

THE CHALLENGES OF SMART PHONES IN HUMAN COMPUTER
INTERACTION

By
SULAIMAN AZIZAH ASABE




Project Paper Submitted in Partial Fulfilment as the Requirement for the Masters in
Information Technology by Course Work in the Faculty of Creative Media and
Innovative Technology

IUKL

2016

DECLARATION

I declare that the thesis, entitled "The Challenges of Smart Phones in Human Computer Interaction" is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Infrastructure University Kuala Lumpur or any other institution.

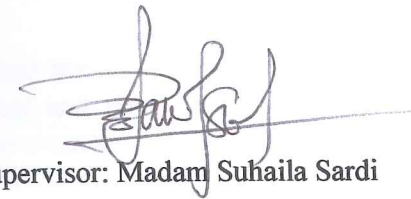
Signature: 

Full Name: SULAIMAN AZIZAH ASABE

Date: 17/10/2016

APPROVAL PAGE

We have examined this manuscript and verify that it meets the program and University requirements for the Master in Information Technology.



Name of Supervisor: Madam Suhaila Sardi

Name of Faculty: Faculty of Creative Media and Innovative Technology

IUKL

Date: 17/10/2016

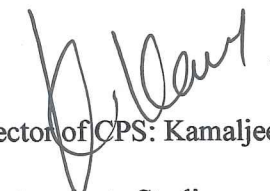


Name of Internal Examiner: Madam Soraya Tairan

Name of Faculty: Faculty of Creative Media and Innovative Technology

IUKL

Date: 17/10/16



Name of Director of CPS: Kamaljeet Kaur

Centre for Postgraduate Studies

IUKL

Date: 17/10/2016

KAMALJEET KAUR
Director
Centre for Postgraduate Studies
Infrastructure University Kuala Lumpur

ACKNOWLEDGEMENT

First and foremost, I want to thank Allah the most magnificent and merciful, in whose hands lay all success and prosperity. He who has guided me with power, opportunity and courage to the successful completion of this research work, praise be to Him.

I want to thank my supervisor Madam Suhaila Sardi who guided me during the course of the project and whose efforts, vast experience, interest and commitment have enhanced the success of this project immensely.

My immeasurable and deepest appreciation goes to my beloved parents Alhaji Muhammad Lawal Sulaiman and Hajiya Saadah Junaid Sulaiman, for your love, guidance and moral support.

My gratitude to all my lecturers in IUKL, and to all the people I met here.

My special gratitude goes to my brothers, Junaid, Sulaiman and Muhammad, May Allah bless you all.

ABSTRACT

**THE CHALLENGES OF SMART PHONES IN HUMAN COMPUTER
INTERACTION**

By

SULAIMAN AZIZAH ASABE

September 2016

Chair: Madam Janagiammal Ramasamy

Faculty: Faculty of Creative Media and Innovative Technology

These days, computers and mobile devices have such a huge influence on our lives. They are literally everywhere we go in the form of tablets, PDA's, mobile phones, GPS's etc. Human's interaction with the computer has changed overtime. The more progress occurred in technology, the better the human-computer interaction became. Current day mobile devices have replaced the traditional keypads with a touchscreen. The design of mobile device interfaces have only recently gained attention and is an area that is being addressed in the human computer interaction (HCI) field. However, due to the various layouts which have occurred from varying screen sizes and screen density, users are often heard complaining about the bad interaction design of mobile devices. This project work aims to present the challenges facing mobile device interfaces and provide possible solutions for future use.

