SINHALA DISPLAY TYPEFACES;

VISUAL CLASSIFICATION OF SINHALA BOOK TITLE

P. H. S. D. Gunawardhana

(198030M)

Master of Science (Major Component of Research)

Department of Integrated Design

Faculty of Architecture

University of Moratuwa

Sri Lanka

April 2023

SINHALA DISPLAY TYPEFACES;

VISUAL CLASSIFICATION OF SINHALA BOOK TITLE

P. H. S. D. Gunawardhana

(198030M)

Thesis submitted in partial fulfillment of the requirements for the degree

Master of Science (Major Component of Research)

Department of Integrated Design

Faculty of Architecture

University of Moratuwa

Sri Lanka

April 2023

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgment 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 acknowledgment is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

P.H.S.D. Gunawardhana

UOM Verified Signature ……01/09/2023……

Signature Date

The above candidate has carried out research for the Masters thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

. UOM Verified Signature ……01/09/2023……

Supervisor: Dr. Sumanthri Samarawickrama Date

UOM Verified Signature …. ……01/09/2023……

Supervisor: Prof. Girish Dalvi Date

ACKNOWLEDGMENT

I would like to express my heartfelt gratitude to everyone who supported and encouraged me throughout the completion of this thesis.

First and foremost, I would like to thank my two supervisors, Dr. Sumanthri Samarawickrama, Department of Integrated Design, University of Moratuwa, and Prof. Girish Dalvi, Industrial Design Centre, Indian Institute of Technology – Mumbai, for their unwavering guidance, valuable insights, and continuous support throughout my research. Their expertise and commitment to my success have been a constant source of inspiration for me. I am also grateful to Prof. Ravi Poovaiah, Industrial Design Centre, Indian Institute of Technology – Mumbai, for sharing his knowledge and expertise with me as a subject expert. His feedback and suggestions have helped me improve the quality of my research.

I extend my thanks to Ms. Ruwandhika Senanayake for coordinating my research activities and providing me with timely assistance whenever I needed it. I would also like to thank the HOD of the Department of Integrated Design, University of Moratuwa, and the academic and non-academic staff of the department for their support throughout my academic journey.

I am grateful to the Faculty of Graduate Studies at the University of Moratuwa staff for providing me with the resources and opportunities to pursue my research interests.

I would like to extend my appreciation to the Director and staff of the National Museum Library in Colombo for providing me with access to their resources, which have been vital to my research.

I am deeply indebted to my parents and my wife for their unconditional love, support, and motivation throughout my academic journey. Mr. James Balmond, Creative Director at Balmond studio for his understanding and support. Last but not least, I would like to express my gratitude to my friends and colleagues from the University of Moratuwa who have supported and encouraged me during this research. Their intellectual discussions, critiques and feedback have been valuable and greatly appreciated.

Thank you all for your support and encouragement throughout my academic journey.

This thesis is dedicated to the contributors of typography in Sri Lanka
for their legacy and inspiration.

ABSTRACT

Keywords: *Sinhala Display Typography, Sinhala book title, Visual classification*

This thesis is a systematic documentation of letterform variations in Sinhala display typefaces through a visual classification in early Sinhala book titles. The research primarily focuses on documenting and classifying letterform variations of Sinhala book titles used in early printed books in Sri Lanka (from 1890 to 1960).

Historical research and documentation is essential for the growth and development of any subject domain including design. Under the major subject domain of graphic design, Latin typography has a long history in its historical studies. As a result, the subject has grown to a substantial level. Since design education in Sri Lanka is nearly two decades old, subject areas such as graphic design and typography lack documented knowledge of early Sri Lankan typographic practices. The historical data that contributes to these subject areas are found at archival locations in Sri Lanka. In Colombo National Museum Archive, we found a collection of early Sinhala book cover design as primary data for historical studies in graphic design. Some of these data have been already lost due to inadequate preservation, conservation procedures, and lack of interest in preserving graphical material. Therefore we identify the research gap as the need of documenting primary data for graphic design; typography in Sri Lanka.

Thesis introduces classification as a method of systematically documenting the primary data. It investigated Latin and Devanagari typographic classification systems and confirmed the importance of the variables for classifying data. We identified variables and values for the main study by conducting a literature survey on display typefaces and classification systems. We selected a random sample of early printed book covers from the Colombo National Museum Library and scanned a total of 1,410 book covers published between 1872 and 1960, along with their meta data including cover size, publisher, author, and so on.

We uncovered 17 categories (variables) and 77 subcategories (values) under the visual variations of Sinhala book titles in early printed book covers in Sri Lanka. We

classified all the book cover titles within the variables. We conclude the research by presenting the findings and interpretations in a series of tables and graphs. This thesis primarily contributes towards fulfilling a key requirement for the development of the subject of typography and graphic design in Sri Lanka: the documentation of historical data.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

This thesis adds to the body of knowledge on typography and display typography within the context of Sri Lanka. Specifically, the knowledge forming and preserving primary data for the subject. The core contribution of the thesis is to record and visually classify Sinhala book cover titles under the subject of Sinhala typography within that display typography, which has recently begun to emerge as a subject, research field in Sri Lanka. The research aims at recording and classifying visual variations in early Sinhala book cover titles. The research fills the gap of knowledge in Sinhala display typography by fulfilling the theoretical need of documenting and classifying historical data.

1.1. Background and context

In Sri Lanka, the term "Sinhala" is used to describe both the majority ethnic group, the Sinhalese, and the script used to write their language. The Sinhala script serves as the visual representation of the Sinhala language, which is the primary language spoken in Sri Lanka.

Going through the historical timeline, we identify that Sri Lanka has a long history about before and after the printing and publishing in Sri Lanka. The common belief is that Arahant Mahinda's arrival on the island from India in the third century BCE, along with his mission to spread Buddhism, marked the beginning of the island's writing tradition (Fernando, 2008). From there on we can find several writing surfaces being used in Sri Lanka.

Scholars in the field of epigraphy, including H.C.P. Bell, P.E.E. Fernando, S. Paranavitana, and D.M. de Silva, have made significant contributions to our understanding of the historical development of the Sinhala letter form. They have documented the evolution of the visual representation of the Sinhala letter through an evolutionary chart, drawing from their analyses of lithic, metallic, and wall inscriptions. Their research findings are archived at the Department of Archaeology in Sri Lanka.

The historical timeline is the only document that shows how script evolved from antiquity to the present. There is no chronological documentation of the Sinhala letterform beyond the 15th century because this chart stops at this point.

Media and tools of Sinhala writing

	Media	Surface	Surface layout	Tool
Lithic		Cave Pillar Slab	Static large surfaces Four-sided surface, tall in height, small in width and breath A single face with a larger width and breath and shorter height	Chisel
Other	Clay	Potsherds	Earthenware	Bone
	Cloth	Silk Cotton	–	Brush
	Metal	Gold/ Silver/ Copper	Flat portable surface, composed as plates and leaves	Metal stylus
	Leaf	Palm leaf	Treated palm leaves, composed into a book of multiple leaves.	Metal stylus
		other leaf	–	–

Figure 1: Media, surface, tools of writing (Samarawickrama, 2017)

Among all the surfaces, palm leaf, also called Ola leaf manuscripts, was the dominant writing surface in Sri Lanka. Society held very high esteem towards the Ola leaf books, terming them "*poth wahanse*" (addressing the book as an honoured person) as they included very religious and essential content such as teachings of Buddha and knowledge on herbal medicine. Preparation and the writing of the Ola leaf was a distinctive and long process followed by many steps. Literature confirms that much other indigenous knowledge within several subject areas has contributed to the process, such as herbal medicine and astrology. Furthermore, many indigenous ingredients, herbs, tools and techniques can be found within the Ola leaf book-making process.

Ola leaf manuscript books were compiled with treated palm leaves, while the letters were inscribed with a metal stylus and ink rubbed over to bring out the letter. . The composition of text and images, pagination, decorative covers, binding method was unique to these traditional books. These books typically range in size from 9 to 32 inches in length, and 2 to 3 1/4 inches in width. These books cover a wide range of subjects, including the teachings of Lord Buddha, traditional knowledge related to herbal medicines, folk rituals, and more. Writing on a palm leaf was more challenging than writing on paper with a pencil. Great skill and practice were required to do that. This skill was gained through years of practising with a teacher. The writing and the knowledge about the letters, words, sentences, punctuations, symbols, numeric, grammar and many other language skills were essential to writing an Ola leaf manuscript.

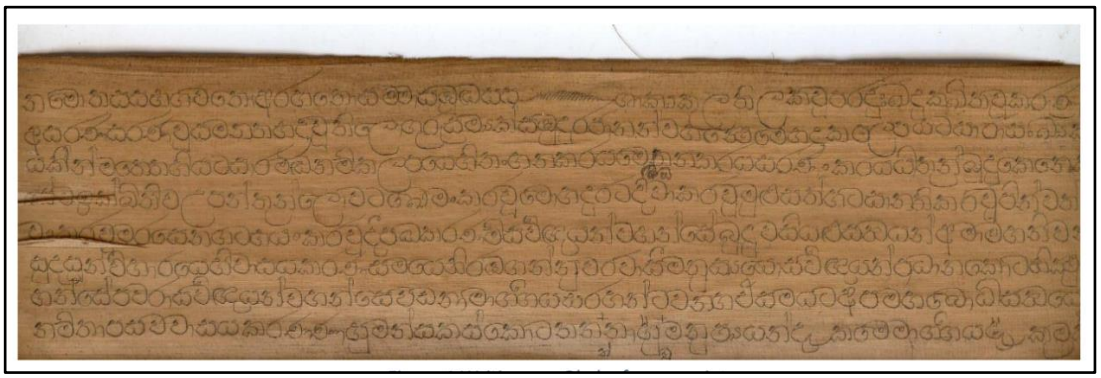


Figure 2: Writings on ola leaf books

Archaeological evidence proves that there were many religious beliefs towards the Talipot tree as a sacred tree among the locals in the early ages of Sri Lanka. Because of the enormous uses of these trees, locals had respect towards Talipot trees and believed as their god of protection. Lagamuwa states that these beliefs and the respect towards the Talipot tree could be the reason for using Talipot leaves for Ola leaf books. Moreover, this caused the locals to build honour towards the Ola leaf book.

By the year 1505, the Portuguese, the first Europeans, stepped into Sri Lanka in their mission of evangelization. At this time, the local Sri Lankan people wrote on palm leaf

manuscripts, while the Portuguese used ink and quill to write on paper. Even though the Portuguese introduced paper and ink, locals did not accept this new writing method during the ruling period of the Portuguese. (Gunawardhana & Samarawickrama, 2020) states that the inexpensive nature, easy availability of Ola leaf manuscripts and the high esteem held by the locals towards Ola leaf manuscripts are the reasons why locals disapproved of paper as a suitable writing surface. After the Portuguese, Dutch set foot on the island in 1656 with similar objectives as the Portuguese. Under the governing body of the Dutch (The Dutch East India Company), Schools were started attached to the churches. In order to fulfil their objective of spreading Christianity and providing administrative documents by reaching the locals in their native tongue on the island, the printing press was introduced which uses ink on the paper.

It took almost two decades from the first proposal to establishing the printing press on the island under different governors. A proposal for a press in Sri Lanka was initiated during the period of Governor Issac A. Rumph in 1716, but his death stopped the project. In 1725, Chief of the company's armoury in Colombo Gabriel Schade was responsible for starting the printing press in Sri Lanka. Then the governance of the company goes to Dutch governor Petrus Vyust. During his cruel ruling period, Shade was seized and imprisoned for no reason, and the project was dropped. After Petrus was detained for his criminal nature, he continued his project on the establishment of the press to the final stages.

Consequently, the first printed document in Sri Lanka, known as a "plakkaat," was a single sheet of an administrative document published on April 5th, 1737, using the first Sinhala typeface. This document is considered to be the oldest surviving printed material in Sri Lanka. After that, the first Sinhalese book was printed. It was a prayer book with 40 pages. A page includes 11 lines, and the width is 5”, and the height is 7.8”. The first two pages included the introduction from both Sinhala and Latin scripts. The next page included the crest of the Dutch company. The book was written with connected letters to represent long sounds apart from using “lengthening mark” to make a long sound in Sinhala letter writing. It is very similar to the writings of Ola leaf books. So, with these facts, it is clear that the traditional Ola leaf book has influenced the writing style of this book.

After the initiation of the printing press in Sri Lanka, a set of milestones were created due to the changes in technology, social political changes and initiations of printing

presses in the country. As an example Buddhist revival is the most significant influence of the natives on the printing establishments. As a result a series of books, magazines are published but no records are left on type related matters (Samarawickrama, 2016) Samarawickrama further describes the Sinhala typefaces within the newspaper industry and technological development. The author's discussion is primarily focused on the historical evolution of Sinhala typefaces. According to her research, the growth of the printing press industry in Sri Lanka coincided with the development of various types of Sinhala typefaces. Many of these typefaces were created to overcome technical challenges, and as a result, they often lack important meta-data such as the name of the designer, the typeface, the foundry, and the date of creation.

Therefore it is evident that Sri Lanka has an active history regarding the subject of graphic design and typography. But most of the knowledge has been left unrecorded and some artefacts are left alone. The majority of knowledge has been left undocumented, and some have been abandoned or trapped within archaeology.

1.2. Scope and limitations

The main focus of this research is knowledge formation and primary data recording for the development of Sinhala display typography under the main subject of typography in Sri Lanka. We identify that as a result of the profound history of the printing and publication of Sri Lanka, we have a collection of old printed books in Colombo national museum library in Sri Lanka. Apart from its content as a cultural artefact these books hold the evidence of printing technologies, graphic design, typography in an era. Therefore as the sample collection of this study, we take nearly 1000 scanned digital copies of early Sinhala book covers ranging from 1890 to 1960 from Colombo National Museum Library archive. The study will focus on documenting letterform variations of Sinhala display typefaces in these book cover titles based on observations and visual classification.

Research is subjected to several limitations as follows,

- The study will be limited to early book titles in Sinhala script only.
- The study may be limited by the availability of relevant historical materials, and some data may be inaccessible.

- The study may not capture the impact of typography on the content of the book.
- The research may be limited by the sample size of book titles analysed, and the results may not be representative of the broader publishing industry.
  The results may be subjected to the observations and interpretations of the coders.
- The research will not include an in-depth analysis of the readability of the Sinhala display typefaces.

1.3. Aim and research questions.

The aim of this research was to record and classify visual variations of Sinhala display typeface in early Sinhala book cover titles in Sri Lanka. This is an investigation of Sinhala display typefaces. Thesis explores the research objectives by answering these questions.

1. What is the role of historical research and primary data in establishing graphic design knowledge for typography, and why is it important to preserve and document this data for future research in Sri Lanka?
2. What does the literature say about classification systems, book covers, book titles, display typefaces, and Sinhala typography, and how can this information be used to identify relevant variables for the main methodology, particularly in terms of how to classify historical data and what is the role of parameters in classification systems?
3. What are the letterform variations found in early Sinhala book titles, and how can they be documented and classified using identified variables?

1.4. Methodology

The study primarily employed qualitative research methods and utilized a historical research approach. The primary analytical technique used in this study was based on content analysis and involved an observational process.

Part 01: Identifying the gap.

The problem is defined via four phrases within background research.

- We explore the recording and classifying historical data within the subject of typography. Under that, we discuss the significance of documenting primary data.
- We investigate the evolution of typographic knowledge in Latin and related scripts and compare it with the development of Sinhala typographic knowledge. We identify the lack of knowledge and need for the development of systematic documentation of Sinhala typography is essential.
- The early Sinhala printed book is identified as a significant primary source to establish Sinhala typographic knowledge especially in display typography.
- We observed the Colombo National Museum Library archive where most of the early Sinhala printed books are preserved and questioned the current preservation process of early Sinhala book covers with a semi structured interview.

We define that historical research and documentation of primary data are important and it is essential to the growth and development of a subject domain. We conclude that, Compared to other scripts, there is a need for documentation and classifying primary data within the subject of Sinhala typography due to the lack of established knowledge in the subject area and the poor preservation and conservation practices.

Part 02: Defining variables via literature.

We propose classification as a method of systematically documenting primary data. Then we identify the importance of variables in developing a classification. Then we examine the existing knowledge on typography and display type through a literature survey. This includes classification systems in other scripts including Latin typography as a major component since it has a long history and development, secondly the existing knowledge on display type and type anatomy to understand the characteristics and changes in type anatomy in display type. Thirdly we explore the existing literature on Sinhala typography to gain insights on Sinhala display type characteristics. We conclude the literature survey with a list of variables defined via literature.

Part 03: Classification

The third part is the visual classification of the display typefaces on book covers using content analysis as the main analysis method. We take the total number of samples; 946 scanned copies of the Sinhala book cover titles 1890 to 1960) from Colombo National Museum archive using random sampling. We gather a list of variables using literature and a pilot visual survey. We classify the book cover titles according to the variables through a coding scheme and conclude the research with a complete list of visual variations in each book cover title. A coded sheet of book cover titles into extensive amounts of visual variations came out as a result of this analysis. We argue that this database could be useful to identify patterns and information on chronological development of typography in Sri Lanka.

1.5. Organization of chapters

This thesis comprises of a total of five chapters, which includes an introduction and conclusion. Introduction chapter presents the background to the subject and introduces the research questions related to the topic. Chapter identifies the scope and limitations of the research and narrows down the research area. It outlines the methodology used for the study.

Second chapter; background of the study presents an introduction to the historical studies and significance of the historical research in typography and graphic design. Chapter details the historical studies and documentations of graphic design and Latin typography. It outlines the benefits of these studies for the subject growth. Then it analyses the historical studies on Devanagari typography as a South Asian script as well. After that chapter explore the existing knowledge and historical documentation of Sinhala script. Chapter highlights the need of historical research and documentation within the subject of typography and graphic design in Sri Lanka. We discuss classification as a systematic way of documenting primary data. It further highlights the importance of primary data in historical research. Chapter introduces early Sinhala printed books; specially its cover as a source of primary data since they have a lot of graphic elements (Typography, illustrations, layouts etc) belonging to an era. It investigates the preservation and conservation of these books in archival locations. Chapter highlights the lack of preservation and conservation of early printed books in

Sri Lanka and confirms the need of documenting and classifying these historical data specifically under the major subject domain of graphic design, under that typography.

Third chapter: Literature review of the study aims to understand the variables. The chapter outlines that variables are necessary to document and construct a classification system. We explain the type classification systems and understand the variables inside it. In the next phrase we discuss the book, significance of the book cover and the cover title under display typography. We survey the literature on display typography in Latin script as an established knowledge domain and the study expands to Devanagari as well. Then we discuss the existing knowledge on Sinhala typography and display type. Within the literature this chapter concludes with a list of variables for the main study.

Fourth chapter: Methodology and analysis is dedicated to identify and document the letterform variations in early Sinhala book titles and classify them with identified variables.

Fifth chapter is the conclusion and we first summarise all the research procedures with outcomes at each level. We present the contribution of the research and the significance of the findings and outline the further research suggestions.

2. BACKGROUND STUDY: DOCUMENTING HISTORY

This chapter presents a brief introduction to history followed by a discussion on the purpose and significance of historical studies and historical research in any subject domain. We investigate the significance of historical data, documentation, and their contribution to the establishment of graphic design knowledge. Furthermore, we explore the simultaneous development of typography as a subdomain of graphic design throughout history. We discuss the influence of typographic studies, documentation on the development of a formalized knowledge of Latin typography. Nevertheless, we understand the evolution of typographic knowledge for South Asian scripts such as Devanagari. Then we moved into the development and documentation of typographic knowledge for the Sinhalese script.

