	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	5 min	✖		
	2	1 hr	5 min	5 min	10 min	10 min	✖
	3	1 hr	5 min	5 min	10 min	✖	
Participant B	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	40 min	5 min	5 min	✖		
	2	40 min	5 min	5 min	10 min	10 min	**Quit**
Participant C	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	10 min	5 min	✖		
	2	1 hr	10 min	5 min	10 min	✖	
	3	1 hr	10 min	5 min	5 min	10 min	✖

Table 10 Data of Performance, Day 3 of First Experiment

As described in Fogg behavior model (Fogg, 2002), motivation is always change like a wave. When people are busy or focusing on something, the motivation to change behavior is rather low and the cost to perform prolonged behavior change is huge. When the reminder comes as a persuasive cue solely to trigger the behavior change, it is hard to work when user is concentrating on works. But it could be cheap and more easy to come with other associated persuasion design. And it somehow reveals the participant's idea that they feel the persuasion is more powerful when a people comes by for asking to do something together. This reflects to component of companionship in the theory of social support.

What prevents participants to perform behavior change, is the concentration on continued working and consideration of the risk to forget the thought and lose ideas. Here the room was

found out, which is to improve the motivation during they are working. The ability to perform the behavior change is rather low, which is simply to leave the computer by get off the chair or take coffee break and so on. Referring to Fogg behavior model, when the motivation is high enough, the persuasion is able to break these preventions and make the behavior change happens.

3.4 PHASE 3 – MAKING THE SOLUTION TANGIBLE

This phase of our study is to construct the solution and make it tangible. From the first experiment, the preventions are found out, which described two main concerns of the concentration on continued working and the consideration of the risk to forget the thought or lose ideas. Here is to apply the theories studied collectively, which aims to enhance the persuasive power to be able to break the preventions for motivating computer user to change prolonged usage behavior.

3.4.1 THE REQUIREMENTS OF CONTEXTUAL USAGE

According to Fogg behavior model, the behavior change requires three factors contributing enough effort at the same time. Regarding to change the prolonged computer usage behavior, the ability is rather low, which is simply to get off the computer by taking action like standing up and leaving the computer or going to take a coffee and so on. This is considered as normal human ability which can be perform normally. About the motivation, which should be improved to break the prevention of consideration of the risk to forget the thought or lose ideas while working, which comes as the requirement of improving motivation. And about proper trigger, which should be able to break the concentration on continued working, which comes as the requirement of not interrupting or disturbing. Besides that, there are several requirements comes out from the first experiment regarding to the contextual usage, which includes valuing the social persuasion, no forcing, and the supportive tool.

- **Improving Motivation**

To improve the Motivation is one of the main concerns in our study. As described by Fogg in the Fogg behavior model, to reach the target behavior performance which requires three elements of motivation, ability and trigger working properly at the same time. In our case, the low motivation

is the main problem for user to change the prolonged usage behavior. Before we start the first experiment, the participants are confirmed that they have the prolonged computer usage behavior and the positive will to deal with this unhealthy behavior. Although they understand our goal of study is to help them and health issues is important to their life, but motivation is a wave which is very not stable and depending on many situations. Our participants have the high motivation at the begging of experiment. But the motivation is declining gradually by the time pass due to their working schedule, sickness of under forced, and some other matters. And the persuasive power should be able to conquer the consideration of the risk to forget the thought or lose ideas, which is to improve motivation to break this prevention.

- **No Interrupting and Disturbing**

The interrupting issue is about the reminder comes again and again when user is concentrating on works or in a working schedule like in a daily scrum or other meeting. When the user postponed the break for certain minutes but it will still come to reminder after the certain minutes. It is very disturbing while users are concentrating, which is one of the annoying issues from user's feedback. Also in the situation of the user is in the meeting which requires to be focus on it, the reminder comes to them is very awkward. Because the application of Eyes Relax cannot react to the exact situation like in meeting or out of computer usage. This type of interrupts makes user anxious and frustrated, sometimes even angry.

- **Valuing the Social Persuasion**

Regarding to social persuasion issue, this is the one that participants value it on changing prolonged computer usage behavior. In the experience, their behaviors have proved that the social persuasion is strong. The human persuasion is powerful here, because participants don't want to reject a friendly social invitation to get involved in activities. This reflects to the social belonging and social norm in the behavior change theories. Human persuasion has a strong interaction in the social context which makes people to be more sensitive and protective to care other peoples' feeling.

- **No Forcing**

The forcing issue comes with a big negative output in our experiment. Persuasion comes as enforcement is very unfriendly which makes participants feel like under control. Also, enforcement is not persuasive technology, which relates often discussion that the border between persuasion and enforcement (Fogg, 2002). When the persuasion comes again and again, the user is already under anxious. When the computer system forces them to change behavior, they will eventually freak out and quite the application. The concern is that the persuasion should come more powerfully but should not put computer user under forced to perform behavior change after several persuasions done.

- **The Supportive Tool**

As many issues addressed out above, a tool is needed, which can help to transfer the persuasion design at the proper moment. Because the Eyes relax is light and hard to extend more functions on it. This tool should be supportive on many working situations, also it should be easy to transfer all the persuasive information to our users (participants).

3.4.2 THE DESIGN SECTION

After the requirements are collected for contextual usage, this part is to design the persuasive facilities to fit the requirements, which can enhance the power to persuade users to change prolonged computer usage behavior. The persuasion will be designed based on different behavior change theories and the persuasive technology. Lync is selected as the supportive tool to transfer the persuasive design. The design mainly focuses on the trigger design to have proper timely persuasion and the motivation improvement to keep the motivation over the barrier.

- **Lync as The Tool**

A tool is needed because it will be able to transfer our persuasion design to computer users. Regarding to the contextual usage requirements, Lync as part of office software series from Microsoft, is selected to take this job (Currently Lync is switched to Skype for work by Microsoft). Firstly, Lync is part of office software series which is very common tool in

workplace, and our participants get very used to it for many working purposes. Everyday our participants start the computer and the Lync is also launched to work. Users can't just quit or not to launch it due to its necessity for working. Another advantage is that Lync is connected to the employee' mobile which provided by the company. This merit actually provides another opportunity that our design can be transferred by mobile to end users. Moreover, Lync is also a communication tool which supports many different types of information format included text, sounds, graphs, video and many others. Also many functions are supportive for our next experiment.

- **Trigger Design (Proper Timely Persuasion)**

Application Eyes Relax still will be used as the basic persuasive tool in next experiment, also some persuasive design will be added to support by Lync. In our previous experiment, the performance of behavior change is low except in the beginning of day experiment. The reason why the user's motivation is going down in following working period, it's that they are getting more works and more schedules like scrum meetings, project meetings. When the user is in a meeting or concentrating on work, the reminder is becoming annoying and disturbing to them. To make it not annoying is one of the goal needed to achieve from previous experiment. Considered some working situations are hard to persuade user change behavior such as in important work schedule. The idea is not to remind user when the working status shows user is in schedule not just normally working status (figure 18). Then they are recommended to pause Eyes Relax until the status shows they are available again. Also when the user wants not to be disturbed and switch the status, the persuasion won't be sent. But after 1 hour the persuasion will be sent by our observer, aimed to inform the user has to take a break.