TABLE OF CONTENTS

DECLARATION	ii
APPROVAL PAGE	iii
ACKNOWLEDGEMENT	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER 1-INTRODUCTION	1
1.0 INTRODUCTION.....	1
1.1 BACKGROUND OF THE STUDY.....	2
1.2 MOTIVATION.....	3
1.3 AIMS AND OBJECTIVES OF THE PROJECT.....	4
1.4 SCOPE AND LIMITATIONS.....	4
1.5 RESEARCH METHODOLOGY.....	4
1.6 OUTLINE OF THE PROJECT.....	4
1.7 CONCLUSION.....	5
CHAPTER 2-LITERATURE REVIEW	6
2.0 INTRODUCTION.....	6
2.1 DESIGN FOR USERS WITH SPECIAL NEEDS.....	6
2.1.1 THE OVERALL AGING OF THE POPULATION.....	6
2.1.2 SITUATIONALLY-INDUCED IMPAIRMENTS AND DISABILITIES.....	7
2.1.3 LEARN ONCE, WRITE ANYWHERE.....	8
2.2 EDUCATION & MEDICINE ON MOBILE PHONES.....	8
2.3 SOFTWARE USABILITY AND DEVICE SPECIFIC CONTENTS.....	9
2.3.1 NAVIGATING AND BROWSING.....	10
2.3.2 IMAGES AND ICONS.....	10
2.4 LACK OF PROPER TESTING FACILITIES.....	10
2.5 CONTENTS ACCESSED FROM DIFFERENT DEVICES.....	11
2.6 HARDWARE CHALLENGES.....	11
2.6.1 LIMITED INPUT FACILITIES.....	12
2.6.2 LIMITED OUTPUT FACILITIES.....	12
2.6.3 DESIGNING FOR MOBILITY.....	13

2.7 AUTHENTICATION INTERFACE DESIGN ON MOBILE DEVICES.....	13
2.8 LIGHTING CONDITIONS.....	14
2.9 ACCIDENTAL TRIGGER.....	14
2.10 CONCLUSION.....	14
CHAPTER 3-RESEARCH METHODOLOGY.....	15
3.0 INTRODUCTION.....	15
3.1 RESEARCH METHODOLOGY.....	15
3.2 HYPOTHESIS.....	16
3.2.1 NULL HYPOTHESIS.....	16
3.2.2 ALTERNATIVE HYPOTHESIS.....	16
3.3 INDEPENDENT VARIABLE.....	17
3.4 DEPENDENT VARIABLE.....	17
3.5 QUESTIONNAIRE.....	17
3.6 SAMPLING SIZE.....	18
3.7 DATA COLLECTION.....	18
3.8 DATA ANALYSIS.....	18
3.9 PILOT STUDY.....	19
3.9.1 DATA ANALYSIS OF THE PILOT STUDY.....	19
3.10 OBSERVATION METHOD.....	21
3.10.1 SAMSUNG GALAXY MEGA OBSERVED AND ANALYSED.....	21
3.10.2 USER MANUAL.....	22
3.11 CONCLUSION.....	23
CHAPTER 4-DATA ANALYSIS.....	24
4.0 INTRODUCTION.....	24
4.1 RESPONSE RATE.....	24
4.2 ANALYSIS OF THE RESPONDENT DEMOGRAPHICS.....	24
4.2.1 GENDER OF THE RESPONDENTS.....	24
4.2.2 AGE DISTRIBUTION OF THE RESPONDENTS.....	25
4.2.3 EDUCATIONAL LEVEL OF THE RESPONDENTS.....	27
4.2.4 EMPLOYMENT STATUS OF THE RESPONDENTS.....	28
4.2.5 TYPE OF MOBILE DEVICE USED BY THE RESPONDENTS.....	29
4.3 ANALYSIS OF SURVEY QUESTIONS.....	31
4.4 DESCRIPTIVE STATISTICS.....	45
4.5 T-TEST.....	50

4.5.1 INDEPENDENT SAMPLE T-TEST.....50
 4.6 ANOVA.....52
 4.7 CONSTRUCT VALIDITY.....54
 4.7.1 FACTOR ANALYSIS.....55
 4.8 CORRELATIONS.....59
 4.9 CONCLUSION.....62
CHAPTER 5-CONCLUSION AND RECOMMENDATION.....63
 5.0 CONCLUSION.....63
 5.1 RECCOMENDATION AND FUTURE WORK.....65
REFERENCES.....67
APPENDICES.....72

4.5.1 INDEPENDENT SAMPLE T-TEST.....50
 4.6 ANOVA.....52
 4.7 CONSTRUCT VALIDITY.....54
 4.7.1 FACTOR ANALYSIS.....55
 4.8 CORRELATIONS.....59
 4.9 CONCLUSION.....62
CHAPTER 5-CONCLUSION AND RECOMMENDATION.....63
 5.0 CONCLUSION.....63
 5.1 RECCOMENDATION AND FUTURE WORK.....65
REFERENCES.....67
APPENDICES.....72