Later in this chapter, we outline the significance of primary sources and primary data to perform a comprehensive historical study. We emphasize this idea by confirming the importance of data preservation as a segment of historical research. We discuss the early Sinhala printed book (with a variety of typography and lettering, illustrations, layout styles, compositions, and images, among many other design elements) as a significant source of primary data on the subject of typography and graphic design in Sri Lanka. Furthermore, we survey the preservation process of early printed books in archival locations in Sri Lanka. We observe the existing system and preservation techniques compared to the preservation standards. Finally, the chapter identifies the research gap and confirms the requirement of bringing out new knowledge through documentation and classifying these primary data in the field of typography within history.

2.1. History and design

The Cambridge English dictionary defines history as the examination and recording of past events, particularly those that pertain to a specific period, country, or topic. In essence, the term "history" is often used interchangeably with "the past" and is typically associated with events that have occurred in the distant past. From a social science perspective, history is concerned with documenting and interpreting past events or series of events (Berg, 2001). This whole series of changes in past events is

called history. Traces of the past, such as landscapes, buildings, artifacts, written documents, and other printed and visual records, help us to understand history. Nevertheless, these changes in past events emerge frequently, and we can understand a specific time frame by looking at historical records in relevant periods (Mcdowell, 2013). These historical records include advancements in science and technology, culture, art, social and political, as well as design. Therefore, history encompasses all aspects of human civilization.

2.1.1. Documenting design history

Compared to well-established fields of design-related historical studies, such as industrial design, decorative arts, and architecture, the history of graphic design is a relatively new area of inquiry. (Triggs, 2009). Triggs further suggests that one reason for the relatively recent emergence of graphic design history as a field of study is the fact that graphic design has roots in multiple disciplines such as art, typography, printing, photography, and advertising. The diverse origins of graphic design make it challenging to establish a single, cohesive historical narrative for the field.

According to Triggs (2009), Jeremy Aynsley, who was among the first British historians of graphic design, has recognized the vast expanse of graphic design and its history. From designing bus tickets and highway signage to packaging cigarettes, organizing dictionaries, directing the intro to nightly television news, and art directing magazines, graphic design has encompassed a diverse array of design project.

In his journal paper "Designing Graphic Design History" in the Journal of Design History, Triggs highlights significant events related to historical studies on graphic design and its impact on the subject of graphic design and its subdomains such as packaging design, typography, etc. In order to comprehend the significance of the evolution of historical studies in graphic design, we have compiled the following brief chronology.

Important landmarks of early studies on design	**Nature of the study**	**Impact on the development of graphic design domain**
In 1983, "Coming of Age: The First Symposium on the History of Graphic Design" was held at the Rochester Institute of Technology.	Reassessment of the origins of design history and advocated for the acknowledgement and systematic exploration of the history of graphic design.	The symposium's organizers stated that defining the history of graphic design would advance the graphic design profession.
The late historian and educator P. Meggs published his "definitive history of visual communication" in its first edition in 1983.	In the first edition of his book, Meggs presents a chronological visual narrative of graphic design history, starting with prehistoric times and the cave paintings of Lascaux. He concludes the book by exploring the viewpoints of postmodernist designers.	Following the format of survey texts, history books have been chronologically organized from cave dwellings to digital design. Nevertheless, A distinct graphic design history canon emerged and created a diversity beyond the range of architecture or graphic design.
Graphic design and typography historian Clive Dilnot wrote a two-part article titled "The State of Design History" in Design Issues in 1984.	Dilnot was a graphic design practitioner and historian; he also engaged in a discussion on typography and its history.	Marked a significant shift in recognition of design history theory and critique. The relationship between graphic design history and design history became debated. Nevertheless, a series of studies on design history emerged with a focus on objects and design practices.

The series of typography books by Rick Poynor, beginning with Typography Now: Next Wave was published in 1991.	Reproduced some of the defining pieces of the 1980s' typographic explosion.	Understanding the history of graphic design was evolving. Poynor's editorial selection featured works by typographers such as Phil Baines, Barry Deck, and Jonathan Barnbrook.
"Graphic Design: A Concise History" by Richard Hollis was published in 1992.	Hollis creates visual and text-based narratives from the authorial perspective of a modernist.	More forward-looking books were published.
Crowley and Jobling's Graphic Design: Reproduction and Representation since 1800 was published in 1996.	It is said that the book was well-researched and written. This approach fitted well with any discussion of posters, or magazines.	Presented a more detailed historical overview of graphic design, focusing on the social, cultural, and political contexts of the graphic artifact.
"Graphic Design: A New History" by Stephen J. Eskilson was published in 2007.	Reviewed by other publishers as a more or less chronological survey.	Provided a contrast to the conventional style of graphic design history books and design monographs.
Graphic Design History: A Critical Guide, published in 2008 by Johanna Drucker and Emily McVarish.	They go on to suggest a different position on the history of graphic design.	Explored the potential of establishing other approaches to graphic design history.

Table 1:Important landmarks and their impact on graphic design history (Triggs, 2009)

The accounts of graphic design history have varied from chronological and biographical to visual and contextual. This suggests that there are multiple approaches to understanding the history of graphic design. In addition to these historical landmarks, he discusses design monographs written throughout history in which

designers portrayed their own work and many other mainstream publishing practices such as little magazines.

2.1.2. Importance of documenting design history

Research conducted on the evolution of graphic design history has demonstrated that studying its history has significant advantages for the field of graphic design. These benefits are outlined below.

- Graphic design emerged as a separate subject out of other established areas such as architecture, art, and industrial design.
- Graphic design appeared to become more of a design profession.
- More theories and criticisms have been built up on the subject.
- A set of subdomains such as typography, packaging, and publication design were explored under the main domain of graphic design.
- Diversity in graphic design has been identified with social, cultural, and economic circles of society.
- As a result, chronological study on graphic design has emerged organizing from cave dwellings to digital design.

Therefore it is evident that studies on history have shaped the subject of graphic design over the years by debating and documenting its history. Phillips B. Meggs' book "A History of Graphic Design" is considered a noteworthy effort to document the evolution of graphic design history. It offers a thorough and inclusive review of key stages and accomplishments in the development of graphic design. Rather than being a historical encyclopedia, it is viewed as a broad and informative examination of influential stages and achievements in the history of graphic design.

An objective of A History of Graphic Design has been to document graphic design innovation and those designers who have influenced its continuing evolution...Since it was first published in 1983, A History of Graphic Design has remained the most thorough book in its field. With its balanced insight and comprehensive historical background, it is widely accepted as the most authoritative and enlightening book of its kind. No other work on the subject approaches the range of its coverage.

Alston W.Purvis (Meggs et al., 2006)

Meggs' history of graphic design

We looked into Megg's study on design history (4th edition with recent updates towards the subject) to comprehend the nature of his chronological documentation of design history, which has influenced the subject domain. Throughout this process, we were concerned about the impact of the documentation in this type of study.

The first chapter of the study is an evolutionary study on graphic communication and writing since the prehistoric era. Meggs has identified the evolution of the earliest records of writing and drawings, such as cave paintings to clay tablets, papyrus, hieroglyphs, manuscripts, etc. He further describes the tools, drawing techniques, and writing traditions associated with each method. Most significantly, he has analysed the characteristics and evolution of visual elements and the layouts, compositions of text, and images of each wiring method. From a graphic design standpoint, the study examines various alphabets and their properties, such as strokes, spacing, and letter forms.

The next chapter is dedicated to the evolution of printing technology, books, and typography. In his own words, typography is the most significant advancement in communication since the invention of writing, and it played a critical role in the social, economic, and religious changes that took place during the 15th and 16th centuries. This highlights the importance of typography in shaping various aspects of society and culture. (Meggs et al., 2006). He has chronologically documented all the advancements in typography printing. The chapter continues with a discussion of the Renaissance and the innovative approaches to graphic design that emerged alongside it.

Part three of the study explores twentieth-century design, starting with the industrial revolution. It recognizes and records movements in art, design, and architecture. Art and craft movement and Art Nouveau are significant movements distinguished by their distinctive characteristics. Throughout the chapter, a large number of designers, artists, and their designs are presented in chronological order.

The fourth chapter describes the movements of the modernist period. documents various art movements such as cubism, futurism, dada, surrealism, expressionism, and modern art, showcasing the works of prominent artists and designers from each era. This provides a comprehensive view of the development and evolution of these art movements and their impact on the world of art and design. Meggs further emphasizes

that the concepts, images, and visual organization techniques of cubism, futurism, Dada, surrealism, expressionism, and the Bauhaus have provided graphic designers with valuable insights and processes. artists, designers, and illustrators continue to be influenced by the pioneers of these movements. This research extends to the modern art movement and shifts to the age of information in the next paragraph.

The final chapter reviews more recent advancements in the subject alongside the concept of the global village. It examines the worldwide typographic style, its ambitions, and its influences, as well as its pioneers and their works. The study then expands toward publication design and corporate identity design with visual systems and the study ends with postmodern design and the digital revolution.

Throughout this study, we noticed the following:

- It is a comprehensive documentation of designers and their design practices throughout history.
- The study documents graphic history in chronological order as well as its evolution.

> An objective of "A History of Graphic Design" has been to document graphic design innovation and those designers who have influenced its continuing evolution… Graphic design is built firmly upon historical foundations, and history now occupies a central role in graphic design education.
>
> - Alston W. Purvis (Seddon, 2014)

- The study covers some of the categorizations and classifications of graphic design elements in history.
- Alongside the text, a collection of photos of landmark designs are documented throughout the book.
- The study explores typography as a subdomain of graphic design.

The subject of graphic design and its historical studies has evolved. Movements have been identified as a style or popular trend in art or design that promotes a particular philosophy or ideal and is followed and promoted by a group of artists for a predetermined time period. Gradually, a full chronology of design movements has been compiled within the historical studies of art, design, and architecture.

Nevertheless, this classification of design movements has been developed over many years with the contribution of graphic design historians and contributors from other related subject areas such as art and architecture as well.

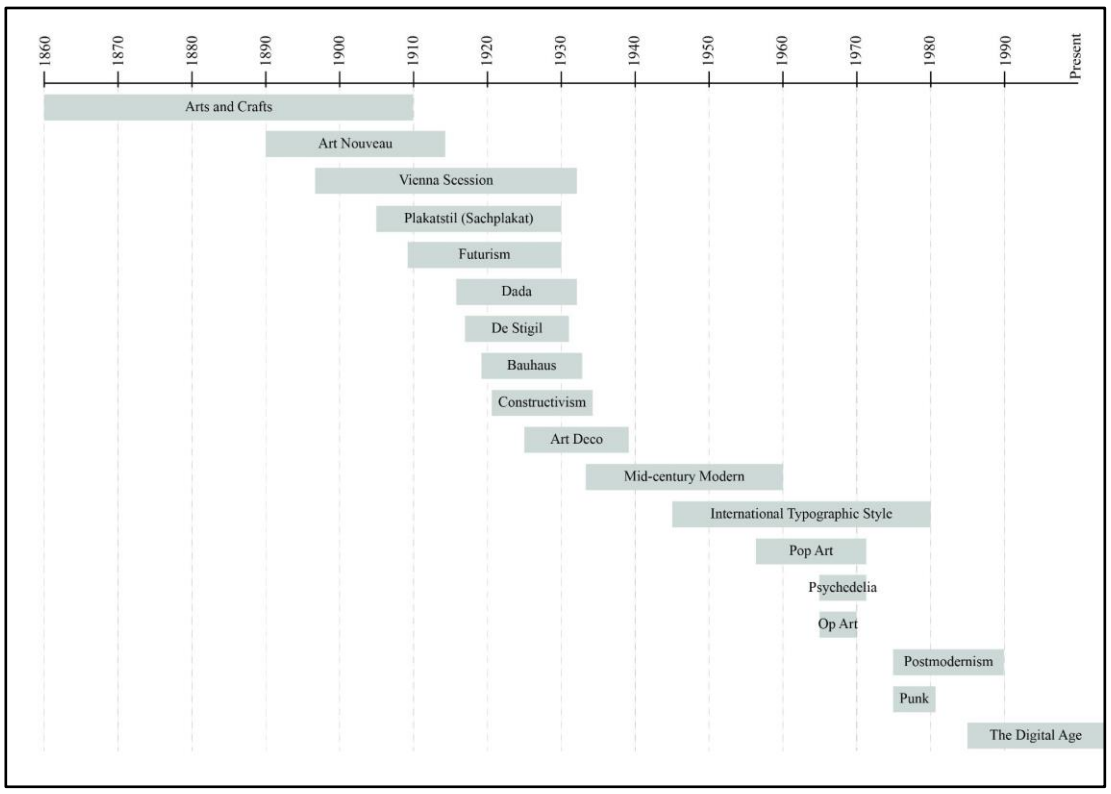


Figure 3: Design movements in chronological order (Seddon, 2014)

This historical documentation of movements, artists, and their artworks contributes directly to the expansion of the knowledge domain of graphic design. Therefore, this chronological classification of design movements continues to be an important component in design education at present.

In this phase of the research, we pointed out the importance of historical studies by understanding graphic design history as a knowledge domain and comprehending the nature of building graphic design history over the past years. Furthermore, we noted that each of these studies has documented and classified numerous designers and their original designs over history. Therefore, we conclude that historical studies, specifically historical research and documentation, are essential to the subject's growth.

2.2. History and typography

As mentioned in the previous section, typography has also evolved in parallel with the development of graphic design. As graphic design has evolved over time, so too has typography. Latin or Roman typography has spread across the world. The development of printing techniques, new technologies, and cultural and social changes have influenced it. Compared to other scripts, it has a long-recorded history, and Its knowledge continues to grow to the present day.

Typography has been studied from a variety of perspectives over the years, including its historical evolution and classification, technological aspects such as typeface/ font design and printing techniques, aesthetical and cultural significance. These studies have contributed to the legitimacy of typography as a field of study by creating theories, practices, and traditions around the subject.

2.2.1. Documentation of typographic knowledge

This section explores the documented history of Latin, Devanagari and Sinhala typography and the evolution of typographic knowledge. We explore how the historical research and documentation of each script have contributed to the expansion of knowledge in each discipline. Nevertheless we discuss the development of Sinhala typography and the existing knowledge in the field.

Historical development and documentation of Latin typography

The knowledge on typography has been documented through a variety of approaches during the course of its development. The chronological approach which is also known as the historical method involves examining the evolution of typography with a focus on significant developments in the field over time.

Taking a chronological or historical approach, we observe that many typographic styles have been recorded across the time. Among these, A typographic timeline with

distinct categories of styles, trends has developed. The twentieth century was a time of revolution and transformation. Typography was influenced by advances in science and technology, as well as revolutionary innovations in art and design. (Carter et al., 2015) In terms of the potential to influence contemporary typography, the 20th century receives the most attention as following styles emerge within that period.

- Arts and crafts is a revival of handcrafted forms inspired by classical and medieval styles.
- Art nouveau is a style of organic, fluid and expressive letterforms.
- De Stijl contains elemental, geometric and grid-based letters.
- Dadaism is for lettering and types that celebrate the chaotic and absurd.
- Bauhaus contains geometric and mechanical forms.
- Modernism is about rationalized, precise forms, putting Bauhaus ideals into practice.
- Psychedelia records wrapped letterforms and a revival of nineteenth century styles.
- Postmodernism has created deconstructed types and digital experiments.

(Willen & Strals, 2009)

Figure 4:Herbert Bayer's Universal Alphabet, Bauhaus

Moreover, researchers and type historians have established typographic knowledge by analysing common visual characteristics, identifying key movements in historical contexts. This timeline continued to evolve until present day and is still developing.

In a similar approach, typographers and type scholars have attempted to document and classify Latin typefaces. Many attempts have been made to come up with a standardized classification system throughout history. These studies have been conducted by early subject experts Theodore Low De Vinne and Maximilien Vox, as well as the contemporary type scholars Ellen Lupton and Robert Bringhurst. We observe that classification attempts have made a great impact on establishing typographic knowledge for Latin script by documenting typefaces and its characteristics. We further discuss these classification systems in chapter 03. Efforts towards building a standard classification system have helped the subject growth in numerous ways.

- Typographers were able to communicate about the styles and characteristics of typefaces.
- With type classification attempts the anatomy of letterforms has been defined such as the differences between serifs and sans-serifs.
- Such attempts have allowed to standardize and classify the various styles of typefaces.

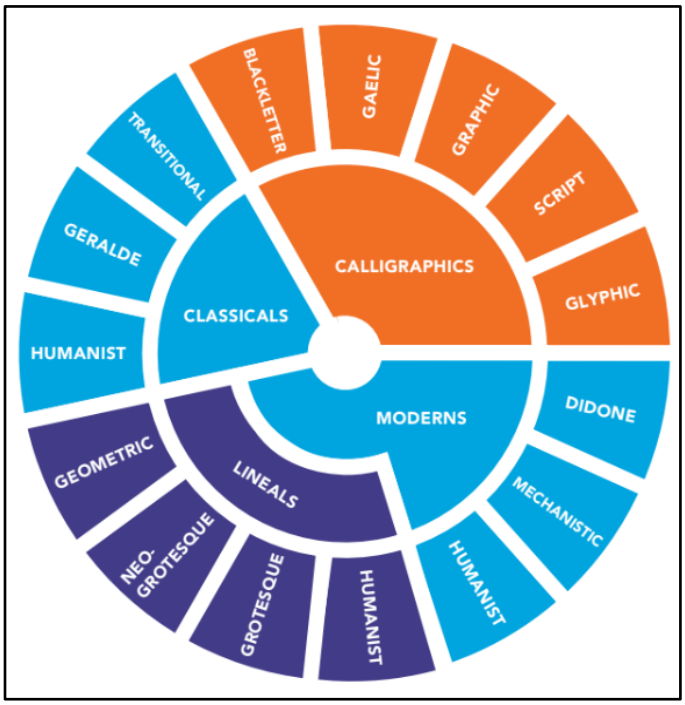


Figure 5: The Vox AtypI system by Maximilien Vox

The knowledge of the anatomy of Latin typefaces has been built by many typographers, type designers, and scholars over the centuries. Studying and documenting type technology has significantly contributed to this. Therefore, a standard system for the basic principles, anatomical structure and letterform standards, and typographic terminology have been built around Latin typography. This includes the decisions about the x-height, length of the ascenders and descenders, serifs, character width, counter space, crossbar placement, and understanding special characteristics such ligatures.

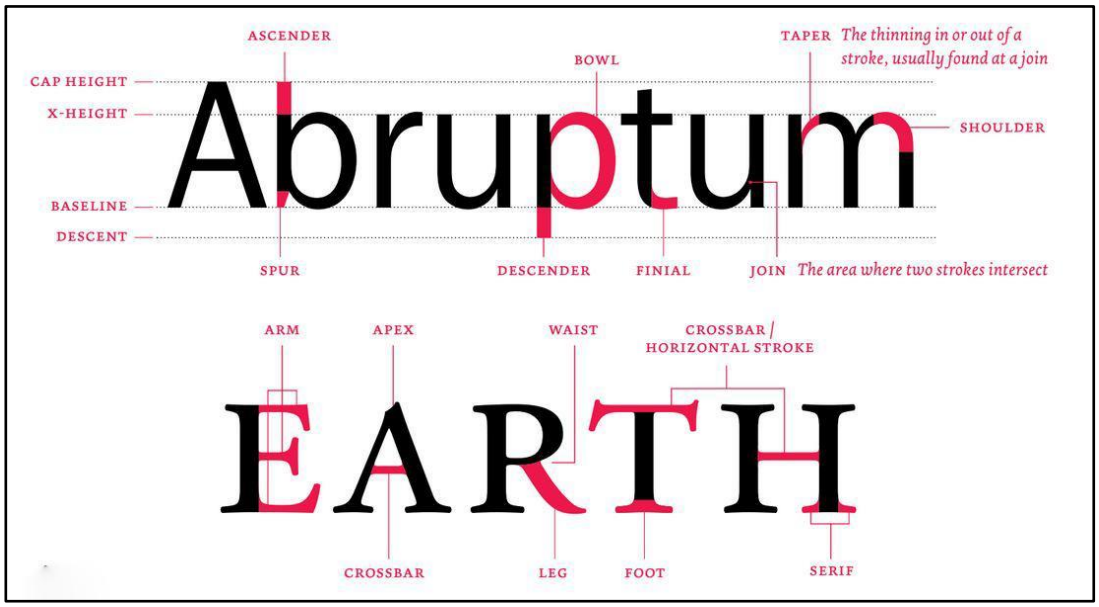


Figure 6: Type anatomy (Willen & Strals, 2009)

Therefore, it was evident that a solid and formal knowledge has been established around Latin typography due to the in depth studies and documentations done by typographers and type scholars throughout the history. Passing down this knowledge through generations they have created a body of knowledge that includes type history, theories and standards, type anatomy, type classification, readability and legibility studies, lettering, calligraphy and display type studies, and many other sub sections.