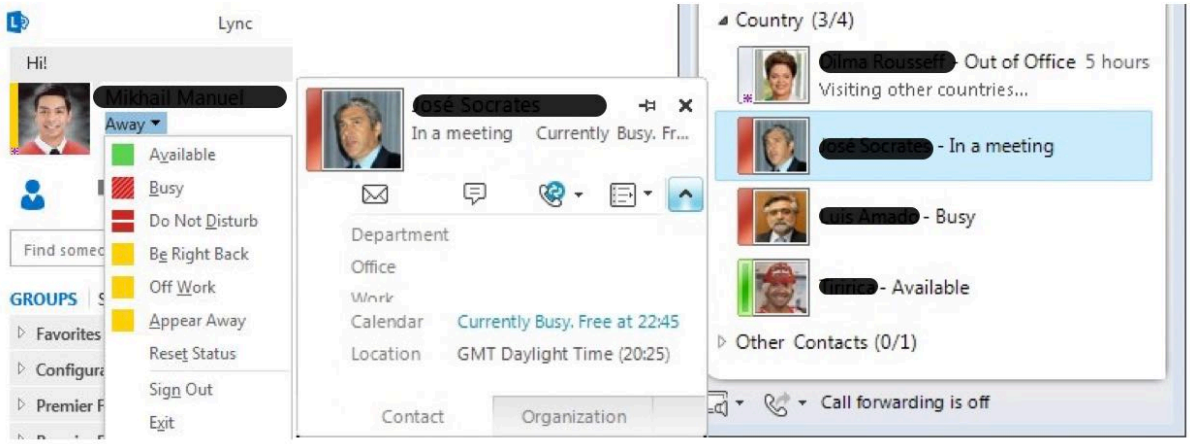


Figure 18 Interface of Lync, Microsoft

- **Motivation Improvement**

Motivation is one of three key elements in Fogg behavior model, as well is an important factor in other behavior theories. As described above, motivation is like a wave which is unstable depended on different situations. As Fogg described (2009), When the motivation is high the user feels easier to perform the behavior change even can perform more difficult task. Inversely, when the motivation is low the user feels difficult to perform the behavior change and prefers to do easy task. Here the point is to improve the motivation which are able to conquer the the consideration of risk to forget the thought and lose ideas and lead user to change prolonged computer usage behavior.

According to the health belief model, the elements of perceived susceptibility, perceived severity and perceived benefits are taken to design. We spread advices everyday regarding to how easy to get the serious health problems form performing the prolonged usage behavior. Some papers with slogan like 'You sit more with computer then your back will pay more for it. Don't risk', which are printed out to stick on their tables. Also the messages are sent out through Lync by our observer such as 'Don't forget to take a break unless you want to earn more money to pay your medicine bill'. Moreover, the performance of behavior change in our previous experiment shows that users are getting lower motivation to change behavior and even quit it by the time goes. To make the persuasion even more powerful, the element of perceived threat is applied. Some images which are relative with health effects of prolonged usage behavior, are sent to our

participants timely (figure 19). This is aimed to improve the awareness of dangerous behavior and push user to move to take action.

Figure 19 Persuasive Images

The element of social norm is also valued in our design referring to the theory of planned behavior. The suggestions are transferred to our participants like 'In our team, people who knows how to take care their health, knows how to take care the work better. So don't forget to take a break and just leave you damn computer alone' and 'In our team, we like people who didn't get stuck with computer'. It builds up a social sense that helps participants to realize that this is a behavior their colleagues don't like and they better perform the same behavior as others.

As described above, Lync is also connected with mobile devices which are provided by the company. Once the users are in a working status of in meeting or away, that means it's better not to remind and disturb them. But when the user is in normal working situation but they just turn the status of busy in Lync. Then the reminder and information will be sent to them through their

mobile. The notification from mobile devices are valued to catch the users' attention effectually. According to Stothart, Mitchum & Yehnert (2015), it is continued working to insist on reminding users with the information sent. Even user does not response to it but it will still work in their mind which can lead them to achieve the goal.

The next concern of improving motivation, is the social value. This is also valued as the element of companionship support in the theory of social support. This type of support is considered as the appraisal to access him/herself to get engaged with companions into social events or activities (Uchino, 2004). The social persuasion is valued by our participants in a coffee meeting before we started the experiment. The design of social persuasion is aimed to trigger a move of human persuasion. When the working length is almost finishing in the last 5 mins. The message will send to remind the user to take a coffee break, also to suggest participant to invite another participant to join the break when the participant is finishing the working length. The human persuasion is more powerful in the real situation which is about to reject an invitation by face to face is difficult than by responding through computer.

The last concern of our design is to provide proper instruction of behavior change. This part of design is based on our literature review about the possible health effects. The warning notifications are sent to participant, which are using persuasive language to push user stop performing prolonged usage behavior, like "stretch your body, it needs", "Release your brain, take a break for next better performance" and "Don't hurt your eyes, take a walk and see outside". Some simple instruction is provided to help user perform the target behavior, like the example (figure 20) for neck health. This interaction is designed to drag user's attention to read the text which is a poem, meanwhile the user has to shake their head to follow reading, which are helping to stretch neck and release the stress.

All of these design above is to make the computer users to notice that how serious if performed prolonged usage behavior and how easy to avoid if they take a regular break, together to improve the motivation to perform the behavior change.

