GESTURE-BASED INTERACTION FOR AN OFFICE SYNDROME PREVENTION: HEALTH COMMUNICATION THROUGH INTEGRATING EXPERIENCE INTO DAILY LIFE FOR AN ARM-SWING INPUT DEVICE

Nuanphan Kaewpanukrangsi

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy (Communication Arts and Innovation) The Graduate School of Communication Arts and Management Innovation National Institute of Development Administration 2018
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______/______/______
ABSTRACT

Title of Dissertation
GESTURE-BASED INTERACTION FOR AN OFFICE SYNDROME PREVENTION: HEALTH COMMUNICATION THROUGH INTEGRATING EXPERIENCE INTO DAILY LIFE FOR AN ARM-SWING INPUT DEVICE

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Arm swing is a well-known exercise practiced throughout Asia. The benefits of regular exercise affect a person’s gait, shoulder function as well as head and body strength. This research presents a new study of gesture-based interaction by using arm swing as a gestural input command applied to any digital device used by people aged 21 to 50 years of age during their workday. After selecting five different occupations, i.e., student, lecturer, office worker, designer and industrial worker, their different routine tasks were studied. The sampling comprised 30 participants, 6 persons representing each occupation. Data was collected through focus groups. The objective of this study is to provide possibilities to integrate proper user experience of gesture-based interaction towards an arm-swing input device onto participants’ routine activities as a message of self-health communication. The arm-swing input device acts as a medium that transmits a health message to participants. It is believed this research can have a significant impact on the quality of a modern lifestyle. User experience methodology, like a field experiment, is applied to provoke participants to follow the correct sequence case by case.

This action research applied a qualitative approach, focusing on user experience measurement. A proper user experience occurs when one understands how strength and weakness are affected by gestural input. An input gesture, feedback, system, and output can then be mapped together into a complete scenario of a person’s daily life. The embodied interaction while performing the exercise has motivated participants to swing their arms. Each participant was encouraged to raise various ideas on how they access technology rather than on how technologies allow them to access information.
Based on the experimental results, this dissertation will then discuss the possible tasks performed in the five occupations in which an arm-swing input gesture is integrated. The influence of this integration into the participants’ daily activities presents confirmation of a preferable wearable input device for all focus groups. Office syndrome prevention is communicated to participants via the act that can contribute to wellbeing in their workplace. This wearable input device can then be integrated into activities without any interruption in a person’s main actions. The awareness of office syndrome prevention on a new arm-swing device could possibly lead to changes in an individual’s health-oriented behavior.

Ultimately, sign consumption of arm-swing action in terms of a postmodern perspective is reflected after a participant’s performing the exercise. The meanings of a new form of health communication through the arm-swing input device have been integrated into workplaces, which create a paradigm shift of some of the participants. There are more than 80% positive opinions for the arm-swing input device and the gesture in all participants' reflection.
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Nuanpha Kaewpanukransi
May 2019
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>v</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>1</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER 1 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Background</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Research Motivation</td>
<td>5</td>
</tr>
<tr>
<td>1.2.1 Significance of Health Communication on Arm-Swing Exercise Gesture</td>
<td>7</td>
</tr>
<tr>
<td>1.2.2 The Significance of Gesture-Based Interaction</td>
<td>9</td>
</tr>
<tr>
<td>1.2.3 The Focus Groups (The Participants)</td>
<td>10</td>
</tr>
<tr>
<td>1.2.4 The Users’ (Daily) Experience</td>
<td>11</td>
</tr>
<tr>
<td>1.2.4.1 Sign Consumption</td>
<td>11</td>
</tr>
<tr>
<td>1.3 Statement of Purpose</td>
<td>12</td>
</tr>
<tr>
<td>1.4 Research Questions</td>
<td>13</td>
</tr>
<tr>
<td>1.5 The Overview of Methodology</td>
<td>13</td>
</tr>
<tr>
<td>1.6 The Ground and Significance of Action Research</td>
<td>14</td>
</tr>
<tr>
<td>1.7 Role of Researcher</td>
<td>15</td>
</tr>
<tr>
<td>1.8 Research Assumptions</td>
<td>17</td>
</tr>
<tr>
<td>1.9 Definitions of Key Terminology</td>
<td>19</td>
</tr>
<tr>
<td>1.10 Dissertation Structure</td>
<td>21</td>
</tr>
<tr>
<td>CHAPTER 2 LITERATURE REVIEW</td>
<td>22</td>
</tr>
<tr>
<td>2.1 Part I: Gesture-Based Interaction as a Form of Health Communication and Action Research</td>
<td>22</td>
</tr>
</tbody>
</table>
2.2 Part II: The Office Syndrome Domain ................................................................. 23
  2.2.1 Remedial or Supplement or Prevention ......................................................... 23
  2.2.2 Arm-Swing Gesture: Health Communication for Office Syndrome
      Prevention ........................................................................................................... 24
2.3 Part III: Changing Behavior .............................................................................. 26
  2.3.1 Change by User Experience Design to User Interface Design ..................... 27
  2.3.2 Proper User Experience in terms of Input Component (the Right Users) 28
2.4 Part IV: Sign Consumption of Jean Baudrillard .............................................. 29
2.5 Part V: Health Communication Aspect: Social Interaction .......................... 32
  2.5.1 Media Ecology: from Mass to Individual about Health ............................... 33
  2.5.2 The Relationship between Technology and Society ................................. 35
  2.5.3 The Relationship between Technology and the Individual ....................... 35
  2.5.4 The Ritualistic (Health) Communication Model ....................................... 35
      Under this theme, The Ritualistic (Health) Communication Model, ............ 35
2.6 Part VI: Medium on Health Communication ................................................... 37
  2.6.1 Media for Health Communication concerning Office Syndrome .............. 38
  2.6.2 Artifacts for Different Purposes of Arm-Swing Gesture ............................ 41
  2.6.3 Wearable (Input) Devices for Health Promotion ..................................... 42
  2.6.4 Media Comparisons of Health Communication ....................................... 43
2.7 Part VII: Technology Centric Aspect ............................................................... 44
  2.7.1 Internet of Things (IoT) ............................................................................. 45
  2.7.2 Interaction between Artifact and User ....................................................... 47
  2.7.3 Arm-Swing Gesture Input Component ...................................................... 47
2.8 Part VIII: Designing an Arm-Swing Input Device ......................................... 49
Figure 2.16 Arm-Swing Input Device prototype .................................................. 50
2.9 Part IX: Related Works of Action Research .............................................. 52

2.10 Part X: The Conceptual Framework ..................................................... 52

2.11 Part XI: Summary of Chapter 2 ............................................................ 54

CHAPTER 3 ACTION RESEARCH METHODOLOGY ....................................... 56

3.1 Participatory Action Research Methodology (PAR) ................................. 56

3.2 The Focus Groups ................................................................................... 58

3.2.1 Office Workers .................................................................................... 59

3.2.2 Students .............................................................................................. 59

3.2.3 Lecturers ............................................................................................. 60

3.2.4 Designers ............................................................................................ 60

3.2.5 Industrial Workers .............................................................................. 60

3.3 Arm-Swing Input Device as a Tool for Health Communication .............. 61

3.4 Field Experiment Flow of Use Case Scenarios ...................................... 63

CHAPTER 4 DATA ANALYSIS ....................................................................... 67

4.1 Officer Workers ...................................................................................... 68

4.2 Students ................................................................................................. 73

4.3 Lecturers ................................................................................................. 78

4.4 Designers ............................................................................................... 84

4.5 Industrial Workers .................................................................................. 89

4.6 Cross Focus Group Analysis ................................................................... 98

CHAPTER 5 DISCUSSION OF RESULTS AND FUTURE WORK ..................... 101

5.1 Action Research Contributions ............................................................... 102

5.2 Reflections ............................................................................................... 103

5.3 Possible Future Work ............................................................................. 103

5.3.1 To Expand New Health Communication Campaigns .................... 104

5.3.2 To Explore Gesture Interaction ......................................................... 104

5.3.3 To Expose Behavior of the Participants ........................................... 105

5.3.3.1 For self-health improvement ....................................................... 105
5.3.3.2 For waiting time................................................................. 106
5.3.3.3 For device control ............................................................ 106
5.3.3.4 For social norm............................................................... 106
5.3.4 To Explain Sign Consumption ........................................... 107
5.3.5 To Experience the market.................................................... 107
BIBLIOGRAPHY ........................................................................ 109
APPENDIX ............................................................................ 119
BIOGRAPHY ........................................................................... 132
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2-1:</td>
<td>Health communication media comparison</td>
<td>44</td>
</tr>
<tr>
<td>Table 4-1</td>
<td>Data of each occupation group</td>
<td>97</td>
</tr>
<tr>
<td>Table 4-2</td>
<td>Preferred input devices during working hours</td>
<td>99</td>
</tr>
<tr>
<td>Table 4-3</td>
<td>Preferred input devices outside of working hours</td>
<td>100</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1</td>
<td>Arm-swing postcard by Thaihealth.org</td>
<td>8</td>
</tr>
<tr>
<td>Figure 1.2</td>
<td>Corporate Social Responsibility (CSR) event</td>
<td>8</td>
</tr>
<tr>
<td>Figure 1.3</td>
<td>The Hooked Model</td>
<td>18</td>
</tr>
<tr>
<td>Figure 2.1</td>
<td>Arm-swing exercise posture</td>
<td>26</td>
</tr>
<tr>
<td>Figure 2.2</td>
<td>The disciplines of user experience design</td>
<td>28</td>
</tr>
<tr>
<td>Figure 2.3</td>
<td>The relationship of the use of digital equipment</td>
<td>29</td>
</tr>
<tr>
<td>Figure 2.4</td>
<td>Transmission Model</td>
<td>36</td>
</tr>
<tr>
<td>Figure 2.5</td>
<td>Ritualistic Model</td>
<td>36</td>
</tr>
<tr>
<td>Figure 2.6</td>
<td>The attributes of Participatory Communication in this research</td>
<td>37</td>
</tr>
<tr>
<td>Figure 2.7</td>
<td>Office Syndrome Rescue Brochure</td>
<td>38</td>
</tr>
<tr>
<td>Figure 2.8</td>
<td>Easy way to do arm-swing video</td>
<td>39</td>
</tr>
<tr>
<td>Figure 2.9</td>
<td>Yoga for shoulder pain relief video</td>
<td>39</td>
</tr>
<tr>
<td>Figure 2.10</td>
<td>Exercise for office syndrome</td>
<td>40</td>
</tr>
<tr>
<td>Figure 2.11</td>
<td>Five methods to relieve office syndrome</td>
<td>40</td>
</tr>
<tr>
<td>Figure 2.12</td>
<td>User wearing artifact while walking on</td>
<td>41</td>
</tr>
<tr>
<td>Figure 2.13</td>
<td>Fitbit, Garmin and iPhone</td>
<td>43</td>
</tr>
<tr>
<td>Figure 2.14</td>
<td>Convergence of IoT</td>
<td>46</td>
</tr>
<tr>
<td>Figure 2.15</td>
<td>Operation with an android freeware application</td>
<td>50</td>
</tr>
<tr>
<td>Figure 2.16</td>
<td>Arm-Swing Input Device prototype</td>
<td>Error! Bookmark not defined.</td>
</tr>
<tr>
<td>Figure 2.17</td>
<td>The Design Process</td>
<td>51</td>
</tr>
<tr>
<td>Figure 2.18</td>
<td>The Conceptual Framework</td>
<td>54</td>
</tr>
<tr>
<td>Figure 3.1</td>
<td>Details of the arm-swing input component</td>
<td>62</td>
</tr>
<tr>
<td>Figure 3.2</td>
<td>Tablet display when connected</td>
<td>62</td>
</tr>
<tr>
<td>Figure 3.3</td>
<td>Function of input components</td>
<td>63</td>
</tr>
</tbody>
</table>
Figure 3.4 Field case study flow chart and questions ........................................65
Figure 4.1 Action research in CPF (Thailand) office ...........................................69
Figure 4.2 Arm-swing at an airport .................................................................70
Figure 4.3 During action research at .................................................................70
Figure 4.4 Arm-swing at Interactive Design Studio ...........................................71
Figure 4.5 Vimol talks about her hobbies ..........................................................72
Figure 4.6 Arm swings while waiting for her advisor ...........................................73
Figure 4.7 Arm swing exercise during model making .........................................74
Figure 4.8 Kitti putting on an arm-swing ..........................................................75
Figure 4.9 Dissertation presentation to fellow students .......................................75
Figure 4.10 Putting on a device before an arm-swing action ..............................76
Figure 4.11 Before an arm-swing action ............................................................77
Figure 4.12 During conversation at KMUTT .....................................................79
Figure 4.13 Arm-swing activity during a break at KMITL .................................79
Figure 4.14 Answering questionnaire ...............................................................80
Figure 4.15 Using simple equipment .................................................................80
Figure 4.16 Using the arm-swing input device ...................................................81
Figure 4.17 Onscreen results ............................................................................81
Figure 4.18 Arm swing exercise with input device at Zagreb Bus Terminal ........82
Figure 4.19 Arm-swing at KMITL ...................................................................83
Figure 4.20 Arm-swing exercise when waiting for food .......................................83
Figure 4.21 Pleasure performing arm-swing exercise .........................................85
Figure 4.22 Watching feedback via the Samsung tablet .....................................85
Figure 4.23 Arm-swing before her pizza ordering .............................................86
Figure 4.24 Completing the questionnaire .........................................................87
Figure 4.25 Using the arm-swing input device ...................................................88
Figure 4.26 Arm swing to control a door ............................................................88
Figure 4.27 Using arm-swing input device .........................................................89
Figure 4.28 Arm-swing at home .....................................................................90
Figure 4.29 Wiwat showing his arm-swing result ............................................................91
Figure 4.30 Performing arm swings using a ....................................................................91
Figure 4.31 Swinging arms during break time..................................................................92
Figure 4.32 Performing arm-swing exercise....................................................................93
CHAPTER 1

INTRODUCTION

1.1 Background

Today, health has become an essential part of a modern lifestyle. Health communication, not actually a new term, has now become more integrated into daily life. While in the past the purpose of health communication was mostly to prevent epidemics, today, it concerns the symptoms of a modern lifestyle (Kaewthep & Nilphueng, 2013). During the past ten years, health services and products have been focused on more as people do not seem to have the time to take care of themselves properly. Now, as health communication aims to promote well-being in one’s life, people’s views on health behavior are very much influenced by the media (C Atkin & Silk, 1996; Pokasung, 2551). Television, radio, brochures and posters are forms of health communication media. As people know learn what is good for their health, they focus on their symptoms more than on prevention.

In addition to eating healthy, people need to exercise and find a physical and mental balance. As technology, is changing rapidly in all dimensions, people have adapted their lives with less concern about the quality of their life. It is hard to organized their time to become less dependent communication screens. To exercise, people need to allocate at least three times a week for fitness. They should feel motivated enough to arrange exercise into their schedule (Wilson, Mack, & Grattan, 2008) and actually, it is not so difficult integrate exercise into daily life through routine activities, especially at the workplace such as climbing stairs, raising arms and arm-swing. Most health-oriented research has claimed regular arm-swing exercise can promote good health in a proper posture whenever a person has time to perform it. In fact, arm-swing posture can affect gait and function of the shoulders, head, and entire...
body (Jewpattanakul, Reungthongdee, & Tabkeaw, 2012; L. Lee & Grimson, 2002; Matsuo, Okumura, Hashimoto, Sakazawa, & Hatori, 2007a).

Leelayuwat’s research was a starting point for the study of promoting arm-swing posture in Thailand more than 10 years ago, and found it was successful in elderly people, especially those with no specific exercise preference. Her research focused on arm-swing posture in diabetic patients (Leelayuwat, 2006). Unlike other research that examined rehabilitation, gait and arm-swing were found to be essential body movements (Barnes, 2015). There are several benefits from these studies in terms of equipment itself and physical monitoring.

According to Leelayuwat et al, arm-swing posture can also improve exercise capacity and oxygen consumption in young adults (Prasertsri, Boonla, Phoemsapthawee, & Leelayuwat, 2017). Another view is that arm-swing posture contributes to physical rehabilitation, particularly for the elderly. This has then affected Thai people’s mindset towards arm-swing as an aged posture as there are no limitations on doing it (Jewpattanakul et al., 2012).

Another byproduct of arm-swing exercise is relief for office syndrome, which occurs in most employees who must sit several hours each day in front of a computer (Lart-udomsp, 2014; Ooi & Goh, 1997). However, arm-swing, thought of as an exercise for the elderly, is not yet popular in any offices (Chitanuntavitaya, 2016; Ooi & Goh, 1997). In this dissertation, participants have been chosen to represent five different occupations related to office syndrome: office workers, students, lecturers, designers and industrial workers.

According to Baudrillard, these situations can mimic the way people translate well-being into something like a fitness or merely hygienic diet which requires time (Baudrillard, 1994; D. Agbisit, 2014). In reality, health does not just mean fitness, but rather the integration of exercise gesture into one’s daily life (Baudrillard, 1994; Best & Kellner, 1991; D. Agbisit, 2014). Although, most health product promotion still relies on screen-based communication, such as mobile applications designed to track and motivate, some people use these for only a short period of time because they are unable to adopt health behavior integration and intention into their daily lives on a regular basis, including diet and exercise (Grijincu, Nacenta, & Kristensson, 2014). Most modern technologies are designed to merely provide a fast track between users
and their devices, especially in health-oriented subjects (Leddy, 2006; Markov, 2019; Nhu, Syin, & Chiew, 2015).

In health care, mobile applications and wearable computer devices are designed mostly to monitor patients and for training purposes (Ventola, 2014), not health communication. Patients use digital devices to track themselves regularly and maintain good health. In the contrast, smart watch users may use their devices to track body data when not exercising and then do not feel impelled enough to exercise. As not everyone can organize their time to exercise regularly, the arm-swing posture can solve their fitness requirement as it does not require any sport equipment, simply input gesture motivation. The system allows participants to practice and exercise and receive feedback. This embodied interaction can then encourage them to swing their arms further (Brueckner & Freire, 2017; Grandhi, Joue, & Mittelberg, 2011; Sellen, Rogers, Harper, & Rodden, 2009). Hence, arm-swing exercise is an appropriate gesture that can be integrated into routine activities for all kinds of occupations during working hours (Lu, Chen, Zhao, & Wang, 2011; Wang et al., 2017; Yamamoto, Terada, & Tsukamoto, 2011).

From an interaction design point of view, an arm-swing input device is different from other health-care products and services. It is more like an exercise device than a body data tracking tool (Lewek, Poole, Johnson, Halawa, & Huang, 2010). Both an arm-swing input device and other health-care professional tools need to be integrated into a person’s daily life activities. These days, technology is making people more productive without the requirement of movement. Each profession adopts new habitual input gestures, which interact with technology in the form of digital devices such as a mobile phone or notebook computer, depending on an occupation’s needs. The mobile phone is used mainly for daily communication while a notebook is commonly used in work. Both have become ubiquitous digital equipment regarding our routine gestures.

The mobile phone is an explicit example a device changing human gestures and affecting our behavior more quickly than any other past invention (Ventola, 2014). Smartphones can now carry out multiple functions, promoting one-stop service and multitasking both during and outside of working hours. This phenomenon has had a direct impact on human gestures, hand gestures to operate a smart phone. From the
launch of this new technology in 2007, digital technology has forced us adopt ‘gesture-based interaction’. In the last decade, competition has become fiercer in this domain of advanced technology. These days, when the many digital products have become almost equivalent in their major functions and features, gestural input is praised as a marketing gimmick that makes a product stand out (Brereton, Bidwell, Donovan, Campbell, & Buur, 2003; Meyns, Bruijn, & Duysens, 2013; Strom, 2002; Yoon, 2014).