LIST OF TABLES

TABLE 3.1	CASE PROCESSING SUMMARY.....	20
TABLE 3.2	RELIABILITY STATISTICS.....	20
TABLE 4.1	GENDER OF THE RESPONDENTS.....	25
TABLE 4.2	AGE DISTRIBUTION OF RESPONDENTS.....	26
TABLE 4.3	LEVEL OF EDUCATION OF THE RESPONDENTS.....	27
TABLE 4.4	EMPLOYMENT STATUS OF THE RESPONDENTS.....	28
TABLE 4.5	TYPE OF MOBILE DEVICE USED BY THE RESPONDENTS.....	30
TABLE 4.6	DESCRIPTIVE STATISTICS.....	45
TABLE 4.7	GROUP STATISTICS BETWEEN HOME MAKERS AND STUDENTS.....	51
TABLE 4.8	INDEPENDENT SAMPLE TEST.....	51
TABLE 4.9	ANOVA DESCRIPTIVES.....	53
TABLE 4.10	ANOVA RESULTS.....	54
TABLE 4.11	KMO AND BARTLETT'S TEST.....	55
TABLE 4.12	TOTAL VARIANCE EXPLAINED.....	56
TABLE 4.13	ROTATED COMPONENT MATRIX.....	58
TABLE 4.14	CORRELATION BETWEEN BROWSING AND SCREEN SIZE.....	60
TABLE 4.15	CORRELATION BETWEEN DATA ENTRY AND KEYPADS.....	60
TABLE 4.16	CORRELATIONS BETWEEN GESTURES AND COGNITIVE LOAD.....	61
TABLE 4.17	CORRELATION BETWEEN AGE AND DATA ENTRY USING ONE HAND.....	62

LIST OF FIGURES

FIGURE 3.1 STAGES OF FIELD RESEARCH.....21

FIGURE 3.2 IMAGE OF SAMSUNG GALAXY MEGA.....22

FIGURE 4.1 PIE CHART DEPICTING RESPONDENT GENDER.....25

FIGURE 4.2 PIE CHART OF AGE DISTRIBUTION.....26

FIGURE 4.3 PIE CHART OF LEVEL OF EDUCATION OF THE RESPONDENTS.....27

FIGURE 4.4 EMPLOYMENT STATUS OF THE RESPONDENTS29

FIGURE 4.5 TYPE OF MOBILE DEVICE USED BY THE RESPONDENTS.....30

FIGURE 4.6 QUESTIONS 6 AND 7.....32

FIGURE 4.7 QUESTIONS 8 AND 9.....33

FIGURE 4.8 QUESTIONS 10 AND 11.....34

FIGURE 4.9 QUESTIONS 12 AND 13.....35

FIGURE 4.10 QUESTIONS 14 AND 15.....36

FIGURE 4.11 QUESTIONS 16 AND 17.....37

FIGURE 4.12 QUESTION 18 AND 19.....38

FIGURE 4.13 QUESTION 20 AND 21.....39

FIGURE 4.14 QUESTION 22 AND 23.....40

FIGURE 4.15 QUESTION 24 AND 25.....41

FIGURE 4.16 QUESTION 26 AND 27.....42

FIGURE 4.17 QUESTION 28 AND 29.....43

FIGURE 4.18 QUESTION 30 AND 31.....44

FIGURE 4.19 HISTOGRAM DISPLAYING THE STANDARD DEVIATION.....48

FIGURE 4.20 HISTOGRAM DISPLAYING THE STANDARD DEVIATION.....49

FIGURE 4.21 HISTOGRAM DISPLAYING THE STANDARD DEVIATION.....50

FIGURE 4.22 SCREE PLOT.....57

CHAPTER 1

INTRODUCTION

1.0 Introduction

Everything has been made easier in this new era of mobile computing. Among other things, emails are viewed and replied on the go, it is possible to access documents with handheld devices like smart watches, PDA's, handheld communicators, tablets, pocket music players, mobile phones etc. and locating an unknown area is accomplishable with a GPS unit. All this is possible due to the fact that mobile devices are small, portable and versatile. Mobile devices makes it possible for data to be accessed from anywhere. In addition, wireless mobile devices connects users to the internet which provides access to even more data (Halpert, 2005).