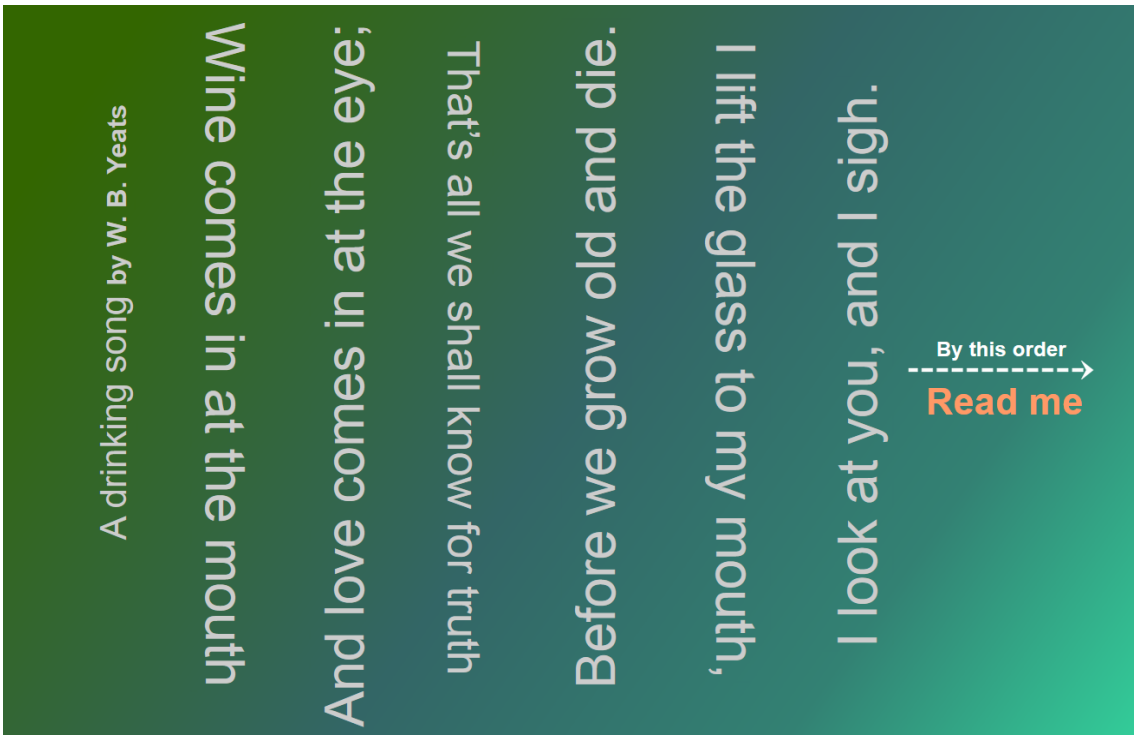


Figure 20 Instruction of Recommended Behavior

3.5 PHASE 4 – THE SECOND ITERATION CASE STUDY

The iterated case study will be conducted in this phase aimed to evaluate the performance of new solution designed, which is to study how users experience (feel and react to) use of the new persuasive design. All the data of the experiment are collected to compare with the first experiment. It is to verify if the new design enhances the persuasive power on motivating computer user too change prolong usage behavior. In practice, the semi-structured interviews were conducted with implementation and observation.

3.5.1 THE EXPERIMENT PROCEDURE

In this iteration case study, our experiment basically is conducted as similar as previous one, which help us to measure that all the data collected has relative value to compare and to avoid the deviation. Before we start the experiment three participants are invited to have a short and informal discussion. It aims to declare our purpose of this experiment and the study goals again.

It's also a place for them to share different ideas how they feel after the first experiment, which helps us to understand what the participants think about it, as well to make sure that all the participants will keep the positive attitude and have the will to continue the following experiment. Participants are the same as in previous experiment, two of them are involved for the totally 3 days' experiment and only participant A was unavailable in office at the 3rd days' experiment. As the same of first experiment, observer is keeping tracking on the behavior change and collecting data, combined with interviews and short talking.

The experiment included 3 parts of interview, implementation and observation. The empirical study in this part is conducted by applied the same application *Eyes Relax*. Also the tool Lync will be the plus which can transfer our persuasion design. These two main tools with some paper printed with text, all together are used to enhance the persuasion power aimed to motivate computer user to change behavior.

The printed papers with persuasive text are used to stick on participants table. Eyes Relax is suggested to run in the background with customized setting by their own. Since Lync is always running on computer, our observer can detect the working status and send request to participant if to run the Eyes Relax or pause it. Similarly, at the beginning participants are asked to specify the working periods of computer usage and breaking length by their personal wills. Then the application starts running in the background. Before the time is up, extra persuasion design of text will be sent to our participants through Lync. After they received the persuasion and the working length is over, reminder comes then they can decide to follow the instruction to take break or postpone the break. If the user decides to take break, then they will receive a request to invite other participants who is also about take break timely. Once the user decides to postpone the break, the persuasion design with images of possible health effects will be sent to our user by Lync. When the postponed time is up, they can decide again if to take break or postpone it. When the user changes their working status to be busy and they are just in normal working but not in meeting or other running schedule. Then it means the user prefers not to be disturbed. After one hour, the persuasion message will be sent through Lync to the user on PC and mobile. The process of the experiment is under tracking in 3 days as previous one by the observer. And short interviews are conducted every day mixed some short talks during their break time. The data are only collected by 3 rounds per day due to their working schedule and personal plan.

After experiment is finished, three participants are invited to a happy afternoon tea time with some delicious cake to express how thankful for their participation and contribution.

3.5.1.1 INTERVIEW PROCEDURE

The interview procedure includes two parts. One happens at the end of the day experiment and another is informal like short talks happen during the break time. At the end of the day experiment, the quick interviews to each of them respectively, aimed to understand the time with more persuasion designs how do participants feel about the persuasion when the time is up. The responses are collected to analyze the motivation when persuasion comes aimed to change prolonged usage behavior. During the break time, short talks happen to know the immediate feeling and motivation, because feeling and motivation are instant and fleeting, sometimes even ineffably. Interview questions are rather open to bring out the room for our participants to talk more but narrow on the persuasion to motivate behavior change in this design. The interviewer and observer are the same person, to organize the process and collect the data.

Interviews after the day experiment performed included:

	Interview questions	Measurement Scale and aim
1	How do you feel this time, Eyes Relax combined with Lync?	To know what's, the idea about these two applications combined for their usage.
2	How do you feel when the time is up and reminder comes up to you?	To know the feeling and motivation when the persuasion comes to user.
3	How do you feel when you received our persuasive messages to remind you to take break?	To know the feeling when participants receive the persuasive messages, and to review our persuasive design.

4	How do you feel when you received our persuasive design of images?	To know the feeling when participants receive the persuasive images, and to review our persuasive design, like if they feel scared or sick.
5	How do you feel when the reminder comes when you are concentrating on your work? Score the annoyance from 1 up to 5 of supper annoying.	To understand the scope of annoyance after we improve the motivation.
6	How do you feel when you received persuasive messages from mobile phone?	To know that if mobile phone could be used as proper medium to persuade.
7	How do you feel after this experiment today?	To know if the experiment too long or too easy for modification.
8	What do fell when you postpone the reminder?	To understand their feeling while they don't want to perform the behavior change.

Table 11 Interview Questions (after second experiment)

Some questions are asked in short talks as usual during the break time, as blow.

	Interview questions
1	How do you feel right now?
2	Do you feel relax?
3	Feeling good hum? Get off so many crap

4	Coffee break helps, right?

Table 12 Interview Questions (during breaks in second experiment)

3.5.1.2 IMPLEMENTATION PROCEDURE

The implementation is carried out to see in this second experiment how participants' response to the persuasion after adding more persuasion design and how does behavior change. It helps to see if the motivation is improved, and how participants experience the use of the new persuasive design aimed to change prolonged computer usage behavior. The office software Lync is applied to add it on the current persuasive tool of Eyes Relax. Similarly, participants are asked to use Eyes Relax during the experiment, which is to run it in the background with customized setting by their own. Meanwhile Lync launch automatically when the computer starts working. Also, participants are requested to specify the working length of computer usage and breaking length by their personal wills. Then the application starts running in the background. And during the process, the participants will receive some extra persuasion designs through Lync depended on the situation and their reactions. When the time is up, the reminders comes and the user is able to follow the instruction to take break or postpone the break.