Historical development and documentation of Devanagari typography

The Devanagari script, which is used in India, is an important and well-known script when it comes to the development of typographic knowledge in South Asia. Unlike well-established knowledge in Latin typography, we find fairly established knowledge in Devanagari typography, established with conducting a series of typographic explorations and researches throughout the history.

Similar to the Latin typography developments, experts have taken several approaches to describe and define the anatomy of Devanagari letters and form classification systems. Within the studies such as graphical classification of Devanagari by S. V Bhagwat and Bapuro Naik (Dalvi, 2010) we noticed the following contributions to Devanagari typographic knowledge.

- Explorations were made regarding the need of defining guidelines for the letters.
- Typographers were able to define and standardize the terminology.
- Re-defining and clarifying complex letterforms and anatomical parts of the letters.
- Building up comparisons with Latin typography and adopting terminology, guidelines and other inspirations to improve Devanagari typography.
-

Studies by type scholars such as Mukund Gokhale and K.C Aryan have contributed towards forming vocabulary, typographic grids and proportions for Devanagari typography. Another set of studies with a technological approach has been conducted on the graphical development of printed letters. It was traced through significant printing technology milestones such as manuscript writings, mechanical typesetting, and phototypesetting.

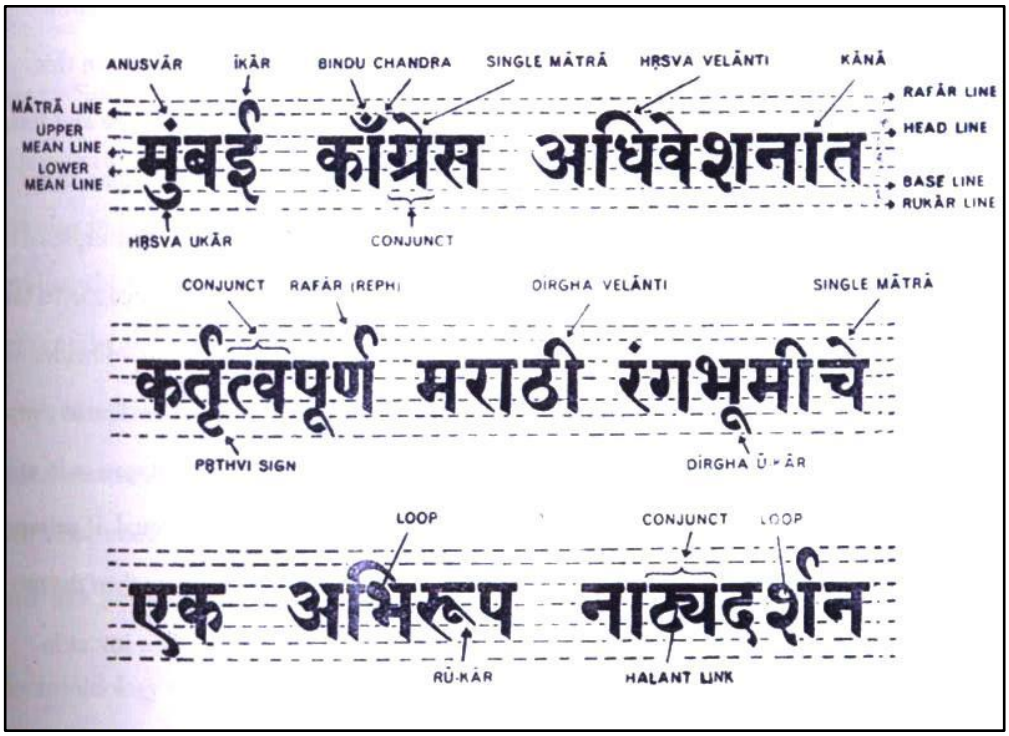


Figure 7: S.V. Bhagwat's figure for graphic elements in Devanagari letter letterform (https://www.dsource.in)

We observe that documentation and knowledge gathering in Devanagari typography has been conducted mostly on historical, graphical and technological perspectives. This knowledge will advance with time and the acceptance of criticisms and evaluations from type scholars and typographers.

Along with Devanagari, South Asian scripts such as the Brahmi script, and their offspring such as Bengali, Tamil, Telugu, and many others have also had their typographic knowledge carefully documented and passed down through the type scholars continuously evolving.

2.2.2. Development and Documentation of Sinhala typographic knowledge

Introduction to the Sinhala script

The term 'Sinhala' refers to both the Sinhalese people, who comprise the majority race in Sri Lanka, and the script used to write the Sinhala language. The Sinhala script is the symbolic representation of the Sinhala language, which is spoken by a large number of Sinhalese people in Sri Lanka. (Samarawickrama, 2016).

There is a development of the number of characters included in the Sinhala alphabet within the time periods. Throughout history we find three alphabets with its own set of characters for each alphabet. These are called *Suddha Sinhala hodiya* (pure Sinhala alphabet), an extended version of it called *Mishra sinhala hodiya (*Mixed Sinhala alphabet) and *Sidath Sangarava hodiya* (Fernando, 2008). The modern appearance of the Sinhala script emerged during the 14th century CE. This writing system comprises sixty characters, with the inclusion of pre-nasal sound characters and the letter 'fa'. These components are integral to the Sinhala alphabet, which is widely used for writing the Sinhala language. This alphabet was officially recognized by the National Institute of Education (NIE) in Sri Lanka in 1989 and taken into practice.

Development of the Sinhala typography

From a technological standpoint, there have been three significant phrases in the evolution of Sinhala typography. Lithic surfaces, palm leaf manuscripts and

introduction of the printing press. Experts of epigraphy recorded the earliest written medium of the Sinhala script as lithic surfaces. Early Sri Lankan mediums were discovered to include lithic surfaces, clay, cloth, metal, and most significantly palm leaf manuscripts. These conclusions were primarily drawn from the research of epigraphers and archaeologists. According to Samarawickrama, there has been a gap in transforming the Sinhala alphabet, particularly in Sri Lankan palm leaf manuscripts, from the fifth century CE to the present (Samarawickrama, 2016). Nevertheless, these studies have not involved graphic designers, typographers, or type scholars. Therefore, it was clear that all the studies had been done from an archaeological perspective rather than a design perspective.

Due to its authenticity, palm leaf manuscript writing plays a significant role among the many writing surfaces and tools mentioned above. Type of the writing is usually a form of engraving here. Scholars have found three different types of letterforms in palm leaf manuscripts. However, they have not discussed the letter in detail from a typographic standpoint in these studies either.

The introduction of the printing press to Sri Lanka occurred in 1737 by the Dutch, with the British taking control of the island in 1796. During the Dutch administration, printing was mainly used to produce pamphlets, bibles, and books as part of their efforts to spread Christianity. These materials were primarily used for evangelization purposes (Kularatne, 2006) and (Samarawickrama, 2016). The development of printing and the production of various print materials expanded during the British period in Sri Lanka (1796-1948). This period saw the arrival of several missionaries who brought their own printing presses to the island, leading to a significant increase in the number of printing presses in operation.

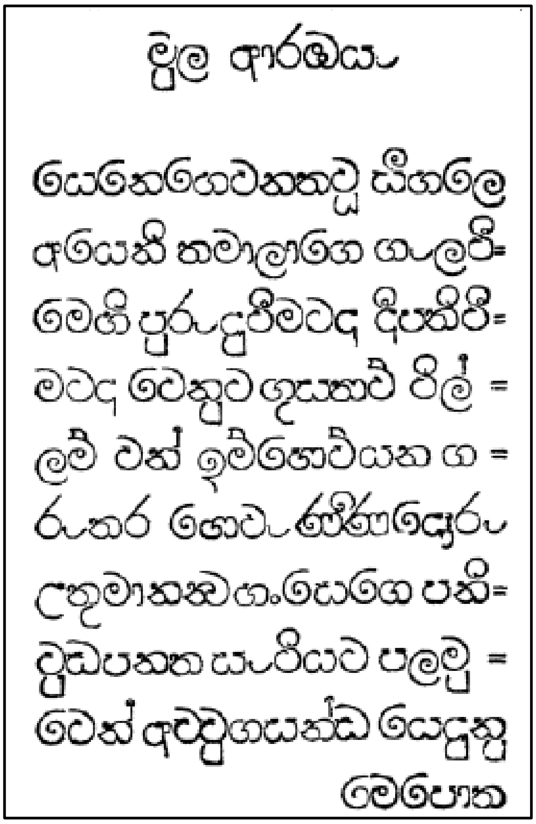


Figure 8: A page form the first book printed in Sri Lanka

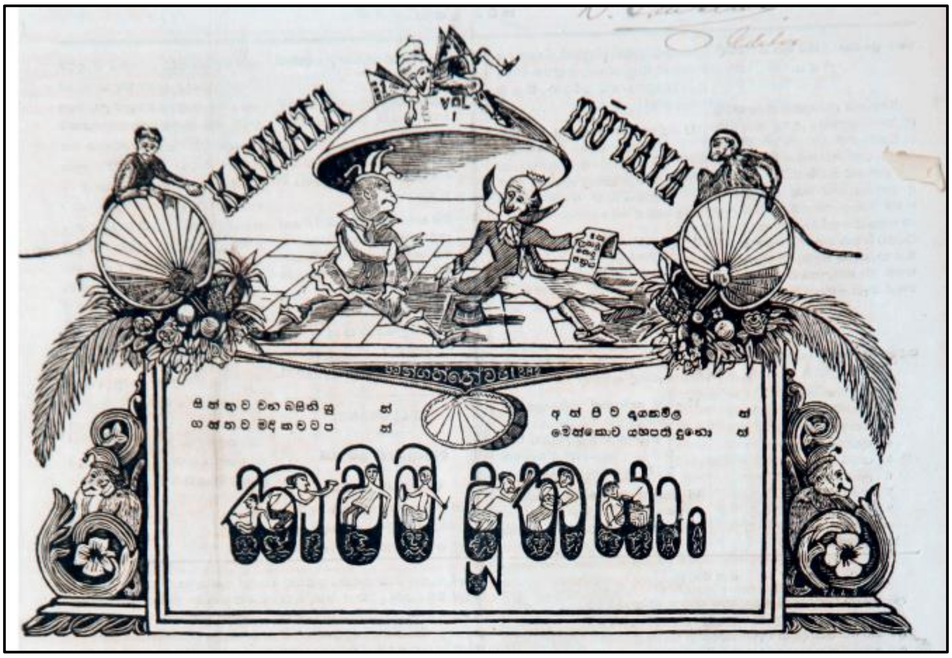


Figure 9: A Sample of Wood Block Newspaper Titles

The introduction of the printing press significantly impacted the development of Sinhala typography. There was no direct literature on the Sinhala type before

Samarawickrama's study of the anatomy and the historical development of the Sinhala typeface (Samarawickrama, 2016). These studies have recorded the literature on the development of the Sinhala typefaces with the growth of the printing press in three phases called the Dutch, British, and Buddhist revivals. The Buddhist revival period can be taken as the next turning point concerning the printing press and the development of Sinhala typography. During this era, there was growing resentment among the local population against the colonizers, and a conspiracy began to take shape. As part of the social and political changes, many printing presses came under the control of the locals. This change resulted in many newspapers, books, posters, and pamphlets circulating within the island.

We observe the recorded data on printing presses, publications, typefaces, and their influences in each period from a typography point of view in Samarawickrama's study. Therefore, we find this study a significant breakthrough and pioneer in forming knowledge in the subject of Sinhala typography. The study has constructed the knowledge of the printing press and its development from a typography point of view.

Within the development of Sinhala typography, it was evident that typography as a subject is a recent advancement in Sri Lanka. However, only a few researches have been conducted, and many untouched areas need to be researched. Also, the lack of literature and recorded data has affected the subject growth. Therefore we identify a theoretical need to document and analyse primary data to establish the knowledge and further contribute to the subject of typography in Sri Lanka

2.3. Importance of the primary data in historical research

In the above sections, we understand that, undoubtedly, Latin script has an established knowledge of its typography due to the historical studies and documentation conducted throughout history. Devanagari typography also has a comparatively average established knowledge due to the historical studies and documentation conducted, and the subject is continuing to grow up in the present.

Next, we investigate the documentation of typographic knowledge in Sri Lanka. Furthermore, We understand Sinhala typography as a recent establishment as a subject in Sri Lanka. Even though Sri Lanka has a history of its own graphic design and

typography practices, it needs more literature on early Sri Lankan graphic practices and a systematically recorded graphic history. Therefore, this section explores historical research as it can be used to build new knowledge for Sinhala typography using our existing data in archival locations in Sri Lanka. It further identifies the importance of the data sources and their contribution to the type of study.

2.3.1. Historical research approach

A definition of historical research can be taken as any method that aims to gather and organize information from previous events or circumstances and then construct a coherent understanding or explanation of them. This approach takes a range of printed or written evidence as sources. These sources are diverse and can include manuscripts, books, school records, magazines, letters, and diaries, as well as textbooks, journals, and other printed materials from the relevant time period. then given as a factual story with the sources themselves, in chronological order. (Junilla, 2015).

Historical research usually takes a process of five stages in general. The first stage is to identify the researchable phenomena, time period related to the study. This includes the researcher's interest, reading relevant literature, and hearing the latest opinions on the phenomenon. Secondly, the development of a hypothesis or research question. This stage further identifies the process of data collection by having a clear focus on the research. Then research moves to the data exploration and collection stage.

This stage depends on many other facts including the accessibility to the data sources. Because the entire procedure is dependent on the subject of study, this step is considered the most crucial of the process.(Junilla, 2015) All this data falls into two main sources called primary sources and secondary sources. Primary sources are the original artifacts, documents, and items that relate to the direct results of an event or experience, whereas secondary sources can be interpreted as descriptions of events, documents written, or objects created by people who were not immediately present at the time of the event (Berg, 2001). This may include the majority of eyewitness testimony, both written and oral. Next stage is all about evaluating the data. Research analyses the data gathered from each source and forms generalization and it concludes the results.

In this section we observe that the historical research method can be taken as a method of preserving data and documentation, as well as the way in which it contributes to the establishment of new knowledge in the field. Furthermore, we understand the importance of primary sources and data preservation in historical research.

As a component of the third stage of the historical research process, primary data contributes to preserving and documenting data by exploring, collecting, and recording primary data on any subject. Primary data can also be used to challenge or expand on existing historical narratives, providing a broader understanding of the past. As a result, when conducting historical research, researchers must prioritize collecting and analysing primary data to ensure the accuracy and completeness of their findings.

2.3.2. Sinhala printed book as a primary source of data.

Printed books are an important primary source when researching the history of graphic design and typography. Since the invention of the printing press, books have been an important medium for the spread of information, ideas, and culture. From the earliest printed books to contemporary publications, books have served as a platform for graphic design and typography experimentation, innovation, and expression.

Printed books contain a wealth of information on the evolution of typography, including typefaces, layouts, and printing techniques. They shed light on the aesthetic trends, cultural influences, and technological breakthroughs that have shaped the field.

As discussed in the above section, many local and Buddhist presses were established in Sri Lanka due to the Buddhist revival's social and political events. This was a very active period of continuously publishing newspapers, books, and other publications around the country. As a result, we can find many early printed books preserved in archival locations in Sri Lanka. These contain numerous graphic elements such as Sinhala display and body typefaces, illustrations, and different layouts that can be taken into studies as primary data within the subject of graphic design and typography. Furthermore, the cover elements of the books hold the characteristics of the printing techniques, illustration styles, typographic elements, and graphic movements in each era.

Therefore we understand the importance of early Sinhala printed books as primary data for graphic design and typography studies that have been archived and preserved in several archival locations in Sri Lanka.

2.4. Preservation and Conservation in archival locations

Preservation involves preventive measures to minimize the risk of damage to books, including proper storage, handling, and environmental controls. Archival institutions use specialized equipment, such as temperature and humidity monitors, acid-free storage materials, and pest control measures, to ensure the books are protected from harm.

Conservation involves repairing and restoring damaged books to their original condition using specialized techniques and materials. This process requires highly trained professionals who are skilled in bookbinding, paper conservation, and other related disciplines.

Preservation and conservation of books in archival locations are critical to maintaining access to historical records and cultural heritage. Books provide an essential source of information on the past, and without proper care, they can be lost forever. By preserving and conserving books, archival institutions can ensure that they remain accessible to future generations of researchers, scholars, and the public.

The British Museum, the Department of the National Archives, the National Library, the Royal Asiatic Society Library, and the Colombo National Museum Library all maintain Sri Lanka's early printed book collections.

2.4.1. The preservation process of early printed books in Sri Lanka

In 1885 the law required that a copy of every document printed in the country must be deposited in the Colombo National Museum library. As a result, the library currently accommodates over 12 million rare books, periodicals, and palm-leaf manuscripts.

We observed the Colombo National Museum library facilities. To understand the preservation and conservation process. Upon examination, it has been observed that the oldest printed books are stored on a particular shelf that is labelled as the 'shelf with the oldest books'. These books are not arranged in chronological order but are

catalogued alphabetically. However, these books are seldom referred to by readers. The majority of these publications were printed in the local language during the early 18th century. They are mostly in good condition since they have been rebound and provided with additional covers for protection. However, during this preservation process, it has become apparent that the original covers of the books are replaced with plain cover boards, which leads to the loss of historical data such as early book cover graphics layouts and styles.

We conducted a semi-structured interview with G.R. Madhuranga Prasad Wijewardhana (Librarian. - Senior Librarian Grade 3) and Ms. Nimmi Deshapriya

(Assistant Director) in Colombo National Museum library. The objective of the interview was to identify the documentation and classifying process, preservation process, functions, and objectives in archival locations in Sri Lanka. A pre-prepared questionnaire was focused on three main sub-sections.

- Aim and Objectives, Functions, and structure of the Archival location.
- Storage and preservation process of books
- Book cataloguing and documentation

Within this interview, we identified that they are still using the same old cataloguing system as in the English period (e.g., using magazines in the same category of books) in the library. Furthermore, Books were catalogued according to the book's subject and title only. As a result, they do not have a proper chronological system to access. Technical issues with the digital cataloguing software were revealed. Only a manual cataloguing system called " Suchi Cabinets" is used now. The manual system is a set of cards with a locker system that is not durable, time-consuming, and complicated. There is no keyword searching system either.