Convenience, comfort and suitability are the early-use qualities designers and engineers have tried to incorporate in the development of their products and services. Presently, users can do almost anything using their smartphone; however, it does not really support practical input gesture as an exercise because our brain has been trained to find the easiest way to access our digital device (Cooper, Reinmann, & Cronin, 2007; Donald a. Norman, 2010). Furthermore, the high price of a smartphone is another reason why it doesn’t support proper exercise. On the other hand, most people are not concerned about exercise when using digital equipment (Fabricant, 2005) while there are other factors such as social cosmetics, budgets, and professional tasks, that must be considered when using a digital device (D. A. Norman, 2008). In fact, an intrinsic influence when using a digital device is that it is task oriented and related to the user’s own goals.

In this research, the goals that drive participants to do arm-swing gesture are feedback from performing arm-swing which actually serve as reinforcement. Feedback is a reward for each participant. In terms of professional delivery and time, it is necessary for each user to become accustomed to the input and apply digital equipment gestures as a new norm of health communication. These intuitive behaviors could be part of expertise reflection. Hopefully, these gestures become routine actions aimed to accomplish task rewards that encourage workers to move and protect against office syndrome.

This task is thus designed as health communication to encourage behavioral change in the way a person works. This effect does not only help prevent and combat office syndrome, but also raise activity in the workplace. The arm-swing gesture can be an activity employed over the long term if one does not change their occupation, uses the same sort digital device and inputs commands using the same set of gestures.
(Da Saffer, 2005). According to Lee, a set of international user interfaces supported by design or graphics can provide an intuitive guideline for users who perform natural gestures correctly (J. C. Lee, 2011). People can also apply their mental model to recognize an interface and then perform a proper gesture (Meyns et al., 2013).

Today, people interact through physical computing as there are so many disciplines that have derived during the past thirty years. It is now almost impossible to avoid interaction with digitized devices and Internet of things technology. Fields such as industrial design, communication design, human-computer interaction (HCI), interaction design (IxD), human factor, user experience (UX) and user interface design (UI) fields must also be considered (Dan Saffer, 2009) as well as interaction design, which covers an arm-swing input component and wearable device that acts as a gateway to a system and output. This applies the Internet of things (IOT) concept achieved through a seamless technology between users, objects and environment (Lu et al., 2011; Raiwani, 2013; Sahin, 2013; Yamamoto et al., 2011). As a smart world, which we are advancing towards, the Internet of things concept has been applied in terms of forming connects to any products or services anywhere and anytime (Bernaerts, Steensels, & Vermeulen, 2014; Fortino, Guerrieri, Russo, & Savaglio, 2014; Jenson, 2017; Raiwani, 2013). In this research, an arm-swing input component acts as a store that is open 24-7 hours for self-configuration. It acts as wearable exercise equipment that can be operated any place and any time for self-tracking. An arm-swing input component can act as a starting point for user movement in daily life.

### 1.2 Research Motivation

As an interaction designer, the aim of this research is to find ways to integrate an arm-swing exercise gesture into the routine of focus group members. The role of a designer is to integrate digital artifacts to shape people’s everyday life (Da Saffer, 2005; Smith, 2004). Presently, technology has become a part of everyday life and culture. Therefore, self-configuration is required (Smith, 2004).

The office syndrome is a silent danger office workers face (Chitanuntavitaya, 2016; Ooi & Goh, 1997). According to Sethpitak, there is 98.6% of her research sampling facing computer or office syndrome (Sethpitak, 2015). Office syndrome can
cause physical pain that can affect work outcome. Thus, office syndrome has become a significant health issue.

Due to the two main reasons presented above, action research was selected for this dissertation. Office syndrome is caused by changes in behavior because of the computer and can be rectified through medical treatment. Patients need to change behavior to be more health oriented.

In this research, to improve health, the most suitable posture to treat office syndrome is an arm-swing posture or arm-swing exercise. A proper arm-swing posture has been studied over the last decade (Matsuo, Okumura, Hashimoto, Sakazawa, & Hatori, 2007b). Most of these studies examined human gait stability while performing arm-swing postures (Barnes, Hejrati, & Abbott, 2015). Other research focused on effects on the elderly. It found that arm-swing posture was practiced the most as it is less harmful compared to its benefits (Ortega, Fehlman, & Farley, 2008). Some researchers focused on patients with a specific disease. For example, Jewpattanakul focused on those suffering from hypertension while Lewek and his colleagues looked at persons debilitated by Parkinson disease (Jewpattanakul et al., 2012; Lewek et al., 2010). In normal people, arm-swing exercise has been tested for intensity levels, and results showed that calories consumed by one hour of arm-swing exercise is nearly the same as those consumed by walking for one hour (Siengluecha, Intarakamhang, & Senakham, 2008).

In addition, significant research has been conducted to improve quality of life via the use of an arm-swing input component in the workplace. Different occupations were found to have different gesture-based interaction in their routine behavior with digital devices. In this digital age, the findings from focus groups could reflect how respondents use technology via modern devices in their own contexts and various scenarios (Don, 1996; Sellen et al., 2009). It can be a challenge with to integrate an arm-swing input component in a person’s daily life experience. For this research user experience methodology has been applied to measure field work in several contexts (J. R. Lewis, 2006) along with user centered design methodology (McLoone, Jacobson, Hegg, & Johnson, 2010)
1.2.1 Significance of Health Communication on Arm-Swing Exercise Gesture

Health communication is to make people aware of public health issues, like office syndrome and other illnesses (Khopolklang & Gunpai, 2010). Health communication can be considered a social development device, tool or medium to promote wellbeing (Khopolklang & Gunpai, 2010). Presently, most health-oriented organizations aim to “build (health) before repairing it” (Khopolklang & Gunpai, 2010), and today, there are several organizations which work to promote well-being.

Thai Health Promotion Organization in Thailand (ThaiHealth) plays a significant role in promoting wellbeing (Thaihealth.org, 2001). They have initiated a number of campaigns such as “Quit drinking alcohol during the Buddhist Lent”, “Swing arms to reduce disease” and “Swing arms to reduce fat” (Thaihealth.org, 2001). Communication channels ThaiHealth use in health communication include postcards (Figure 1.1), brochures, television advertising, youtube, websites and corporate social responsibility (CSR) events (Figure 1.2). One of their main purposes is to make Thai people healthier by getting them to move, i.e., regularly exercise, including arm-swing posture promotion. On 9 August 2561, ThaiHealth promoted a moving campaign, which included wellbeing activities conducted at the Bangkok MRT underground Lat Phrao station. Thai massage to relieve for office syndrome was a very popular activity.

Figure 1.2 presents interactive dolls that move when a person moves by making a specific gesture. A screen shows the arm-swing posture people should perform in their workplace. It shows how arm-swing posture has become a popular exercise in Thai culture since the Government advertised the advantages it provides people who do it regularly. Providing evidence that arm-swing posture should be integrated into daily life. Most health-related research also claims that arm swing is a proper exercise gesture for anyone suffering from office syndrome (Jewpattanakul, et al, 2012). Still, most Thai people misunderstand and believe this posture is merely an exercise for the elderly as it does not required any equipment to get started. This research, on the other hand, aims to shift people’s mindset from the elderly posture positioning into a technology-oriented positioning that promotes integrating an arm-

An interactive activity can attract persons to participate before long-term persuasion. So, ThaiHealth also gave a souvenir to participants at its CSR event, a paper clock to remind office workers to move around in their office. Figure 1.2 presents the souvenir paper clocks. However, if workers do not have a fixed place to work or exercise, the paper clock will be useless. Still, ThaiHealth hoped the exercise...
postures will motivate a little movement in the workplace. Their goal of this health communication is to get workers to integrate some postures into their work to reduce and cure office syndrome. One well-known posture is an arm-swing exercise. Thus, there are significant reasons for this research concerning gesture-based interaction for office syndrome prevention through integrating an arm-swing input device into one’s daily life.

1.2.2 The Significance of Gesture-Based Interaction

Today, new technology is becoming more a part of people’s lifestyles. Most professions now depend on new technology in the form of paperless, digital files. These persons have become accustomed to input gestures and feel virtually no resistance (Ni & Baudisch, 2009; Thad Starner et al., 1997). Moreover, each profession adopts new habitual input gestures according to new innovations. Nowadays, devices are being replaced by new models in less than six months. People who can afford a new model will be willing to change to acquire a more advanced or fancier feature, yet they remain accustomed to a previous set of gestures. These is one of the significant negative fructifications that affect human behavior.

People now become addicted to gesture-based interaction, not digital artifacts (Cooper et al., 2007; de Béringy Wall & Wang, 2008; Donald a. Norman, 2010). To support this statement, remember when you started using a computer with a mouse. We have retained these gestures though with the new touch pads or touch screens, we no longer require the mouse skill set (Sahin, 2013). Gesture-based interaction has not changed much even with new advancements. Modern technologies trend to be faster and more convenient that require an existing set of gestures without concern for health improvement.

Gesture-based interaction requires physical movement which is reinforced through action in this digital age (Sellen et al., 2009). When people know the value of something, they usually invest money or effort into it (Eyal, 2014). As gesture-based interaction is as an effort that people invest, in this research, an arm swing input device is as a thing with value when it comes to office syndrome prevention.
1.2.3 The Focus Groups (The Participants)

For this gesture-based interaction project, it was necessary to select participants using a purposive sampling technique. The main aim is to consider a busy work place and focus on gestural behavior toward digital equipment during work hours. An office syndrome-related behavior was chosen rather than a specific workplace. Previously, office syndrome was called sick building syndrome (SBS) because of the energy shortage crisis in 1960 (Chitanuntavitaya, 2016; Norback & Edling, 2008; Ooi & Goh, 1997). This caused buildings to remain unlit in certain indoor and outdoor areas and have interior temperatures controlled to save energy. In the 1970s, a number of workers suffered from SBS. During 70’s and 80’s, several studies about SBS considered environmental factors. Later, when work places had been improved, workers still showed the same SBS symptoms because of a new work machine, the “computer”. So, while the term SBS was changed to “computer syndrome” the symptoms were virtually identical.

There are three main factors related to the prevalence of office syndrome: environmental, occupational and personal. Nowadays, with the advent of computers and then the Internet, many people can work whenever and wherever they want, and their leisure life has also been broadened. Many workers have no need to attend a static workplace and can work in or out of their home, possibly in a coffee shop.

Thus, the focus groups for this study are based on occupations that mainly face the problem of office syndrome. Each occupation has a risk of causing office syndrome while work tasks can be roughly defined according to levels of office syndrome pain. The five occupations selected all have a high prevalence of office syndrome. These include lecturers with writing tasks, students with projects that research, designers who sit in front of a computer for long hours and industrial workers who work on the same machine for long periods. The criteria of selecting participants were slightly different for each occupation.

Participants were also selected according to how serious their level of office syndrome. Participants were also selected to represent to different stages of the illness. A personas technique was applied to create a mapping between character and occupations before searching for a specific place and designing a device. Usability testing is one of the user experience measurements that had to be conducted during
the action research (Tcha-Tokey, Loup-Escande, Christmann, & Richir, 2017; Westling, Witchel, Needham, Healy, & Chockalingam, 2013; Wimmer, Wöckl, Leitner, & Tscheligi, 2010). For usability testing, participants served as an end user who was given no cues beforehand for this project before. Each user participated in an individual use case in his/her own environment. The participants were asked to perform arm-swing while having a conversation with a moderator. This will be explained in more detail in chapter three when discussing the discussion groups.

1.2.4 The Users’ (Daily) Experience

According to the arm-swing exercise recommendation, people should perform this posture at least once a day as they should be disciplined in performing exercise. Many people say they have no time to exercise regularly because of work and other daily activities. However, they do have time to operate digital devices either for work or informal communication. According to Norman, the everyday objects we interact with are designed to be a part of our normal experience (Don Norman, 2013) and can be incorporated into new forms of health communication on a daily basis. This research will sketch the user experience with digital devices to show their practicality into daily life (Buxton, 2010). The user experience in this project will focus on scenarios using an arm-swing input device by each participant, feedback and open-end output achieved through swing arm (Eyal, 2014; C. Lewis & Rieman, 1993; Sauro & R. Lewis, 2012). The participants will be described using personas (Alises) to define their character before conducting field research at each participant’s workplace. The participants in this research are considered real users who use an arm-swing input device, which can be a tool for communication when performing the usability test as it can stimulate thoughts of how it can be incorporated into their daily lives (J. R. Lewis, 2006).

1.2.4.1 Sign Consumption

This action research examines an arm-swing input device as a tool for an act which has meaning. In Thai culture, an arm-swing gesture has been translated into an exercise posture for the elderly. Sign consumption is a reflection for qualitative research to learn respondents’ opinions (Anjum et al., 2014; Baudrillard, 1994; D.
Agbisit, 2014). The sign consumption in this research refers to Baudrillard’s perspective on semiotics. According to Brian Curtin, “Semiotics is concerned with meaning, how representation, in the broad sense (objects, images, gestures) generates meanings of the processes by which we comprehend or attribute meaning.” (Curtin, 2000; 51). The representative meanings of arm-swing gesture and arm-swing input device can be intuitive. Each intuitive representation can be determined not only through a questionnaire, but also through action research. The elements of the act are considered crucial data that reflects the relationship between the user and their arm-swing input device and arm-swing gesture itself.

Participants’ opinions follow their actions and can be a positive, neutral, or negative attitude toward the arm-swing input device. There are several factors that can affect a user’s perspectives; however, this dissertation focuses on only three issues as follows:

1) Painfulness of office syndrome (recognition, prevention and maintenance periods)
2) Knowledge of arm-swing posture (possible use of an arm-swing input device)
3) Attitudes toward arm-swing practice using an input device (action can reflect attitude rather than a questionnaire)

1.3 Statement of Purpose

This research has two main objectives:

1.3.1 To integrate an arm-swing input device into the daily life health communication experience of focus group participants to increase their physical movement during working hours

The intended outcome of this first objective is to motivate action in the workplace of the focus groups by using an arm-swing input device as a new form of self-health communication. This input device can be integrated into actual situations of the focus groups to raise awareness on office syndrome prevention and increase the physical movement.
1.3.2 To encourage arm swing activity that could possibly help prevent office syndrome of focus group members in their daily routine

The intended outcome of the second objective is achieve a paradigm shift of focus group members in their use of an arm-swing input device as a tool to prevent office syndrome.

An arm-swing input device can serve as a new form of health communication in sign consumption based on Jean Baudrillard’s perspective.

1.4 Research Questions

1.4.1 Are focus group members aware and will they increase their physical movement during working hours to prevent office syndrome using an arm-swing input device as a health communication tool?

1.4.2 How does the embodied interaction of the arm-swing input device motivate focus group members to swing their arms?

1.4.3 How do focus group members shift their paradigm towards the arm swing gesture to a daily modern exercise from that as a posture performed by the elderly?

1.5 The Overview of Methodology

This research comprises four phases: focus group observation, design of an arm-swing input device, introduction of the device and research and arm-swing use field research as there is a necessity to apply essential user experience methodology to find a proper workplace scenario (Kuniavsky, 2003; J. R. Lewis, 2006; McLoone et al., 2010). The motivation to perform arm swing is considered an embodied interaction.

The first phase is onsite observation to learn about the workplace culture. At the same time, office syndrome, possible solutions and people’s acknowledgment of this issue were researched. Focus groups were categorized according to five occupations: office workers, students, lecturers, designers and industrial workers. This
phase provided the requirements for the design of an arm-swing device, the next phase.

During the second phase, a literature review was conducted to incorporate multidisciplinary philosophies into this work, including health communication, sign consumption theory of Jean Baudrillard, interaction design and user experience design, and technology.

The third phase, the design process, focuses on developing an arm-swing input device and visualization of possible outputs to communicate the research concept to participants. This phase thus combines two phases as well, developing the arm-swing input device and the introduction of the project and input device.

The fourth phase, the action research is designed as a field study to be conducted in participants’ workplace. Questionnaires were prepared for specific focus groups. Moreover, user experience discipline was applied to analyze user performance in this research.

Sign Consumption philosophy of Jean Baudrillard was applied to analyze qualitative data while some of quantitative data have been analyzed and highlighted when it appeared to be crucial.

1.6 The Ground and Significance of Action Research

The literature review reveals the benefits of arm-swing posture and why it should be introduced and encouraged as an exercise that can be incorporated into daily tasks to prevent office syndrome. The communication theory ground presents diverse aspects on how new technology has become to dominate human gestures (Bhandari & Lim, 2008; Profita et al., 2013; Rakubutu, Gelderblom, & Cohen, 2014). Not to challenge new technology, this study aims to play a significant role in improving quality of life by integrating arm-swing movement into routine activities mostly related to digital devices. Therefore, this action research has studied “User Interface”, “Wearable Computing”, “User Experience”, “Input Device”, “The Internet of things”, “Gesture-based Interaction”, “Health Improvement” and “Health Communication in the digital age” while focusing more attention on “User Interface” and “User Experience”. 
Both User Interface and User Experience can contribute health communication because of ubiquitous computing technology and pervasive digital devices (Atkin & Silk, 1996; McQuail, 2010; Nayman, 2001; Press, 1995a; Van Belleghem, 2015). Today, the new technology and modern devices have become integral parts of our daily lives. Marshall McLuhan said, “We become what we behold. We shape our tools and thereafter our tools shape us” (Smith, 2004). To demonstrate McLuhan’s message, the period of ‘shaping our tools’ has become almost saturated, yet the period of ‘our tools shaping us’ still faces indeterminate challenges (Press, 1995).

1.7 Role of Researcher

The role of the researcher can be clarified in three phases of the research process: Structuring, Action, and Data analysis.

The first phase, Structuring the research, is similar to a sketching process during which researcher will study the criteria for design, structure, construction and planning for the entire research project. After studying past research and action methodology, a questionnaire, a model for case study, and the field research action plan will be developed, including timing and context (Kuniavsky, 2003; Rauschenberger, Schrepp, Perez-Cota, Olschner, & Thomaschewski, 2013; Yu & Ingalls, 2011). The focus groups will be formed during this stage as well. There are three aspects of the design research interaction to be considered:

Health communication aspect: this aspect is sometimes called “Social Interaction Design” (Dan Saffer, 2010,5). There are many forms of health communication media. In this research, it will be an arm-swing input device that communicates one on one following the Ritualistic Communication model.

A user will control the arm-swing input component set for self-regulation. It is hoped that health communication applying the arm-swing digital device can shift a person’s paradigm from thinking the arm-swing gesture is a posture for the elderly to the idea it can serve in the workplace as a prevention for office syndrome.

Sign consumption has now to a new meaning. As the user interface communicates through a set of graphics or product design, graphical instructions and
messages are included in the health communicative forms generated by the researcher (Baudrillard, 1994; Chantawanich, 2012; D. Agbisit, 2014). The arm-swing act thus represents “an office syndrome prevention” as the health message in this research context.

Behavioral aspect: Human behavior in this context includes interaction thru digital artifacts, systems and environments (Cooper et al., 2007). This implies a human factor, represented through the personas technique (representing user type) which will influence the user design experience and actual testing of an arm-swing input component (Dan Saffer, 2010). During the early stage of the Structure phase, behavior that caused office syndrome was observed. As sitting for long periods is crucial in several occupations, five different occupations were identified, after which a search was conducted for participants who face or suffer from different levels of office syndrome in each occupation: office workers, students, lecturers, designers, industrial workers. In this dissertation, the behavior aspect focuses on physical gestures.

Design technology aspect: Most value qualities of technology include usefulness, usability and use enjoyment (Da Saffer, 2005; Stone, Bentley, White, & Shebanek, 2016). Artifacts, Internet of things and major data are modeled by a who an interaction designer and researcher in the field. The researcher will introduce a system, including software, to construct a piece of hardware for wearable computing as one arm-swing input component. For this study, designing an arm-swing input device was a part of the Structuring phase to produce a communication tool for the Action phase. This arm-swing input device serves as an interaction tool for health communication as it can persuade participants that specific data feedback.