Experiment steps performed included:

Step	Experiment design	Measurement
0	The printed papers with persuasive text are used to stick on participants' tables. And the Lync is working properly on their computers.	Preparation steps done
1	Launch the application Eyes Relax	Launch succeed
1.1	Pause the application Eyes Relax	• The working status is in meeting or away and other

		schedules. • The participant doesn't want to be disturbed.
1.2	The persuasive messages are sent out to participants about 1 hour to run up to remind user to take break. (iteration works)	• Accept to take break (Done) • Reject
2	Customize setting: specify the working periods of computer usage	Working Period set up
3	Customize setting: specify the breaking length	Breaking length set up
4	Confirm to run in background	Program runs on background
5	The persuasive messages are sent out to participants about the time to run up.	Persuasive messages are received.
6	Time is up and reminder comes to persuade user take break	• Accept to take break (Done) • Postpone the break time
7	The persuasive images are sent out to participants about the time to run up.	Persuasive images are received.
8	Second reminder comes to persuade user to take break	• Accept to take break (Done) • Postpone the break time
9	Third reminder comes to persuade user to take break	• Accept to take break (Done)

		• Postpone the break time
10	The persuasive messages and images are sent out to participants about the time to run up.	Persuasive messages and images are received.
11	Forth reminder comes to persuade user to take break	• Accept to take break (Done) • System rejects to postpone (Only allow to postpone 3times)

Table 13 Implementation Steps (second experiment)

3.5.1.3 OBSERVATION PROCEDURE

Observation is carried out by our observer to understand the behavior change when persuasion comes, but also to collect the data of the performance from the implementation process. The process of the experiment is under tracking in 3 days by the observer, except the participant A at the 3rd day due to his nonattendance. The data are only collected by 3 rounds per day due to their working schedule and personal plan.

The observation steps performed included:

	What was observed	Measurement Scale and aim
1	Participants' expression and behavior in general	To see how they behave when persuasion comes
2	What is the working status shown on the Lync	• they are in a meeting or away • just don't want to be disturbed

3	Participants' expression and behavior when they receive extra persuasive design like messages or images.	
4	How long the working period is set	
5	How long the breaking length is set	
6	Performance of behavior change: Take break when persuasion comes	• Accept • Postpone
7	How long the postponed time length	
8	The next performance of behavior change: Take break when persuasion comes	• Accept • Postpone

Table 14 Observation Steps (second experiment)

3.5.2 THE RESULTS AND DISCUSSION

The result is described from interviews and observation to understand how participants experienced the persuasion design and how they performed the behavior change.

3.5.2.1 INTERVIEWS

Our interviews are conducted after the day's experiment, also mixed with some short talks during the breaks. In this experiment, the positive responses we get are more than the previous experiment. Most response are regarding to the extra persuasive design.

The printed papers with persuasive text bring them a subjective norm. According the responses received, they feel that they always remember the persuasive text somehow due to viewing it

every day. Also there is a feeling like someone is requesting to them to take a break even they actually knew that is just a paper. They feel that the persuasion is much stronger, especially those persuasions come from the Lync. Regarding to the tool Lync added to Eyes Relax, three participants all agree that it's a helpful tool. They appreciate that this time the experiment is less annoyance, compared with the previous experiment. Because when they are in meetings or daily scrum there is not notifications to remind them to take break which makes them can totally concentrate without any interrupts. And they also consider this friendly function should be in the application of Eyes Relax. Moreover, the new persuasive design which is transferred through Lync, actually did enhance the persuasion power. They feel more motivated and the persuasive message is actually like a voice telling them how easy they will get the healthy problems if they continue to work on computer. Another one they feel more being motivated, is the persuasive images. Those persuasive images give them a vision of what they will really get if not to change the behavior of prolonged computer usage. In this point, we see the perceived threat is working very well to improve the motivation.

Additional responses are collected from the short talks during the breaks. The pros we get is that they feel the persuasion comes from the mobile has more effects. When they receive the reminder from Eyes Relax, they get the feeling like 'yes, of course it is you again'. But when they receive some scared images or messages from their mobiles, they feel the persuasive power is stronger because they don't expect it will come from the phone instead of some normal notification of working schedule. Also they like idea that we sent the instruction through Lync to them when they decide to take break, which helps them to do some simple stretch. The cons we received, one is that they still receive the persuasive message when they change the working status of busy because they don't want to get disturbed. Another one is that they get struggling to decide whether to take break when they are concentrating on work when the persuasion comes.

3.5.2.2 OBSERVATION

The observation includes two parts, that one is to observe the expression of participants, and another is to observe the behavior change. All the data of the performance are collected by observer. The result from our observation is presented as below (table 15, table 16, table 17), showing that the performance of behavior change has improved comparing with the data from first experiment. However, the performance is still declining in general by the time goes on,

which means that motivation is getting lower following the time goes. This is because at the beginning of the day user usually keep high confidence and motivation to make some change. But when the time is passing they get tired to perform some task and the motivation is getting lower and lower. Especially in 1st day's experiment, all the participants only postpone once respectively. But the next 2 days' experiment, the performance of behavior change is lower. But the behavior change is always successful when the participant invites another participant to take break together. There is one more thing observed, is that participants will easily to ignore the reminder from personal computer (PC) but not from mobile. Participants more care about notification come from mobile. They will pick it up and check what comes to them. This somehow value the mobile persuasion power. Still, in most situation when participants are concentrating on their works they don't want to get rid of the idea in their mind at the moment. But compared with the first experiment, the extra persuasion design like text and images have enhance the persuasive power which motivating them to take action of behavior change. The postponed behaviors are less than in the previous experiment. Moreover, the instruction of recommended behavior is working very successful in this experiment. Participants follow the instruction to stretch the body, and even when we didn't send to them any instruction they will still remember and perform the similar stretch behavior.