Figure 10: Manual catalogue system (Suchi cabinets)

We identified that the library doesn't have an air condition system or a humidity control system to keep the books in optimal humidity level and temperature. Also it doesn't have a fire protection system. The pest control system (to control termites and other insect diseases) is not functioning. Since the library digitization process is outdated and not in use anymore the library is using the same old manual scanning process which requires flipping the book and pressing it down to the scanning surface which can create a serious damage to the book. Therefore A possible risk of losing all the historical data has been identified due to the lack of preservation and conservation in Colombo National Museum Library in Sri Lanka.

2.5. Conclusion

We first emphasized the importance of historical studies by understanding graphic design history as a knowledge domain and how it has developed over time. Each of these studies has documented and classified numerous designers and their original designs. Thus, historical research and documentation are crucial to the subject's growth.

Then we examined Latin and Devanagari typographic knowledge. We examine how historical research and documentation have advanced each discipline. Sinhala typography development and knowledge are discussed. Then we discovered that Sri

Lanka has recently made advances in typography. Few studies have been done, and many unexplored areas remain. Lack of literature and data has impacted subject growth. Thus, to advance typography in Sri Lanka, we must document and analyse primary data.

We observe that The historical research method can be used to preserve data and documentation and create new knowledge. In historical research, primary sources and data preservation are crucial. Furthermore, we discussed early Sinhala printed books as primary data for graphic design and typography studies and have been archived and preserved in several Sri Lankan archives. Also identified that due to poor preservation and conservation, Colombo National Museum Library may lose all historical data.

In conclusion, this chapter confirmed the research significance of historical research and primary data in establishing graphic knowledge in Sri Lanka, with an emphasis on typography, and emphasized the research gap of the need of data preservation, documentation, and additional research in the field of typography in Sri Lanka.

3. LITERATURE REVIEW

The objective of this chapter is to provide an overview of the relevant literature related to classification systems, book covers, book titles, display typefaces, and Sinhala typography, in order to identify relevant variables for the main methodology, with a specific focus on how to classify historical data and the role of variables in classification systems.

We begin this study by introducing the classification system, focusing on documenting, and organising the data. We discussed the process, structure and formation of the type classification systems. This is followed by a survey on Latin type classification systems. The next section of this chapter investigates the book and significance of the book cover. The study further narrows down into book titles focusing on display typefaces. We survey on display type and its applications and characteristics as well as the Sinhala type anatomy. Chapter concludes with a set of variables for the main study defined via literature.

3.1. Organising data: Classification systems

Classification is a system of classes ordered in accordance with a predetermined set of principles and used to organise a set of entities. This is constructed upon three concepts; a system of classes, an individual group or class, and the process of assigning entities to classes (Jacob, 2004). As the classification involves the systematic assignment of each entity to mutually exclusive classes with an established set of principles, This process has been identified as a systematic process which can be used to systematically organise the recorded data that we utilise for our research.

Content analysis, which is the main analysis approach of the research, is also considered as a basic step of classification because of the applicability of the theories and approaches in common. (Kumbhar, 2012) nevertheless content analysis takes variables and values to form its framework as the classification systems use a classification criteria for each class using a set of principles. Regarding the typographic classification systems, we find an established set of principles that creates a framework which consists of a set of variables, a dimension or any range of options of a similar type.

3.1.1. Type classification systems

Since the invention of the printing press a variety of typefaces with a variety of styles has emerged. Therefore, there was a need for a standardised classification system. Even though many attempts have been made by type scholars throughout history, no general adaptation could be found. As a result, we find more than twenty-five classification systems published by typographers, scholars and associations in the last century. As Latin typography has an established history of typography and classification we take it into a discussion.

There exist many classification systems available and have been developed with different approaches such as historical, functional or hybrid approaches. Even Though some of these have contributed more towards classifying display type, it cannot be taken into study as they lack systematic classification, because of the criteria used to define classes.

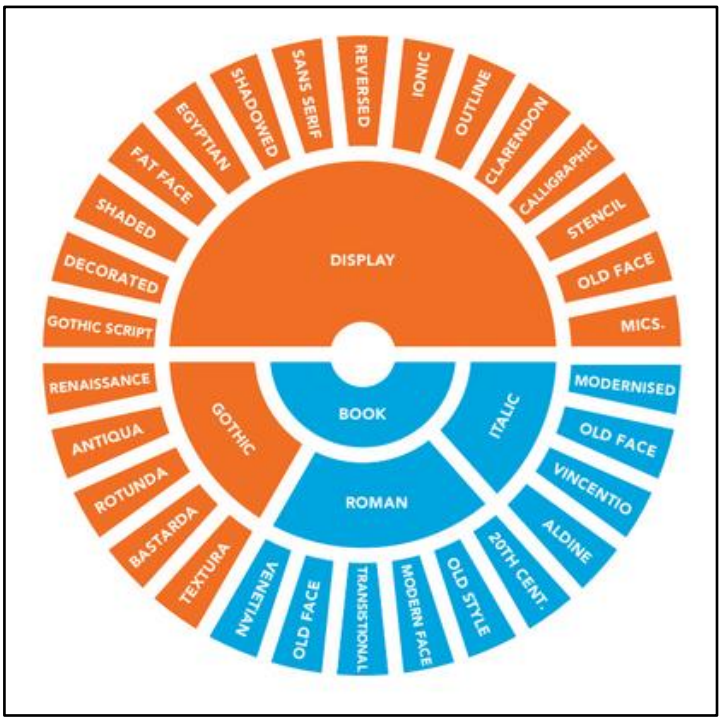


Figure 11: Dowding's classification system (childers et al., 2013)

Dowding's classification has a fairly large section with a number of sub-classifications dedicated to the display type. But due to the inconsistency such as naming some sub

categories with the name of the century we find it doubtful to take into the study regarding its credibility and consistency. Daniel Berkeley's classification has eight main categories as well, but experts are doubtful that a system that classifies types by century will work as we continue to evolve over time.

Therefore, we take four classification systems out of the large Latin typographic classification systems based on the selection criteria of the classes, evolution of the classification within other classification systems, usage and the credibility given by subject experts and practitioners, as well as the nature of the construction of classification system within the structural characteristics of Latin typefaces. As a result, we take these significant classification systems to a discussion.

Classification system	Classification criteria	Categories
Thibaudeau Classification One of the initial rational systems for categorising types. Created by the Parisian Typesetter Francis Thibaudeau.	Using serifs as the main distinguishing feature.	Scripts Display Elzevir Didot Egyptienne Antique
Vox-Atypi classification This was created by Association Typographique Internationale (ATypi) in 1957. This system is based on The Vox System from 1954. Comparatively, a widely accepted classification.	Primarily used the visual properties along with the historical, chronological development. Primarily relied on only these two attributes.	Calligraphic ● Blackletter ● Gaelic ● Graphic ● Script ● Glyphic Moderns ● Didone ● Mechanistic ● Humanist ● Lineals Geometric Neo-grotesque

		Grotesque Humanist Classicals ● Transitional ● Geralde ● Humanist
British Standard classification British Standards (BS) is a global service provider for businesses in 150 countries. This is also based on the Vox System.	Classified by characteristics and style.	Lineale Glyphic Slab Didones Transitionals Geralds Humanist Script Graphic
Bringhurst Classification A classification scheme based on calligraphy and chronology can be found in Bringhurst's book Elements of typographic style.	Based on the visual characteristics of the typefaces.	Realist Geometric modernist Neoclassical Lyrical modernist Post modern. Romantic Renaissance

Table 2: Outline of the type classification systems

All the above classification systems are based on visual properties/ visual characteristics of the anatomical features of Latin typefaces. Each of these classification systems provides a unique framework for understanding and categorising typefaces into classes. We further understand that, while classification

systems such as Thibaudeau are based on serifs as their single distinguishing feature/ parameter, other systems, such as the British standard classification system, based on a variety of characteristics and styles such as stroke thicknesses and transitions, axis, contrast, serifs, curves, inclinations and many more as their parameters. Either way has created a system and a process of assigning each typeface into a specific category.

Figure 12: Thibaudeau classification system and its classes (use of the serif as the only parameter)

Renaissance (15th & 16th centuries)	
	• Modulated stroke. • Hunasit axis (oblique) • Axis: crisp, pen formed • Terminals: large • Aperture: italic
Neoclassical (18th century)	
	• Modulated stroke. • Rationalist axis (Vertical) • Adanate serifs (Flowing into the stem) • Lachrymal terminals (Tear drop shaped) • Moderate aperture

Table 3: Characteristics of Renaissance and Neoclassical classes in Bringhurst classification (set of parameters)

Some classification has evolved through history with added sub classes. This process creates a great credibility towards the particular classification system. The Vox ATypI system, which utilizes the 1954 version of The Vox System, was widely adopted as a standard classification system upon its initial introduction.

Since all classifications used characteristics of Latin typefaces as their variables, the same visual property can be identified across different type classifications. As an example, the classifications Vox-Atypi, British Standard, and Bringhurst have “axis” as a parameter. However, different variations of the same variable can be found in each classification system. With regard to the thesis' methodology, these variations on the values can be referred to as values. This could be due to the objective of their classification, perspective of the type scholar or the association that conducted the classification or available knowledge on the variable/ characteristic.

Variable - Axis **Values** ● Vox Atypi ○ Slanted to left. ○ Vertical axis ○ Horizontal axis ● British standard classification ○ Left inclined. ○ Right inclined ○ Vertical ● Bringhurst classification ○ Humanist(oblique) ○ Rationalist (vertical) ○ No axis	**Variable - Serifs** **Values** ● Vox Atypi ○ Bracketed, ○ Unbracketed ○ Wedged - shaped. ○ Triangular - shaped ● British standard classification ○ Bracketed ○ unbracketed ○ Square ended. ○ No bracket ○ No serif ● Bringhurst classification ○ Modelled ○ Thin ○ No serif

	● Thibaudeau classification ○ Triangular serifs, ○ Simple/Hairline serifs, ○ Squared/blocked serifs, ○ Unbracketed, ○ bracketed, ○ Rectangular ○ Reverse contrast ○ No serif
Variable - Weight **Values** ● Vox Atypi ○ Six different weights including Regular, Medium, bold. ● British standard classification ○ Light ○ Regular ○ Bold	**Variable - Contrast** **Values** ● Vox Atypi ○ High ○ Medium high ○ Medium low ○ Low ● British standard classification ○ High ○ Low ○ No contrast ● Bringhurst classification ○ High contrast ○ Low contrast ○ Equal weight
Variable - X Height **Values** ● Vox AtypI	**Variable - Aperture** **Values** ● Vox AtypI

○ Small ○ Medium ○ Large ● Bringhurst classification ○ Increased X height ○ Medium ○ Low	○ Small aperture ● Bringhurst classification ○ Small ○ Moderate ○ Large ○ Generally reduced

Table 4: Variables and dedicated values in each classification system

Therefore, the research analyses all four classification systems and takes all the possible values and variations for the main analysis. (Table 5). This can be summarised as follows.

Thibaudeau classification	**Vox-Atypi**	**British Standard**	**Bringhurst classification**
Serifs Triangular serifs, Simple/Hairline serifs, Squared/blocked serifs, Unbracketed, bracketed, Rectangular, Reverse contrast, no serif	**Axis** Slanted to left, Vertical axis, Horizontal axis	**Axis** Left inclined, Right inclined, vertical	**Contrast** High contrast, Equal weight
	Serifs Bracketed, Unbracketed,	**Contrast** High, low, no contrast	**Stroke** Modulated, unmodulated

	Wedged - shaped, triangular - shaped		
	Contrast High, Medium high, Medium low, Low	**Serifs** Bracketed, unbracketed, Square ended, No bracket, no serif	**Axis** Humanist(oblique), Rationalist (vertical), no axis
	Weight Six different weights including Regular, Medium, bold	**Weight** Light, Regular, Bold	**Serifs** Modelled, thin, no serif
	X Height **Small, medium, Large**	**Style** Cursive writing style Drawing style chiselled	**Terminals** Pen-formed, Modelled, Lachrymal, Swash, Round
	Stress Vertical, diagonal, no stress		**Italics** Present, absent, visual independence, vertical/ slope stem,
	Aperture Small aperture		**Aperture** Small, Moderate, large, generally

			reduced
			X-height Increased x-height Medium, Low
			Bowl Circular, elliptical

Table 5: Identified variables through classification systems

3.2. Book cover titles and display type.

As we have identified early Sinhala books as a primary source for historical research in graphic design and typography in previous chapter (chapter 02), this section we discuss the anatomy of a book cover and the significance of book titles. Secondly, we investigate the knowledge base regarding display typefaces in Latin script as well as Devanagari script as a closely related script to Sinhala. Then we provide a foundation for understanding Sinhala display typography through anatomy and the development of Sinhala typefaces.

Book and its structure in Sri Lanka

The composition of text and the structure of the book within Sri Lanka can be discussed under two categories; the ola leaf manuscript book and the modern book. Among many surfaces and tools documented, the ola leaf manuscript writing plays a significant role due its authenticity while the introduction of the printing press by the Dutch in 1737 ACE is another significant change that can be identified.

Ola leaf manuscript books were compiled with treated palm leaves, while the letters were inscribed with a metal stylus and ink rubbed over to bring out the letter. The composition of text and images, pagination, decorative covers, binding method was

unique to these traditional books. The average length of a book ranges from 9” to 32” and a width range of 2” to 3 ¼”. The content of these books includes the teachings of Lord Buddha, indigenous knowledge on herbal medicines, folk rituals etc (Gunawardhana & Samarawickrama, 2020). The modern book on the other hand is composed with kadadasi (paper) introduced by the Portuguese to the Island. The content initially was on Christianity followed by language studies, and entertainment etc. The structure of the book includes the modern-day book: cover, spine, pages, text and images etc.

3.2.1. Book

The concept of the book is still up for debate despite being one of the most significant breakthroughs in the distribution of knowledge and technology itself (Brienza, 2011). The book can also be defined as "a series of pages on which meaning-communicating symbols appear, and they are all bound in an authorised order." Several book historians use the term book as a shorthand for a variety of written forms, including the old codex, manuscripts, journals, newspapers, and magazines (Luck et al., 2016). A book exists simultaneously as a physical object, a sign system, and the product of diverse arts and labour. Following that, a book can also be taken as an artefact because it does not change when the world changes. Furthermore its tangible state is stable in its letter and fixed in its form.

The publication of a book with its cover serves as a tangible representation not only of the author's ideas, but also of the cultural values and aesthetics of a particular historical period (Drew & Sternberger, 2005).

Defining the book cover

Early book covers were made of leather, wood, or parchment as a protection to its inner pages specifically as an attempt to support the title page. In the 19th century, with the rise of mass-produced books and the publishing industry, book covers were used for marketing and promotion. Then the cover became an almost exact replication of the internal title page. Publishers realised that a well-designed cover could attract buyers and differentiate their books from their competitors. As book sales increased, the

significance of book covers increased. To attract readers, publishers hired professional designers and artists to create visually stunning book covers. Numerous publishers dedicate a great deal of time and resources to book covers in order to attract readers and sell books. (Drew & Sternberger, 2005)

Significance of the title

A book cover's layout aims to engage readers. It provides both direct and indirect information about the quality and content of the book, including the title, drawings or pictures, and the colours and materials used. From a marketing perspective, we find the design elements of a book cover, such as the illustration or image, and the title can all have a significant impact on a book's sales and overall success (Yampbell, 2005).

The cover design is the first thing a reader sees, but the title is what will stick with them and awaken their interest in the book's subject matter. According to the studies, a strong title can convey the book's central theme, tone, and genre, as well as capture the reader's imagination and awaken their curiosity. Therefore, among all the other content and elements of the cover, the title should be concise, memorable, and relevant to the book's content and genre.

3.2.2. Display type.

We begin this section by starting a literature survey; existing knowledge on display typefaces in Latin script to provide a basis for understanding Sinhala display typography. Furthermore, we survey the literature on Sinhala typography from its anatomical feature’s perspective to gain insight into Sinhala display type characteristics.

Introduction to the display type

To get a better understanding of the display type we first observe the book types which can be taken as the complete opposite of the display types. Book typefaces are often regarded as the basis of typography. They are designed to set large amounts of text at a particular point size and are primarily focused on ensuring legibility and readability.

Book types mostly function at smaller sizes and uses at between six and twelve points. They mostly expand the counters, apertures to maintain the legibility and avoid extreme delicate detailing. Therefore, we find presenting content effectively as the major goal of a book typeface. These book styles can rarely function at display sizes as well.

Figure 13: Futura book typeface

Display type and lettering, on the other hand, express the tone and spirit of a design when a large san-serif headline in all caps gives a modernist feeling while the same headline in decorative type gives a sense of fussiness. These typefaces are designed for different purposes and are meant to call attention often at large sizes. Nevertheless, these are less adaptable in small sizes. Fonts with tight letter spacing, intricate details, and embellishments are designed to be used at larger sizes, but are not suitable for smaller sizes due to their characteristics. But designers occasionally use Therefore successful display types are created for a specific environment with a unique combination of letters (Willen & Strals, 2009) and even pushed the boundaries of legibility.

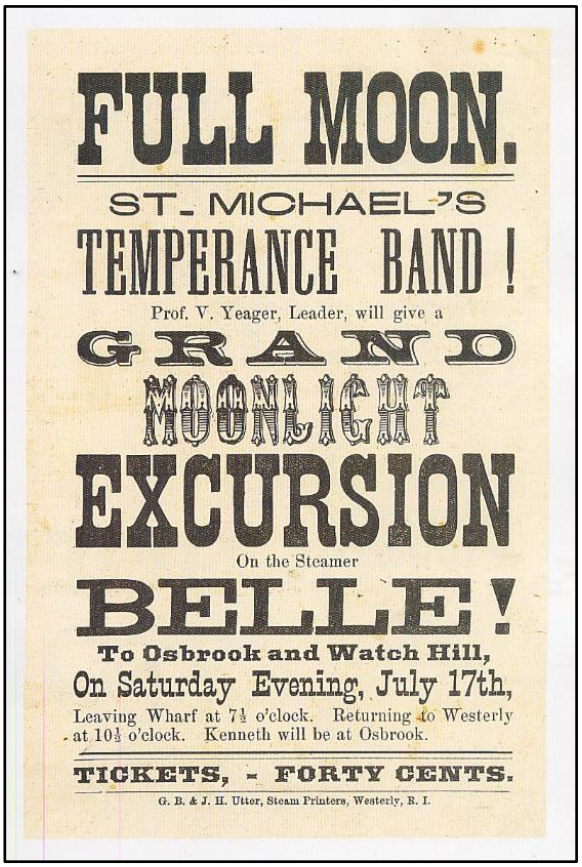


Figure 14:A letterpress poster in 1875 created with display types

Historical overview

The nineteenth century witnessed a significant increase in advertising due to the rise of industrialization and mass markets. A new form of communication necessitates a different type of typography. the advent of advertising led to the creation of large, imposing typefaces that distorted the anatomical features of traditional letters. Fonts became remarkably tall, wide, and deep, while expanding, contracting, shadowed, inlined, fattened, faceted, and floriated elements were incorporated into typographical design. Type designers in the past were no longer limited to traditional typography and classical writing, as they began exploring and experimenting with new forms and styles in type design. Decorative lettering was widespread and fat faces; inflated, hyper bold type styles came into practice. The metal type was too soft to maintain its shape at large sizes under the press pressure. Therefore new technologies such as wood type are invented.