This research had to blend these three aspects into the actions of the next two processes with everything structured according to time.

The Action phase, or field research, is conducted after the previous Structure phase was completed. All participants in each focus group were allotted a specific time and place to conduct the field study. The researcher acted as moderator and
facilitator after organizing a workshop. Observation, including still photography and video recording, was conducted during this session.

After previous phases were completed and all data collected, the data were organized and analyzed to answer the research questions. It should be noted that not all action research data were fully constructed for traditional linear research writing (Flicker et al., 2008; Goodyear, 2013). The relationship between the data and health communication was analyzed during this phase.

1.8 Research Assumptions

This research has assumed that there are possibilities to integrate experience into daily life scenarios of the busy officers through use of an arm-swing wearable input component. This can then provide significant data to design computing technology in a wearable digital device. The way participants swing their arms can be considered a new form of health communication in Thai culture and their actions can reflect their acknowledge of gesture-based interaction. Furthermore, the presumption of arm-swing exercise benefits could play an important role in improving quality of life even as just a starting point for a healthy lifestyle. Since each person has individual needs in their daily life, arm-swing can be open-end activity for participants to generate exercise. Therefore, the Hooked model was applied to integrate an arm-swing input component into a participant’s daily life. According to Nir Eyal and Ryan Hoover, who wrote Hooked, the concept of ‘Habit-forming product’ consists of four elements: Trigger, Action, Variable Reward and Investment (Figure 1.2) (Eyal&Hoover, 2014).
Figure 1.3 The Hooked Model  
(Eyal, 2014)

Trigger: use of habit-forming products starts with an alert that triggers them, i.e., call to action. The call-to-action stage has been divided into two parts: first, the internal trigger and second, the external trigger. The concern then becomes how to make an arm-swing input component become part of a person’s everyday routine through an intuitive response. What will be the cue for users to perform an arm-swing gesture? How will arm-swing movement become an intuitive, crucial interaction to be performed every day?

Action: the arm-swing posture is a specific action of this project that is comprised in the main content of this research. According to the book, *Hooked*, this stage is concerned mostly with usability and includes psychological motivation to perform the arm-swing posture in the workplace. The environment and situation will must be explained to understand use scenarios. Experience measurement will be explained in Chapter Three.

Variable Rewards: various output of the activities are considered variable rewards that trigger users to invest their time and energy and perform arm swings
(Eyal & Hoover, 2014). These variable rewards act as a physical motivation for users to invest their time to input commands and perform the arm-swing posture. The output is not feedback. For example, when we turn on a light bulb, the switch will have a small voice when it is pressed. This small voice acts as feedback while light acts as output, or feed forward. Most users turn on a light bulb for a reason, not merely to hear the small voice feedback. In this research, the reward will be open-end products and services.

Investment: This stage occurs when users sacrifice heir time and energy as well as to acquire products or services. Users will invest something if they feel it has value. In some cases, the investment can imply an action, especially user experience.

To apply all elements of the Hooked model, a Hooked canvas was developed, which will be explained in the next chapter.

1.9 Definitions of Key Terminology

Affordance implies to a theory that explains the possibilities of a user’s actions using an object after recognition of its functionality.

Arm swing refers to an exercise gesture which can be integrated into daily life communication. In this research, arm-swing posture is an input gesture to trigger an action such as opening a door or ordering a piece of pizza.

Designer refers to a member of a group of participants who work mostly in front of a computer screen. Most are visual art oriented.

Embodied Interaction refers to an action through full interaction of the body and mind.

Gesture-Based Interaction refers to a set of gestures that interact or provide access to a digital device which play a major role in daily life. In this project, Gesture-Based Interaction represents arm-swing gesture.

Health Communication refers to the combination of the two disciplines, health and communication.

Industrial worker refers to a participant who works in a factory environment, often in front of a computer and or while operating a machine.
Input device refers to a digital component that allows users to enter a system using gesture communication. Users can trigger a system or a computer using an input device. In this research, an input device is represented by a medium that conveys a health message to participants.

Internet of things (IoT) refers to scenarios where objects, sensors or everyday items extend to computing capability and network connectivity. In this research, Internet of things is as a facilitator for input interaction and output products and/or services.

Intuitiveness refers to the mental mode of a person’s recognition with the proper use of a digital product through commonsense.

Lecturer refers to a participant who teaches at a university.

Office worker refers to a worker who mainly uses a notebook computer or PC in the workplace. Most of their gestures during work hours are influenced by sitting in front of and operating a computer as well as smartphone as a tool communication tool.

Output refers to goals of a user’s actions, which could be any form of products or services related a digital system.

Personas imply to the five characters of the focus groups for this field research. The benefits of applying personas is to help craft a prototype computing device for testing with real users.

Physical computing refers to a digital artifact, or object with a tangible external appearance and internal computer. In other words, this is a visible object user can see and operate.

Student refers to a participant who is studying in university and is required to submit reports, attend lectures and meetings and well as entertain themselves using a computer or digital device.

Use Case refers to action research that allows a participant to use a digital device case by case so they can be observed while during usability testing on the device.

Use Scenarios refers to a use experience scenario that consists of a user, interaction, digital device and surrounding environment.

User Experience refers to the everyday scenario of each participant in each focus group with a focus on the use experience of routine digital devices and the goals of each activity in their environment. Space and time are concerns in as many aspects while using a digital device.
User-generated Content (UGC) refers to a system of components that allows users to apply their gestures or actions to a digital device to fulfill their goals of need. For communication in this research, content concerns an arm-swing posture. Users could generate arm swings multiple times to control a product or service.

User Interface technology refers to device guidance which can help users interact or communicate through their devices using correct gestures.

Ubiquitous refers to the pervasive, or wide spread of new technology through technology infrastructure such as Internet connectivity and digital devices.

Wearable computing refers to an electronic component, or personal accessory, that is worn on the body such as wrist, neck, waist, leg or head. The functionality of wearable computing lets a user track body movement and collect personal health-related data. In this research, wearable computing refers to a form of an arm-swing user interface.

1.10 Dissertation Structure

Chapter 1 presents an overview of all aspects of the research. Chapter 2 offers a literature review of embodied interaction design, user experience design discipline, health communication, the postmodern perspective of Jean Baudrillard and how the message from an arm-swing gesture can be communicated to a user in terms of a health experience. Chapter 3 presents the action research methodology for this study in detail. The main structure of this methodology provides the user experience measurement which is then further explained through a qualitative approach to better understand the action research and the design criteria based on user requirements and practice in the workplace. Chapter 4 reports the findings of thirty use cases of the five focus groups (office worker, student, lecturer, designer and industrial worker). Diversity scenarios are also given in this chapter. Finally, Chapter 5 offers a discussion concerning integrations of gesture-based interaction in input devices in terms of user experience design and health communication, ending with a synthesis of all findings. Recommendations will also be given for future research.
CHAPTER 2
LITERATURE REVIEW

2.1 Part I: Gesture-Based Interaction as a Form of Health
Communication and Action Research

Most digital products adopt the interface technology from previous products or mimic the natural behavior of users to support simple, intuitive gestural input (Donald a. Norman, 2010; Reeves et al., 2004; Tetzlaff & Schwartz, 1991). This interface technology does not just provide a visual means to make a device function, but rather helps users perform a gesture-based interaction. In this study, the form of interface technology is a wearable input device, which encourages a user to perform arm-swing gestures during their workaday when they cannot allocate time for exercise. Thus, integration between an input gesture and daily digital equipment had to be developed. Modern technology now is rapidly advancing to make devices faster or thinner than a previous version; however human ergonomics evolves more slowly. Consequently, an input device or component has not been altered to any degree in dimensions, when compared with its technology. Obviously, the components related to human gesture mostly have a broader capacity than the brain of modern computers (Chen, 2010; Cooper et al., 2007; Ferraro & Ugur, 2011). Common input devices such as a mouse and keyboard are pervasive examples; yet, neither has an interface technology that intuitively allows a user to include an exercise as part of their gestural input. Therefore, the wearable input device for this study has been designed to communicate with participants.

This dissertation aims to identify proper scenarios to integrate arm-swing gesture input experience into five different occupations. It also has been designed to promote arm-swing gesture integration into daily activities. This is why gesture-based interaction has been incorporated into this action research that focuses on the motivation and adoption of an action (Goodyear, 2013). However, this research is not
concerned with a participant’s dominant mind set, only their actions during the process (Thorgeirsdottir, 2015).

According to Neunghathai and Kitti, health communication can serve as a social development device mostly related to public health issues (Khopolklang & Gunpai, 2010). The purpose of several health communication studies has been to prevent symptoms rather than afford treatment by medical professions, like health traditional research that emphasizes scientific aspects more than behavior aspects (D. A. Norman, 2008; Donald a. Norman, 2010; Viller et al., 2016). Public health issues can be categorized into two main dependences: health issues with advanced medical dependence and the health issues with changeable behavior dependence, which are interrelated. One symptom can possibly be treated through both medical and behavioral theories. This will depend on how the patient’s condition and required treatment. Health issues with advanced medical dependence include cancer, diabetes, cardiopathy and cerebral infarction. Health issues more dependent on changeable behavior include influenza, obesity and office syndrome.

2.2 Part II: The Office Syndrome Domain

Office syndrome, or sick-building syndrome, gets its name from symptoms caused by working in the same posture for a long period of time (Ooi & Goh, 1997). According to health-related research, people who use a computer more than seven hours a day may risk of suffering from cumulative trauma disorder, an office syndrome caused by stress (Chitanuntavitaya, 2016; Lart-udomsp, 2014; Matsuo et al., 2007b; Ooi & Goh, 1997). This indicates an unbalanced life, which is common for people nowadays. To make life more balanced, it is necessary for people to adjust their daily routine to include exercise either during or outside of working hours. (Chitanuntavitaya, 2016; Kaewpanukrangsi & Kerdvibulvech, 2019; Ooi & Goh, 1997).

2.2.1 Remedial or Supplement or Prevention

Office syndrome can be treated in several ways including supplementary treatments and prevention. Thai massage, acupressure or acupuncture, chiropractic
medicine, yoga, regular exercise and ingesting medicine for muscle pain (Lart-udomsp, 2014; Ooi & Goh, 1997). Thai massage and chiropractic medicine are popular treatments for office syndrome. Normally, a person has a Thai massage to relax however, office syndrome patients may require a professional osteopath which can be quite expensive (Lart-udomsp, 2014). Chiropractic treatment helps a patient make adjustments to their body to reduce pain. They may choose to purchase a chiropractic course package rather than independent appointments. Chiropractic treatment does not require medicine nor injections, but it can cost more than other treatments. This treatment requires a licensed chiropractor Doctor of Chiropractic Medicine, DC). Whatever course a person takes, the best methods is to practice office syndrome prevention while working, which means not sitting for too long a period of time.

There are three stages of office syndrome: The Remedial stage, Supplement stage and Prevention stage. The Remedial stage refers to a period of pain when a person is suffering from office syndrome. They may need both physical treatment and medicine. The Supplement stage means a physical warning or the start of pain. Such cases can be treated by massage, or yoga, or just stretching. The Prevention stage refers to a period free of pain, which can be maintained through regular exercise, focusing on muscle strengthening activities.

As mentioned previously, office syndrome can be cured by changing behavior. Prevention can entail something like yoga or changing posture while working every 30 minutes (Lart-udomsp, 2014). This study did find that numerous yoga asana, or postures, will help practitioners attain and maintain a more flexible body. An arm-swing gesture is another posture that can be integrated into daily life wherever and whenever it is convenient to prevent office syndrome.

2.2.2 Arm-Swing Gesture: Health Communication for Office Syndrome Prevention

The arm-swing posture has its origins as a Chinese exercise that promotes good health. In Thai culture, the arm-swing exercise has become well known because the Thai Government has promoted its advantages through media, including television programs. The usefulness of arm swing exercise can reduce fat and
strengthen the body in all ages who perform this exercise regularly. According to Leelayuwat Narumon in 2006, “Research on the effects of arm exercise on metabolic parameters in type 2 diabetic patients was a starting point of this field of knowledge (Jewpattanakul et al., 2012). Thai Health organizations, nowadays, promote arm-swinging as a salutary gesture as there is no need for any equipment nor a large space. The arm-swing posture, moreover, is suitable for an exercise that can be integrated into daily life. With ubiquitous modern technological, digital equipment now plays a major role in almost phase of daily life. Therefore, it can be very beneficial to integrate the arm-swing gesture into a quotidian task that is digital device related. For this study, an arm-swing posture was selected partially because it is recognized by Thai people. The media usually recommends a proper arm-swing posture, offering the following instructions:

1. Stand with a slight space between the feet.
2. Swing both arms, forward and backward, in a proper arc so each body part moves (30 degrees from the body axis for light exercise and 60 degrees from the body axis for heavy exercise; Figure 2.1).
3. 30 minutes of exercise daily is recommended, or approximately 2,000 rotations (Jewpattanakul et al., 2012).
Figure 2.1 Arm-swing exercise posture  
(Kaewpanukrangsi & Kerdvibulvech, 2019)

Following the three steps, a person who practices this regularly for only 15 minutes a day will have better physical balance and reduce 50 calories of fat (Lewek et al., 2010; Matsuo et al., 2007a; Prasertsri et al., 2017).

2.3 Part III: Changing Behavior

This action research has as a goal changing participants’ behavior (Julie M. Davis, 2007). Changing behavior in a concrete situation is not easy because of several factors, both internal and external. Acceptance in a workplace social structure can be one factor dependent on self self-determination (Julie M. Davis, 2007; Eyal, 2014). Mindset is another factor that will affect change. Greater “emancipation” is how Ajum and colleagues put it (2014). Due to the two main factors to make a change mentioned above, a number of related disciplines were examined.
2.3.1 Change by User Experience Design to User Interface Design

Recently, user experience design has become more pervasive. This user experience design can be applied to many artifacts that are used. Meanwhile, technologies are being studied more and more in all its forms as they become integrated into all aspects of our everyday experience. According to Smith, most user experience design projects consider the interaction between humans and digital artifacts (Buxton, 2010; Don Norman, 2013). These studies are always discussing about personas, environment in use, situation in use and artifact in term of using and user interface (Holtzblatt & Beyer, 1998; Smith, 2004). User Experience Design (UXD or UED or UX) embraces several disciplines, including Human-Computer Interaction (HCI) Design (Bacikova, 2015; Sellen et al., 2009). In 2009, Invision precisely designed an infographic based on Dan Saffer’s book published in 2008, *The disciplines of User Experience Design* (Figure.2.2).

User Interface Design is considered a part of the user experience, their first feeling of like or dislike. User Interface is a tiny detail but can have the most impact on users who use the artifact. It can be a graphical interface of a product or a form of the artifact (Donald a. Norman, 2010; Cooper et al., 2007; Tetzlaff & Schwartz, 1991). User Interface is all about the appearance of an artifact that leads a user to make the right gestural interaction. ‘PULL’ and ‘PUSH’ labels on both sides of a door are examples of a communication that leads to an action (Don Norman, 2013). In this day and age, when technologies have become an integral part of our daily lives, most User Interface Design and User Experience Design have affected the contexts when we use these new technologies and digital devices.
2.3.2 Proper User Experience in terms of Input Component (the Right Users)

An appropriate user experience consists of the right interface that permits an input gesture to access a system, a system to do a task, to complete a goal in a suitable situation, within the right time and in the right place; these are all mapped together specifically into one user experience scenario (Smith, 2004). Maximum use scenarios have been drawn in order to design a right thing with some useful criteria that can be applied to an input component (Fronemann & Peissner, 2014; Hassenzahl, 2008). In this research, occupation influenced the digital equipment operated, which influenced the gesture-based interaction the user accessed (Figure 2.3).
An oriented task is a correct situation for office syndrome prevention as the requirements of each occupation create a task goal, which requires an action. This will form a loop for gesture-based interaction in an office.

2.4 Part IV: Sign Consumption of Jean Baudrillard

This research study, “Gesture-based interaction for office syndrome prevention: Health communication through integrating experience into daily life for an arm swing input device”, focuses on designing an-arm swing input device (an object) that can communicate with participants. During the field study, participants had to consume the new artifact to trigger their ideas on the arm-swing input device. To better understand the communication process in terms of highlighting arm-swing signifiers, it is necessary to study the “Sign Consumption” concept developed by Jean Baudrillard (D. Agbisit, 2014).

From the modern and postmodern periods up to now, people has used products and services not because of function alone, but also because of sign consumption.
This phenomenon makes ‘cultural commodity’ a product sign. According to Baudrillard, images and objects have extended functionality in a cultural world and ‘Symbolic Exchange’ beyond their initial use value. These affect exchange value in an economic system where money serves as a mechanism for exchange (Baudrillard, 1994).

“Semiotics is concerned with meaning: how representation, in the broad sense (language, images, objects) generates meanings or the processes by which we comprehend or attribute meaning” (Curtin, 2000). The object in this research is intentionally created as an arm-swing input device that can generate meaning through health communication. While participants swing their arms, they are attributing meaning to this. The signifier and signified concept can be self-constructed independently without any real reference. The representation of signifier (Signified) is changeable and adaptable. A previous meaning for something can construct additional meaning for the signifier (object). A new meaning occurs as the signifier and signified integrate and create a new meaning. A person’s mental model when they see the object will apply to the new meaning as well.

Definition of signifier refers to its function or acts as a representative of something that is missing or nonexistent. This study’s arm-swing input device as an object did not exist before, thus, offering a new meaning to health communication for office syndrome prevention. It then has a new significance as it becomes a “cultural commodity” or “sign commodity” (Baudrillard, 1994).

From Baudrillard’s perspective, medium refers to a signifier, and signifier represents a message or signification. This supports McLuhan’s idea, “Medium is the Message” (Lyons & McLuhan, 1966). This also reflects the difference between general commodity and cultural commodity, which can be in the form of medium or message. Even though cultural commodity has declined in initial use value while the symbolic has altered value, spiritual value remains constant, which can compare to arm-swing gesture in this research.

Today, people do not consume cultural commodity alone, but also for signifier consumption. Daily life consumption (image or object) is dependent on a proper circumstance. Integration of use can be disordered or unnatural, but social contexts do frame the constructive process by dictating lifestyle. People work to convert this into
money as society helps construct what can be defined as desirable well-being that also affords social meaning. People then often desire to be someone different than themselves. According to Supang on Desuassure, a meaning, or signifier, is generated when there is something different. For example, if there is no white, black has no meaning (Chantawanich, 2012; D. A. Norman, 2008). One needs to identify self from others to have personal social meaning. This instigates various consumption plans based on ‘limitation and distinction ‘concepts related to ‘class’, ‘lifestyle’ and ‘belief’. In a health communication context, each consumption plan can shape one behavior pattern related to health. Such plans have been divided into three kinds of behavior patterns (Kaewthep & Nilphueng, 2013):

1) Remedial behavior: This behavior pattern relies on advanced medical technology that focuses on symptoms. A patient will feel confident to go to a good hospital or consult an expert doctor when they enter the treatment stage for a symptom.

2). Supplement behavior: This behavior pattern usually depends on supplements such as an energy drink or vitamins. A person will not change their lifestyle, and, in some cases, they do not exercise. They believe the supplement can help prevent an illness or symptom.

3). Prevention behavior: This behavior pattern can shape a wellbeing lifestyle. A person will adopt a healthy diet and make sure they get enough rest and exercise to prevent from illness. In some cases, a person will face a serious symptom before changing their lifestyle. This is why an arm-swing input device can be integrated into a daily routine. Preventing office syndrome requires long term commitment the same as treatment once a symptom has appeared. The treatment stage of office syndrome can feel more painful than the prevention stage. This is why this research promotes taking action during the prevention stage

Three scenarios for office syndrome behavior are:
Remedial stage >> Physician consultation >> Supplement stage >> Prevention stage
Remedial stage >> Physician consultation >> Prevention stage >> Supplement stage
Prevention stage >>> Supplement stage
2.5 Part V: Health Communication Aspect: Social Interaction

Social Interaction in this study relates to how an innovation is introduced to communicate wellbeing to participants. During the pilot study, communication tools needed to be designed in various forms such as a moderator, dialogue, a manuscript, video introduction and other devices, or channels. At first, participants who use an arm-swing input component needed to understand the core concept of the project. Then they could input an arm-swing gesture command to produce output.