Furthermore, with the advent of touch screen technology, using mobile devices while on the move has been made easier. Most mobile devices employ touch screen as the medium of interaction with the user because they are considered an intuitive interface. According to Colle and Hiszem (2004), "touch screens are the preferred option for mobile devices because they are highly intuitive and require little space to implement. In addition, it is easy to adjust certain functions like key size, spacing between keys, and location on the screen".

The interaction between the device and the user is referred to as Human-Computer Interaction. According to Esteban (2012), "Human Computer Interaction involves the study, planning, and design of the interaction between users and computers". Such interaction is mainly done at the user interface. In order to support people in their day to day activities, developers design interactive products. The interaction between the user and the computer occurs at the user interface (Huang, 2009).

REFERENCES

- Bertini, E., Catarci, T., Dix, A., Gabrielli, S., Kimani, S., & Santucci, G. (2009). Appropriating heuristic evaluation for mobile computing. *International Journal of Mobile Human Computer Interaction (IJMHCI)*, 1(1), 20-41.
- Botha, ADELE, Van Greunen, DARELLE, & Herselman, MARLIEN (2010). Mobile human-computer interaction perspective on mobile learning.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.
- Budiu, R. (2015). Mobile user experience: limitations and strengths. *Nielsen Norman Group*, 19.
- Colle, H. A., & Hiszem, K. J. (2004). Standing at a kiosk: Effects of key size and spacing on touch screen numeric keypad performance and user preference. *Ergonomics*, 47(13), 1406-1423.
- Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education*. Routledge.
- Cudeck, R. (2000). Exploratory factor analysis. *Handbook of applied multivariate statistics and mathematical modelling*, 265-296.
- De Sá, M., & Carriço, L. (2008, September). Lessons from early stages design of mobile applications. In *Proceedings of the 10th international conference on Human computer interaction with mobile devices and services* (pp. 127-136). ACM.
- Dunlop, M., & Brewster, S. (2002). The challenge of mobile devices for human computer interaction. *Personal and ubiquitous computing*, 6(4), 235-236.
- Eliasson, J. (2012). Human-Computer Interaction for Mobility and Learning. In *mLearn* (pp. 332-335).

- Esteban, A. P. (2012). Human-Computer Interaction: some challenges for the next year
- Fallman, D., & Waterworth, J. (2005, April). Dealing with user experience and affective evaluation in HCI design: A repertory grid approach. In *Workshop Paper, CHI* (pp. 2-7).
- Farooq, U., Iqbal, M. A., & Nazir, S. (2011). A Glance into the Future of Human Computer Interactions. *arXiv preprint arXiv:1107.4217*.
- Flood, D., Harrison, R., Jacob, C., & Duce, D. Evaluating Mobile Applications: A Spreadsheet Case Study.
- Gong, J., & Tarasewich, P. (2004, November). Guidelines for handheld mobile device interface design. In *Proceedings of DSI 2004 Annual Meeting* (pp. 3751-3756).
- Halpert, B. J. (2005, September). Authentication interface evaluation and design for mobile devices. In *Proceedings of the 2nd annual conference on Information security curriculum development* (pp. 112-117). ACM.
- Henze, N., Rukzio, E., & Boll, S. (2011). 100,000,000 Taps: Analysis and Improvement of Touch Performance in the Large.
- Huang, K. Y. (2009, October). Challenges in human-computer interaction design for mobile devices. In *Proceedings of the World Congress on Engineering and Computer Science* (Vol. 1, pp. 20-22).
- Holly Anubhav Patrick. Observation,
<http://www.public.asu.edu/~kroel/www500/Observation.pdf> (accessed on 31/1/2016)
- Inostroza, R., Rusu, C., Roncagliolo, S., & Rusu, V. (2013, November). Usability heuristics for touchscreen-based mobile devices: update. In *Proceedings of the 2013 Chilean Conference on Human-Computer Interaction* (pp. 24-29). ACM.
- Johnsons, C. (1998). First Workshop on Human-Computer Interaction with Mobile Devices'.

Joppe, M. (2000). The research process.

Kjeldskov, J., & Paay, J. (2012). A Longitudinal Review of Mobile HCI Research Methods.

Kurniawan, Sri. "Mobile phone design for older persons." *interactions* 14, no. 4 (2007): 24-25.