Day 1							
Participant A	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	10 min	×			
	2	1 hr	5 min	×			
	3	1 hr	5 min	5 min	×		
Participant B	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	×			
	2	1 hr	5 min	×			
	3	1 hr	5 min	5 min	×		
Participant C	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	45 min	3 min	×			
	2	1 hr	5 min	5 min	×		
	3	45 min	5 min	×			

Table 15 Data of Performance, Day 1 of Second Experiment

Day 2							
Participant A	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	×			
	2	1 hr	5 min	5 min	×		
	3	1 hr	3 min	5 min	5 min	×	
Participant B	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	×			
	2	1 hr	5 min	×			
	3	1 hr	3 min	5 min	5 min	×	
Participant C	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	8 min	×			
	2	1 hr	5 min	5 min	×		
	3	45 min	5 min	5 min	×		

Table 16 Data of Performance, Day 2 of Second Experiment

Day 3							
Participant B	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	1 hr	5 min	5 min	×		
	2	1 hr	5 min	×			
	3	1 hr	5 min	×			
Participant C	**Round**	**Working Period**	**Break Leagth**	**postponed 1**	**postponed 2**	**postponed 3**	**postponed 4**
	1	45 min	5 min	×			
	2	45 min	5 min	×			
	3	1 hr	5 min	5 min	×		

Table 17 Data of Performance, Day 3 of Second Experiment

3.6 FINAL CONSIDERATIONS

The design and exploration study are divided into 4 phases of design opportunities, first exploration case study, solution tangible design, and second iteration case study. Two experiments are conducted to research how users experience (feel and react to) the use of the persuasive design and to compare the performance of behavior change. The results are drawn based on analysis. The persuasive power has been enhanced after adding the new persuasion design based on the current persuasive tool of Eyes Relax. There are some points need to be addressed out, which are considered being valuable to enhance the persuasive power. First is the mobile as persuasive tool which bring out another path to improve motivation. Perceived

susceptibility and perceived severity enhance the perception of being threat, also with perceived benefits together effectually to increase the likelihood of behavior change. Meanwhile, companionship support has been verified it's very effectual to persuade user to change behavior. Last point is the instruction which is used to recommend user to perform the target behavior for relax or to stretch the body. It brings user a direction to take action by easily following the giving instruction.

Thus, some issues still need to be concerned about how to lower the annoyance when user is concentrating on work. It still needs to be discussed what is the line between well persuasion and enforcement. Also the proper time and cue are considered to be important elements on a behavior change. In sum, this part of our study has many positive outputs which helps us to understand better on how to enhance persuasive power based on context to motivate user to change prolonged computer usage behavior.

4 DISCUSSION

The last section of the study, is to summarize the main result we achieved from theoretical study and exploration case study. Also some important elements to improve motivation will be recommended. Regarding to changing prolonged computer usage behavior, a possible solution of persuasive design will be proposed. And more is about the conclusion and future work.

4.1 THE RESULTS ACHIEVED

The main results achieved included two parts of theoretical study and practical exploration study.

The correlate theoretical background has been studied started in literature review. Many relative health effects caused by prolonged computer usage behavior are studied, and it leads to figure out its severity and pervasiveness. These health effects include physical and psychological healthy issues such as Carpal tunnel syndrome, Back, neck and shoulder problems, Eye and vision problems, and stress. Moreover, many behavior theories are studied, which include the health belief model, theory of planned behavior, social cognitive theory and social support. These behavior theories lead to understand how to approach the behavior change, also provide wide theoretical support to help us to sort out most important elements which are more valuable to change behavior prolonged usage behavior. Furthermore, the persuasive technology with Fogg behavior model have been studied due to its attributes of interactive mechanism. Fogg behavior model is built based on many other behavior theories which is a simple architecture with three elements and is considered as a combination of behavior theories over others. The advantages of persuasive technology have been studied, which is over many traditional persuasive techniques. Computer is valued as a tools, media and social actors, which means computer systems are capable to react to people's responses. This way of human-computer interaction effectually enhances persuasive power. Therefore, persuasive technology with Fogg behavior model are taken to apply in our practical exploration study.

The practical study is divided into four main phases, which are design opportunities, first exploration case study, solution tangible design, and second iteration case study. These four phases reflect to a circle of research process (figure 10). The personas and scenarios are created

based on literature review, which are used to pitch down to define the sample and venue in real context. The users' experience of the use of the persuasive design has been researched in the case study. The room which aim to improve the persuasive power has been found, which is aimed to break two preventions. One is the concentration on continued working. Another one is the consideration of the risk to forget the thought and lose ideas. After that, the solution is constructed based on the requirement and theoretical study to enhance the persuasive power. Another tool is selected to applied in second experiment, which helps to transfer these persuasion designs to user. In the iteration case study, the persuasive power has been verified as stronger to motivate user compared with the first experiment. All the data are collected for analysis, and it successfully revealed the differences between two experiments. And it results in that our solution designed has enhanced the pervasive power to motivate user to change prolonged computer usage behavior.

In sum, the main results we achieved has reached our study goal which is to understand the persuasive power on motivating users to change behavior. The theoretical study and practical study were conducted through by answering the research question of how users experience (feel and react to) the use of persuasive design. The theoretical study constructed the theoretical basis to support the practical study, and the practical study reflected to the theoretical supports. Collectively the study had revealed that some important elements are valuable to enhance the persuasive power, and this persuasive power is capable to motivate computer users to change prolonged usage behavior.

4.2 THE PROPOSED DESIGN

In the theoretical and practical study, we have explored how to enhance the persuasive power on motivating user to change prolonged computer usage behavior, and we gain a deeper understanding of persuasive power on motivating computer user to change behavior. The concept designed is evaluated in our case study and many positive outcomes have verified the persuasive power on motivating user to change behavior. There are many valuable elements about to enhance the persuasive power and a design recommendation will be proposed.

4.2.1 THE VALUABLE ELEMENTS

There are many elements which are valued to enhance persuasion power in our study. Here we address these elements under the architecture of Fogg behavior model combined with other behavior theories.