Health Communication discipline that integrates ‘Health’ and ‘Communication’ disciplines (Kaewthep & Nilphueng, 2013). According to Atkin and Silk, health communication can be traced back more than 300 years in Europe and the United States. A brochure about smallpox prevention was promoted by Cotton Mother Saint in Boston (C Atkin & Silk, 1996; Kaewthep & Nilphueng, 2013; Thompson, Parrott, & Nussbaum, 2011). In 1975, the International Communication Association (ICA) established the Health Communication Division. Thompson pointed that most of the issue studied concerned physicians’, nurses’ and public health practitioners’ backgrounds (Thompson et al., 2011). Not much changed until 1986 when Wilbur Schramm established the research journal, ‘Communication for Health’. After this, in 1993, the Center for Disease Control and Prevention (CDC) established their Office of Health Communication., and the following year, Tufts University’s School of Medicine and Emerson College introduced the first master’s degree programs in health communication. These placed more emphasis on health than communication (Charles Atkin & Wallack, 1990; Kaewthep & Nilphueng, 2013; Kreps, 2015). Two more health communication journals were also established to publish multidisciplinary articles, “Health Communication” in 1989 by Lawrence Erlbaum Associates (LEA) and “Journal of Health Communication” more recently in 1996 (Kaewthep & Nilphueng, 2013).

In Thailand, Kaewthep and Nilphueng claim that between 1950 to 1970, health communication was developed, focusing on three issues: agriculture, population planning, and nutrition (Kaewthep & Nilphueng, 2013). In 1978, research
in health communication research was conducted to meet the requirement of a Master degree in ‘Development Communication’, “Health Communication as a social development device” by Neunghathai and Kitti (Khopolklang & Gunpai, 2010).

Health is a delicate matter. There are various issues to communicate, and these continue to change over time as, for example, modern technology today is not the same as previous technology for treating the same symptom. At the same time, the definition for wellbeing has changed drastically (Hinviman, 2003). According to Neunghathai, “research of health communication considers “social development devices” (Khopolklang & Gunpai, 2010). These social development devices examined in this health communication research concern “public health issues”. In this research, there are four factors to be considered (Kaewthep & Nilphueng, 2013):

1) Risks to society (Hinviman, 2003)

Unavoidable conditions such as air pollution can be a risk to society. Other risks may cause office syndrome because of workplace conditions such as space, furnishings and position of a computer.

2) Causes of disease

Diseases today often occur because of behavior rather than inflection (C Atkin & Silk, 1996; Kaewthep & Nilphueng, 2013; Version, 2017) as technology and lifestyles have changed, for example, now sitting in front of a computer more than seven hours a day, applying debilitating gestures when operating a machine.

3) Capitalism of healthcare

There are several treatments for office syndrome such as Thai massage, acupuncture and herbal medicine as well as Western pharmaceuticals.

4) Failure of the medical system

Most communities concerned with wellbeing resist ingestion of prescribed medicine. They focus more on prevention rather than treatment of symptoms; which today’s medical sector continues to ignore.

2.5.1 Media Ecology: from Mass to Individual about Health

Media Ecology, or Communication Technology Determination (CTD), is a group of communication theories concerned with the relationship between new technology and humans. The theories emphasize ‘Message’ and ‘Channel’ of the
SMCR (Source, Message, Channel, Receiver) Communication Model. Marshall McLuhan is noted for saying, “The medium is the message” (Lyons & McLuhan, 1966) and many will agree that while the message has impact on receivers, not any more than the channel it is communicated through. Because of modern technology, the Communication Model has become more complex as people communicate more and more communicative via digital devices, or electronic screens, compared to direct face-to-face communication.

Health communication should be disseminated to everyone. In the past, most media about health has been mass, like television and newspapers. Now though, social media is becoming much more prevalent. In Thailand, health communications which divided into three categories based on source.

1. Government and Nongovernment health communication: Most health communications of this type is related to a critical situation such as diseases following a flood. People, as a receiver, can apply the message, of information, to their personal situation. A message is likely to be an announcement or credible facts (Kaewthep & Nilphueng, 2013).

2. Private sector health communication: Its purpose is to develop a company’s image by promoting ways to achieve wellbeing. They can by through the voice of a hospital or physician offering useful tips for real life situations and can cover almost all health subjects, including healthcare technology.

3. Mass and individual health communication: The power of the internet today, gives a sender virtually unlimited opportunities to share health communication. The comments from a sufferer given through social media can provide valuable suggestions for treatment, for example where to get a massage, to treat office syndrome.

With the internet, modern technology has become an integral part of people’s daily life. Technology is shaping the way we live and interact more and more in diverse aspects. For example, most urban people are attached to their mobile phone. It has become like another extremity and now often replaces live face-to-face contact with others through video chat apps.
2.5.2 The Relationship between Technology and Society

In this digital era, modern technology is changing the shape of society day by day. Some technologies have come and gone. Still, we are dependent on adopting new technologies to be equal with others globally. The adaptation of technologies still requires a fluency in English. With new advancements, it is necessary to become conversant in new IT vocabulary (Pangaro, 1999). It happens so fast, it is difficult to prepare, and some local cultures cannot adopt all this technology, for example, the voice shutter in a smart phone camera in Japan. The Japanese government does not allow a voice shutter, especially in a smart phone camera, because Japan is a society that respects privacy and thus does not allow people to take a photograph of another without permission (Srivastava, 2005).

2.5.3 The Relationship between Technology and the Individual

As modern technology is adopted more and more, it is helping to shape lifestyles in more diverse ways. People are often seen looking at their mobile phones rather than conversing when they eat together. They also do not feel a need to get home or meet friends or family as they can connect visually through their smartphone (Fish, Kraut, Root, & Rice, 2002).

2.5.4 The Ritualistic (Health) Communication Model

Under this theme, The Ritualistic (Health) Communication Model, two communication models have been identified (Kaewthep & Nilphueng, 2013): 1) Transmission communication model and 2) Ritualistic communication model.

The Transmission Communication model, as presented in figure 2.4, is applied for announcement or persuasion. It is one-way communication while the Ritualistic Communication model is two-way communication, as depicted in figure 2.5.
In this research, the emphasis is on participatory communication, particularly concerning shared information about office syndrome. The Ritualistic Communication model that portrays shifting roles between senders and receivers has as its purpose the creation of a common bond through communication. The attributes of this model are presented in figure 2.5.

These attributes of participatory communication applied in this research show the relationships between contextual elements. Office syndrome prevention is created in the form of an arm-swing input device (medium or object). An arm-swing gesture represents a health message integrated into an office activity. The field work methodology among the arm-swing input device can possibly represent a conversation that can create actions and stimulate answers to the questionnaire. Participants have been divided into five groups according to their occupations which are related to office syndrome. They acknowledged they believed that an arm swing gesture is a
form of exercise for the elderly. By developing a prototype arm-swing input device, this research hopes to change their attitude and behavior.

![Diagram](image)

Figure 2.6 The attributes of Participatory Communication in this research

### 2.6 Part VI: Medium on Health Communication

This research study, “Gesture-based interaction for office syndrome prevention: Health Communication through integrating experience into daily life for an arm swing input device ”, has two main objectives:

First, to integrate for an arm-swing input gesture into daily life health communicating that will serve each participant’s needs.
Second, to encourage an arm swing activity that could help prevent office syndrome for the participants. While there are several aspects that relate to their work, this study has selected three aspects explained in more detail as follows.

2.6.1 Media for Health Communication concerning Office Syndrome

Office syndrome cannot be treated by medication alone, as mentioned previously. There are a number of media that can be employed to communicate about this issue and exercise.

1. Print media: Brochure can be produced to tell how to diagnose and then treat through exercise office syndrome. This can serve as a first touch point with receivers while print media is somewhat passive for users and will need to be handed out or placed in conspicuous locations. An example of an office syndrome brochure produced by the Thai health organization is shown in figure 2.6 (Thaihealth.org, 2017).

![Figure 2.7 Office Syndrome Rescue Brochure](Thaihealth.org, 2017)

2. Online media: This could include a video to prevent office syndrome about an exercise or yoga, to demonstrate how arm swing is easy to perform. Figures 2.8 to 2.11 show examples of such health communication. The videos can visualize postures but should not be too time consuming. If an exercise is performed in an office, the sound of the video can be turned off so as to not interrupt work. Figure 2.8 illustrates a video on how easy it is to perform arm swing. Yoga using a gym ball for shoulder pain relief is presented in figure 2.9.
Figure 2.8 Easy way to do arm-swing video adapted from www.youtube.com

Figure 2.9 Yoga for shoulder pain relief video adapted from www.youtube.com

Figure 2.10 presents “Exercise for office syndrome” while figure 2.11 talks about five methods to treat rock shoulder. Both printed and online media have the same communication model, Semi-Transmission model (Kaewthep & Nilphueng, 2013). In office syndrome content, the roles of the sender and receiver remain mostly fixed because it is necessary to develop reliability in the sender or source. In figure.
2.11, the video, produced by a reliable health organization, has a license about physical therapist present therapeutic methods to create even greater trust.

![Image of an exercise for office syndrome](image1.png)

Figure 2.10 Exercise for office syndrome adapted from www.youtube.com

![Image of five methods to relieve office syndrome](image2.png)

Figure 2.11 Five methods to relieve office syndrome adapted from www.youtube.com

In this communication model, the sender(S) will create a Message(M) which will then be sent via a channel (C) to the receiver (R). After, receiver can give feedback to the sender. The main purpose of the communication to persuade the receiver to attempt the behavior.
2.6.2 Artifacts for Different Purposes of Arm-Swing Gesture

Swing-arm gesture is beneficial for enhancing physical capabilities. Thus, there are several projects that study arm swing. The “walk with arm swing” project aims to determine the effect of the arm swing on human gait stability. Figure 2.12 presents a mechanism to study this phenomenon (Bruijn et al., 2010).

![Figure 2.12 User wearing artifact while walking on treadmill](Bruijn et al., 2010)

Another project, the “Myo Armband”, was designed to study arm-swing gesture in a Virtual Environment VE in 2015 (McCullough et al., 2015). The Myo Armband is another example of a wearable device for arm-swing research. Presented in figure 2.12, it is a hands-free device with broad gesture input commands used mostly to operate games and applications and costs $199.
In 2017, arm-swing gesture was studied for accessible and immersive navigation in Augmented Reality and Virtual Reality (AR/VR) spaces (Pai & Kunze, 2017), which was a different approach as most arm swing related activities examine gait ability and health conditions (Lewek et al., 2010; Ortega et al., 2008).

2.6.3 Wearable (Input) Devices for Health Promotion

Wearable computing is applied in many products. The Smartwatch, iWatch, Fitbit and Nike free run are all examples of wearable devices that mostly focus on activity tracking. Wearable items can be used freely whenever and wherever and are sometimes called ‘seamless technology’ (Popat & Sharma, 2013; Roggen, Perez, Fukumoto, & Van Laerhoven, 2014; Scholl & Drugge, n.d.; T Starner, 1996). Using other input devices may interrupt the main activity while using a wearable device (Popat & Sharma, 2013; Roggen et al., 2014). Presently, there are several uses of wearable devices such as augmented memory, face recognition, navigation, visual filter, finger tracking, military, industrial, repair instruction and maintenance, communication management, medical, sport and fitness, tourism and remote sensing (Jhajharia, Pal, & Verma, 2014). Starner said that a wearable device should be able to input from different levels of pressure (KEYLIMEINTERACTIVE, 2015; T Starner, 1996). Today, most wearable computing allows users to generate some content such as a password code and task command. (Krumm, Davies, & Narayanaswami, 2008).
Wearable devices are popular in health-related activities. The Wildland Urban Interface (WUI) toolkit is a wearable input device that Witt employed in his study on human-computer interface using wearable input device technology (Witt, 2007). For health-related issues, there are numerous wearable devices that have been developed.

The three top wearable smartwatch brands are, Fitbit, Garmin and iWatch are presented in figure 2.13. Fitbit users mostly do exercise a gym while Garmin users love outdoor activities, like running and biking, because of its GPS function. iWatch users are mostly generic users loyal to iPhone.

![Figure 2.13 Fitbit, Garmin and iPhone](adapted from www.amazon.com)

Moreover, tangible wearable interactions do not just take place with a smartwatch. There is also glove input, for example, which allows users to command an electronic machine (Murao, 2015).

### 2.6.4 Media Comparisons of Health Communication

As mentioned earlier, there are various forms of media for health promotion, each with their own pros and cons (Robinson, 2003). A comparison is presented in table 2-1.

In conclusion, the most suitable method to conduct an action study is to study a gesture-based interaction using a wearable device.
Table 2-1: Health communication media comparison

<table>
<thead>
<tr>
<th>Health Communication Media</th>
<th>Media Channel</th>
<th>Behavior Purpose</th>
<th>Communication Model</th>
<th>Experience Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper based</td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>One way</td>
<td>Not Integrated</td>
</tr>
<tr>
<td></td>
<td>Wellbeing</td>
<td>Promotion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advertisement</td>
<td></td>
<td></td>
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<tr>
<td>Paper based</td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>One way</td>
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<td></td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
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<td></td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
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<td></td>
<td>Promotion</td>
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<tr>
<td></td>
<td>Advertisement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YouTube, TV, Website</td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Semi one way</td>
<td>Not Integrated</td>
</tr>
<tr>
<td></td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Semi one way</td>
<td>Not Integrated</td>
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<td></td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Semi one way</td>
<td>Not Integrated</td>
</tr>
<tr>
<td></td>
<td>Awareness</td>
<td>Embodied interaction</td>
<td></td>
<td>Not Integrated</td>
</tr>
<tr>
<td>CSR and Events</td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Two way (Occasionally)</td>
<td>Not Integrated</td>
</tr>
<tr>
<td></td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Two way (Occasionally)</td>
<td>Not Integrated</td>
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<tr>
<td></td>
<td>Awareness</td>
<td>Embodied interaction</td>
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<td>Not Integrated</td>
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<tr>
<td></td>
<td>Embodied</td>
<td>interaction</td>
<td></td>
<td>Not Integrated</td>
</tr>
<tr>
<td>Personal device/</td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Two way (everyday)</td>
<td>Integrated</td>
</tr>
<tr>
<td>Wearable device</td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Two way (everyday)</td>
<td>Integrated</td>
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<td></td>
<td>Awareness</td>
<td>Wellbeing Promotion</td>
<td>Two way (everyday)</td>
<td>Integrated</td>
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<td></td>
<td>Embodied</td>
<td>interaction</td>
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<td>Integrated</td>
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</tbody>
</table>

2.7 Part VII: Technology Centric Aspect

Nowadays, modern technologies make life more convenient, making it difficult for people to live without them. From waking up till going to bed, most people interact with numerous electronic devices and automatic sensors. Thus, a proper Information Technology (IT) infrastructure can promote a convenient lifestyle
dependent the internet (Fortino et al., 2014; Selke, 2014). People can use a mobile phone to open a door, switch on a light and shut off their air conditioner. Moreover, they can now even use a smart refrigerator to order groceries. Amazon’s Alexa, for example, is a smart home electronic device popular in the US which operates through voice commands, making people’s lives even more convenient. In Thailand, there are a lot of products and services, including startup businesses, which enhance a convenient life through online and mobile phone applications (Don, 1996).

2.7.1 Internet of Things (IoT)

Internet of things (IoT) has become the standard in many places around the world where objects are dependent on internet infrastructure. Users are able to access the system when they are online. It is called ‘The Internet of things’ (IoT) (Raiwani, 2013; World, 2015). However, the definition of the Internet of things is not clear cut; yet the IoT concept can be applied to several systems and objects surround us. In the future, some technology researchers have predicted that humans not need any handheld digital devices because every object with be digitized and connected (Fortino et al., 2014; Gemmell, 2014). Raiwai said IoT may play a major role in society and replace information and communication technology (ICT) for the environment (Raiwani, 2013:1). The IoT communication model reflects an interdependent relationship between human values and digital devices (Viller et al.). Users can command or input through a gesture dependent on one of the five senses, after which the system provides feedback. Users may then input again, and the ubiquitous system may react with feedforward. Finally, the system provides output, which is the objective of the users’ action. Figure 2.14 shows the convergence of IoT, i.e., the convergence of various technologies such as ubiquitous computing, sensors, actuator Information Communication Technologies(ICT), embedded technology and internet technologies (Pandikumar & Vetrivel, 2014).
Today, many conveniences are integrated through invisible technology, and the Internet of things acts to automate access and, at the same time, possibly trigger some objects and services such as an automatic door, automatic air conditioner, mobile phone or computer (Fortino et al., 2014; World, 2015). For example, a mobile phone could order a cup of coffee automatically as the user walks past a machine. Thus, there is no embodiment nor concentration while using this kind of automated digital equipment. However, if it were merely an accidental action, there would be no actually designed interface technology and/or input gesture involved. On the other hand, with personal digital equipment there is, and as security is increased, so is access (Soultanopoulos, Sotiriadis, Petrakis, & Amza, 2016; Varshavskiy, Harris, & Kravets, 2016). In a mobile phone or notebook computer, for example, there are six security code blocks, rather than four code blocks, or a fingerprint scan. Another example is a home appliance that has no need for this function. Users, however, tend to become familiar with routine input gestures. An old remote control at home is a common example. The screen and keys could be faded, yet the user is familiar with the operation and can press the correct keys numbers. As another example, most users tend to purchase a new mobile phone with a similar gestural input to their previous mobile phone. In other words, a mobile system, like iOS or Android, directly
influences user behavior. If the previous mobile phone of a user was iOS, then the user tends to choose the same system for the next purchase (Bonfield, 1974).

These three examples address finding the appropriate interface that is not the only influential factor to make people act habitually. Consequently, to study gesture-based interaction, the wearable input device for this research was designed to act first in order to focus on finding a proper user experience with emphasis on behavior modification.

2.7.2 Interaction between Artifact and User

People have interacted with communication artifacts since first fixed line telegraph and then phone were invested. The digital artifact has now replaced these. Previous technology could have forced action; yet today, humans have the ability to do self-regulate their use of to technology and artifacts. Modern technologies do open opportunities for each user to control their digital devices according to their concerns for privacy. At the individual level, a user may be more attracted to hardware color, which Nokia acted upon during the last decade. The concept of user-generated content has also become much more a common because of the capabilities of digital technology and artifacts (Krumm et al., 2008).

For this research, a wearable device has been designed to generate time of arm swings afford command input. At the same time, a user can track their number of arm swings when using the device and have a performance record.

2.7.3 Arm-Swing Gesture Input Component

According to previous research, people who use a computer more than seven hours a day risk exposure to cumulative trauma disorder, an office syndrome caused by stress (Matsuo et al., 2007b). This indicates an unbalanced life, which has become common. To make one’s life more balanced, it is necessary for people to adjust their time to include exercise, either during or outside of working hours. As mentioned previously, arm swing is a recommended posture that can be integrated into input devices. Most past research has aimed at training rehabilitators to utilize arm-movement exercise using special devices (Barnes, 2015). Some studies have analyzed only how arm swing is related to other actions such as gait or running (L. Lee &
Grimson, 2002; Matsuo et al., 2007b). When comparing the abovementioned research with this study, the following issues have been identified:

1. Arm-swing gesture: Related studies have mainly addressed measurements and exploration of arm movement from different aspects such as angle of movement and number of arm swings. This research presents the proper arm-swing posture for all ages.