An example of a change in the anatomical features of typography is the shift in the role of serifs. They were originally considered finishing details but eventually became independent architectural structures. Additionally, the traditional vertical stress of letters migrated in new directions, leading to a departure from traditional letterforms. (Willen & Strals, 2009)

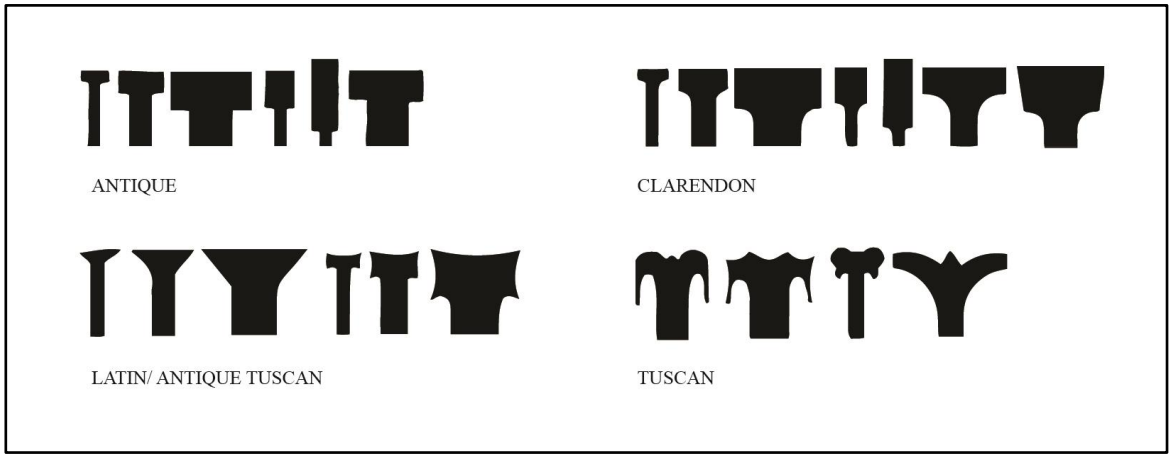


Figure 15: Diversity of serifs in 19th century typefaces

Ellen Lupton has identified historical milestones on the gradual development from calligraphic tradition towards display types as below.

- Renaissance typography did seek to establish standards and proportions for typography.
- 18th century typography was influenced by new styles. Some printers abandoned the rigid nib and changed it to a flexible steel pen, pointed quill. These tools created a fluid and swelling path.
- During the turn of the 19th century, Bodoni and Didot emerged in the typographical scene with their extreme contrast between thin and thick strokes, crisp, wafer-like serifs, and a completely vertical axis. These forms collided with traditional typography and opened a gateway to a new style. Designers have conducted experiments with the structural attributes of letters, including the use of serifs and stems, thick and thin strokes, and vertical and horizontal stress, among other factors.

- Industrialization in the 19th century has distorted anatomical elements of classical letters creating an explosion in typography. Big bold faces came into practice. Movements like Bauhaus, De stijl have constructed alphabets from basic geometric forms such as circles, squares and triangles.
- Design experiments have approached the alphabet as a system of abstract relationships, where individual letters are not seen as isolated entities but are rather understood as parts of a larger typographical system. Moreover, digital design tools have facilitated the seamless reproduction and integration of media into typographical design.. (Lupton, 2004)

We conclude that the emergence of the display type dates back to the nineteenth century, and it was one of the most influential times for type design and laid the foundation for modern display lettering thanks to its innovative styles.

Type anatomy and display type.

Typography conventions in book design become more flexible and elastic when it comes to display typefaces. This approach treats typography as a system of formal features that can be adjusted and modified, including weight, stress, stem, crossbar, serifs, angles, counters, curves, ascenders, and descenders. In order to understand this flexibility and the adaptability of anatomical features, we investigate the distortions and changes in formal anatomical features.

As we discussed, distortions and drastic changes in type anatomy and anatomical features bring out the desired effect of a display typeface. Therefore the knowledge on general type anatomy can be applied to comprehend the articulations of these characteristics in display typefaces. Moreover, by putting display type in a common ground for both Latin and Sinhala scripts, we believe that this knowledge will provide a basis for understanding Sinhala display typography.

Based on the information presented in the two previous chapters, there appears to be a limited amount of theory and literature regarding the anatomy of Sinhala letters in comparison to Latin script. However, studying the practices and anatomy of Latin and other scripts can help identify the key factors that contribute to the anatomy of any given script.

The concept of letter anatomy originated in the Latin script, and it refers to the structural makeup of a letter. Letter anatomy describes the various parts that make up a letter within a typeface. Anatomy uses certain terminologies to define its properties. For the anatomy of Latin typefaces, there's a well-developed nomenclature. Other scripts such as Devanagari have borrowed terms from Latin script and adapted them.

Reference lines

In Latin typography, four standard reference lines are typically used to align the letters and provide a consistent text structure.

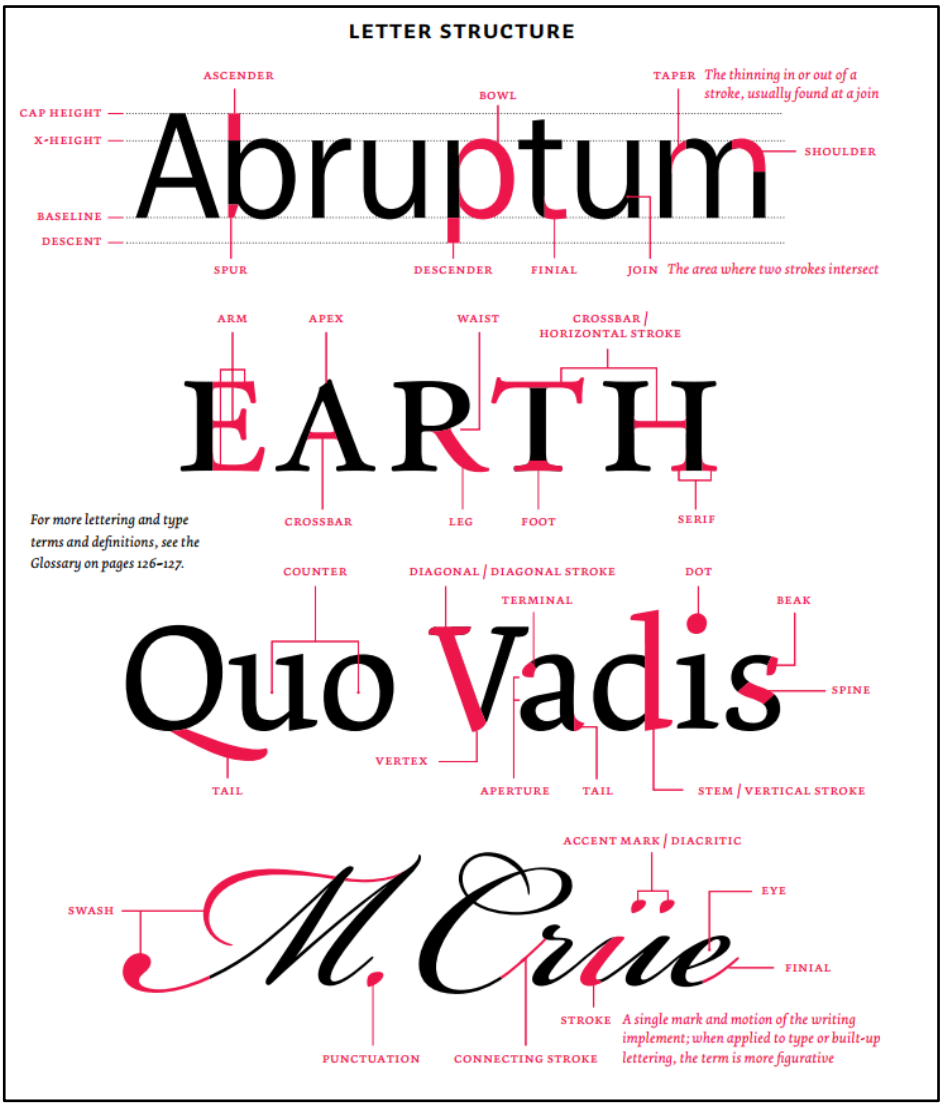


Figure 16: Latin type anatomy and nomenclature

Reference lines and x height are important components of Latin typography even if they are book types or display types. They affect how the text appears and feels as a whole. X height is the vertical measurement of a lowercase letter, and it is defined by the height of the lowercase letter “x”. Appropriate x heights: usually occupies slightly more than half of a cap height, improves the legibility of a typeface. Excessively large or small x heights are commonly used in display typefaces. It may reduce the overall readability of the text but serves the purpose of creating a display typeface. The uniformity and individuality of both lettering and display type are influenced by these guidelines.

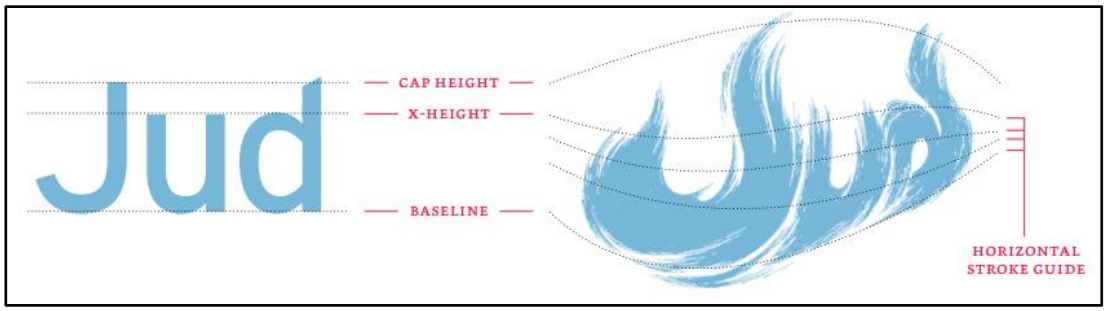


Figure 17: Use of reference lines in display type and lettering

Using Latin typography as a guide, subject experts such as S.V Bhagwat, Muknd Gokhale, Mahendra Patel have formed terminologies and reference lines for Devanagari script in India. Considering all these studies by the experts, a list of lines has taken out in common. Those are the *Upper matra* (topmost line), Shiro-rekha (Headline), Upper mean line (Shoulder line), Baseline (Foot line), Lower matra line (Extreme bottom line) (Dalvi, 2010).

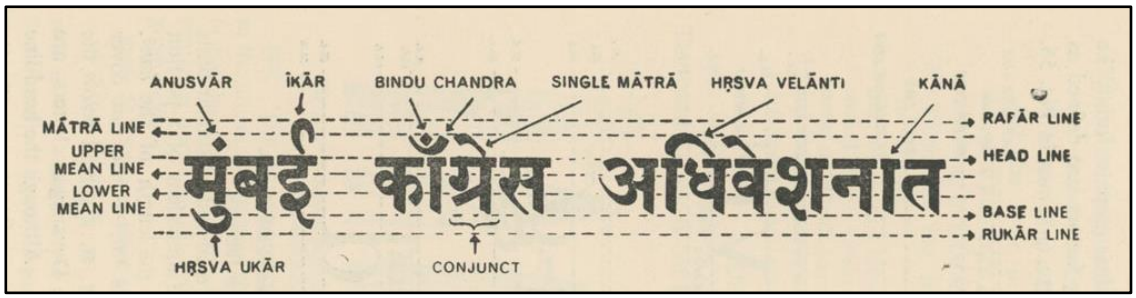


Figure 18: Bhagwat’s reference lines for Devanagari script

Considering the sinhala letter there were several proposed reference lines.

- Five reference lines - by The National Education Commission (NEC)
- Six reference lines - developed by Wickrama, the general manager of the state printing corporation.
- Four reference lines - by National Institute of Education (NIE)

Samarawickrama has created a guideline with five reference lines based on the above early studies. According to the study, this was created for the purpose of letterform analysis of Sinhala typography. Nevertheless the study has proposed a gridline within the five reference lines and also proposed a base character ("*pa height*") as well.

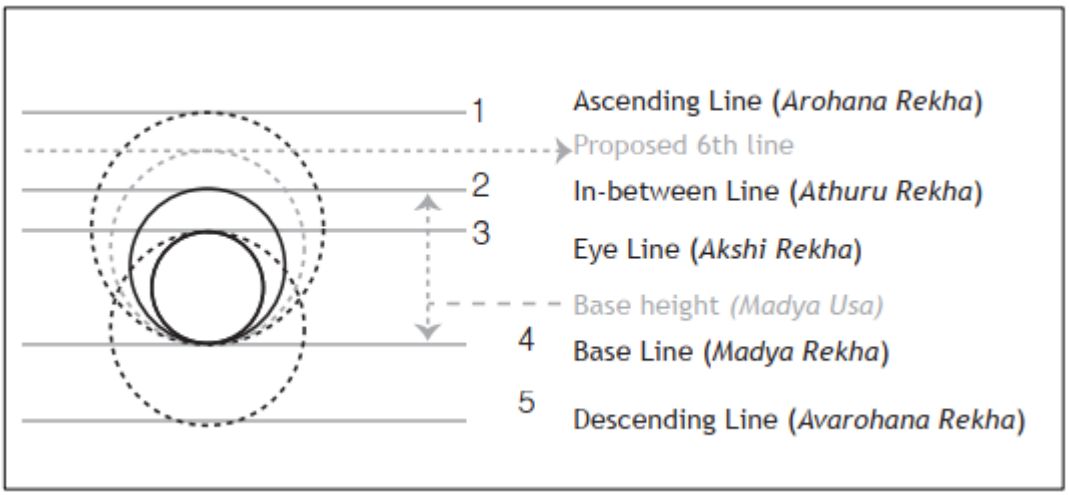


Figure 19: Five guidelines for typographic purposes

As in Latin typography refers to letter "x" as the base character, this study also proposes Sinhala letter "pa" as its base character. Also suggest a guideline of three letters to represent ascender line (letter "Ma"), base height (letter "Pa") and descender line (letter "Tha").

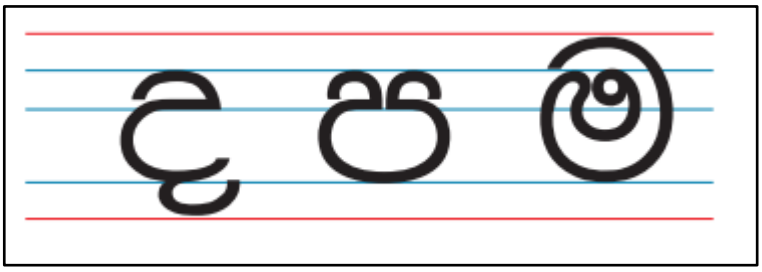


Figure 20: "Tha", "Pa" and "Ma" letters in order

Tool

Tool is the device that is used to draw the letter. Selecting the proper tool that fits the work is considered as one of the first moves of a type designer. While most of the typefaces use a single tool some typefaces contain evidence of more than one tool. The basic Latin anatomy is considered to be derived from a broad nibbed pen; a writing device with a flat tip from the past. Devanagari typography identifies tools as Devanagari pen, Roman pen, Monolinear pen and brush while Sinhala typography identifies copper nibs, mono linear pen/ stylus, brushes etc. There's on limitation for the tool, specifically in a display font. Nevertheless, it isn't limited to a physical tool because typefaces designed for low res LED boards also reflect the qualities of a tool with square edges and the bitmap look. Tools can affect several other parameters as well. They can be as taken below.

- **Stroke and stress**

  Stroke refers to the individual lines or curves that make up a letterform. Stress refers to the angle and direction of the curved strokes that make up the letterforms. It typically describes the amount of contrast between the thick and thin parts of a letter. In a stroke this thick to thin or thin to thick transformation happens in many ways. Some typefaces create a gradual transformation and specially display types create an instant transformation. In general, these are called modulated strokes and strokes without thin and thick contrast are called monolinear.

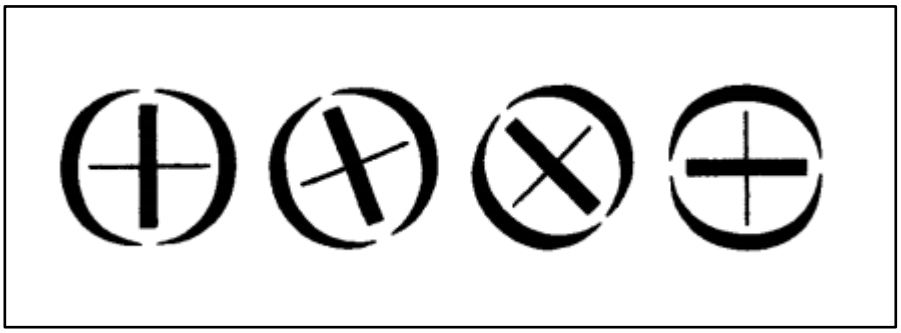


Figure 21:Strokes and stresses created with a flat tipped tool

- **Flesh and grey value**

  The typeface's flesh is made up of the stroke boundaries that give the type its appearance. While most of the book typefaces have a solid build of flesh, display types create broken and interrupted flesh. Stencil typefaces are common examples for these.

Figure 22: Interrupted flesh in a stencil font

We can see these types of typefaces in other scripts as well. As an example Dalvi in his thesis has taken this into his study.

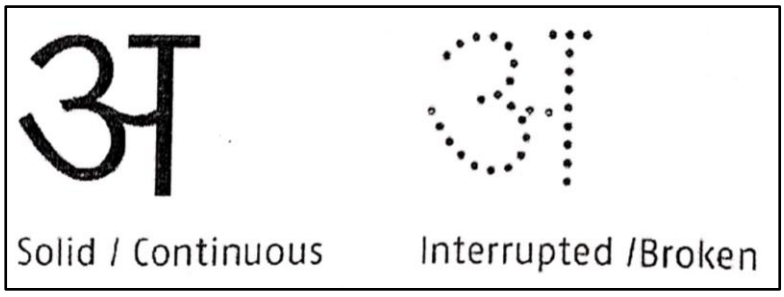


Figure 23: Interrupted flesh variation in Devanagari

Even Though these decorative forms and breaks create stencil letters, these are also related to the fundamentals such as norms of stroke axis, modulation, and serif placement as well. Similarly, the grey value is the overall darkness of letters. It can be light, regular, or bold, semi bold in normal.

- **Contrast and axis**

  The difference between a typeface's thickest and thinnest strokes is its contrast. The tool used to draw the letter is also associated with contrast a lot. This can be identified by examining the stroke of the font especially in a curvilinear letterform. Axis is the other property clearly related to the contrast. Axis is the angle of thinnest parts of the stroke within a curve in a letter form. Basic variations of the axis can be horizontal, vertical, or left or right inclined. Contrast can be measured as low, high, or medium.

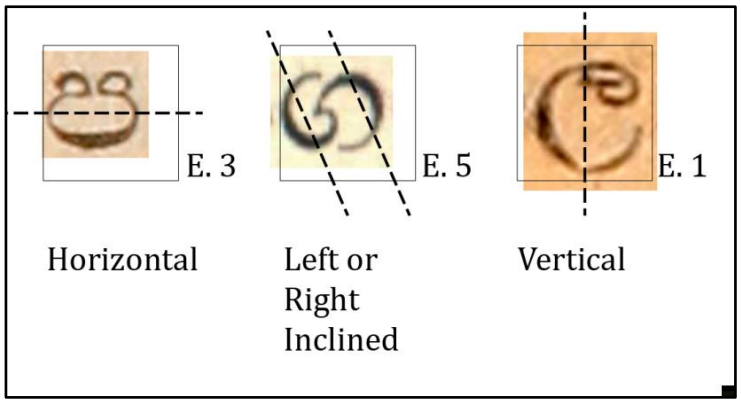


Figure 24: Behaviour of the axis in Sinhala script

Instead of the tool, these two can also be affected by the hand which is the style or the way of drawing.

- **Terminals**

  Terminal is one of the most significant properties in a letterform. Beginning and end points of a stroke are defined as a terminal. This can be taken as the

most closely related property that describes the tool. Latin typefaces usually maintain their consistency across all the typefaces in a family.