Kwon, S., Kim, C., Kim, S., & Han, S. H. (2010). Two-mode target selection: Considering target layouts in small touch screen devices. *International Journal of Industrial Ergonomics*, 40(6), 733-745.

Kwon, S., Lee, D., & Chung, M. K. (2009). Effect of key size and activation area on the performance of a regional error correction method in a touch-screen QWERTY keyboard. *International Journal of Industrial Ergonomics*, 39(5), 888-893.

National Institute of Standards and Technology. (2004). Electronic Authentication Guideline (NIST Special Publication 800-63).
http://csrc.nist.gov/publications/nistpubs/800-63/SP800-63v6_3_3.pdf

Norman, D., & Wadia, B. (2013, June). 39.1: Invited Paper: The Next Touch Evolution Advancing the Consumer Experience in Other Realms: Tasks and Tough Environments. In *SID Symposium Digest of Technical Papers* (Vol. 44, No. 1, pp. 541-543). Blackwell Publishing Ltd.

Oulasvirta, A., Tamminen, S., Roto, V., & Kuorelahti, J. (2005, April). Interaction in 4-second bursts: the fragmented nature of attentional resources in mobile HCI. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 919-928). ACM.

Parsian, N., & Dunning, T. A. (2009). Developing and validating a questionnaire to measure spirituality: A psychometric process. *Global journal of health science*, 1(1), 2.

- Park, Y. S., & Han, S. H. (2010). One-handed thumb interaction of mobile devices from the input accuracy perspective. *International Journal of Industrial Ergonomics*, 40(6), 746-756.
- Park, Y. S., Han, S. H., Park, J., & Cho, Y. (2008, September). Touch key design for target selection on a mobile phone. In *Proceedings of the 10th international conference on Human computer interaction with mobile devices and services* (pp. 423-426). ACM.
- Park, Y. S., & Han, S. H. (2010). Touch key design for one-handed thumb interaction with a mobile phone: Effects of touch key size and touch key location. *International journal of industrial ergonomics*, 40(1), 68-76.
- Pressman, R. S. (2005). *Software Engineering: A Practitioner's Approach*. 5th Ed. New York: McGraw-Hill.
- R. Rosenbaum, H. Schumann, and C. Tominski, "Presenting large graphical contents on mobile devices - performance issues," in *Proceedings of IRMA'04*, 2004.
- Shelly, G., & Rosenblatt, H. J. (2009). *Systems analysis and design*. Cengage Learning.
- Smith, M. J., & Salvendy, G. Human-Computer Interaction: Software and Hardware Interfaces. In *Proc. Fifth Conf. on Human-Computer Interaction, (HCI International'93), Orlando, Florida* (Vol. 2).
- Southern, C., Clawson, J., Frey, B., Abowd, G., & Romero, M. (2012, September). An evaluation of BrailleTouch: mobile touchscreen text entry for the visually impaired. In *Proceedings of the 14th international conference on Human-computer interaction with mobile devices and services* (pp. 317-326). ACM.
- Tidwell, J. 2010. *Designing Interfaces*. O'Reilly Media, Inc.; Safari Books Online. Second edition. <https://www.safaribooksonline.com/library/view/designing-interfaces2nd/9781449379711/>
- Villamor, C., Willis, D., & Wroblewski, L. (2010). Touch gesture reference guide. *Touch Gesture Reference Guide*.

Vuolle, M., Tiainen, M., Kallio, T., Vainio, T., Kulju, M., & Wigelius, H. (2008, September). Developing a questionnaire for measuring mobile business service experience. In *Proceedings of the 10th international conference on Human computer interaction with mobile devices and services* (pp. 53-62). ACM.

Winters, N., & Price, S. (2005, September). Mobile HCI and the learning context: an exploration. In *Proceedings of Context in Mobile HCI Workshop at MobileHCI05*.

Wobbrock, J. O. (2006, April). The future of mobile device research in HCI. In *CHI 2006 workshop proceedings: what is the next generation of human-computer interaction* (pp. 131-134).

Ziefle, M., & Jakobs, E. M. (2010). New challenges in human computer interaction: Strategic directions and interdisciplinary trends. In *4th International Conference on Competitive Manufacturing Technologies* (pp. 389-398).