2. Focus groups: Most focus groups in related research have involved rehabilitators, the elderly, or people with movement disorders who do not use digital devices in their daily life, whereas this paper considers participants who mainly use digital devices during work, with the focus groups classified according to five different occupations. Additionally, the arm-swing input device was integrated into their daily tasks.

3. The device: This research employed the arm-swing input device as a communication tool, not for measurement or monitoring a new system like other studies.

4. Device output: This research is open-ended for the study of device output after swinging arms using any object or service a participant chooses, which is different from other research that focused on a number of body capabilities which would provide similar outputs.

By considering the four issues mentioned above, this research will be able to answer the question of how arm-swing gestures can be integrated into daily life activities as a prevention for office syndrome. The study will elaborate on arm-swing gesture as the input device has been designed to communicate healthy posture integration, even though it is not specifically for engineering measurement purposes. As the wearable arm-swing input device can record the number of arm swings using a freeware android application, the android device screen provides feedback rather than the screen on the wearable device.

Moreover, arm-swing exercise in this case can help participants to clearly understand the input device’s operating system. As the prototype system is more transparent for participants, it enhances their positive experience during testing (Lee, 2011). As explained earlier, one objective of this research is to find possibilities to
integrate arm-swing gestural input into routine activities during and outside of working hours for the five elected occupations. This can then support each group member’s lifestyle as the study looks for exercise activities that can be integrated into everyday tasks with the potential of solving the problem of exercise time allocation. To find the right scenario or best experience for each occupation, the methodology selected applies case scenarios for the arm-swing input device along with a questionnaire to determine proper sequence on a case-by-case basis.

2.8 Part VIII: Designing an Arm-Swing Input Device

As this research is does not focus on design, the development and usability testing stages are not of major concern. However, building the prototype, as presented design process in figure 2.17, is important.

The design process for integrating experience in health communication has four stages as follows:

Research: observations and literature review to know and understand office syndrome, and wearable technology, including user experience and user interface design.

Design: Research data is applied to develop design criteria. Five occupation groups were examined to create personas. Use scenarios must be determined for a workplace and time allotment. Arm-swing gesture interaction for “office syndrome prevention” is the study domain. Participants, office syndrome space and wearable technology must be incorporated into the “Design Criteria” that also considers specific conditions. Design criteria can then direct a rough sketch to produce a low-fidelity prototype (Figure 2.15, Figure 2.16) before integrating the technology in next stage.

Testing: determining the best communicating concept as a new medium to communication office syndrome prevention.

Further development: in the design domain, the artifact will be tested and developed furthermore. Figure 2.15 shows the use of Android free ware in the Samsung Note 10.1. Figure 2.16 presents the prototype in detail.
Figure 2.15 Operation with an android freeware application

Figure 2.16 Arm-Swing Input Device prototype
Figure 2.17 The Design Process

The Design Process of “Gesture-Based Interaction for an Office Syndrome Preventing: Health Communication through Integrating Experience into Daily Life for an Arm-Swing Input Device”
2.9 Part IX: Related Works of Action Research

For this action research, there are two related crucial works that had to be studied: the first, “Rethinking the architecture: An action researcher’s resolution to writing and presenting their thesis” by Julie M. Davis (2007), the second, “Participatory action research and health promotion of grandmothers’ stories” by Dickson (1997). Both studies provide good examples of action research methodology as they show how to motivate focus groups. Davis shows how he find congruence in nonlinear action research data and the traditional research format (Julie M. Davis, 2007). She said, “Live research process” is the hallmark of action methodology (Davis, 2007). In her research with its domain a Queensland primary school, she found how science and social science are interrelated with results that show alternative structures. She then identified two forms of action research: 1) collaborative and 2) live theory.

Dickson conducted action research to promote health among grandmothers. His study demonstrates how action research is congruent with health promotion as he claims that key characteristics of his project and the action research environment are opportunity, encouragement and mediation (Dickson, 1997). In his discussion, he highlights an analysis of experience, analyzing tensions and accomplishments.

2.10 Part X: The Conceptual Framework

In this research, three aspects design interaction are examined:

Technology: In this project, the aspect of technology refers to an arm-swing input device, or artifact, including possible systems and technology, like Internet of things (IoT), that shape behavior. Use qualities of technology comprise Usefulness, Usability and Pleasure. The technology for wearable computing is developed through design method in terms of prototyping the arm-swing input device for health communication.

Behavior: The aspect of behavior implies the integration of arm-swing posture in the daily life behavior of the five-selected occupations’ focus groups. In this respect, user interface design should contain shape and form and visuals that inform and drive human action. Time and (office) workplace are both significant for integrating
experience into focus group behaviors. The main purpose of this action research is to trigger users to change their individual health behavior as depicted in figure 2.18.

Health communication: refers to the relationship between ‘gesture-based interaction’, or ‘interaction’, and the user and component, an arm-swing input device. This aspect applies communication theories such as the Ritualistic Model, or participatory communication, and the action research process to explain relationship. Furthermore, by applying the semiotics concept of Jean Baudrillard, the arm-swing input device acts as a signifier that transmits meaning to users. Meanwhile, users present meaning through action and dialogue as the signified.

The Ritualistic Model consists of Sender (S), Message (M), Channel (C) and Receiver (R). Sender refers to users who use their input device to command the object and action. Message refers to the arm-swing gesture the user generates in the command stage for output. Channel or medium implies to an arm-swing input device as a new health communication channel for office syndrome prevention. Receiver refers to the researcher who receives data from users. However, the role of Sender and Receiver can be shelved as Sender refers to the researcher who designed the artifact, and Receiver refers to a user who tries to understand the project.

The ‘Hooked’ model is about developing a habit to form a product (Eyal&Hoover, 2014) based on one innovation methodology related to user experience design (UXD). This model provides four stages that shape a product through user action. The first stage triggers the user: this stage is similar to promoting a new object or service in the market. The second stage is action: for this project, it refers to the use of an arm-swing input device. The third stage is variable reward: the preferred output of the action and fourth is investment: the time and energy users invest in the swinging arms gesture. These four stages are applied to the design process and research method because of its significance shown in the arm-swing input device. Users know the value of integrating arm swing exercise using the input device into their daily life. It would be expected that most users would want to surpass their arm-swing record from the previous day. This then acts as an internal trigger to motivate behavior. Users
employ the arm-swing input device in the action stage. The screen on the device will display data for arm swings of each user, which is considered as feedback and serve as a reward for users. Users invest energy in performing arm swings to prevent office syndrome and can become a habitual action that evolves into a new wellbeing behavior in a hooked circle. The conceptual framework is displayed in figure 2.18.

The Conceptual Framework of "Gesture-Based Interaction for an Office Syndrome Preventing: Health Communication through Integrating Experience into Daily Life for an Arm-Swing Input Device"

2.11 Part XI: Summary of Chapter 2

In Chapter 2, the theories explained are interconnected. This leads to a methodology that incorporates questions and answers into discuss during a workshop for participants. Questions for this study will be utilized to trigger data collection on participants. The logic behind each question is as follows:
1) Questions about personal data on occupation (area of work) and duties and mobile device model (iOS or Android). All data is concerned with gestures-based communication during and outside of working hours.

2) Questions about symptoms, or body pain, experienced during digital device routines, accessible gestures and use behaviors.

3) Questions about input gestures during and outside of working hours presenting workplace conditions and work position and lifestyle.

4) Arm swings that demonstrate understanding of the input device and promote proper gestures that should be integrated into routine-based activities.

5) Ordinary tasks of participants reflected in the use of digital devices and frequency as some positions in a company do not match expected digital device use. These questions reconfirmed participants’ behavior using digital devices.

6) The output questions are based on task objectives of the five occupation lifestyles. They were analyzed according to proper scenarios for user experience in each occupation.

All answers were analyzed and formatted to illustrate possibilities of proper scenarios for users to integrate arm-swing posture into input gesture behavior.

The next chapter will describe the methodology in more detail.
CHAPTER 3

ACTION RESEARCH METHODOLOGY

3.1 Participatory Action Research Methodology (PAR)

Participatory action research methodology (PAR) is an approach that emphasizes action elements of integrated research (Dickson, 1997). PAR is an interdisciplinary methodology potentially transferring both informal and formal knowledge to change participants realities (Dickson, 1997; Goodyear, 2013). The two fundamental purposes of PAR are to generate open-ended knowledge through the research process and reorient participants’ perceptions of any issue in a form that will influence attitudes and change behavior (Dickson, 1997). PAR is a proactive research that contains a variety of research methods: questionnaires, in-depth interviews and analysis of health communication media (Dickson, 1997).

PAR offers appropriate values to health communication aimed at promoting wellbeing. PAR is different from other social research which examines participants’ without considering office syndrome prevention. A distinguishing feature of PAR is “dialogue in action”. Smith, cited in Dickson’s dissertation about PAR-based values, of considers capacity, equity and commitment (Dickson, 1997; Kremer, Sies, & Lindemann, 2016). Generally, these three values can be found when conducting action research: capacity in terms of participants, triggers and situations; equity, or as a stage of balance, referring to a participant’s physical body while performing arm-swing action with equilibrium determined by arm-swing input device assessment; and finally, commitment to performing arm-swing, or engagement which restricts freedom of action and limits time. For these reasons, only one gesture, the arm-swing, was focused on in this study.

PAR, because of the following characteristics, offers significant benefits that can be adopted for this research.
**Action-oriented moment**

Participants, for this study, performed arm swings in their natural workplace settings, not a controlled environment. There is no ‘end-state’ of any action research and thus, in this research context, distinctions are tentative and incomplete (Julie M. Davis, 2007). A participant’s action can be changed within fifteen minutes after acknowledging feedback in what is called the “action-oriented moment”

**Storytelling**

A narrative writing style can take an alternative textual form to report the action (Davis, 2014). This can employ critical ethnography, which is narrative writing style that discusses current understandings of the performance and related issues (Davis, 2014). The storytelling of each action acts as a significant tool for writing the PAR report. For this research, narrative and report style writing is combined into the storytelling, which is presented in Chapter 4.

From the PAR characteristics discussed above, an action research methodology was selected for this study, including a qualitative approach designed to include a combination of UX measurement and an iterative process to explore the integration of the arm-swing input device into the everyday lives of the sample in their five different occupations in their normal work environment as occupation is a basic factor along with environmental and personal factors affecting office syndrome (Norback & Edling, 2008; Ooi & Goh, 1997). The iterative process comprises in-depth interviews, field exploration and data analysis. There were different kinds of occupations in one location. So, each participant of each occupation sample used the arm swing input device independently. The 30 use case samples include male and female samples among the six participants per occupation group. These use cases focused on each participant’s performance performing the arm-swing gesture and the answers to all 12 questions that were designed to communicate specifically with each participant by occupation group. The input device included a screen on a tablet that displayed the number of times the arm-swing exercise was performed in real-time (Kaewpanukrangsi & Kerdvibulvech, 2019).
Hence, the next step process was to generate interpretations of ideas and actions found during the review (Davis, 2007) with the action research consisting of the following (Davis, 2007):

1) Narrative through dialogues as they unfold and change perspectives of office workers, students, lecturers, designers’ industrial workers. The story should be told in nontechnical language, so a reader is given a sense of how each participant feels about the arm-swing input device and gesture.

2) Highlights showing the changing aspects and new evidence in presented in context.

3) Display of how participants understand the integration of the arm-swing input device or gesture into their life scenarios.

4) Analysis of data and interpretation supported by the literature review.

3.2 The Focus Groups

The participants of each focus group were selected using a purposive sampling technique. According to Norback D. and Edling C., there are three main factors behind the prevalence of office syndrome: environmental, occupational and personal, including background and physical and mental conditions (Norback & Edling, 2008). There are several studies of office syndrome that focused on environmental factors such as a small space and controlled environment causing symptoms. However, a working environment in these cases is not a concern as most workers can decide on their own work space. According to Vanichvatana S., there were more than 700 co-working space scenarios in a global context in 2011, and these increased to 13,800 co-working space scenarios in 2017 (Vanichvatana, 2018).

This study considers the integration of the daily experience of each occupation, focusing on gestural behavior toward digital equipment mainly during work hours in five workplaces. In addition, the user-centric approach was applied to these five participatory groups related to office syndrome.

To begin, five relevant occupations to office syndrome have been selected: office workers, students, lecturers, designers and industrial workers. Each occupational group has 6 persons with different symptom levels of office syndrome.
Each participant had to examined to determine their level of pain for selection. The Office Syndrome condition has also been divided into three classifications: remedial, supplement and prevention. No one can prevent office syndrome if they do not recognize it as symptoms do not suddenly appear. Office syndrome will occur when a person continues their behavior for a long period. The time it takes cannot be estimated as it depends on an individual’s body, mind and workplace.

The use case methodology has been employed in this research to provide a gender mix, male and female, of a total thirty participants aged between twenty to fifty years and divided according to five career types that use digital equipment and perform arm swinging in their work environment.

### 3.2.1 Office Workers

The office worker group has a high prevalence of office syndrome sufferers in the general population. The group consists of representatives of six occupations: salesperson, human resource worker, secretary, programmer, manager and accountant. All participants are employed in an office and sit in front of a computer for more than five hours a day conducting routine-based computer operation. All six participants, two men and four women, have worked more than 2 years in their company. It was found that gender has little effect on the requirements of this research, but it should be noted that women are in the majority in general in office setting. Different workplace scenarios were selected for this field work. Four of the workers were employed at the time of the study by three companies: CPF (Thailand), Auto Alliance (Thailand) Co., Ltd. and Chillington Tool (Thailand) Co., Ltd.

### 3.2.2 Students

It appears that most students are addicted to mobile phones to conduct both online and offline activities such as social media, games music (??). While watching a screen or monitor they have little body movement, except for their eyes and fingers. Today, for this reason, students also suffer from office syndrome. This group comprises three men and three women, students of King Mongkut’s Institute of Technology Ladkrabang (KMITL) and King Mongkut’s University of Technology
Thonburi (KMUTT). Because students today are involved in many computer-related projects, there is also a prevalence of office syndrome among this group.

3.2.3 Lecturers

Lecturers can face office syndrome while they correct exams, write papers or conduct studies for long period of time in static postures. Computers now play an ever more important role in lecturers’ activities, including preparing presentations, writing digital documents and doing research. This occupation group comprises two men and four women who have all been lecturers for more than five years. It should be noted that over half of this group have suffered from serious symptoms of office syndrome while the remainder have faced the early stage of office syndrome. They are employed by three Thai and one foreign university, King Mongkut’s Institute of Technology Ladkrabang (KMITL), King Mongkut’s University of Technology Thonburi (KMUTT), Bangkok University (BU) and the University of Zagreb.

3.2.4 Designers

Company designers, two males and four females, selected were those who work on computer design programs everyday. Their tools include a digital pen, large digital pad and/or touch screen. Their occupation is deadline oriented even if they are not a freelance designer. Selected designers had worked a minimum of two years. Most of their workplaces have space for them to relax; however; they have little time or energy to relax because of their deadline-oriented work. They were employed at three companies: Interaction Design Studio, Innovation Print Service and Academy of Fine Arts, University of Zagreb, Croatia.

3.2.5 Industrial Workers

Industrial workers have routine work, usually operating a machine. Most of the selected industrial workers had to drive to their workplace, particularly those in executive level positions who would drive more than two hours a day. In addition to work, driving hours can be a cause of office syndrome. The two men and four women selected for this group were employed by Chillington Tool (Thailand) Co., Ltd.
located in Bangpu, Samutprakarn province, CPF (Thailand) Plc., and Auto Alliance (Thailand) Co., Ltd.

### 3.3 Arm-Swing Input Device as a Tool for Health Communication

For the use case methodology, the arm-swing input device was a major component in the communication between the designer and a participant. The input device was designed in a wearable computing form connected to a table with an Android operating system, which was portable and flexible in all selected workplaces. Moreover, the Android device could help participants mimic using the participants’ own devices in their daily lives. Figure 3.1 shows the wearable arm-swing input device covered with black stretch fabric, fashion elastic and black Velcro tape to make it more resilient for this research. The overall size took into account the dimensions of an average human arm, applying a universal design rule (Bacikova, 2015; Hassenzahl, Diefenbach, & Gritz, 2010; Mace, n.d.). The arm-swing input device’s system components comprised an Arduino platform, accelerometer, Android Bluetooth function and screen. The system was connected to a 5-Volt battery (a lightweight power bank of 2500 mAh).

The input device could connect to an Android tablet such as a Samsung Note 10.1 using Bluetooth as pictured in figure 3.2. It could provide digital feedback on the number of times a participant performed an arm swing in real-time. Each participant could watch the number while swinging both arms as the device also recorded the data. Figure 3.3 illustrates a user wearing the arm swing input device on her right arm and swinging both her arms together in order to send a signal via Bluetooth to the Android device. The input device triggers the system with any product or service suitable for the lifestyle of the five occupations.
Figure 3.1 Details of the arm-swing input component
(Kaewpanukrangsi & Kerdvibulvech, 2019)

Figure 3.2 Tablet display when connected
3.4 Field Experiment Flow of Use Case Scenarios

During the PAR process in this research, each participant performed arm swings while using the arm-swing input device. This iterative process created the field experiment flow. The tool to provoke use in each case was a hard copy of the three-A4 page questionnaire. This also involved a combination of an interview and use case scenario in the real environment of each participant. The questionnaire was divided into two parts, in which the first part contained four personal questions and the second comprised 10 specific questions with a choice of possible answers provided describing symptoms caused by using the digital equipment, health-related gestural input, daily tasks, output and the types of input devices each user would want to use during working hours and non-working hours. During the tests, the moderator explained the relationship between gesture, input, tasks and output to each participant using pictures. To create a proper user experience, a flow chart was used to direct participants to perform in an orderly and logical sequence during testing. Figure 3.3 presents the flow and sequence of the usability testing in this research. The yellow circle represents the moderator’s actions while the green-lined box refers to the actions of the participant in the experiment flow.
The experiment flow was divided into three phases as depicted in figure 3.4.

1) Understanding: This phase contained the interview using the questionnaire during face-to-face communication. First, the moderator explained the project, “Gesture-based interaction”, after which the participant answered the personal questions such as name, current position and their phone operating system. Then, the participant was asked about symptom/pain that occur during working hours and outside working hours based on personal experience. After the moderator explained gestural input and the relationship between occupation and digital devices, the participant continued to answer questions about preferred health-related gestural-input. Participants could select more than one answer for the input gesture questions.

2) Action in real environment: This phase recorded use cases in the real workplace. The arm-swing input device operation was first demonstrated by the moderator while reiterating the importance of arm-swing posture. The participant would then put on the device and press the start button to prepare the device. Each participant was told to swing both arms together approximately seventy-five times and try to understand the concept of integrating this gesture into their everyday experience. This phase could also be called “Knowing by Doing”. Each participant swung both arms together while seeing feedback on the Android screen. Two arms were used to swing because this is faster than one arm and was recommended by the moderator. There were no instructions about whether to perform one or two arm swings because the system for this input device did not allow slow swinging. An intuitive rhythm was needed. Video recording, photographs and observation techniques were included in this phase.
Figure 3.4 Field case study flow chart and questions
(Kaewpanukrangsi & Kerdvibulvech, 2019)
3] Open-ended thinking: This phase is more like a discussion. While the participant answered the questionnaire, the moderator tried to inspire them. First, the moderator explained the input gesture, the system and the output goal. The participant explained routine tasks conducted during working hours and outside of working hours as they provided answers regarding task goals. The moderator further explained three kinds of device that the participant could use: 1) wearable device 2) portable device and 3) static object, which are explained in detail in the results and discussion section. Each participant could choose more than one answer for each question. Overall, the field experiment in each case would take approximately twenty to forty minutes.
CHAPTER 4
DATA ANALYSIS

It is hoped this research can have a significant impact on the quality of people’s daily lives through the integration of arm-swing exercise, which could be difficult to estimate. Hence, UX methodology was applied to the iterative process that includes interviews; field experience or the case study; and data analysis. The results have been divided into five categories according to the five selected occupations: students, lecturers, office workers, designers and industrial workers, as presented in table 1. Figure 1 present a flow chart for each individual participant’s case study. Answers are presented according to the sequence the questions were asked. Some of the more interesting answers have been highlighted. The upper sections of the results presented in the table address the age range of each occupation and the percentage of the iOS and Android operating systems used by each occupation sampling. The next set of results are related to device use and gestural input during working hours of each of the five occupations. They include:

1. Type of digital input devices
2. Health-related gestural input
3. Daily tasks
4. Task goals / output
5. Preferable input device forms

The last results cover device use outside of working hours for the five occupations and include:

1. Body parts that experience symptoms related to gestural input
2. Types of digital input devices
3. Health-related gestural input
4. Daily tasks
5. Task goals / output
6. Preferable input device forms
All questions focused on examining integration of use of the arm-swing input device in appropriate situations. The focus group results for each selected occupation are presented in figures 4.1 to 4.5 with a code name for each participant and personal details. Code names were used in place of real names to protect the privacy of all participants. The analysis is described in detail below and presented in table 1.

