SINHALA TYPEFACE FEATURES TO OPTIMIZE READABILITY FOR SMALL SCALE DIGITAL DEVICE SCREENS

Ravindu Subasinghe

198031R

Degree of Master of Science

Department of Integrated Design

University of Moratuwa

Sri Lanka

March 2023

DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

R.P. Subasinghe

UOM Verified Signature

Signature

22/04/2023

Date

The above candidate has carried out research for the MSc thesis under our Supervision.

UOM Verified Signature

Supervisor: Dr. Sumanthri Samarawickrama

01/09/2023

Date

UOM Verified Signature

Supervisor: Prof. Gihan Dias

01/09/2023

Date

ABSTRACT

Keywords: Sinhala Typography, Legibility, Similar Letter Misidentification, Small Screen Digital Devices, Sinhala Digital Fonts

The widespread use of digital devices for reading and communication has highlighted the need for optimized fonts for small-scale digital screens. This need is particularly important for languages with complex scripts like Sinhala, which require specific features to ensure readability. Unfortunately, the lack of digitally optimized Sinhala fonts is a major issue in the Sinhala typographic industry, prompting the need for research in this area. This thesis aims to identify the specific features of Sinhala typefaces that optimize readability on small-scale digital devices. The study has two objectives: first, to identify the role of general anatomical features of a script in designing a font for a particular purpose, and second, to identify the anatomical features of Sinhala typefaces that contribute to optimizing legibility on small-scale digital device screens.

The thesis discusses the challenges posed by small digital screens and the importance of legibility, as well as the research gap in Sinhala fonts designed to optimize legibility on small digital screens. A visual experiment was conducted to identify the most appropriate Sinhala font for the research based on legibility, and Noto Sans Sinhala was selected. The experiment identified the anatomical features that contribute to letter misidentification, and a visual survey was conducted on the most commonly misidentified letters in the selected sample font. The purpose of this experiment was to identify the impact of legibility on Noto Sans Sinhala through changes to its anatomical features.

The thesis discusses the differences between the Distinct Visual Features and the anatomical structure in Sinhala letters, how the legibility of a font is directly affected by anatomical changes to their Distinct Visual features through similar letter misidentification, and the anatomic features that need to be considered when designing a Sinhala font centered around increasing legibility for small digital screens.

The practical implications of this research are significant for designers seeking to optimize legibility and reduce similar letter misidentification in Sinhala fonts on small-scale digital device screens. By manipulating the visual parameters of each anatomical feature, designers can make specific changes to the DV features of letters and improve the legibility of Sinhala fonts on digital platforms. This research contributes to the field of Sinhala typography and legibility on digital screens by providing a deeper understanding of the specific features that impact legibility and similar letter misidentification, enabling designers to create more effective and legible Sinhala fonts for digital devices, improving the user experience and enhancing the communication of messages in Sinhala.

Dedicated to my pillars in life,
my parents, my wife and
my inspiration.

ACKNOWLEDGEMENT

I express my deepest gratitude to Dr. Sumanthri Samarawickrama from the Department of Integrated Design acting as my main supervisor and for her unwavering support, guidance, and encouragement throughout the course of my research. Also my heartfelt gratitude to Prof. Gihan Dias, my supervisor from the Department of Computer Science & Engineering, University of Moratuwa for his insightful feedback and constructive criticism which has been invaluable in shaping my work.

I am also grateful to Prof. Girish Dalvi, the subject expert from the Industrial Design Center, IIT, Bombay, for his expert advice and valuable insights which helped me to improve the quality of my research.

My sincere thanks go to Ms. Ruwandika Senanayake, my Research Nominee for being a panel member and guiding me through the work and Archt. Sithumini Rathnamalala, former head of the Department of Integrated Design, University of Moratuwa, for his assistance and support in various aspects of my research.

I would also like to acknowledge Ms. M. K. Dissanayake, the Head of the Department of Integrated Design, and Dr. Mrs. SBA Coorey, the Director of Postgraduate Studies at the University of Moratuwa, for their support and encouragement in this journey.

I am also grateful to Mr. Isuru Wickramarathne from the Department of Integrated Design, University of Moratuwa, and Mr Ruwan and Ms Priyanwada from the Postgraduate Office, University of Moratuwa, for their assistance and support.

Also I express my deepest gratitude to Ms Nethma Mettananda and Mr Tharindu Maddegoda for their valuable support and feedback.

Finally, I would like to extend my heartfelt gratitude to my wife and my parents for always being my pillar of support and encouragement throughout this journey. Their unwavering faith and love have been my driving force and inspiration to achieve this milestone.

Thank you all once again for your invaluable support and guidance.