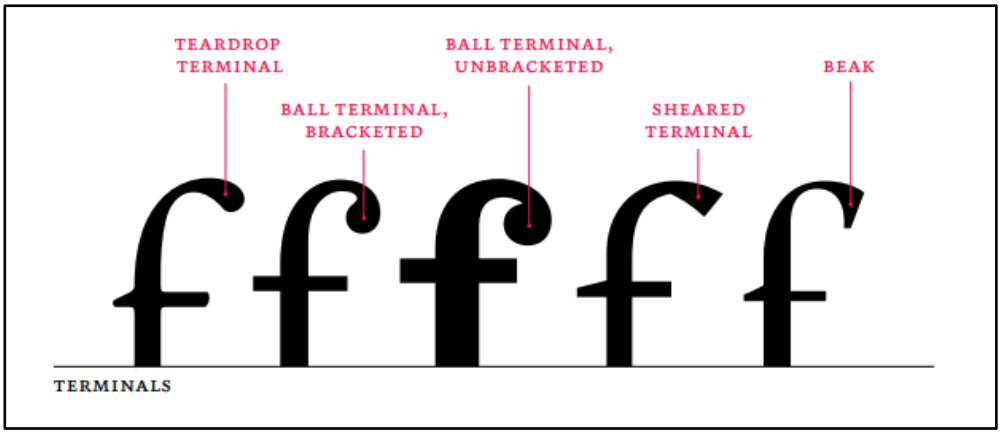


Figure 25: Different terminals in letter "f"

In Devanagari typefaces there have been some typefaces with inconsistent terminals. Smarawickrama also explains that the majority of typefaces lack consistency in terminals. Vertical, horizontal, Rounded, oblique, swoosh, fills and loops are discussed under the terminals in Sinhala typography.

Hand/ Style

Both literature on Sinhala and Devanagari typography has explained this as the way of drawing/ writing based on three parameters which is translation, rotation and expansion. Translation is considered as the contrast created by the pen. Rotation is the way the pen rotates while drawing the stroke and expansion is the way the tip of a flexible pen tip expands when applying the pressure.

Six types of styles are described within these parameters such as Handwritten, Humanistic, Rational etc. Among these, The letters incorporate aesthetics with the purpose of design mainly for the large displays referred as Display/ Lettering style.

Curves and Counters

Considering the Sinhala letter grid, the closest geometric shape is the circle (Samarawickrama, 2016) Since we can derive all the Sinhala letters from this shape, it is considered as the base shape of the Sinhala letter. For the Sinhala alphabet, Samarawickrama has proposed a grid line with circles on each of the five reference lines, with the eye and the base stroke as the primary features.

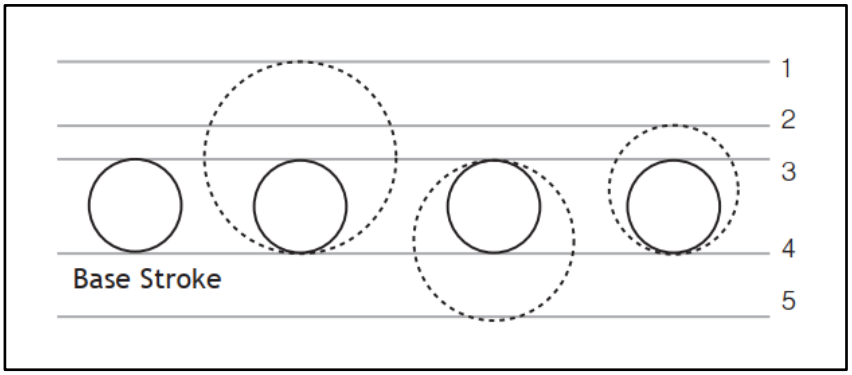


Figure 26: Proposed circular grid for Sinhala letters

Because of the circular nature of the Sinhala letters, we find a lot of curves as anatomical features in a Sinhala typeface. This causes a number of counter spaces within the typeface as well. These curves can be treated in different ways according to the choice of hand of the designer. In Devanagari we find squarish treatments for the curves within mechanised or display typefaces.

Eye

Eye is considered as one of the fundamental properties of a letter. Most letters are constructed initially with this shape. This property is interpreted as the eye, because of the visual appearance which is closer to a human eye. We can see similar properties in other scripts as well. Devanagari also has a similar property called a loop. We observe three variations of the eye counter in literature as open eye, filled eye and omitted eye.

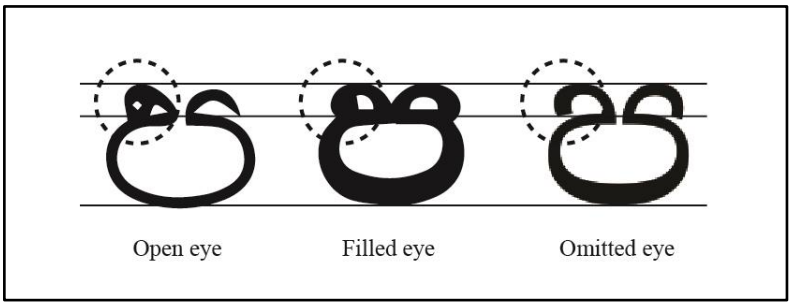


Figure 27: Variations in eye

Furthermore we observe that it is a small element yet has the ability to change the appearance of the typeface. In Latin typography we could see a similar effect in the dot if the letter “i”. Willen and Strals highlights this in their book lettering and type.

Figure 28: Even the dot in eye can speak

The dots in a typeface can vary in shape, including being round, square, asymmetrical, calligraphic, or an uncommon shape. The height of the dot above the stem, as well as its relationship to other punctuation marks, can also have an impact on the overall characteristics of a typeface system.

Ligatures

In Latin typography, ligatures refer to two or more characters that are combined to create a single glyph. Bringhurst gives a comprehensive explanation about the beginning of the Ligatures in a technical point of view. In metal type, some letters overlapped because of the physical nature of the lead type. Letter elements such as the

arm of the “f” or tail of the “j” reach the space beyond it. Then the arm of the “f” can be collided with certain letters like “i” and “l”. To avoid this, typographers created individual glyphs combining these letters.

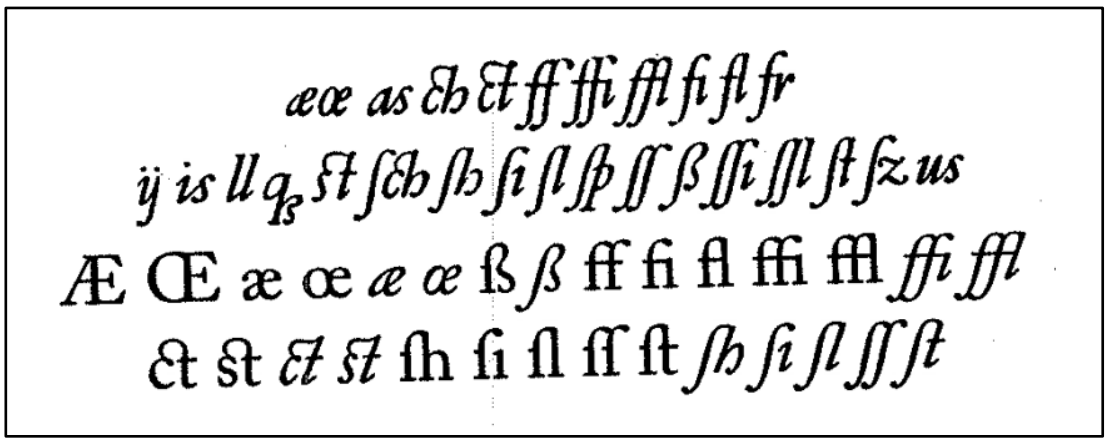


Figure 29: Set of ligatures

In the contemporary world of typography there is no such need of doing this because of digital technology. Nevertheless, people still use this in a different way. Typographers add contextual or decorative ligatures to give them a personality and flexibility.

Figure 30: ATypeI logotype in 2005

According to the definition given by the Latin typography, Sinhala script also has two letters combined in a single letter since they cannot be termed as a ligature, considering its origin.

Text and image

Designers and typographers traditionally considered text and images as two different elements in a composition. Usually, the written content is engaged with the images to explain expressive, emotional and informational content. Nevertheless with the use of display typefaces and lettering text also became a container for the expression of visual ideas. These attempts challenge the general expectations of a book type such as maintaining legibility, but it meant the viewer to spend more time with the text looking at it.

Figure 31: A comic book title in 1948

In the 19th century, artists began to blend letterforms with various physical objects, such as plants and animals. This movement, known as Art Nouveau, blurred the lines between art and typography. Through their creative exploration, artists were able to break free from traditional forms and develop highly expressive alphabets. However,

as letterforms were transformed into imagery, legibility became less of a priority, though the resulting designs often conveyed meaning beyond the text itself.

3.3. Variables based on the literature survey.

Based on the knowledge we gathered in the above section; we have selected a list of only 17 variables for the main study as a result of the conducted literature survey. As we discussed literature within two sections as display type and classification systems, this list of variables has been selected by taking the variables either from previous knowledge on display type or/and variables in previous classification systems. According to the criteria below, generally proposing the most important properties that define the structure and appearance of the letter we have selected a set of 14 variables out of all the variables that we found in the literature.

- Theoretical base with established definitions in the literature.
- Representative of the research questions.
- Variables that have been taken into similar studies or classifications were concerned. (Mainly within the studies on previous type classification systems)
- The possibility of having an average amount of variations within the variable.
- The variable is observable or measurable.
- The complexity of the variable because of the extensive sample collection.
- The adaptability of the Sinhala type anatomy to the particular variable.
- Representative of the Sinhala type anatomy.
- Contribution to the visual appearance of the typeface and adaptability towards the display.

List of Variables	Description	Literature	
		Display type and anatomy	Classification systems
"X" Height/ "pa" Height	The distance between the baseline and the midline of an alphabet which is normally the approximate height of the unattended lowercase letter “x”. In Sinhala script the letter “Pa”.	Yes	Yes
Axis	The direction of stroke emphasis within a letter. Letters with modulated strokes display thick and thin areas based on the angle of the writing tool used to create them.	Yes	Yes
Contrast	The amount of variation from thick to thin within and between the strokes that form a character.	Yes	Yes
Stroke transition/ Stress	Direction of a curve stroke and changes of the weight along the stroke.	Yes	Yes
Inclination	Degree of deviation from the vertical	Yes	Yes
Stroke modulation	A single mark or motion of the writing implement when applied to type or build up lettering. In contrast we are referring to the difference between the thinnest part and thickest part of the stroke.	Yes	Yes
Terminals	The way in which the letters terminate	Yes	Yes

Counters	A partially or fully enclosed area within a letter.	Yes	
Curves	The manner in which the curves are treated throughout the font.	Yes	Yes
Eye	Eyeball/ An enclosed full circular stroke on the eye line	Yes	
Intersections	The overlapping of two strokes	Yes	
Ligatures	Two or more letters tied into a single character.	Yes	
Overall Proportion	Vertical and horizontal proportions, Ratio of the "Pa" height to the Ascender and descender heights.	Yes	
Flesh treatments	Decorations applied on the flesh of the letter. Flesh is the appearance of the exterior boundaries of the stroke in a typeface.	Yes	

Table 6: Selected variables based on the literature.

3.4. Conclusion

First, we analysed existing type classification systems and their process of documenting and recording data. According to the study we identified that, a proper classification system uses variables to classify data. Surveying typographic classification systems in Latin script we identified the variables that have been used. In the next section we identified the significance of the book cover and its title. Then we surveyed the Latin typographic knowledge related to display typefaces and gained insights into Sinhala display typography. We concluded the chapter compiling a list of selected variables within the literature.

4. METHODOLOGY AND ANALYSIS

Introduction

The main objective of this chapter is to Identify and document the letterform variations in early Sinhala book titles and classify them with identified variables. The chapter identifies the relevant research design. We understand our collection of data using a pilot study and re-define the variables. Afterwards we organize the set of data and prepare to analyze. Afterwards we identify and document the Sinhala book cover titles systematically. Then we classify the Book cover titles with identified variables.

4.1. Historical research and the content analysis

This research takes the historical research process in order to answer the research questions. Historical research aims to use scientific processes to verify and explain the history of various areas of human activities, subjects, or events. This involves systematically investigating past events in order to provide an account of what happened in the past. (Junilla, 2015). Moreover, one of the primary goals of conducting historical research is to record and evaluate the past. Therefore, this method is expected to perform well in this research.

In this process the research follows several stages in general. First, we identify a researchable phenomenon. This is due to the investigation of relevant literature related to the focus of the study and depending on the researcher's interest. Then we identify the research question and identify the theoretical perspective. This guides us to the process of data collection, choosing a specific time period, and interpretation of results of the study.

Next, we explore and collect the data. This depends on the accessibility to the primary data in archival locations. Research collects and documents primary data in archival location, which we collect first hand for this research purpose. In the next stage, which is the analysis we evaluate the data forming generalizations and conclusions. We explore different approaches including ethnography, grounded theory, phenomenology for the analysis. We proceed with the content analysis method as it is one of numerous research methods used to analyse text data.

Content analysis

The approach to the content analysis can be qualitative or quantitative. Qualitative content analysis is defined as a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns (Hsieh & Shannon, 2005). The qualitative approach usually produces descriptions or typologies. It is an observational process and the most basic way to find out, Something about the media's meaning. It allows classifying observable content into distinct categories. Qualitative content analysis shows three distinct approaches; conventional, direct, or summative as follows.

Type of content analysis	**Study starts with**	**Defining codes**	**Source of codes**
Conventional content analysis	Observation	Codes are defined during data analysis	Codes are derived from data
Directed content analysis	Theory	Codes are defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative content analysis	Keywords	Keywords are identified before and during data analysis	Keywords are derived from interest of researchers or review of literature

Table 7: Three approaches of qualitative content analysis (Hsieh & Shannon, 2005)

According to the amount of data and research on existing theories, we determine that direct content analysis is an appropriate method for the research because the aim of the research is to identify and categorize all instances of the particular phenomenon. With existing theory or research, direct content analysis can provide predictions about the variables. It further helps to determine the initial coding system. This is guided by a more structured process. Analysis begins by identifying key concepts or variables through literature as initial coding categories. Additional codes are added and the initial coding system is revised and developed as the coding proceeds. Following these

steps any text that could not be categorized with the initial coding scheme would be given a new code.

4.2. Sampling

To investigate past events, in this case the earliest printed books, in a systematic manner, it is necessary to identify a location where historical primary data is stored in a systematic manner. Therefore, we identified several archival locations with the collections of earliest printed books. Many of the early printed materials have been lost over time, but the remaining ones are typically catalogued in various archival locations. Examples of such locations include the British Museum, the Department of the National Archives, the National Library, the Colombo National Museum Library, and the Royal Asiatic Society Library. We accessed the Colombo National Museum Library which accommodates over 12 million titles including rare book collections, periodicals and palm leaf manuscripts.

Furthermore, we observed the library premises. As a result we identified, the 'shelf with the oldest books' houses the earliest printed books, which are not arranged chronologically, but catalogued alphabetically. As a result, readers rarely refer to these books unless they know the titles. The publications that have been archived demonstrate the growth and development of the publishing industry in Sri Lanka. The collection includes a significant number of books published between 1870 to 1980, with the majority of them being published in Sinhala (Gunawardhana & Samarawickrama, 2020). As a random sampling we selected one of the oldest printed book shelves and started recording the data.

4.3. Data recording

We scanned a total number of 1410 book covers in 160 dip resolution range from 1870 to 1960. We also recorded a set of metadata for further references. It includes book number, book title, author’s name, publisher’s name, published place, printed edition, thickness of the book, width and height of the book. Finally we tabulated all the data in a data sheet digitally.

Book No.	Book title	Author's name	Publisher	Published place	Published date	Edition	Thickness	Width	Height
01					1872				
1410					1960				

	L.No	Book Title	Author's Name	Publisher
C9-3	104 J20	පෙම් හර	වී.ඩී.ද. ලැනරෝල්	අමරසිංහ සහ සමාගම
C9-10	104 J20	කවි මුතු බරණ	වැලිතර ශ්‍රී ධීරාලංකාර ස්ථිවිරයන් වහන්සේ	ඇන්.ජේ.මැන්ඩිස් (වැලිතර)
C9-13	104 J20	සෙනෙහෙලතා කාව්‍යය	මරදානේ වෛද්‍යාචාර්ය ජී.කරුණාරත්න/ ජේ.ඇලෝසියස් පෙරේරා (පරි)	
C11-9	104 B4	ජිනවංශගීතය	ඩී.ජේ.ද ලාන්	පී.එම්.සුවාරිස් අප්පුහාමි
C11-10	104 B4	ඉරණම නොහොත් ලෝකයේ බලවන්තයෝ හයදෙනාගේ කතාව	ඩී.එච්.සමරසිංහ	ආර්.ඩබ්.ඩී.මාර්ටින් සිංඤො
C11-22	104 B4	චන්ද්‍රපාල කුමරුගේ සහ මයුරාවතී කුමරියගේ කතාව කොක්කනම් පයියේ රහස	ඇල්.ඩී.ජ් රත්නායක	ආර්.ඩබ්.ඩී ඇඩ්වින්
C11-29	104 B4	ඉන්ද්‍රකාම සහ ශ්‍රියාවතී	ඇෆ්.පී.අමරසිංහ	ඇන්.ජේ.කුරේ
C50-14	104 K4	ඔවා මිණි වැල	ඩී.ඩී කරුණාරත්න	
C50-3	104 K4	කර්මචතුෂ්කය හෙවත් චතුර්විධකර්ම විභාගය	මැවිකොටුමුල්ලේ දේවානන්ද ස්ථවිර ස්වාමීපාදයන්	මන්චනායක මුදියන්සේලාගේ බණ්ඩප්පුහාමි
C50-7	104 K4	සත්කාව්‍ය තත්තව දර්ශනය	ඇන්.එච්.ඇල්.ඇම් සේනාරත්න	ඩී.සී. පොන්නම්පෙරුම/එච්.ඩී.පී ජයසේකර
C19-5	104 V10	ශක වර්ෂ 1847 පංචාංග ලිත	ඇම්.ජී.විද්‍යාරත්න	ධර්මරත්න,ජේ.ඩී
C9-7	104 J20	කුති කවි මල්දම	කේ.ඇල්.මුනිදාස ගුනතිලක	කර්තෘ
C9-35	104 J20	චන්ද්‍රපාල කුමාරයාගේ කථාව හෙවත් පුදුම සන්ධාර හත	ඇස්.ඇම්.මුදලිහාමි	ජී.ඩී.ඇල්බට්
C9-37	104 J20	නිමල සුන්දරී කථාව හෙවත් පුදුම මැණික් ගල් තුන	ජී.පී ඩේවිඩ් සිල්වා	කේ.ඩී. පෙරේරා සහ පුත්‍රයෝ
C11-42	104 B4	ඉන්ද්‍රකාම සහ ශ්‍රියාවතී	ඇෆ්.පී.අමරසිංහ	පී.ඇස් සිල්වා සමාගම
C50-19	104 K4	ශෘංගාර පුෂ්ප	රාමචන්ද්‍ර	පී.යූ. පොඩි අප්පුහාමි
C50-23	104 K4	වනද්නා කවි පොත	වැලිගම ශ්‍රී සිමානන්ද ස්ථවිර	කේ.ජ්.බී වර්ණකුලසූරිය
C50-2	104 K4	අබඩ සීමා විනිශ්චය	කෝදාගොඩ උපසේනාභිධාන	ඩී.ජේ.අමරතුංග
C50-15	104 K4	බුදුමුල උපත සහ බුදුගුණ සාන්තිය හෙවත් මරහන සැහැල්ල		ආර්.ඩබ්.ඩී සල්මන් අප්පුහාමි
C50-16	104 K4	විත්‍රවල්ලි වත හෙවත් මාතලන් කතාව	ඇම්.ඇස්.පෙරේරා	ආර්.ඩබ්.ඩී සල්මන් අප්පුහාමි
C50-17	104 K4	ශ්‍රී වික්‍රම රාජසිංහ ඇමති පරම්පරාවේ බෝධි පිහිටුවීම හෙවත් බෝධිසත්ව විරිය		ඇස්.ජානිස්

Figure 32: Data sheet

Arrangement of data

There were 1410 book covers spread across 72 years randomly. We sorted all the scanned copies into folders by the year/ in chronological order.