4.1 Officer Workers

Six office workers were selected with different levels of pain, a symptom of the office syndrome. The group of office workers comprised six occupations, a salesperson, human resource worker, secretary, programmer, manager and accountant, most in support administrative positions which require long hours sitting in front of a computer screen. They were employed by CPF (Thailand), Ford Automobile (Thailand) and other companies. The data of the six participants follows:

*Mrs. Veena TedMode* works as a salesperson who contact with customers at CPF (Thailand). Her office syndrome symptoms include neck, trigger finger and eye pain.

“For a small space like my office, I think the device can force me and my colleagues to do movement when operating equipment or appliances such as a copy machine, or coffee brewer. None of us feel any concern about symptoms until we experience pain. This will then force us to take action!”

Most of her work involves making calls while checking data on a computer screen. She work also requires cooperating with colleagues. She agrees with the value of the arm-swing posture and prefers to use it for entertainment. Figure 4.1 shows a picture of action research performed in the CPF (Thailand) office at Trokchan, Bangkok.
Miss Pimane Polmai holds the position of human resource analyst at Auto Alliance (Thailand) Co., Ltd. and needs to work in front of a computer every day. Dealing with numerous documents and attending several meetings can make her feel ill. She often feels pain from neck through her shoulder and down her back. She attempted to perform arm swings with and without the device as presented in Figure 4.2.

“I would order a pizza with the arm-swing input device at lunch time, which can help persuade my colleagues to move not only to prevent office syndrome, but also to reduce.”

As a human resource analyst, she tries to think about her colleagues in other departments. She would like to motivate overweight employees to become more active. She loves traveling but sitting in an airplane for 18 hours can cause office syndrome. She felt that while waiting for a connecting flight in an airport could be an excellent opportunity to perform the arm-swing gesture.
Miss Suda Rattapongpan works in a factory as a secretary for an executive director at Chillington Tool (Thailand) Co., Ltd. While attending meetings, she is required to take notes and conduct searches on a computer. The office syndrome symptoms she has suffered from include back, shoulder and trigger finger pain over several years.

“Trigger fingers is a symptom I feel often. I am not sure how I could integrate this arm-swing input device into my working hours, but maybe outside working hours. Ordering food and waiting before eating would be okay. I usually walk as my routine exercise.”

Figure 4.3 During action research at Chillington Tool (Thailand) Co., Ltd.
When swinging her arms at Chillington (Figure 4.3), she thinks about her work. She thinks a timer would be a better display while practicing. 15-20 minutes each session would be a proper break period.

*Mr. Chaiwut Witchusri* is a programmer at Interactive Design Studio. He admits being addicted to his mobile phone, reading Blognone online. He is a workaholic and has faced office syndrome for many years, suffering from neck and shoulder pain and trigger fingers symptoms. He does not need to go see a doctor and does not believe in office syndrome prevention. Figure 4.4 shows how he swings his arms.

“If I only focused on work, I would never leave my computer even if there is an input device right by my desk. I know that I need to do exercise, but I’ll do this after work.”

He thinks that during work, no one would be interested to perform arm swings, but it is possible after work.

Figure 4.4 Arm-swing at Interactive Design Studio

*Mr. Amat Wisentpitune* is a manager at Chillington Tool (Thailand) Co., Ltd. He says he is addicted to his smart phone and laptop. He watches screens to trade and suffers from postural back, neck and shoulder pain.

“I organize routine tasks at my desk such as schedule my time for the next day of order a cup of coffee. I know I need to integrate movement into my routine. I’m trying to do this; otherwise, I work out only two days a week. Office syndrome is like a silent killer. The pain just appears. There is no warning.”
As he is quite busy, he cannot allocate time to exercise regularly or eat properly. He did not allow any photographs to be taken.

Miss Vimon Supasit is an accountant at Chillington Tool (Thailand) Co., Ltd. Most of her work requires sitting in front of a computer from five to seven hours a day. She has a intense back pain and sometimes needs to ingest medicine. She does not have time to do exercise regularly.

“I always take pills if I have back pain. I don’t know about prevention. I would use this arm-swing device while watching birds. To feed birds, I could swing my arms to command small machines.”

She requires treatment for her back pain. She could perform light arm swings (30 degrees) in her beginning sessions. As she has two hobbies she loves: bird watching and gardening, the arm-swing input device can be integrated into these activities. Figure 4.5 shows Vimon talking about her hobbies.

Figure 4.5 Vimol talks about her hobbies

Most of the participants in this group use company laptops or desktop computers. For this focus group, the routine input gesture took was performed during tasks such as producing digital documents while working with others, for example, colleagues, customers, supervisors and suppliers.

They have experienced neck and back pain caused by sitting long hours in the same position while working. A keyboard and mouse are ordinary input devices they employ, and most complained about office syndrome.
They preferred a rock-paper hand input gesture while working, but preferred walking, arm swinging and rock-paper hand exercise outside of work.

*The proper integration of arm-swing gesture may be during working hours such as when ordering lunch or a taxi, brewing coffee or sending a letter.*

### 4.2 Students

All six users are students at King’s Mongkut Institute of Technology Ladkrabang writing their thesis in different subjects. They have faced office syndrome during the semester. The data of these six participants follows.

*Miss Tanwa Klinjaidee* is doing a thesis about animation and film. She has a problem carrying a big camera for long periods to conduct her study and feels stress during this semester.

*“I think it would be a good idea for me to perform arm swings when waiting, for example, for my advisor or filming. It would be interesting if an arm-swing input device could connect to some games.”*

During this semester, she could not sleep well or eat properly. She had no time to exercise and stretch. She performed arm swings 29 times. There is a space in her advisor’s office where she can practice arm swings (Figure 4.6).

![Figure 4.6 Arm swings while waiting for her advisor](image-url)
Miss Liza Thani is conducting a study about graphic design. She suffers from blurry vision while working and her fingers lock and her back hurts. Sometimes, she feels like she has a hunched back.

“I think an arm-swing input device is not enough to motivate me to leave my computer when working. I feel like I will lose work time, but I love playing games. It is good if it could be integrated with my favorite games, or into tasks like doing laundry time or making instant noodles.”

She would like to have an arm-swing activity for leisure time instead of integrating it into study hours. However, she has no class to attend. She only has to work on her design thesis. Figure 4.7 shows a space in her studio where she can perform are swings.

Figure 4.7 Arm swing exercise during model making

Mr. Kanachat Sonma likes to work on freelance jobs while studying. So, he performs many tasks using his notebook or a desktop computer. He has suffered from neck pain and numb fingers, symptoms of office syndrome.

“This device lets me take a break from my work sometimes, something I need. Waiting for a cup of office is suitable for my situation, since I know I must present my work the next morning.”
He often suffers from numbness in his hands, arms and legs. An arm-swing input device could motivate him to leave his computer for 10 to 15 minutes. It could be a good start for office syndrome prevention.

![Image of Kitti putting on an arm-swing input device](image)

**Figure 4.8** Kitti putting on an arm-swing input device

*Mr. Kitti Wongkummi* is a fourth-year student writing a thesis. He often suffers from back pain.

> “Exercise will help me relax and get rid of my back pain. I think I will mostly use the device when waiting for a pizza I ordered. While writing my thesis or waiting for my model to dry, I can swing my arms.”

There are no classes during semester students must write their thesis. So, most do not need to come to the university. However, the art program provides Kitti with a studio lab, so he works at the university during this period.

![Image of Kitti and his dissertation presentation](image)

**Figure 4.9** Dissertation presentation to fellow students
Miss Nilnit Maha has faced office syndrome for 1 year. She suffers from muscle inflammation in her shoulder when writing using a computer. She likes to jot down notes on a mobile screen as well as use several applications as shown in figure 4.10.

“An arm-swing input device can help me leave my computer sometimes. I hope it will become a new habit as I am addicted to other devices, like my computers and mobile phone that I cannot live without.”

She is tech savvy and cannot be far away from her devices. She has tried to change her behavior in terms of device-orientation such as jotting notes on a digital screen or doing things using mobile application platforms.

Figure 4.10 Putting on a device before an arm-swing action

Mr. Pongpanu Prakarn has faced an office syndrome for half a year since he became addicted to an online game. Shoulder and neck pain and trigger fingers are common symptoms. In figure 4.11 he asks about the arm-swing input device before putting it on.

“Instead of going for a massage, I try to move my body to heal myself. This device can at least remind me to change my posture often. I imagine I will use it during periods when I wait for my laundry or food I ordered to arrive.”
He has thought about quitting playing online games often; however it is hard to do. For game addicts, an arm-swing gesture can be integrated into games. They can take an exercise break rather than watch game advertising.

![Image](image.jpg)

Figure 4.11 Before an arm-swing action

The research found that most of the students had their own MacBook, which can be synchronized with an iOS phone. It can be assumed that they use their digital devices for their research and writing, which is reflected by their input gestures during and outside study hours.

The results of the students focus group show similar device use during and outside study hours. They complained about pain in the upper limbs, fingers, hands, arms, shoulders, neck and back, caused by laptop and mobile phone use. They felt comfortable with the rock-paper hand gesture while studying and performing arm swing exercise during their free time. Taking notes is the task the students performed most with their notebook computers while they read much more using their mobile phone outside of study hours. They also preferred the wearable input device when compared to the portable and static object devices.

From the observation, it was found that most of the student’s participants live in dormitories, in a room with limited space. 50 percent of the participants usually play outdoor sports during their free time in the evening. *The most suitable scenario for arm-swing input gesture was found to be outside of study hours in their dormitories as*
an part of their entertainment such as controlling a television using a remote control or playing video games. In addition, the arm-swing input gesture would be performed for such tasks as ordering a pizza or doing one’s laundry.

4.3 Lecturers

The results show that lecturers perform multiple tasks, like typing when writing reports or other required documents for research and preparing power-point presentations. Ages of the participants ranged from 31 to 50 years of age. Most of the lecturers who participated in this research use a MacBook and iOS mobile phone, or 66.67 percent of the sampling, while 33.33 percent use a notebook computer. Some participants in this group use more than one mobile phone device, however, the iOS or Android system phones operate almost the same. Data of the six participants is presented below.

Mrs. Sunitsa Sathit works at King Mongkut’s University of Technology Thonburi (KMUTT) as a lecturer and administrator for more than 10 years and suffers from early office syndrome. She often does exercise and try not to feel stress. She has a healthy lifestyle which includes healthy eating and doing exercise. Figure 4.12 shows her during work.

“I have more time to take care of my daughter if I don’t work out after work. However, I like to play with my daughter after school anyway. I like wearable and portable device forms which I think I can use in university more easily than other forms of the device.”

She has not experienced office syndrome much because she regularly moves around her office. When she has back pain from working in front of a computer, she will go for a Thai massage after work.
Figure 4.12 During conversation at KMUTT

Miss Daniya Takran is a lecturer in animation and has been working at King Mongkut’s Institute of Technology Ladkrabang (KMITL) for five years. She works in front of a computer for long hours and says she has no time to exercise.

“I probably work out once a week. During working hours is perfect time to integrate some activities like this. You know, last semester I had eleven advisees. I sat to give advice from 9:00 am to 9:00 pm, which made me quite sick.”

She is usually careful about what she eats, not exercise. It would be better if she could develop the habit of using an arm-swing device during work, which is presented in figure 4.13.

Figure 4.13 Arm-swing activity during a break at KMITL

Mr. Krengkrai ThepTaidee is a lecturer at Bangkok University. His work involves sitting in front of a computer in the computer room. He used to work out about three to four hours a day. Eight years ago, he competed in triathlons. Now,
though, he has suffered from office syndrome for the past two years. He has tennis elbow pain. Sometimes he cannot work and needs to take medicine.

"Office syndrome is not about heavy exercise outside working hours, but about little change of postures or stretching during work. The same posture causes the symptoms. The arm-swing input device can be integrated into work life like I did with this simple workout equipment to stretch my legs and body."

Figure 4.14 Answering questionnaire

Figure 4.15 Using simple equipment to work out in his office
Kriangkrai had several ‘do it yourself (D.I.Y)’ exercises he could perform at his office. Figure 4.15 shows how he uses an elastic band. He focused on the arm-swing input device more than his posture because he works out regularly. He has good body balance and an excellent exercise foundation.

Miss Lizalott Jilkov is a Ph.D candidate in the Faculty of Law at University of Zagreb, Croatia. She works in the library and as a lecturer. She has suffered from office syndrome, such as postural back, shoulder and neck pain. So, she practices yoga. Figure 4.18 presents Lizalott swinging arms at Zagreb Bus Terminal.
“Here in Zagreb, I can swing my arms while waiting for my bus at bus station, which it would be about 20 to 30 minutes. Another place I think of is the library. This arm-swing input device could control a self-service borrowing machine.”

Lizalott practices yoga to help cure stress and physical pain; however, the integration of the arm-swing input device could be help cure office syndrome, as it can motivate action. As a yoga practitioner, she likes the way of the arm-swing input device can be integrated everyday life, as it offers feedback for arm-swing exercise such as distance walked.

![Arm swing exercise with input device at Zagreb Bus Terminal](image)

Figure 4.18 Arm swing exercise with input device at Zagreb Bus Terminal

Mr. Amnart Kitchalearn works as a design lecturer at KMITL. He has suffered from serious office syndrome for two years. He tries to not get too stressed and rides a bike not merely to get somewhere, but also for exercise as demonstrated in figure 4.19.

“This arm-swing concept aims to integrating a gesture into daily lifestyle for those who cannot allocate time to exercise, like I use my bike. Office syndrome gives no warming until you face as symptom. Office syndrome prevention means a person must be aware, and this device can help in health communication.”

Now, he walks to the university to lecture, and arm swings help burn calories while walking (Thaihealth.org, 2001).
Mrs. Daliya Wongmaha has been a design lecturer for more than 15 years. She has suffered from office syndrome, experiencing postural back pain, leg numbness and because of stress.

“Every 20 minutes, I need to move my body in some way. I have a smartwatch with an alarm that can tell me exercise, but it does not suggest any gesture. If I have a device like the arm-swing input device, I can set it into any gesture output. It would help motivate me to act.”

She wants to perform arm swings when ordering food and beverages since her workplace is some distance from the faculty cafeteria. She tries to make the lecturers office less formal, so the input device could operate through blue-tooth links to control office equipment or services to match lecturers’ needs as presented in figure 4.20.
Most of the lecturers had experienced some pain in the upper limbs from using their digital devices. They preferred rock-paper hand exercise, walking and neck and shoulder gestural input during working hours while outside of working hours, they preferred whole-body movement exercise such as walking. Outside of work, most of the lecturers preferred watching television or reading on their mobile phone, which are more passive activities. They also preferred the wearable input device compared to the portable device and static object. None liked the static object because their tasks are not only performed while sitting in front of a notebook or desktop computer. They also need to move around, like walking to a classroom, laboratory or, perhaps, library. To integrate the arm-swing input device into the lecturers’ daily lives, the most appropriate scenarios appears to be outside of working hours, during such activities as opening a door, doing laundry or watering plants.

4.4 Designers

For this study, designers refer to persons who work at different hours than others. They often prefer working late into the late night even though they are permanent company employees. The Interactive Design Studio workplace was selected for this research project. Participants included two men and four women. Details follow.

Miss Lanual Phudtawee works as a graphic designer at the Interactive Design Studio. She has suffered from shoulder and postural back pain and trigger fingers, but she does not include these as symptoms of office syndrome. Besides her work, she loves online shopping and social media.

“My work is a continuous. What I draw one day could change the next depending on my mood. I know it is good to leave my work for 15 to 20 minutes to perform health-related exercise. I will try to change my behavior. Indeed, I have seen a lot of designers face office syndrome, and I am afraid of it.”
She has not adopted the exercise because of personal concerns. Once she becomes familiar with the device, then she could enjoy arm-swing exercise. As shown in figure 4.21 she has some difficulty performing arm swings properly because of her posture. Still she could perform arm swings up to 40 times with practice. She is also seen in figure 4.21 her filling in the questionnaire.

![Image](image1)

**Figure 4.21 Pleasure performing arm-swing exercise**

*Mr. Theetawat Bannphetta* is a graphic designer at the Interactive Design Studio. He often has headaches because of office syndrome and then rest.

* "The device can get me to leave my work for a while and help me relax. I can imagine ordering a cup of mocha using the arm-swing device. Outside my working hour,s it would be fun if I could use it while waiting for a motorcycle taxi."*

![Image](image2)

**Figure 4.22 Watching feedback via the Samsung tablet while swinging his arms**

He has tried to integrate the device into his lifestyle, like while waiting for a motorcycle taxi or Grab ride, which is common in Thailand during rush hours.
Miss Jirakorn Prasertsin is a draftsman at the Interactive Design Studio. She has faced trigger fingers and neck pain. So, she likes to go have a Thai massage.

“I feel like I can eat more because I used up my energy exercising. After that, I can eat anything, like a Pizza, whole box... The device should force me to swing my arms and then eat Pizza.”

She does not apply the concept to connect any product or service with arm-swing gesture; however, she is one potential participant who would integrate an arm-swing gesture into her daily life.

![Figure 4.23 Arm-swing before her pizza ordering](image)

Miss Khonchabong Mouhnuch is a 3D designer, who constructs 3D structures on a computer at Interactive Design Studio. She suffers from shoulder and neck pain.

“When I am waiting or producing a 3D rendering, I would swing my arms. It is a perfect situation... I can use the device to order food like Krapaokkai Kaidao or a drink.”
Figure 4.24 Completing the questionnaire

Khonchabong has spare time during work when her computer is rendering her 3D drawings, which can be used to prevent office syndrome.

Miss Isabella Olikov is an artist studying for a Ph.D. at the Academy of Fine Arts at University of Zagreb. She feels enormous stress about her study and work. She suffers from some physical symptoms such as postural back, shoulder and neck pain. Her goal is to find employment abroad after graduating.

“I would like to perform arm swings while waiting for friends. Arm-swing action can be performed in a restaurant or other places. My girls’ gang would be excited to organize a contest while waiting at a restaurant.”

Her case is proof that office syndrome is a universal problem and does not merely affect office workers.
Mr. Jerapan Chanhomnan is a senior designer at the Inprint Company who is involved in developing a startup project rather than ordinary design work. He has suffered from office syndrome, blurred vision and neck and shoulder pain. He had an accident two years ago when he fell and hurt his buttocks and then needed chiropractic treatment. The treatments cured pain not only in his buttocks, but actually pain in the entire body, all symptoms of office syndrome.

“Everyone knows how to prevent office syndrome, but no one can give it priority while working. Using an arm-swing input device can help me to move and consume calories as I walk. I had an accident and hurt my buttocks, but I could perform arm-swing gesture with no harmful effect.”