LIST OF RESEARCH PUBLICATIONS

Subasinghe R., (2019) “Atomic Vs Anatomic features of Sinhala Typefaces”, 10th Typography meeting, Matosinhos, Portugal. 21st to 23rd November 2019

TABLE OF CONTENTS

DECLARATION i

ABSTRACT ii

ACKNOWLEDGEMENT iv

LIST OF RESEARCH PUBLICATIONS v

TABLE OF CONTENTS vi

CHAPTER 01: INTRODUCTION 1

1.1 Background and Context 1

1.2 Scope of the study 2

1.3 Problems identified 3

1.4 Aim and objectives 3

1.5 Methodology 4

1.6 Organization of Chapters 5

1.7 Chapter One Summary 6

CHAPTER 02: DIGITAL TYPOGRAPHY AND LEGIBILITY 7

2.1 Development towards digital typography 7

2.1.1 An introduction to typography 7

a) What is typography and explanation on basic terminologies 8

b) Anatomy of Latin fonts 9

c) The importance of typography in historical contexts (in graphic design trends) and how it plays a major role in the modern contexts: 10

d) Digitization of information and platforms of digitization 12

2.1.2 Technical parameters of digital fonts 14

a) Screen resolution and DPI 14

b) Different types of Encoding Standards 14

c) True-type and Mono-type variables 15

d) Usage of operating systems/platforms and their technology for digital typography 16

2.2 Digital typefaces and Legibility 17

2.2.1 What is legibility 17

a) Methods of measurement 18

b) Metrics of measurement 18

c) How legibility affects the contexts of digital media with special reference to digital screens 19

d) Case studies on how special fonts were optimized with legibility as the main factor 20
i. Georgia 21
ii. Verdana 22
e) Importance of legible fonts in the present day especially in digital media, and how it helps to reduce the sensory overload. 23
f) How legibility affects the reading speed of a font 23
g) Importance of identifying the factors affecting the legibility of fonts 24
h) Factors which affect the legibility of Latin fonts. 25
2.3 Role of legibility in letter misidentification 26
2.3.1 Relationship between legibility and letter misidentification 26
2.3.2 Latin anatomical features affecting letter misidentification 27
a) Effect of font resemblance on letter misidentification 27
b) How Latin fonts counteract font resemblance through anatomy 28
2.3.3 Test methods to carry out legibility testing by identifying letter misidentification tendency in Latin letters 29
a) Distance testing 29
b) Short exposure method 29
c) Parafoveal vision testing 30
2.3.4 Legibility issues in small digital screens 30
2.4 Digitization of Sinhala typefaces 31
2.4.1 Evolution of Sinhala font industry and its digitization phase with a special emphasis on how print fonts were digitized 31
2.4.2 Importance of a digital Sinhala font in the current typographic industry 33
a) Unavailability of optimization for digital Sinhala fonts 33
b) Potentials of a digitally optimized font 34
2.5 Chapter Two Summary 34
CHAPTER 03: SINHALA ANATOMY AND DIGITAL FONTS 36
3.1 Sinhala Type Anatomy 36
3.1.1 Defining type anatomy through the skeletal structure 38
3.1.2 Distinct Visual Features of a Sinhala letter 38
3.2 Defining the independent variable of the visual analysis 39
3.2.1 Sample selection criteria of 12 fonts 39
3.2.2 Selecting the ideal letter set for DV feature comparisons 40
3.2.3 Findings on the DV features of Sinhala letters and anatomy of selected fonts 41

3.2.4 Conclusion from the findings 45
3.3 Defining the dependant variable for the visual analysis 46
3.3.1 Hand and tool 46
3.3.2 Flesh and gray value 49
3.3.3 Contrast and axis 49
3.4 Visual analysis of sinhala digital fonts 50
3.4.1 Potential for using Distinct Visual Features for legibility testing in Sinhala letters 52
3.5 Defining sinhala anatomy for small screens 53
3.5.1 Problems in defining legibility for Sinhala typefaces 53
3.5.2 Selection criteria for Sinhala typefaces in measuring legibility 54
a) Selecting sample fonts to test legibility based on purpose 54
b) Font selection for legibility testing 54
3.6 Comparing features that differ between Latin and Sinhala fonts 55
3.6.1 Effect of letter height on legibility 55
a) Comparison on Latin 'x-height' and Sinhala 'Pa- height' 56
3.7 Experiment on legibility for Sinhala fonts 56
3.7.1 Material preparation 57
3.7.2 Methodology 57
3.7.3 Results 58
3.8 Similar letter misidentification and legibility of Noto Sans Sinhala font 59
3.8.1 Commonly misunderstood letters in Noto Sans Sinhala 60
3.9 Chapter Three Summary 63
CHAPTER 04: ANALYZING LETTER MISIDENTIFICATION AS A METHOD OF OPTIMIZING LEGIBILITY 65
4.1 Impact of distinct visual features in font legibility with special reference to Noto Sans Sinhala font 65
4.1.1 Using superimposition as a method of identifying High Deviating Areas 67
4.1.2 Understanding the impact of DV features on letter legibility by changing highly deviating areas 67
4.1.3 Experimenting with the impact of anatomic features on legibility in Noto Sans Sinhala font using short exposure method 71
a) Font sample preparation 72
b) User group 73
c) Experiment setup 73
d) Methodology 74

e) Results 76
f) Findings 77
4.2 Analysis on how the anatomic features were structured in Noto Sans to reduce similar letter misidentification 79
4.2.1 Comparison of fonts Noto Sans Sinhala with Iskoola Pota to identify structural differences which affect similar letter misidentification. 79
4.3 Increasing legibility of a font by removing similar letter misidentification 81
4.4 Chapter Four Summary 82
CHAPTER 05: CONCLUSION 84
5.1 Objectives of the research 84
5.2 Digital typography and legibility 85
5.3 Sinhala anatomy and digital fonts 85
5.4 Analyzing letter misidentification as a method for optimizing legibility 86
5.5 Major findings 87
5.6 Limitations and future directions 93
5.7 Practical Implications 94
5.8 Conclusion and Final Remarks 95
6. BIBLIOGRAPHY 97