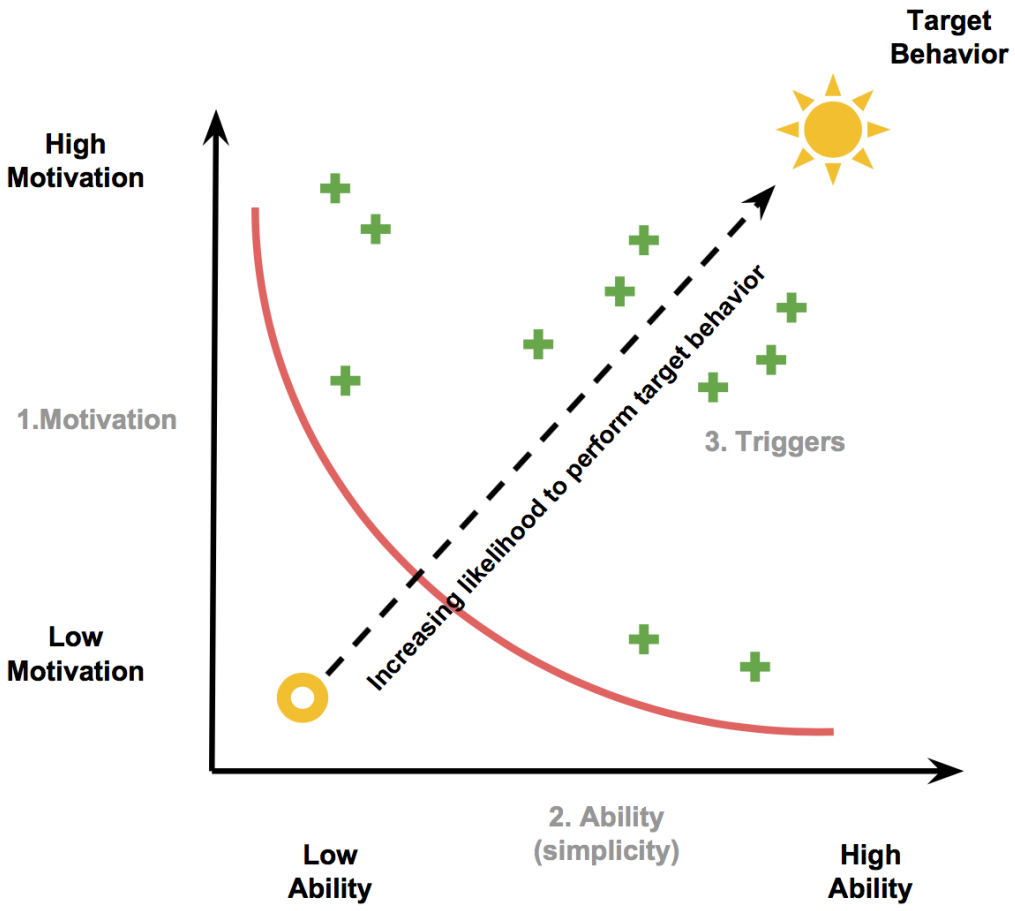


Figure 21 Successful Behavior Change Based on Fogg Behavior Model

Behavior change is a combination of three main factors included motivation, ability and triggers to contribute at the same moment (figure 21). According to Fogg (2009), to perform a target behavior, it's required to have sufficient motivation, sufficient ability (or simplicity) of performing the behavior and proper trigger to cue the action. These three factors should occur at the same moment for successfully performing a target behavior. There are two axes which represent motivation and ability respectively. The red curve divides two segments of successful behavior performance and failed performance. Those green plus marks represent successful

behavior performance. As seen that if the motivation is high enough with sufficient ability, or ability is high enough with sufficient motivation, a proper trigger can make the target behavior happens. Moreover, if both of the motivation and simplicity are high enough with the proper trigger, the likelihood of performing target behavior is very high. About how to enhance the persuasive power to motivate user for changing prolonged computer usage behavior, we value to go through these three factors to increase the likelihood to perform target behavior. In the case of changing prolonged computer usage behavior, the ability to take action is rather low. Therefore, for this sake, the consideration of enhance the persuasive power will go to improve the motivation and to create the proper triggers.

Improving Motivation

- Subjective norm and social norm, according to Amjad & Wood (2009), which refers to person's belief about the importance of social environment if he or she should engage in a behavior. Regarding to prolonged computer usage, subjective norm is about to provide normative belief that everybody has the behavior of proper computer usage and it is important to live a healthy life. Social norm is more considered on the behavior in a group of people or culture context, which can spread the idea of the proper computer usage is a standard of basic requirement in a group. These two types of norm are used together to shape the attitude and create a personal belief of performing a behavior to enhance the intention to fit in context.

- Perceived threat, according to the health belief model there are two brunches behind included perceived susceptibility and perceived severity. Perceived susceptibility refers to a person's subjective perception of risk of health problem. According to Rosenstock & Irwin (1974), individuals who will engage in specific behaviors when they feel that they will get some particular health problems easily, which aimed to reduce their risk. And perceived severity refers to a person's feeling of under a seriousness of illness. According to Glanz Rimer & Viswanath (2008), individuals who will consider the consequences of perform a behavior and evaluate it severity before they perform a specific behavior. These two types of perception together can enhance the perceived threat which can bring to users feeling of under threat if they perform prolonged usage behavior. It increases the likelihood of engaging the target behaviors.

- Perceived benefits, according to the health belief model it refers that an individual's perception of the effectiveness of actions which is possible to weaken the risk or seriousness of health impacts, or to cure the illness. It brings individual's idea of if they accept to perform the recommended health behavior then they will be able to receive the beneficial outcome such as not illness or healthier. Regarding to prolonged usage behavior, it provides computer user a path to of performing recommended behavior and receiving the benefits after performing recommended behavior. This usually combine with perceived threat together to enhance the persuasive power to increase the likelihood of performing the target behaviors.

- Companionship support, according to Wills (1991) it is about presenting a sense of social belonging to an individual which be considered as the appraisal to access him/herself to get engaged with companions into social events or activities (Uchino, 2004). It's also emphasized as social belonging in other theories. It provides computer user information of being in social context, and motivate user to stop prolonged computer usage behavior and to get engaged to the social activities.

- Observation learning, according to social cognitive theory it assumes that the individual can witness a behavior performed by other people and it leads the individual to regenerate and perform those behaviors, which is also titled as behavioral modeling in other studies (Schwarzer, R. 2008). If people observe a successful demonstration of performing a specific behavior, they can also learn to reproduce this behavior successfully. Computer users can model other individual's behavior from different ways. Considering computer as a medium, associated with the theory of social support, the observational learning can happen between human and computer. The users can model the the given behavior by observing the process of performance on computer.

- Reinforcements, according to social cognitive theory it refers to an individual is influenced by internal responses or external responses on the likelihood to continue or discontinue the action. Reinforcements can come from individual' self who generates or from the social environment, which leads to being positive or not. Once the computer user performs the behavior change successfully, the outcome of the experience will reinforce both sides of personal factor and behavior. Especially, the first experience is very important to computer

users. If the performance is successful, then it will be accessed to keep continuing. If else, then user got a big chance to quit and discard the intention to perform it next time.

Proper Trigger Design

- Cues, according to the health belief model, are the stimulus needed to trigger the decision-making process. According to Carpenter (2010), it takes many types which can be internal or external. Cues of action also can be referred from Fogg behavior model (2009), which also emphasized as trigger which is something to inform people that now it is right time to take an action. The trigger could be a spark to motivate behavior, or a facilitator to make behavior easier, or a signal indicates or reminds. A proper cue, should be in a good combination of type and time. To trigger Computer user in workplace, the cues shouldn't be annoying but strong, coming at the correct moment.

4.2.2 PRELIMINARY DESIGN RECOMMENDATIONS

From the results achieved, there are many elements are verified to be valuable to enhance the persuasion power regarding to change the prolonged computer usage behavior. Here the preliminary design will be proposed, which aims to bring out some suggestion or tips regarding to design the prolonged computer usage behavior change.

The working principle is addressed as the diagram shown (Figure 24). Computer as persuasive technologies to provide different type of persuasion, aimed to improve and supplement the persuasive power. It begins with providing subjective norm and social norm to bring out the basic social environment. Then to enhance the persuasive power, the perceived threat will be used to support, which can come with language or image to threaten user about the severity and susceptibility of health risk by continuing the current behavior. Adding to it, is the perceived benefits, which is following by the last step of perceived threat, to convince user that they will get the benefits as the consequences of performing the recommend behavior. The companionship support comes to provide the social support, which push user not to reject a friendly request from sociality and motivate to engage the same activities. Once the persuasive power is enough, it will be able to trigger the behavior change. The standard to determine whether the persuasive power

enough or not is based on the context. Also as mentioned before that motivation is like wave, therefore, the standard is totally depending on situation.