Figure 4.25 Using the arm-swing input device while waiting for friends in a public space

Figure 4.26 Arm swing to control a door
These participants use their fingers and hands extensively while working. Input devices such as a digital pen, tablet or mouse require input gestures. In fact, these participants have encountered the most pain in their fingers and hands. Their tasks are creative oriented. The data show equivalent scores for their preferable input devices, wearable, portable and static, during working hours; however, they preferred only the wearable device outside of work. During work, they preferred the rock-paper hand gesture while outside of work, they preferred walking. *The proper scenarios for designers using an arm-swing input device appear to be during working hours when brewing coffee or ordering food.*

4.5 Industrial Workers

*Miss Chandee Boontoom* is a store worker who checks stock. She has suffered from office syndrome, yet she can bear the postural neck pain. When she has a physical symptom, she has just stopped working for 30 to 60 minutes.

“I stand up counting stock. I sometimes forget to look at the time as I want to finish my work. The arm-swing input device can force me to leave my work for a bit, and if I could control a printer, or QC machine that would be great. Indeed, I love gardening, so it would be nice to integrate this into my gardening activities.”

Office syndrome is a silent danger (Sethpitak, 2015), even though a person who has not been sitting in front of a computer screen can face these physical symptoms.

![Figure 4.27 Using arm-swing input device during lunch time](image)
Miss Japa Kaewsai is a chef who creates recipes to sell ingredients and support CPF affiliated catering services. Besides having to stand as she prepares ingredients and cook, she needs to go out to find these ingredients. Spending a long time as a driver can also cause office syndrome as she will suffer from numbness in her legs and neck and back pain.

“I cannot stand to swing my arms in my car; however, it can make me aware of symptoms. I can integrate the device into my lifestyle outside of working in the kitchen where I cannot integrate something like this. However, in other places like a (super)market, I can arm swing waiting for my orders to be prepared.”

Japa has no time to exercise as her work has no definite separation between eating, exercising and sleeping. Performing arm swings at home while watching television is most suitable for her. Figure 4.28 shows how Japa performs arm-swing practice with the device at home.

Mr. Wiwat Trakultawan works as a chef or assistant. Most of his work entails to preparing ingredients such as vegetables and meat. He needs to stand in the same posture for several hours. He has suffered from trigger fingers, shoulder pain and leg numbness.

“If the device can control a machine in different room than the kitchen, that would be perfect. I could change my gesture or posture sometimes. However, a suitable situation would be waiting time, for example, for water or eggs to boil.”
Wiwat’s work could be further explored to integrate office syndrome prevention using more than the arm-swing input device. He has suffered from office syndrome without working in front of a computer.

Figure 4.29 Wiwat showing his arm-swing result after practicing

Mr. Narong Charan works as a foreman at Chillington Tool (Thailand) Co., Ltd. He works in the factory area checking quality and has suffered from office syndrome for two years with neck pain and eye fatigue.

“I don’t know how arm swings can help me cure office syndrome, that is if gesture can reduce symptoms, but it is interesting. It is something I can do when I order my lunch.”

Narong thinks that office syndrome as computer syndrome that occur only when a person works in front of computer. At first, he did not define his pain as a symptom, just general physical pain from aging.

Figure 4.30 Performing arm swings using a Samsung tablet Note 10.1 interface display
Miss Somsri Kemmanit works as a Japanese translator at Ford Automobile (Thailand). She has been categorized as an industrial worker because her work is not only located in an office but also meeting rooms and factory facilities. She works under stress performing translation. Much of her work is not in front of a computer, yet she has suffered from office syndrome with headaches the most common symptom while shoulder and neck pain have occurred.

“I think I should integrate arm-swing gesture practice into my break time. I could use it to flush a toilet. There are other tasks as well.”

Most of her tasks are not in a static place as she needs to go with her Japanese supervisors. The arm-swing input device should be streamlined as a wearable device is suitable for her.

Figure 4.31 Swinging arms during break time

Miss Papawadee Ditmeang is a catering chef at CPF (Thailand). Her specialty is Thai food. She uses a wok and spatula all day. Besides working in a kitchen, she is addicted to social media and shopping online. These activities cause her shoulder pain and trigger fingers. She also drives a motorcycle which she operates using her wrists.

“Actually, I cannot leave my ingredients for a time because timing is very important for the taste, and appearance. I could possibly use the arm-swing input device during my break time, like when brewing a cup of coffee or ordering a dessert...It is better for people who are gym members, but I have no time for that.”
Papawadee was a gym member the month before the study, but she was sometimes very tired and did not go. This is why she gave an opinion about going to the gym.

Figure 4.32 Performing arm-swing exercise

Participants were observed in their specific workplace, like kitchen, factory, office. They mostly wore sandals or slippers to relax their feet, and the arm-swing gesture does not require sport shoes.

The results of the study show that the sampling was split equally, i.e., 50 percent each, using an iOS or Android phone. They experienced pain in their fingers and hands. They preferred using an arm-swing input device during working hours but to walk, swing their arms or perform rock-paper hand exercise outside of working hours.

For health-related gestural input, they preferred a wearable device both during and outside working hours. Their average duration of exercise was 18 minutes with 810 arm swings. This sampling had the highest number of arm swings compared to all groups. The proper scenario for industrial workers using the arm-swing input device appears to occur during working hours, when queueing to buy lunch and ordering a meal and drink.

From the results of all 30 participants, it was found they have similar arm-swing stabilities and exertions that can have been classified into six arm-swing patterns. Figures 4.1 to 4.32 present the approximate arm-swing patterns categorized as follows:
1) **Stable arm swing and gentle exertion pattern**

The participants performed arm swings stably from the beginning. The arm-swing angle was about 30 degrees from a participant’s body. Most had a basic exercise foundation and some physical restrictions. They could not perform strong swing arms or apply the posture required for the input device. They were careful when swinging their arms, according to device recommendations. Three of the participants, an office worker, a lecturer, an industrial worker who performed this arm-swing pattern are pictured in figures 4.4, 4.12 and 4.27.

2) **Stable arm-swinging and heavily exertion**

The participants performed arm swings stably from the beginning. The arm-swing angle was about 45 degrees from a participant’s body. Most had a basic exercise foundation and some physical conditions. They tried to trigger the input device with heavy arm-swing exertion. They were worried about the number of arm swings they performed using the input device. The highest number, 10, of the participants performed this arm-swing pattern. This arm-swing pattern is presented in figures 4.3, 4.7, 4.14, 4.18, 4.20, 4.25, 4.30, 4.31 and 3.32 and comprises two office workers, one student, three lecturers, one designer and three industrial workers.

3) **Stable arm-swinging and steadily increasing exertion pattern**

The participants performed arm swings stably from the beginning. There was a steady increase in their swing angle from about 30 degrees to 45 degrees from a participant’s body. Most had a basic exercise foundation and physical conditions. They were uncertain about the correct arm-swing posture at first, but once they were comfortable in the arm-swing posture, they would steadily increase exertion.

Figures 4.1, 4.6 and 4.13 present participants performing a stable arm swing while steadily increasing exertion.

4) **Unstable arm-swinging and gentle exertion pattern**

The participants performed unstable arm swings, sometimes swinging and sometimes stopping. Their arm-swing angle was about 35 degrees for a participant’s body. Most had no an exercise foundation but some physical conditions. Most were at first unbalanced and uncertain in their posture. Only two of the participants, a student and a designer have this arm-swing pattern as presented in figures 4.10 and 4.21 respectively.
5) Unstable arm-swinging and heavily exertion pattern

The participants performed unstable arm swings, sometimes swinging, sometimes stopping. There arm-swing angle was about 48 degrees from a participant’s body. Most had no exercise foundation but physical conditions. They tried to trigger the input device sometimes with the heavy exertion. They worried about input device feedback. So, they sometime exerted more in their arm swings. Five persons performed this arm swing, a student in figure 4.11, lecturer in figure 4.19, designer in figure 4.22 and two industrial workers in figure 4.28.

6) Unstable arm-swinging and uncertain exertion pattern

The participants performed unstable arm swings, sometimes swinging, sometimes stopping. There was no certain angle of their arm-swing. They were more curious about the input device than focusing on their action. Seven participants are in this group, two office workers pictured in figures 4.2 Figure 4.5, two students in figures 4.8 and 4.9 and three designers in figures 4.23, 4.24 and 4.26. They sometimes performed with gentle exertion and sometimes heavy during the test.

Based on the six arm-swing patterns discussed above, office workers fall into the first, second, third, and sixth arm-swing pattern with four office workers were swinging their arms stably. Students belonged to each of the arm-swing patterns. Five lecturers performed a stable arm swing, three with heavy intensity. On the other hand, five designers performed unstable arm swings with three of them uncertain about exertion. Five industrial workers performed the arm swing with heavy intensity, three of them stably and three unstably. Only one of industrial worker had a stable arm swing with gentle exertion pattern.

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<tr>
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**Health-related gestural input**

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**Daily tasks**

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**The goals of the tasks / output**

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**Preferable Input device forms**

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**Outside working hours**

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<td><strong>Daily tasks</strong></td>
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Table 4-1 Data of each occupation group (Kaewpanukrangsi & Kerdvibulvech, 2019)

Table 4-1 illustrates all data from the questionnaire and performance divided under the five occupations. The table consists of three sections: personal data, inside working hours and outside working hours. The average age and percent of smartphone system use, iOS and Android, of each group are presented in the personal data.

The last five data in table 4-1 are about participant performance presented as averages. The average duration of exercise refers to arm-swing exertion. The data shows designers have the longest duration, about 22 minutes, while students have only 10 minutes. Arm-swing intensity refers to the level of exertion and relevant time. The percentage of right performance of each group is calculated from the real number of arm swings presented on the input device mini screen. The real number of arm swings always exceeded the number displayed on the mini screen because the arm-swing input device would calculate only arms swings over 30 degrees according to the axis of the body, which is the arm-swing input gesture this study calculated (see chapter 3). The percentage of right performance refers to the presented numbers divided by the real number of arm swings performed. The average gesture quality of movement is reflected in the observations of the overall arm-swing performance with time duration. There are three levels of gesture movement quality: low, medium and high. Even through, the designer group has a high number for the average duration of exercise, the average gesture movement quality is low-medium. for the student group,
the average gesture movement quality is low-high because of the variety of arm-swing gesture quality.

4.6 Cross Focus Group Analysis

The research results show that the different occupations perform specific behaviors to access and operate digital devices during and outside working hours. The choice of each focus group becomes important when determining the best scenario for each occupation. As presented in table 1, a non-movable input device was not selected by lecturers because the device could not fit in with their daily routine and behaviors during working hours. Vice versa, the industrial workers did not choose a moveable input device for use during working hours. The major differences between the five focus groups were found mostly during working hours since each group has different tasks and goals as well as uses different digital devices during their work. There was some similarity found during their time outside of working hours. Still there were differences as each group has different lifestyles and living conditions. However, rock-paper hand gestures were found to be the most possible gesture to be performed during the working hours of all sampling groups because of the limited space of their work environment.

Some of the occupation groups did not totally agree with performing the arm-swing input gesture during working hours as it requires greater space and there was a concern of social acceptability and peer pressure. Furthermore, the arm-swing input device played a major role in studying input gesture during the tests with the number of arm swings varying sometimes greatly. Still, it could possibly be designed to fit the different tasks performed by the participants in their daily life. As UX concerns the value of interaction, most participants knew its value [5]. For example, one participant who worked in an office would like to use the arm-swing input device when opening the door to his room which requires up to nine arm swings in a day. This scenario could provide two main benefits: the subject would not need to bring their door key and they could record this as exercise with a code for opening the door. Another integration scenario that has potential as a proper experience is operating a coffee
machine using an arm-swing input gesture. One of the students raised this idea about making coffee as she had to wait for the machine to complete its task.

To summarize, the following two tables, 4.2 and 4.3, show the percentage of preferable devices (Wearable and Portable) or Static object for the five occupations. Table 4.2 shows the percentage for the focus groups’ preference during working hours, with the wearable device being the most preferred device. The portable device, including a pen, card or handheld device, was not selected by the industrial workers. Moreover, the lecturers did not prefer static objects such as desktop decorative object or clock. Among the designers, they showed equal preference for all three forms of input devices. Table 4.3 shows the percentage of the focus groups’ preference for different input devices outside working hours. There are similarities in preference for the wearable input device during working and outside working hours. The results for all focus groups show above 50 percent preference for the wearable input device outside working hours, rather than portable device or static objects.

Table 4-2 Preferred input devices during working hours (Kaewpanukrangsi & Kerdvibulvech, 2019)
The difference between the number of arm-swing videos recorded for observation and the number of arm swings displayed on the device’s screen were also compared the performance. Each occupation had specific needs, and this is reflected in the data, quality of their arm swings and their answers at that time. Tables 4.2 and 4.3 present crucial data on a wearable device which refers to a device that one can wear, like a watch, waist strap, necklace, or shirt. Most wearable devices can be used whenever worn. Portable object refers to a handheld object which one can keep in a pocket or bag for use during preferred moments. A portable object may be large or small, like a laptop or mobile phone. A portable object could be like a wallet which one can use to pay for purchases. Static object refers to a thing or technology within a specific location, for example, an automatic door, table, wall or large monitor.

The significant numbers of device forms that all participants prefer outside working hours is a wearable device. While during working hours, the designer group is the only one that has three preferable devices (wearable, portable and static object). Portable refers to an object that can be taken with a person while a static object refers to a non-movable object, including ambient technology which is system oriented.
CHAPTER 5

DISCUSSION OF RESULTS AND FUTURE WORK

To recap, the research questions of this dissertation are:

1. Are the focus groups aware and increase the number of physical movements during working hours to prevent office syndrome using an arm-swing input device as a health communication tool?

2. How does the embodied interaction of the arm-swing input device motivate participants to swing their arms?

3. How does the focus group shift their paradigm towards arm-swing gesture from an exercise of the elderly to a modern exercise for their everyday life?

There are three crucial factors that cause office syndrome: environment, personal condition and occupation. This action research takes into account occupation with each selected reflecting a working style while each person has their own individual lifestyle.

To integrate an input gesture into a person’s lifestyle is not a trivial task as found in this research. This study can serve as a starting point for examining arm-swing gesture integration of health communication in Thai culture where up-to-date technologies are used widely. The benefits can enhance quality of life and wellbeing. Further research could focus more on observation of routine activities. For example, CCTV, or VDO cameras could be installed to record observations. However, some participants could feel these are intrusive and make them uncomfortable; thus, the results could be affected. Some participants may also need time to become familiar with the researcher and input device, and participants may have limited time. To enhance their experience, future studies could examine each occupation need specifically to design an appropriate personal device.
Gesture accessibilities may depend on appropriate technology. Today, gestures have become a marketing tool to promote digital products and technology. In the future, as more advanced technology is integrated into infrastructures and user accessibility is no longer a concern, users will expect full and free access using digital devices. Interface technology will be compatible with the composition of new products, systems and services. Thus, the intuitive design in the field of user experience will be a focus for designers. Therefore, even though the value of user interaction is hard to measure, a new norm of generated gesture-based interaction should be further explored.

Behavior of change examined showed that participants already knew the consequences of traditional working behavior that mainly cause office syndrome; yet, they won’t change their behavior. This phenomenon could be described as “despite knowing, not changing”. Most of the participants in this study recognized an apparent office syndrome symptom, but they did not try to change how they work. This study may have helped to motivate the participants to rethink about their routine behavior.

The health communication aspect of the arm-swing action in Thai culture was acknowledged by all the participants. This research could encourage employers and firms to become more concerned about ‘work life balance’ of their employees. Arm swings can be a first significant step towards office wellbeing. Ultimately, an arm-swing input device may serve as a symbol for wellbeing interaction in the modern company.

5.1 Action Research Contributions

Like with other action research, it is not easy to write about a study using traditional academic structure. However, it is a universal platform for academia to access the work (Julie M. Davis, 2007; Dickson, 1997; Fu, Jiang, & Yang, 2016; Goodyear, 2013; Thorgeirsdottir, 2015). Action research is a significant methodology for any discipline in this “tech era”. This arm-swing input device can contribute to the study of communication, interaction design and user-experience design disciplines. The contributions of this action research are not only gained from the field work, but also from the starting point of this project, which was developed from a small idea
and expanded through a literature review. From these actions, the research project was begun. So, the first contribution was demonstrating “how to start the research project”. Mind maps were created that helped connect the ideas and find a research gap in the context of arm-swing exercise and communication. Next, all related data was analyzed and used to develop “design criteria”. The arm-swing input device was first designed as a wearable device to be used in action research in various scenarios. Design criteria are a significant contribution in the interaction design for this action research (Bardzell, Bolter, & Löwgren, 2010). Designing a communication tool for the action research is vital and contributes to the body of knowledge. Motivating designer creativity could be called developing “management potential” in the process. Management potentials such as time management, modelling, design thinking and budget planning, are applied to construct the arm-swing input device as a tool of health communication for this research project. This PAR methodology is one way to reinforce health communication, especially concerning office syndrome prevention which encourages people to change their behavior by “do it right now”.

5.2 Reflections

There are several opinions of participants provided in chapter 4. Their reflections can be grouped into three perspectives: satisfied, moderately satisfied and dissatisfied. From the different questionnaire answers, office workers showed they totally agreed with integration of the arm-swing gesture. The showed that office workers had a positive change in the meaning of arm-swing gesture being an elderly exercise to one for younger people interested in technology integration and not the gesture itself. This paradigm shift does need time, different for diffident occupations, for example, in this study salesperson, human resource worker, secretary, programmer, manager and accountant.

5.3 Possible Future Work

From the study’s results, this research could be expand in five directions, “5Ex”, as follows: to expand new health communication campaigns, to explore
gesture interaction, to expose behavior of participants, to explain sign consumption and to experience marketing.

5.3.1 To Expand New Health Communication Campaigns

From this research, expanded opportunities were seen for new campaigns to prevent office syndrome such as “No Office Syndrome Here!”, “Arm-Swing Challenge at Workplace”, “Arm-Swing for No Pain”, “Arm-Swing for Big Bonus” and “Arm-Swing Viral Challenge”. These could be in the form of roadshow events at different workplaces. It could promote a permanent space or facility, like a non-smoking area, an arm-swing area. Interactive devices or ambient environments could be designed to raise awareness of the dangers of office syndrome. As occupations are performed today, most workers can work outside of their workplace. An event could also be organized in a public space.

Meanwhile, companies should consider promoting the culture of wellbeing in their office, which would include office syndrome treatment and prevention. When employees feel well, they would work more effectively. Furthermore, a company can use wellbeing promotion activities to create a positive image.

5.3.2 To Explore Gesture Interaction

In several articles, different gestures are introduced that can relieve office syndrome. However, a gesture using an interactive product can be adaptable from an arm-swing gesture to other physical gestures such as yoga poses, half-moon, tree, and rabbit, for example. Besides arm swings, other postures can promote office syndrome prevention, but they require more space, quieter conditions, or even a stronger body. If an arm-swing gesture is adopted, technology need to be adapted as well, for instance, Kinect technology. Possible gesture interactions for office syndrome prevention can be categorized into two types: 1) self-resisting, 2) DIY stretching.

1) The self-resisting type emphasizes yoga postures that focus on stretching but against a resistance. These gestures require a basic ability in yoga, more specifically, a body balancing skill. It was found that taking a basic yoga class could help learn and perform the right gestures. Mr. Krengkrai Theptaidee (Pages 84-86) is a lecturer who practices yoga. He has a good balance and he can apply other yoga
postures to office syndrome prevention besides the arm-swinging posture. Another lecturer, Miss Lizalott Jilkov, is also a yoga practitioner. She asked to perform other postures while waiting for her bus at the Zagreb Bus Terminal (Pages 86-87).