Figure 33: Book cover scans categorised in chronological order

Since this study focuses on book cover titles, we cropped only the title part to prevent distractions during the observation process. We randomly go through all the data while doing this. Afterwards we reduced the number of samples to 946 book titles from 1410 initial cover samples as the final sample size. This was due to,

- In some book covers the actual cover was not recorded since it has been replaced with a blank hard cover.
- Some covers had the exact same title with a different color. Had to remove these to avoid the repetitions.
- Some covers had body texts only.
- Some titles are in Latin script.

According to the years, the final number of book title sample looks like this.

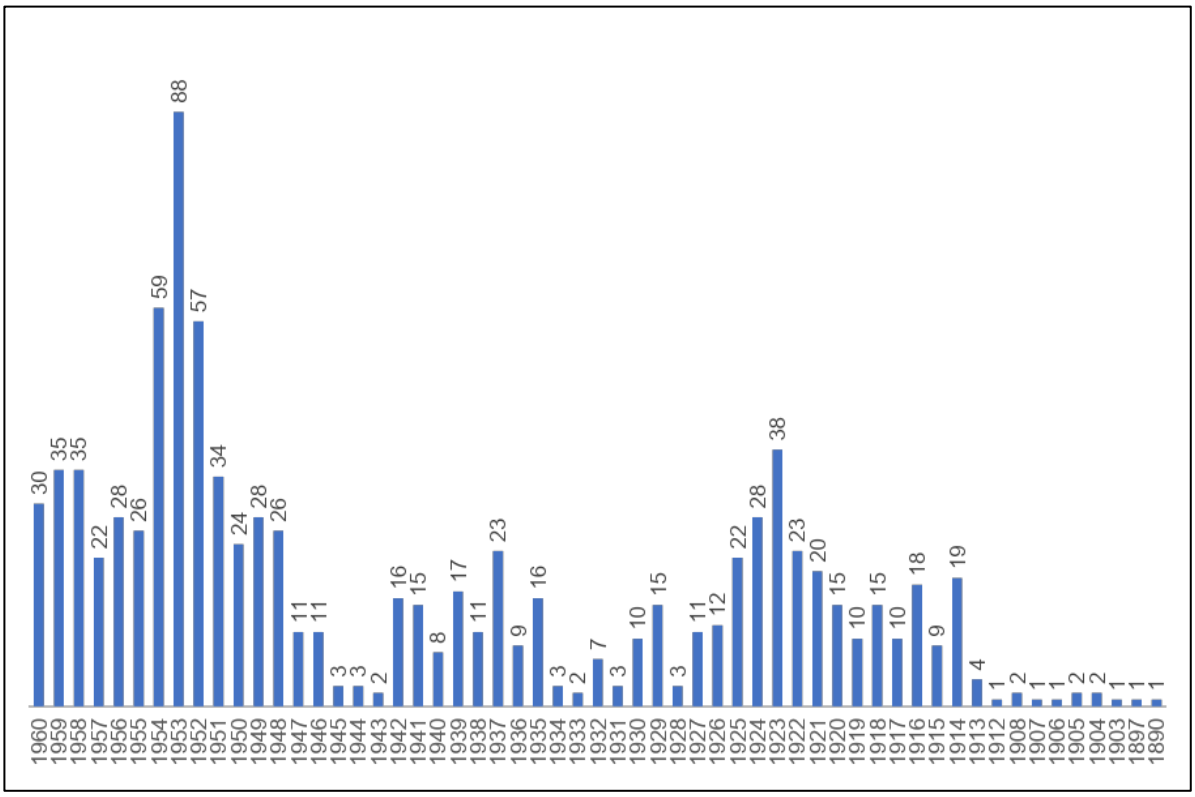


Figure 34: Number of samples per year

4.4. Pilot Study

After the collection and arrangement of the data a pilot study is conducted to fulfil the following objectives.

Objectives

- The main objective was to understand the scope of the visual variations.
- To help understanding the visual variations that can be taken as the categories/ variables for the main content analysis.
- To ensure that the sample is a representative of the variables that were going to be taken into the study.
- As the guidance to understand the possible values inside every variable that is unique to the script.

Procedure

The experiment was conducted with a group of five participants. All of them are design practitioners with academic knowledge and experience in graphic design and typography. The set of samples consisted of 940 book titles, published between 1890 - 1960 AD. The titles were cropped from the scanned book cover image. This is the same sample used in the main methodology.

Book titles were arranged into A4 size, giving enough visibility to clearly see the details of each title. Then samples were printed and cut into individual pieces. The group of participants were given the printed book titles and they were asked to classify them into groups. A brief explanation was given to the participants, asking them to categorize the samples based on the anatomical features, characteristics, look and feel or any other rationale of their preference. No restrictions were placed on time/ number of samples per group or number of groups and subgroups.

They were given two different options to classify using hierarchical cluster analysis as a base. The Top-down clustering method, also known as divisive clustering, begins with all data points being grouped into one cluster, and then gradually splits the cluster into smaller ones based on certain criteria. On the other hand, the bottom-up clustering method, also known as agglomerative clustering, begins with each data point forming

its own cluster, which is then gradually merged with other clusters to form larger ones until the desired number of clusters is reached.

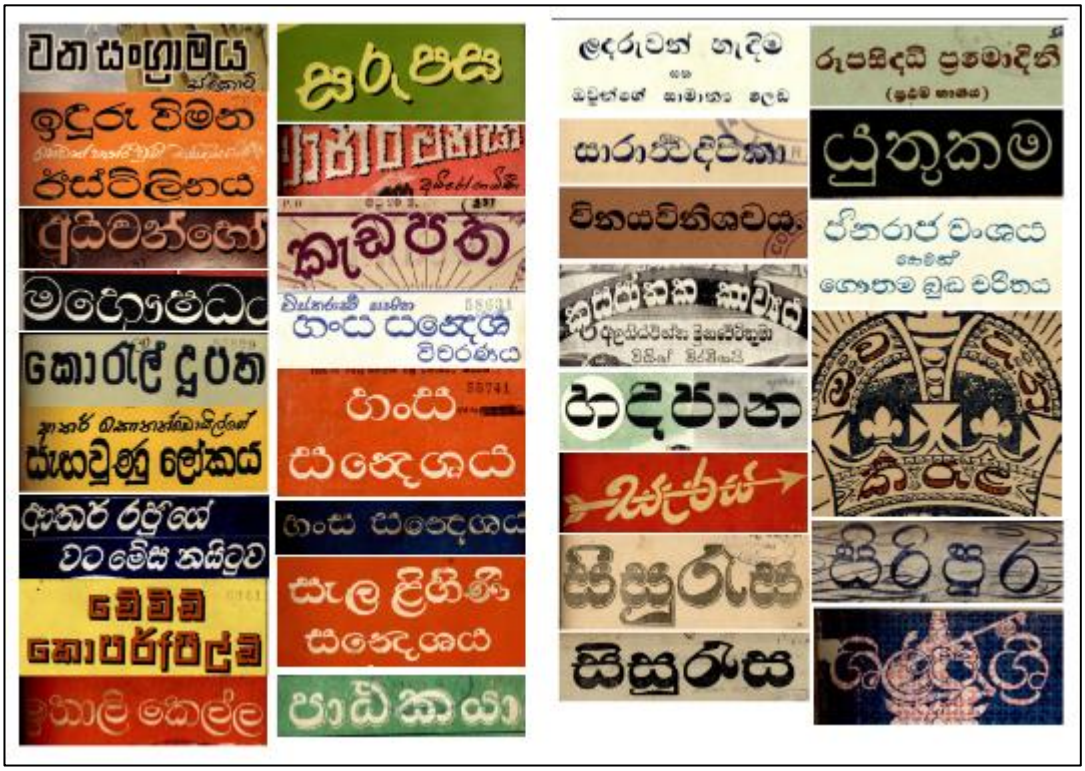


Figure 35: Titles of selected book covers

It was requested from participants to mention the rational and the logic in identified visual variations that they have considered in each classification. They were given the freedom of classifying them based on their own logic, interpretations and observations. The outcome was taken into a tree diagram. The outcome was independently evaluated by the researcher.

Observations

The experiment took around 4 -5 hours, there were discussions with agreed and disagreed points among participants. The sample size was large and participants were trying to classify individual samples and create groups. Several categories were easily identified, as they had clear differences from the rest. Participants were struggling with some samples as they first categorized them to huge chunks based on a common feature. Then they tried to identify sub categories using a top down method.

Participants could easily classify the samples such as the titles with larger x-heights, square/rounded square shaped bowls, illustration based typefaces. But they took more time and effort in classifying tiles with body text typefaces. When drafting the tree diagrams based on their classifications, participants were asked to explain the key observation point that they considered in classifying each sample. Thai is also recorded along with the diagrams.

Figure 36: Conducting the pilot study

Outcome

Participants could identify and classify the samples into 6 main categories. They were based on the visual effects, structure and the look and feel of each title.

1. Category 1 - Decorative, Embellishments on flesh, Well crafted
2. Category 2 - Illustration-based, Pictorial, Drawings alongside the anatomy
3. Category 3 - Expressive, Artistic, Based on the type personality, hand and proportion, Not very consistent, Medium legibility
4. Category 4 - Looks like more of a text font , slightly embellished
5. Category 5 - Square shape letters
6. Category 6 - No decorations or embellishments, Plain fonts

Category 1

Key observation of this category was the flesh of each typeface. The crafty, decorative elements and embellishments on the flesh were identified.

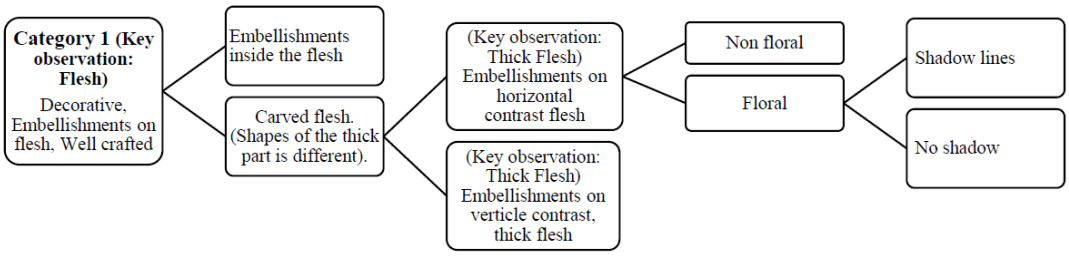


Figure 37: Category 1 from Pilot study

Category 2

Key observation of this category was the anatomy and shape of the letter. Anatomy of each typeface were illustration-based, pictorial and there were drawings alongside the anatomy. There was no room to classify this category into subcategories.

Category 3

Key observation of this category was the overall look and feel of each typeface. They had expressive and artistic qualities which were based on the type personality. It was explained as the handmade quality and playing around with the proportion of letters. Typefaces were not very consistent and most of them had a medium legibility.

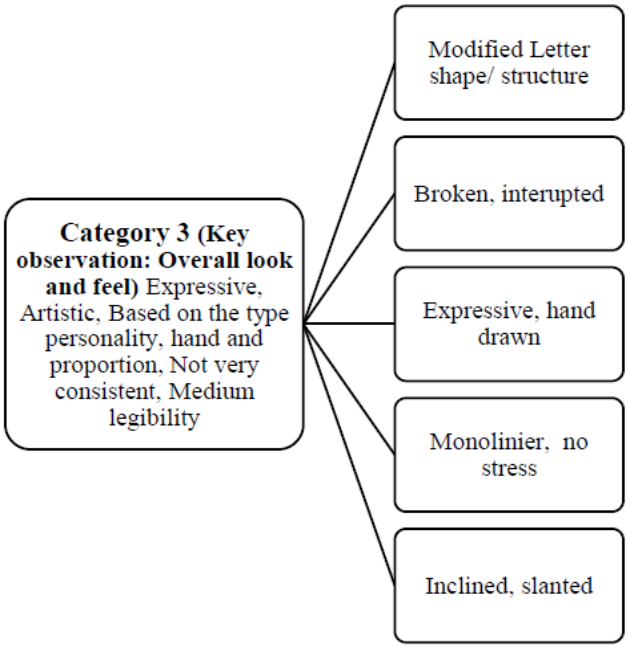


Figure 38: Category 3 from pilot study

Category 4

This category was classified with the key observation of the anatomy, legibility of the typeface. These titles look like more of a text font, with a slight embellishment. Then this category was divided to various subcategories based on the anatomy of the typefaces.

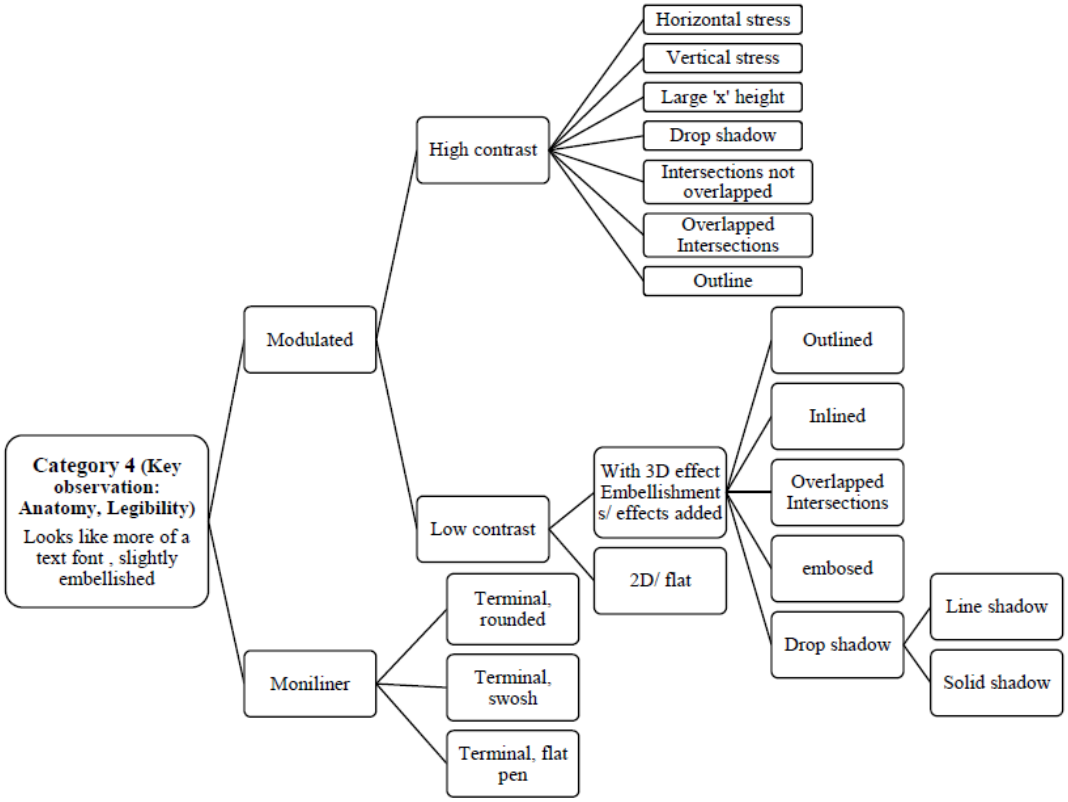


Figure 39: : Category 4 from pilot study

Category 5

This category was based on letter shape as the key observation. It consists of square shape letters that could be found in the samples.

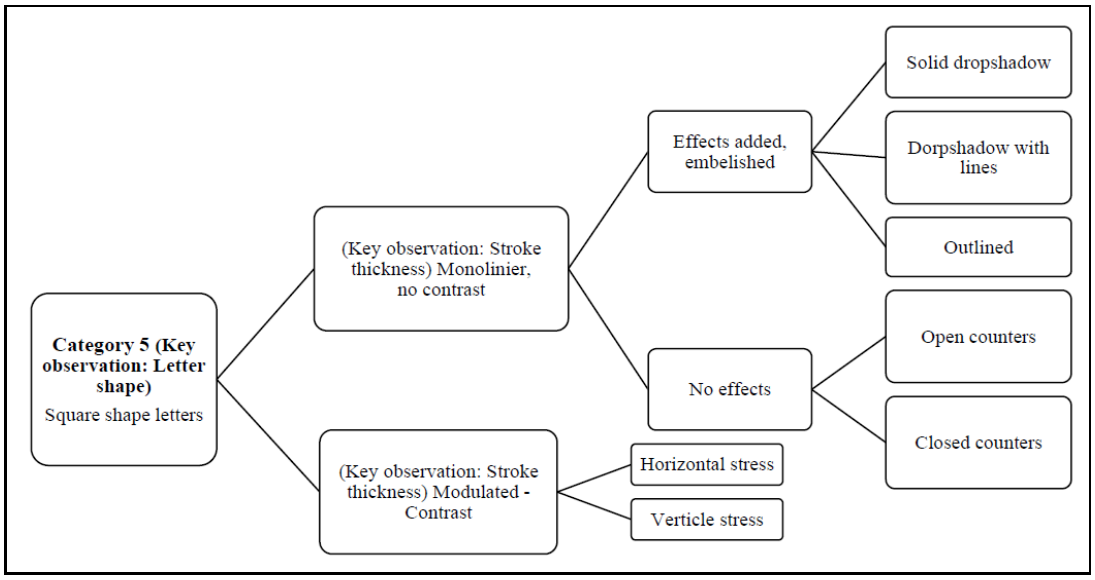


Figure 40: : Category 5 from pilot study

Category 6

This category was based on the overall letterform as the key observation. These are mostly plain text (body text) with no decorations or embellishments.

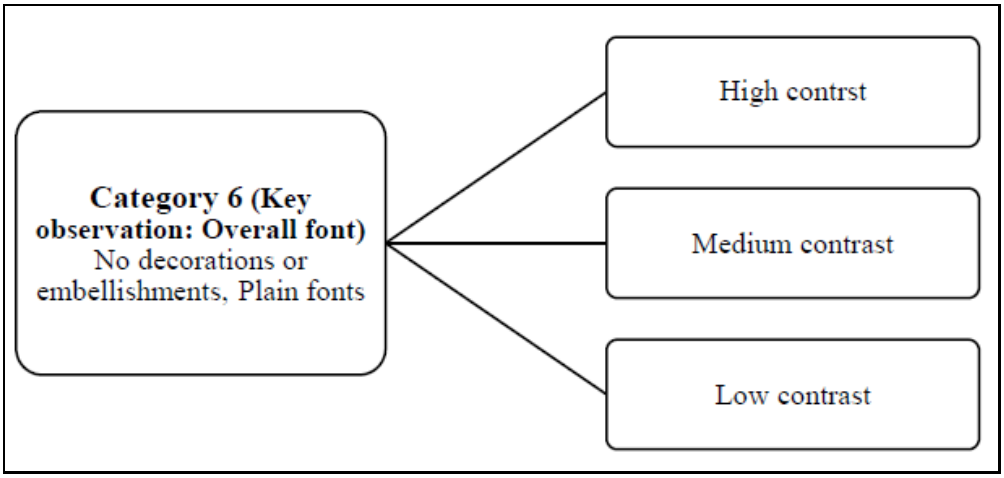


Figure 41: : Category 6 from pilot study

Conclusion of the pilot study

Finally we concluded the study with a list of identified categories and subcategories. This we take into our main study; content analysis as variables. Since they have noted

down the rationales in their own set of terminology while constructing the tree diagrams, we oversee the process and introduced some standard terminologies for the categories.