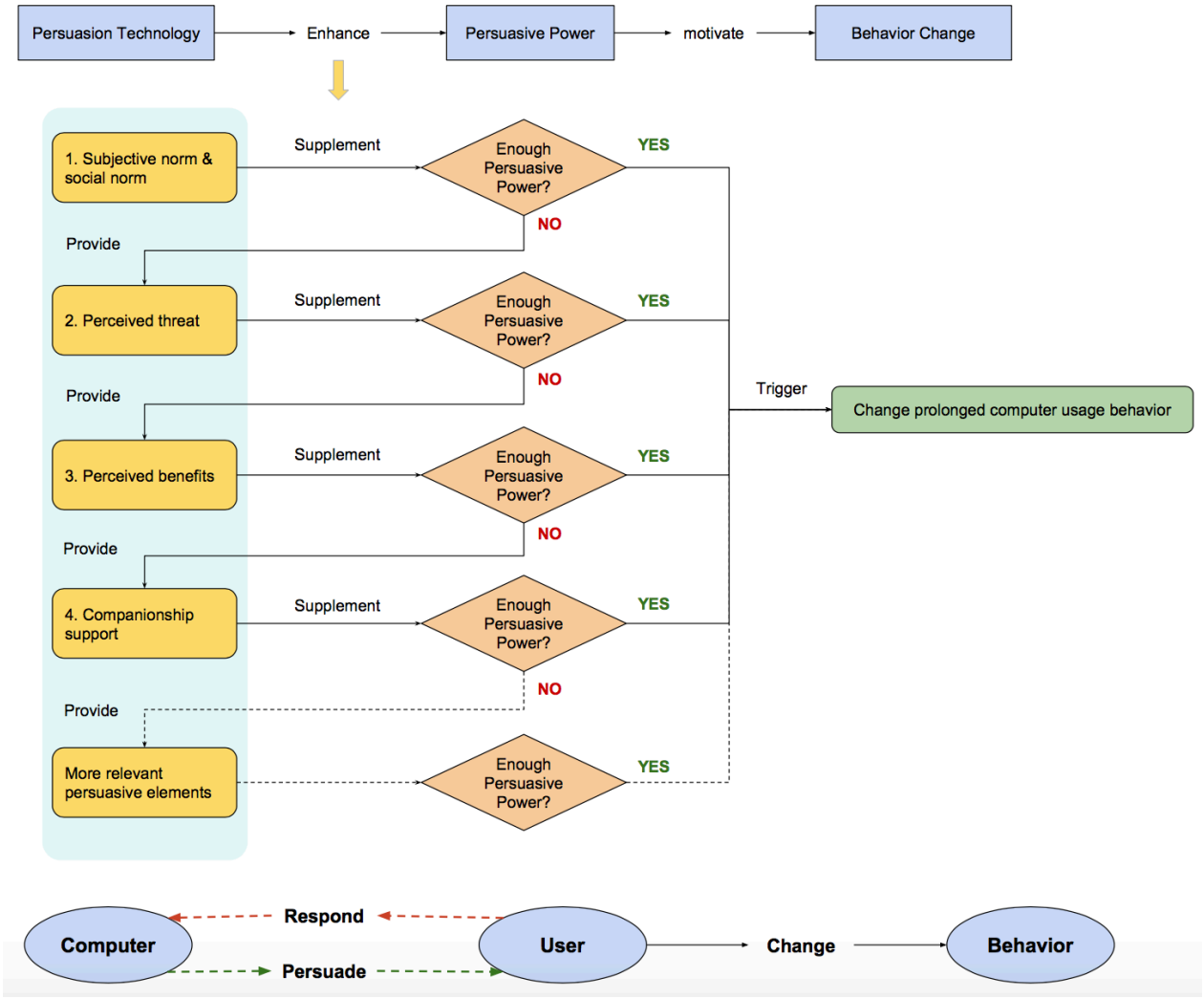


Figure 22 Working Principle of Recommended Design

Beside on this working principle, the possible persuasive design could be generated to persuade computer user to change prolonged usage behavior. Computer as persuasive technology is valued on the way of interactive mechanism. This sort of design reflects to human computer interaction on behavior change, as well refers to behavior on computer. Computer is capable to play different roles to interact with user based on user's responses or feedbacks. Once user customizes the working period and break length, the design should be able to run and detect the user's status whether possible to start persuasion or no. If a user is in meeting or away status, then the design

should be able to modify and postpone the persuasion. But if the user just simply doesn't want to be disturbed and change status, then the program should be modified for the best moment to persuade. When the time of working is up, the design will persuade the user by different levels of persuasive power based on user responses. Every time the trigger comes will be with instruction of recommended behavior, it bring out a path to user for easy forming behavior change. It leads user to change behavior by stretching the body or releasing the tough mind. It improves the simplicity and motivation. In different situation the user will have deferent standard to change the behavior. If the computer doesn't provide enough persuasion or the persuasion power isn't enough to meet the standard, the user will design not to change behavior. The next round of persuasion will supplement to persuasive power to push user to the likelihood of behavior change. Similarly, persuasion comes round by round and stronger than strong, and eventually to persuade the user to change behavior.

4.3 CONCLUSION

Throughout our study, it has been explored to answer the research question about how users experience the use of persuasive design. Also, it has brought us a deeper understanding of how to enhancing persuasive power to motivate computer user to perform behavior change.

From literature review, many theoretical background has been studied. The possible health effects of prolonged usage behavior combined with the theories of individual behavior and behavior change, together construct a picture of prolonged computer usage behavior change. Adding into this theories study, is the persuasive technology with Fogg behavior model. Its three factors in this section are the cornerstones which have built up the theoretical architecture for the following design and exploration study.

The design and exploration study constructed by following the circle process. After to define the design opportunities, the room for enhancing persuasive power has been found from first case study. Solution design were based on theoretical study and contextual usage requirements. The iteration case study has verified the persuasion power was enhanced to motivate users on changing prolonged usage behavior by comparing with the first case study. From the theoretical and practical study, there are some valuable elements for changing prolonged usage behavior has

been defined under the Fogg behavior model, as shown below. These valuable elements are considered into the preliminary design recommendation, which has been proposed above (figure 24), to address the process of enhancing persuasion power and leading to trigger the prolonged usage behavior change. There are seven valuable elements listed as below.

- Subjective norm and social norm
- Perceived threat
- Perceived benefits
- Companionship support
- Observation learning
- Reinforcements
- Cues

This study has verified these elements and proposed a possible solution design to enhance the persuasive power to motivate computer. Meanwhile the persuasive technology has been proofed that has a great efficiency on enhancing the persuasive power that is capable to motivate computer users to change behaviors. The last, the interactivity of persuasive technology has many great values to deal with unhealthy behaviors. As we believe and expect, this study also can bring out many possibilities to contribute in the area of human health and computer usage.