2) D.I.Y. stretching explores the use of *Do IT YOURSELF* equipment to perform stretching in a workplace. Elastic bands, paper boxes, water bottles, a wall and an office chair are favored objects for exercise. These are ways to create self-resistance as a wall, chair or table can be used to resist pressure. A person can easily perform strength tasks without any basic skill requirement. D.I.Y. stretching includes pushing body against a wall, using water bottles as a dumbbell, using elastic bands to stretch arms and back. However, most workers do not think of using a D.I.Y. device in their office because of a small space which cannot cater to exercise or stretching. People also feel uncomfortable doing physical exercise in their workplace, but not outside the workplace, like in their home where they can perform several activities mentioned above using D.I.Y. equipment to stretch.

5.3.3 To Expose Behavior of the Participants

A person’s actions can reveal possible situations in a workplace. For each of the five occupations studied, six people exposed themselves to collect data. Their actions have been categorized according to four goals of using the arm-swing input device.

5.3.3.1 For self-health improvement

The main reason for performing arm-swing in the office is to cure physical pain cause by office syndrome. The arm-swing input device can improve health behavior of office workers as can proper sitting posture in front of a computer. The device can possibly motivate workers to practice arm swings because of the personal feedback displayed. The feedback can reflect their self-improvement as their actions are recorded each round. One goal of self-health improvement is awareness of office syndrome without yet any attempt of arm-swing integration into work time. The aim is to change individual health behavior with the arm-swing input device. As shown in chapter 4, the results of most of the participants address the positive reinforcement of
performing arm swings, which they agree helps them physically. Self-health improvement will occur over time if they practice the arm-swing posture.

5.3.3.2 For waiting time

Chapter 4 also presents several opinions on integrating arm swings when waiting. Waiting time for office workers who participated in this study is when making coffee or instant noodles, for example. The most suitable waiting time scenario was given by the 3D designer who needs to wait for 3D renderings of her work, which takes about 15 to 20 minutes. So, she can integrate the arm-swing input device into her work time. Instead of sitting and bending her head to shop online, she use the arm-swing input device for exercise. (Page 94)

5.3.3.3 For device control

A common function of an input device can be to control a device or action, through gestural interactions such as pull, push, press or hold. Mr. Jerapan Chanhomman, a senior designer, performed arm swings to open and close his door (Page 96). He just wants to replace one movement in his arm-swing gesture. Other ideas of controlling objects among office workers include operating a paper copy machine, printer or coffee brewing machine.

5.3.3.4 For social norm

An arm-swing gesture can be made as a viral activity. This phenomenon may become a social norm in the future. When one starts to do a right thing the first time, it can be hard. Then, followers will adopt the same action, creating a social. An arm-swing gesture is a more recent social adopted by the elderly. This action research can promote the arm-swing gesture among workers.

A social norm cannot be created in a single day; however, an arm-swing input device could be integrated into working life, creating a starting point from which to move. According to chapter 4, when it comes to office syndrome, “people know the silent danger, but they won’t do any practice for prevention.” They wait until a symptom, like pain, appears.
5.3.4 To Explain Sign Consumption

The meaning of arm-swing gesture has shifted from an elderly posture mind set into a new posture for office syndrome prevention since participants presented positive perspectives as provided in the recommendations at the end of the research section. As Jean Baudrillard’s perspective on sign consumption can possibly be changed to shape a new set of behaviors (Baudrillard, 1994). A sign consumption today can be being in a coffee shop rather than drinking a real cup of coffee. We can feel hungry by looking at food photography rather than just from a real taste. We consume things as presented by marketers. The meaning of a representation needs time to promote people to adopt it.

The arm-swing input device also needs time to develop image, color, user interface, language and logo to be a health communication device representation. This action research only presented a concept model, a black wearable device. However, it had a neutral representation created from a sketch of the arm-swing gestural interaction. The participants received the signifier in the device form, feedback through the mini screen and function. Meanwhile, their act was signified through the act of swinging arms, which provided hard data for interpretation. Positive, neutral or negative opinions can reflect what is signified by the participants. Most results, about 80 percent, are positive opinions.

5.3.5 To Experience the market

Nowadays, most products and services have been designed to afford a better experience (Brad, 2009; Fuller, Bohm, & Krcmar, 2016). As results show in chapter 4, experience marketing should be further explored. There is significant data provided in tables 4.2 and 4.3 (page 103) about preferable device forms that could possibly shape participant behavior. Results can be considered as consumer insight for a new experience marketing product for office syndrome prevention. The wearable device had a high score for all participants.

This is an exciting concept of health communication, which can promote wellbeing in the workplace. The embodied interaction of the device as a feedback displayed on a small digit screen on a wearable device and larger screen on the tablet
can motivate people to swing their arms. Experience marketing is an exciting emerging field, which emphasizes a sensory experience (Dalsgard P., 2006; Fuller et al., 2016). Experience marketing can apply to the design thinking process to start and develop a project (Kronqvist & Salmi, 2011; Dan Saffer, 2010). A device can possibly have advertisement of an organization or company. They can promote a firm’s image as a health-technology advocate.
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Stone, M., Bentley, F., White, B., & Shebanek, M. (2016). Embedding user


APPENDIX

1. The example of the questionnaire

แบบสอบถามนี้เป็นส่วนหนึ่งของการทำ การวิจัยกลุ่มตัวอย่างแบบ Field Study (Use Case Scenario)

เรื่อง Gesture-Based Interaction for an office syndrome prevention:

Health communication through Integrating Experience into Daily Life for an Arm-swing Input Device

แบบสอบถามนี้เป็นส่วนหนึ่งของการศึกษาหลักสูตรดุษฎีบัณฑิต คณะนิเทศศาสตร์และนวัตกรรมการจัดการ สถาบันบัณฑิตพัฒนบริหารศาสตร์

การเก็บข้อมูลจากแบบสอบถามนี้เกิดจากการเลือกกลุ่มตัวอย่างแบบเฉพาะเจาะจงและทดสอบแบบหนึ่งต่อหนึ่งในการใช้งานอุปกรณ์นี้เข้าแบบ

ใช้ทั้งหมด 5 ข้อ โดยข้อที่ 1 มีอธิบายถึงอาชีพที่คุณมีในปัจจุบันได้มากที่สุด

1. ข้อใดลงในเบอร์ที่ 1 ถ้าคุณมี

[ ] นักเรียน นักศึกษา
[ ] ครู อาจารย์ วิทยากร
[ ] การสนับสนุนงานธุรการและการบริหาร
[ ] การบริหารจัดการ
[ ] การประกอบธุรกิจและการประกอบธุรกิจการเงิน
[ ] คอมพิวเตอร์และการประกอบอาชีพคอมพิสตร์
[ ] งานสอนโพลิเทคและวิศวกรรม
[ ] ชีวิตการศึกษาทางกายภาพและสังคมศาสตร์
[ ] อารักษ์เทคโนโลยีและสังคมศาสตร์
[ ] การประกอบการจัดการธุรกิจ
[ ] การศึกษาทางกายภาพและสังคมศาสตร์
[ ] จัดการการฟื้นฟูและต้านภัย
[ ] การประมวลผลข้อมูล
[ ] ศิลปะการออกแบบ, บันเทิง, กีฬาและสื่อมวลชน
[ ] อื่นๆ __________
2. ข้อมูลส่วนตัว
ชื่อ แบบสกุล
Name________________________________Surname_________________________
เพศ [ ] หญิง [ ] ชาย [ ] ไม่ระบุ
อายุ [ ] 16-20ปี [ ] 21-25ปี [ ] 26-30ปี [ ] 31-35ปี [ ] 36-40ปี [ ] 40++
ระดับการศึกษา [ ] ต่ำกว่าปริญญาตรี [ ] ปริญญาตรี [ ] ปริญญาโท [ ] สูงกว่าปริญญาโท
รายได้ [ ] ต่ำกว่า 10000 บาท [ ] 10000-20000 บาท [ ] 20001-30000 บาท [ ] 30001-40000 บาท [ ] 40001-50000 บาท [ ] 50000 บาทขึ้นไป
รุ่นโทรศัพท์ที่ใช้ปัจจุบัน________________________________________
เบอร์โทรศัพท์มือถือ________________________________________
Email______________________________________________________
ตำแหน่งงาน _______________________________________________
ชื่อ บริษัท/สถาบัน ___________________________________________
3. คุณหรือคนรู้จักเคยมีอาการที่เกิดจากการทำท่าทางในการใช้อุปกรณ์อิเล็กทรอนิกส์หรือเครื่องในทุกวันในเวลาทำงานหรือไม่ 
[ ] ไม่เคย 
[ ] เคย (โปรดระบุลักษณะอาการ และอุปกรณ์ที่ใช้) 

_________________________________________________________________

4. คุณหรือคนรู้จักเคยมีอาการที่เกิดจากการทำท่าทางในการใช้อุปกรณ์อิเล็กทรอนิกส์หรือเครื่องในทุกวันนอกเวลาทำงานหรือไม่ 
[ ] ไม่เคย 
[ ] เคย (โปรดระบุลักษณะอาการ และอุปกรณ์ที่ใช้) 

Arms Swing Use Case

5. ลักษณะท่าทางแบบไหนเป็นลักษณะท่าทางที่คุณคิดว่าเป็นท่าทางที่ควรใช้ในการออกกำลังกับอุปกรณ์อิเล็กทรอนิกส์ที่ใช้ในเวลาที่สามารถส่งเสริมให้มีสุขภาพดี 
[ ] เดิน 
[ ] กระโดด 
[ ] แกว่งแขน 
[ ] ยกแขน 
[ ] ก้ามือ 
[ ] หมุนคอ 
[ ] หมุนไหล่ 
[ ] หมุนเข่า 
[ ] ยกขา 
[ ] มองไม่ 

6. ลักษณะท่าทางแบบไหนเป็นลักษณะท่าทางที่คุณคิดว่าเป็นท่าทางที่ควรใช้ในการออกกำลังกับอุปกรณ์อิเล็กทรอนิกส์ที่ใช้นอกเวลาที่สามารถส่งเสริมให้มีสุขภาพดี 
[ ] เดิน 
[ ] กระโดด 
[ ] แกว่งแขน 
[ ] ยกแขน 
[ ] ก้ามือ 
[ ] หมุนคอ 
[ ] หมุนไหล่ 
[ ] หมุนเข่า
7. ภารกิจของคุณในช่วงเวลางาน

[ ] พิมพ์เอกสารด้วยคอมพิวเตอร์
[ ] นั่งประชุมด้วยคอมพิวเตอร์
[ ] จัดนัดสัมนาผ่านทางโทรศัพท์
[ ] โทรศัพท์ออกใช้ Handfree หรือ บลูทูธ
[ ] ดูวีดีโอผ่านคอมพิวเตอร์
[ ] ใช้แล็ปท็อปในการทำงาน

8. ภารกิจของคุณนอกช่วงเวลางาน

[ ] ขับรถ
[ ] นั่งรถโดยสาร
[ ] ขับรถโดยสาร
[ ] ใช้โซเชียลมีเดีย
[ ] ดูทีวี
[ ] คุยโทรศัพท์
[ ] เล่นเกมส์ผ่านคอมพิวเตอร์
[ ] เล่นเกมส์ผ่านโทรศัพท์
[ ] เล่นเกมส์ผ่านแท็บเล็ต
[ ] เล่นเกมส์ผ่านไหนก็ได้
[ ] ทำอาหารแบบใช้ไมโครเวฟ
[ ] ทำอาหารแบบใช้อุปกรณ์
[ ] ทำความสะอาดบ้าน

9. การใช้อุปกรณ์อิเล็กทรอนิกส์ในเวลาทำงานแต่ละวัน

[ ] เพื่อประสานงานกับคน
[ ] เพื่อทำผลงานสร้างสรรค์
[ ] เพื่อทำงานเอกสาร

[ ] เพื่อทำงาน present บนคอมพิวเตอร์
[ ] เพื่อทำงานเอกสารบนกระดาษ
[ ] อื่นๆ
10. การใช้อุปกรณ์อิเล็กทรอนิกส์นอกเวลางานแต่ละวันคุณใช้เพื่อวัตถุประสงค์ใด
[ ] เพื่อสุขภาพร่างกายที่ดี เข้า ออกกำลังกาย
[ ] เพื่อการตดนกลอง โดยกระเถก
[ ] เพื่อความผ่อนคลาย โปรดพักผ่อน
[ ] เพื่อความผ่อนคลาย โดยการดูทีวี
[ ] เพื่อความผ่อนคลาย โดยการทานอาหารนอกบ้าน
[ ] เพื่อความผ่อนคลาย โดยการทำกิจกรรมผ่านโทรศัพท์มือถือ เช่น การเล่นโซเชียลมีเดีย
[ ] เพื่อความผ่อนคลาย โดยการทำกิจกรรมผ่านแท็ปเลต เช่น การเล่นโซเชียลมีเดีย

11. อะไรคือรูปแบบของอุปกรณ์ที่คุณอยากใช้ในเวลางาน
[ ] แบบสวมใส่ที่ข้อมือ เช่น นาฬิกา
[ ] แบบสวมใส่ที่คอ เช่น แขวนคอ
[ ] แบบสวมใส่แบบเสื้อ
[ ] แบบสวมใส่แบบปลอกแขน
[ ] แบบสวมใส่แบบปลอกขา
[ ] แบบสวมใส่แบบเข็มขัด
[ ] แบบตั้งโต๊ะ
[ ] แบบตั้งพื้น
[ ] แบบพกพา
[ ] แบบแขวนอื่น ๆ

12. อะไรคือรูปแบบของอุปกรณ์ที่คุณอยากใช้นอกเวลางาน
[ ] แบบสวมใส่ที่ข้อมือ เช่น นาฬิกา
[ ] แบบสวมใส่ที่คอ เช่น แขวนคอ
[ ] แบบสวมใส่แบบเสื้อ
[ ] แบบสวมใส่แบบปลอกแขน
[ ] แบบสวมใส่แบบปลอกขา
[ ] แบบสวมใส่แบบป้าย
[ ] แบบแขวนอื่น ๆ
2. Code for Arm-swing input device

```cpp
// This is for program Arduino ide
// I2Cdev and MPU6050 must be installed as libraries, or else
// the .cpp/.h files
// for both classes must be in the include path of your project
#include "I2Cdev.h"
#include "MPU6050.h"
#include "U8glib.h"

// Arduino Wire library is required if I2Cdev
// I2CDEV_ARDUINO_WIRE implementation
// is used in I2Cdev.h
#if I2CDEV_IMPLEMENTATION == I2CDEV_ARDUINO_WIRE
    #include "Wire.h"
#endif

// class default I2C address is 0x68
// specific I2C addresses may be passed as a parameter here
// AD0 low = 0x68 (default for InvenSense evaluation board)
// AD0 high = 0x69
MPU6050 accelgyro;
//MPU6050 accelgyro(0x69); // <-- use for AD0 high

int16_t ax, ay, az;
int16_t gx, gy, gz;
```
// uncomment "OUTPUT_READABLE_ACCELGYRO" if you want to see a tab-separated
// list of the accel X/Y/Z and then gyro X/Y/Z values in decimal. Easy to read,
// not so easy to parse, and slow(er) over UART.
#define OUTPUT_READABLE_ACCELGYRO

#define bSTART 6
#define bSTOP  5
#define bRESET 4

#define LED_PIN 13
bool blinkState = false;

U8GLIB_SSD1306_128X64
u8g(U8G_I2C_OPT_NONE|U8G_I2C_OPT_DEV_0); // I2C / TWI

void setup() {
    Wire.begin();
Serial.begin(9600);
Serial1.begin(9600);

pinMode(bSTART, INPUT_PULLUP);
pinMode(bSTOP, INPUT_PULLUP);
pinMode(bRESET, INPUT_PULLUP);

// initialize device
Serial.println("Initializing I2C devices...");
accelgyro.initialize();
// verify connection
Serial.println("Testing device connections...");
Serial.println(accelgyro.testConnection() ? "MPU6050 connection successful" : "MPU6050 connection failed");

// use the code below to change accel/gyro offset values

// configure Arduino LED for
pinMode(LED_PIN, OUTPUT);

void drawText(uint8_t x, uint8_t y, char *str)
{
    u8g.setFont(u8g_font_gdr17r);
    u8g.drawStr(x, y, str);
}
void drawTextBIG(uint8_t x, uint8_t y, char *str)
{
    u8g.setFont(u8g_font_gdr25r);
    u8g.drawStr(x, y, str);
}

char* string2char(String command){
    if(command.length()!=0){
        char *p = const_cast<char*>(command.c_str());
        return p;
    }
}

int action = 0;
int swingCount = 0;
int iState = 0;

int pvSTART = 1;
int pvSTOP = 1;
int pvRESET = 1;

int psSTART = 1;
int psSTOP = 1;
int psRESET = 1;

void DrawTextLCD(uint8_t x, uint8_t y, String str){
u8g.firstPage();
    do {
        drawText(x,y,string2char(str));
        u8g.setColorIndex(1);
    } while( u8g.nextPage() );
}

void DrawTextLCDBIG(uint8_t x, uint8_t y,String str){
    u8g.firstPage();
    do {
        drawTextBIG(x,y,string2char(str));
        u8g.setColorIndex(1);
    } while( u8g.nextPage() );
}

#define LIMIT 8000

void loop_() {
    // read raw accel/gyro measurements from device
    accelgyro.getMotion6(&ax, &ay, &az, &gx, &gy, &gz);
    Serial.print(ax); Serial.print("t");
    Serial.print(ay); Serial.print("t");
    Serial.println(az);
    delay(100);
}
void loop() {
    // read raw accel/gyro measurements from device
    accelgyro.getMotion6(&ax, &ay, &az, &gx, &gy, &gz);

    if(iState == 0){
        DrawTextLCD(10,30,"STANDBY");
        psSTART = digitalRead(bSTART);
        if(psSTART != pvSTART){
            if(psSTART == 0){
                DrawTextLCD(50,30,"GO");
                delay(1000);
                iState = 1;
            }
        }
    } else if(iState == 1){
        psSTOP = digitalRead(bSTOP);
        if(psSTOP != pvSTOP){
            if(psSTOP == 0){
                DrawTextLCD(40,30,"STOP");
                delay(1000);
                DrawTextLCD(30,30,"RESULT");
                delay(1000);
                iState = 2;
            }
        }
    }
    if(action == 1){

if(az < -LIMIT){
    action = 0;
    swingCount++;
}
}else if(action == 0){
    if(az > LIMIT){
        action = 1;
    }
}

Serial.println("*s" + String(swingCount)); Serial.print("\t");
Serial1.println("*s" + String(swingCount));
DrawTextLCDBIG(0,50,String(swingCount));
}
else{
    DrawTextLCDBIG(0,50,String(swingCount));
    psRESET = digitalRead(bRESET);
    if(psRESET != pvRESET){
        if(psRESET == 0){
            DrawTextLCD(40,30,"RESET");
            delay(1000);
            iState = 0;
            swingCount = 0;
            Serial.println("*s" + String(swingCount)); Serial.print("\t");
            Serial1.println("*s" + String(swingCount));
        }
    }
}
pvSTART = psSTART;
pvSTOP = psSTOP;
pvRESET = psRESET;

delay(100);
}
BIOGRAPHY

NAME
Nuanphan Kaewpanukrangsi

ACADEMIC BACKGROUND
2nd class honor (gold medal) BA in Industrial Design from
King Mongkut’s Institute of Technology Ladkrabang,
Bangkok

MSc in Interaction Design from Malmö University, Malmö,
Sweden

EXPERIENCES
She received her 2nd class honor BA in Industrial Design
from King Mongkut’s Institute of Technology Ladkrabang,
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Tokai University, Japan 2004. And attended the 2012
summer course about computery design at CIID copenhagen,
and MSc in Interaction Design from Malmö University,
Malmö, Sweden 2013. She is a Ph.D. Candidate in
Communication and Innovation from National Institute of
Development Administration, Bangkok Thailand. Her
Research interests are in interaction design, user experience
design, information architecture, gesture-based
communication, wearable computing, craft-technology,
design thinking. She also works as a lecturer about user
experience design, physical computing interaction, product
design, building startup based in Thailand.