4.4 FURTHER WORK

The first comes to be considered is the prolonged computer usage behavior, our study defined what is prolonged computer usage behavior based on previous study of Ellahi, Khalil, & Akram (2011) as "*an experience of using computer systems extensively over a prolonged period of time.".* So the effects of prolonged usage computer usage behavior, basically is based on to study the health issues of prolonged computer usage. But there are more relevant health issues especially in psychological health area haven't been studied yet.

Regarding to our exploration study, the simples and venue has limits. Because the sampling is based on personas from literature review and the samples are only male and the age range is no wide enough. The surrounding of venue and other variables aren't measured in an exact standard because of some uncontrollable factor like nose. About the data collection and analysis, the result is not one hundred percentages accurate. Because the data gathered from observation includes expression, like face motion which is hard to collect the accurate data with any supportive instruments. Therefore, there are still some room to improve from quantity and quality perspectives.

Also behavior change could successfully happen in one time or many times. But to construct the healthy habit, it could cost months or years. Our study has a shortage that the exploring process didn't last long term, which makes us couldn't have more data to evaluate if the participants feel and react totally differently after these days in experiments. There is a further adventure need to have more attention and to work from promoting healthy behavior to motivate users to construct healthy habit.

Moreover, persuasive technology is primarily being demonstrated on the positive side. However, there are some other issues also important while applying this technology. It can also serve ignoble purposes. This is relevant with the ethics concern which need to have more study while applying such technology further. The next about persuasive technology, is that persuasive technology on human behavior change need to be more discussed regarding to what is the proper persuasion for a behavior change. This concern it comes from a question of how to measure the line between proper persuasion or being annoying to audiences.

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7 APPENDIX A

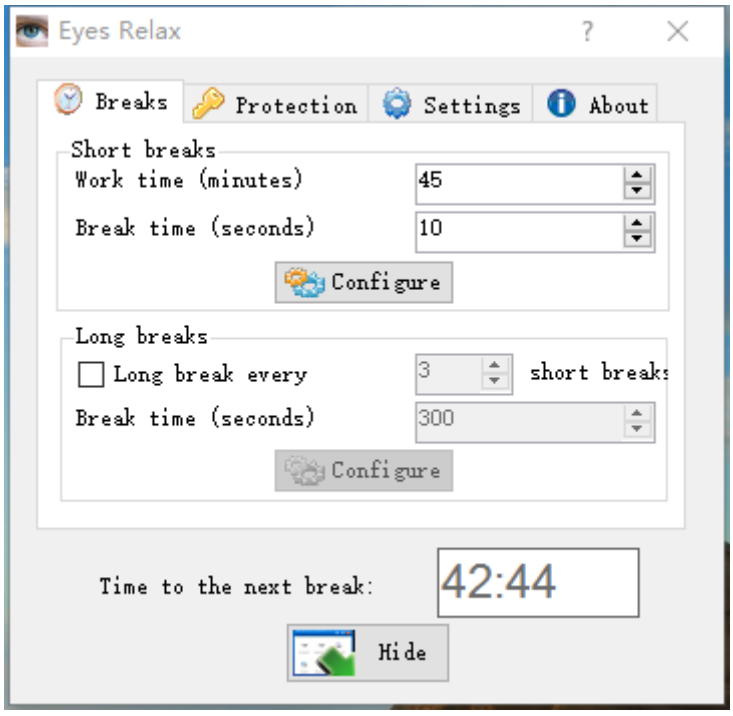

Figure- Setting page of Eyes Relax-1

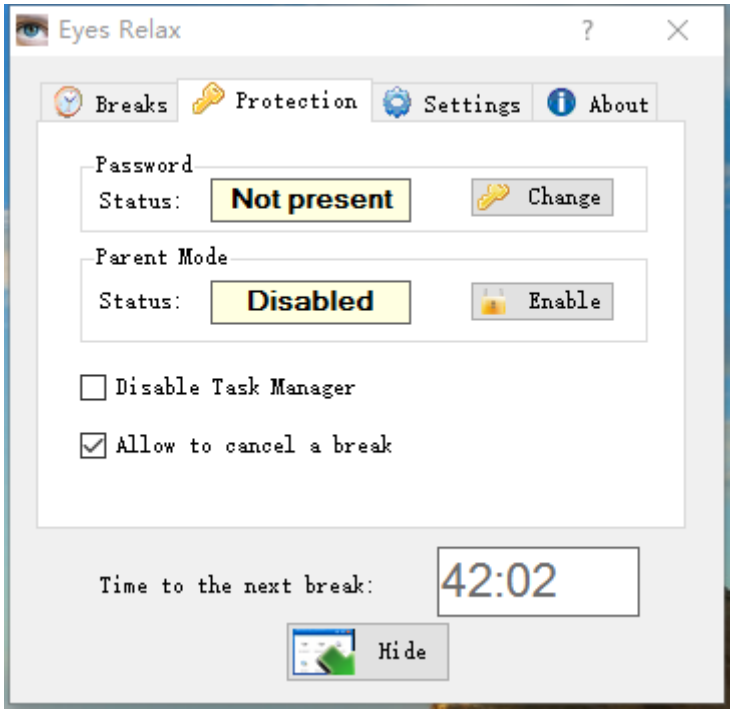

Figure- Setting page of Eyes Relax-2

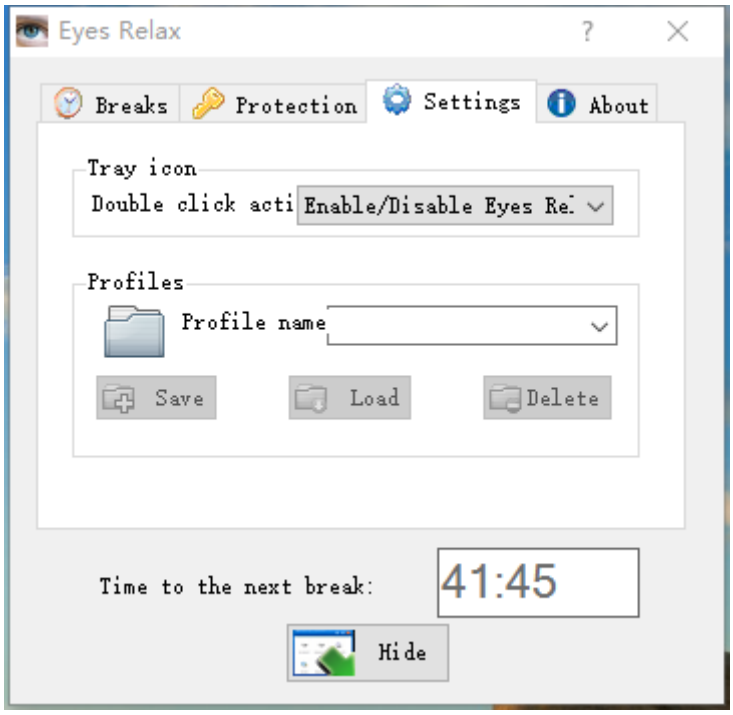

Figure- Setting page of Eyes Relax-3