Observation	Category	Subcategory
Flesh	Flesh	Embellishments inside the flesh
		Carved flesh. (The shape of the thick part is different.)
Flesh	Embellishment	Floral embellishments
		Non-floral embellishments
		Embossed effect
		No embellishments
Shadow effect of the letter	Drop shadow	Solid shadow
		Line shadow
		No shadow
Overall look and feel. The expressive, artistic quality of titles.	Proportion and structure	Modified Letter shapes/ structure
		Broken, interrupted
		Expressive, hand drawn
		Monolinier, no stress
		Inclined, slanted
Anatomy of the letter. Thick and thin areas of the letter.	Stress	Horizontal stress
		Vertical stress
		No stress
lines within the anatomy	line effect	Outlined
		Inlined
Anatomy of the letter	X height	Large x height
Letter joinery	Intersections	Overlapped

		Non-overlapped
Anatomy of the letter. No contrast between thick and thin areas.	Terminals	Rounded terminal
		Flat pen terminal
		Swash terminal
Empty and white space inside letters	Counter space	Open counters
		Closed counters
Stroke	Stroke	Modulated
		Monolinier
Anatomy of the letter. Looks like more of a text font. Thick and thin areas of the letter.	Contrast	High contrast
		Medium contrast
		Low contrast
		No contrast
Overall letter with background	Dimension effect	2D effect
		3D effect

Table 8: List of variables from pilot study

4.5. Content Analysis

Prepare the data.

Before the content analysis begins the data needs to be transformed into observable units. Therefore we prepared all the book cover titles in .JPG format as images and organized them into a folder where we can open one by one using an image viewer.

Define the unit of analysis.

Defining the basic unit of text is important. In content analysis, "text" generally refers to any type of communication material that is being analyzed. In this case book cover titles. We defined the book title as the basic unit of coding. A book's title is the name or heading of the book, which appears on the cover which provides readers about what to expect from the book. To take in a coding scheme we gave a specific code to each image by labelling them.

Figure 42: Book titles (texts)

Figure 43: Labelling

According to the given code in this label "937-14", Number 937 represents the publishing year which is 1937. Number 14 represents the book number. Which means 14th book from the year 1937.

Develop variables and a coding system

In this phrase first we define a set of variables and values which is also termed as categories and sub-categories. These variables can be derived primarily from three sources and since we are using direct content analysis we can also add more variables as analysis proceeds. The variables derive from two sources as theories, previous related studies and data. According to that, we defined a set of variables through literature in the third chapter. This is done by examining previous classification schemes and literature related to the display typefaces. Furthermore we used the outcome of the pilot study to define the variable through literature. As a result we concluded a set of mutually exclusive variables and values for the content analysis as below. There are 17 different variables and 76 values under that.

Variable	Values
"x" Height/ "pa" Height	Average
	Small
	Large/ Increased
Axis	None
	Horizontal

	Vertical
	Left inclined
	Right inclined
	Curvature based/ Random
Contrast	None
	Low
	Medium
	High
Stroke transition/ Stress	None
	Gradual
	Rapid
	Instant
Inclination/ Italic	None
	Left inclined
	Right inclined
Stroke modulation	None/ Monolinier
	Modulated
Terminals	Flat
	Swash
	Filled /Ball
	Rounded
Counters	Open
	Closed
	* Combination
Intersections	Overlapped
	Non overlapped
	* Not enough data
	* Broken

	* Mix
Curves/Bowls	Circular
	Rounded square
	Square
	Oval
	* Triangular
Eye	Open
	Filled
	Omitted
Ligatures	None
	Contextual
Overall Proportion	Condensed
	Regular
	Expanded
Flesh structure/ construct	Solid/ rigid build
	Distorted
	Broken/ interrupted
	Interlocked
	Illustrated flesh
Flesh treatments	None
	Textured
	Carved
	Illustrated/ Motif based
	Outlined
	* Inline
Ambient treatments	None
	* Filled
	* Illustrated

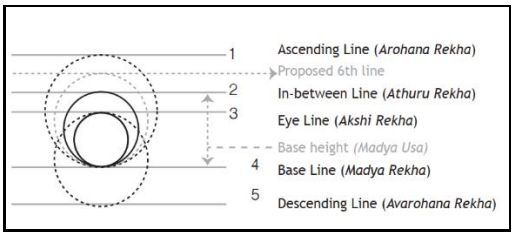
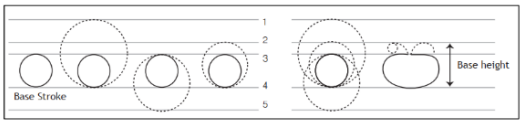
	* Textured
	Solid shadows/ light direction-up
	Solid shadows/ light direction-down
	Solid shadows/ light direction-side
	Line shadows/ light direction-up
	Line shadows/ light direction-down
	Line shadows/ light direction-side
Visual effects	None/ Body text
	Single plane/ flat/2D
	3D effect- Embossed
	Perspective
	Motion- speed
	Motion- Wavy
	Motion- Floating
	Material made/ tactile

Table 9: Final list of variables and values

Development of a coding manual

In a qualitative content analysis, assigning texts to a specific category for a large number of sample texts is a difficult process. Therefore keeping consistency during this coding process is important. In content analysis we maintain a coding manual for this. A manual for coding includes several components such as definitions of categories, subcategories and examples, rules for coding, instructions for making observations, and a section for taking notes during the coding process. Coders can refer to this manual whenever they feel lost in the sample collection and the variables when coding. This is an example of a section dedicated to a single variable in the coding manual.

Variable: "x" height/ "pa" height

Definitions and the description:	**Observation guidelines:**
• The distance between the baseline and the midline of an alphabet. Height of the lowercase x. • In Sinhala script we take the height of the letter "pa".  • Usually occupies slightly larger than half of the cap height. • Bigger x heights make fonts look larger.  Figure 4.16: Initial grid: Ascender and Descender Stroke in relation to the Base Stroke.	The relation of "pa" height to the Ascending Line/ length of ascenders and descending line/ length of the descenders. Compare the size of the "pa" height in a typeface to the height of the ascender letters. Compare the heights of other letters to get a better sense of the overall "pa" height. If the ascenders and descenders are relatively short, it indicates a larger "pa" height.

Values

Average	**Small**	**Large/ Increased**
		

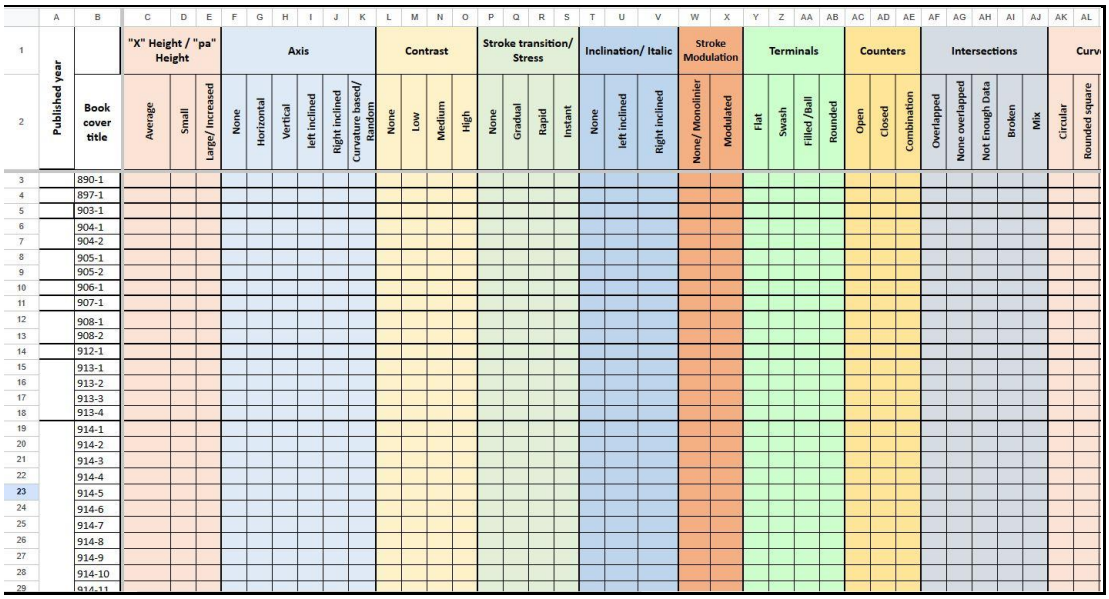
Notes:

……
……
……

Table 10: A page from coding manual

Development of a coding sheet

A coding sheet is a document or spreadsheet that lists codes or categories used for data organization in qualitative content analysis. We use this tool to systematically record visual data.



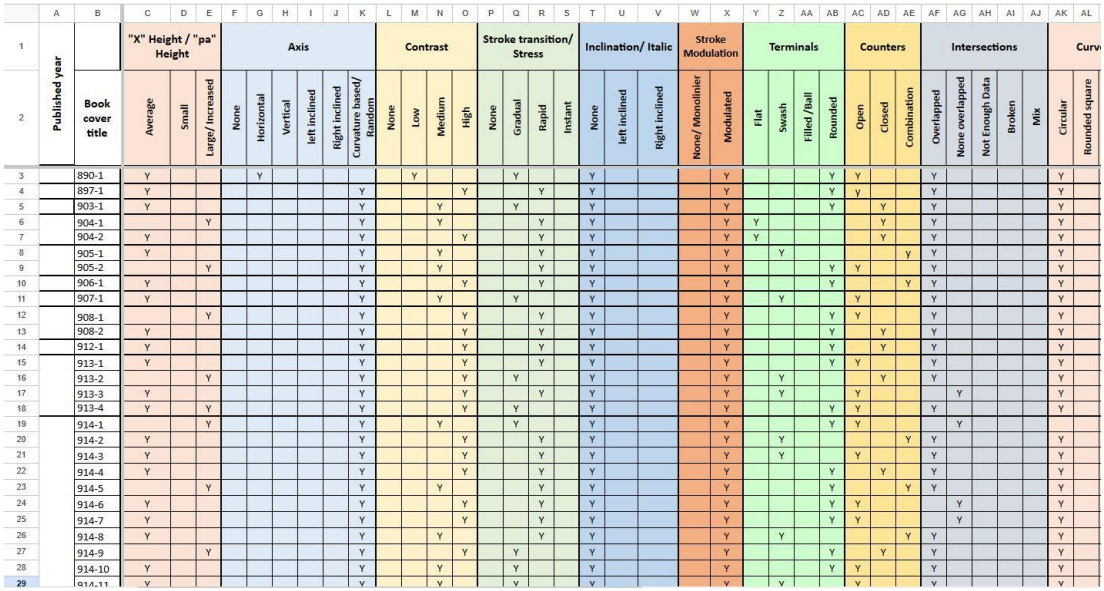
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1			"X" Height / "pa" Height			Axis						Contrast				Stroke transition/ Stress				Inclination/ Italic			Stroke Modulation		Terminals				Counters			Intersections					Curv	
2	Published year	Book cover title	Average	Small	Large/ Increased	None	Horizontal	Vertical	left inclined	Right inclined	Curvature based/ Random	None	Low	Medium	High	None	Gradual	Rapid	Instant	None	left inclined	Right inclined	None/ Monolinier	Modulated	Flat	Swash	Filled /ball	Rounded	Open	Closed	Combination	Overlapped	None overlapped	Not Enough Data	Broken	Mix	Circular	Rounded square
3		890-1																																			
4		897-1																																			
5		903-1																																			
6		904-1																																			
7		904-2																																			
8		905-1																																			
9		905-2																																			
10		906-1																																			
11		907-1																																			
12		908-1																																			
13		908-2																																			
14		912-1																																			
15		913-1																																			
16		913-2																																			
17		913-3																																			
18		913-4																																			
19		914-1																																			
20		914-2																																			
21		914-3																																			
22		914-4																																			
23		914-5																																			
24		914-6																																			
25		914-7																																			
26		914-8																																			
27		914-9																																			
28		914-10																																			
29		914-11																																			

Figure 44: Coding sheet in Excel

We used Microsoft Excel for the coding sheet due to the accessibility and researcher's/ coder's expertise with the software. We put all the variables and values into the horizontal axis and all the book titles chronologically into the vertical axis. Therefore, it was 946 rows and 76 columns in total.

Coding

This step involves assigning each book title to a specific value in each variable. Five coders were involved in the coding process. All the coders had prior knowledge of graphic design and typography. Everyone holds a bachelor's degree in design and has at least two years of industrial experience in the design field. Therefore, it was evident that coders have developed a keen eye for graphics. Each person was given a folder with chronologically arranged book cover title images with systematic labelling and an excel sheet. We assigned around 200 cover titles to each person and initiated the coding process.



	Published year	Book cover title	"X" Height / "pa" Height			Axis						Contrast				Stroke transition/ Stress				Inclination/ Italic			Stroke Modulation		Terminals				Counters			Intersections					Curv	
			Average	Small	Large/ increased	None	Horizontal	Vertical	left inclined	Right inclined	Curvature based/ Random	None	Low	Medium	High	None	Gradual	Rapid	Instant	None	left inclined	Right inclined	None/ Monolinier	Modulated	Flat	Swash	Filled /ball	Rounded	Open	Closed	Combination	Overlapped	None overlapped	Not Enough Data	Broken	Mix	Circular	Rounded square
3		890-1	Y				Y						Y				Y			Y				Y				Y			Y					Y	
4		897-1	Y								Y				Y			Y		Y				Y				Y			Y					Y	
5		903-1	Y								Y			Y			Y			Y				Y				Y			Y					Y	
6		904-1			Y						Y			Y				Y		Y				Y	Y					Y		Y				Y	
7		904-2	Y								Y				Y			Y		Y				Y	Y					Y		Y				Y	
8		905-1	Y								Y			Y				Y		Y				Y		Y					y	Y				Y	
9		905-2			Y						Y			Y				Y		Y				Y				Y	Y			Y				Y	
10		906-1	Y								Y				Y			Y		Y				Y				Y			y	Y				Y	
11		907-1	Y								Y			Y			Y			Y				Y		Y			Y			Y				Y	
12		908-1			Y						Y				Y			Y		Y				Y				Y	Y			Y				Y	
13		908-2	Y								Y				Y			Y		Y				Y				Y		Y		Y				Y	
14		912-1	Y								Y				Y			Y		Y				Y				Y		Y		Y				Y	
15		913-1	Y								Y				Y			Y		Y				Y				Y	Y			Y				Y	
16		913-2			Y						Y				Y		Y			Y				Y		Y				Y		Y				Y	
17		913-3	Y								Y				Y			Y		Y				Y		Y			Y				Y			Y	
18		913-4	Y		Y						Y				Y		Y			Y				Y				Y	Y			Y				Y	
19		914-1			Y						Y			Y			Y			Y				Y				Y	Y				Y				
20		914-2	Y								Y				Y			Y		Y				Y		Y					Y	Y				Y	
21		914-3	Y								Y				Y			Y		Y				Y		Y			Y			Y				Y	
22		914-4	Y								Y				Y			Y		Y				Y				Y		Y		Y				Y	
23		914-5			Y						Y			Y				Y		Y				Y				Y			Y	Y				Y	
24		914-6	Y								Y				Y			Y		Y				Y				Y	Y				Y			Y	
25		914-7	Y								Y				Y			Y		Y				Y				Y	Y				Y			Y	
26		914-8	Y								Y			Y				Y		Y				Y		Y					Y	Y				Y	
27		914-9			Y						Y				Y		Y			Y				Y				Y		Y		Y				Y	
28		914-10	Y								Y			Y			Y			Y				Y				Y	Y			Y				Y	
29		914-11	Y								Y			Y			Y			Y				Y		Y			Y			Y				Y	

Figure 45: Coding sheet with data

We observe that,

- Within the first quarter of the samples, the coders started doubting certain variables and started discussing and resolving between each other on variables in special cases. After that they got comfortable with the system and continued without much discussion.
- After a few hours coders were subjected to fatigue and started drifting from the true definitions of the variables. Then we revisited the coding rules through the coding manual and revised the coding.
- New codes were added by the coders when they found book covers derived from an existing set of variables. This was done by adding a new column to the same coding sheet and marking it with a star mark on the name of the variable.
- The whole coding process took around 10 hours with few intervals in between.

After all the data was coded, all sheets were compiled into a single sheet. As a result, we compiled a list of 946 systematically documented Sinhala book cover titles classified within 76 values under 17 different variables.

4.6. Conclusion

This step involves understanding the meaning of the identified categories and their properties. It explores dimensions of the categories and reconstructs the meanings derived from the data. Furthermore, it uncovers the patterns and relationships within the categories. The conclusion is subjected to the following aspects.

- Analyse the frequency of values:

One approach is to look at the frequency of each value for each variable. This can help you identify the most common typographic elements used in book cover designs.

- Interpret the data:

After conducting data analysis, we interpret the results with significant findings as a result of the analysis.

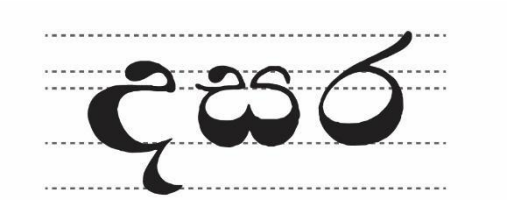
- Present the findings:

To present the findings in a way that is easy to understand and relevant we communicate our findings in tables with infographics. The table includes a clear summary of the analysis, interpretations, and conclusions.

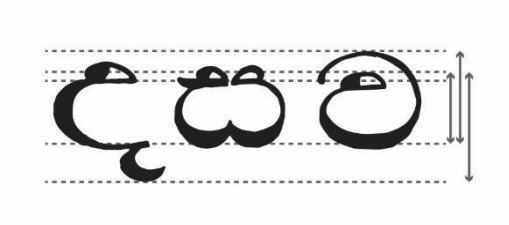
<table>
<tr><td colspan="2">x-height/ “pa” height</td></tr>
<tr><td colspan="2">Definition:

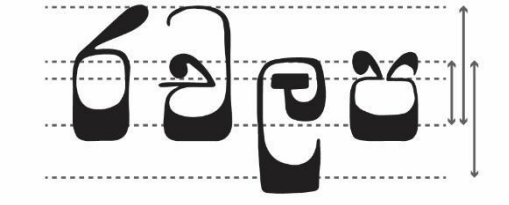
The distance between the baseline and the midline of an alphabet which is normally the approximate height of the unattended lowercase letter “x”. In Sinhala script the letter “Pa”.</td></tr>
<tr><td colspan="2">Identification:

The visual ratio of the ascenders and descenders in comparison to the x-height.</td></tr>
<tr><td>Average “pa” height

  </td><td>This is the variation which has a pa height closer to a standard pa height.

This is the most prominent variation of “pa” height. A large number of titles have this average x heights throughout the timeline.</td></tr>
<tr><td>Large “pa” height

  </td><td>Ascender and descender heights are shorter than the “pa” height and this is the second most prominent variation.</td></tr>
<tr><td>Small “pa” height

  </td><td>Ascender and descender heights are longer than the “pa” height. Rarely appear in the timeline.</td></tr>
</table>

Interpretations:

Apart from display types, book typefaces /body text are the ones which frequently have an average or standard x height. Nevertheless, we find a large number of book titles with average x height in the sample. Typically display types have large x heights. Even though designers have experimented with few small x heights in the titles, we observe lot of typefaces with large x heights.

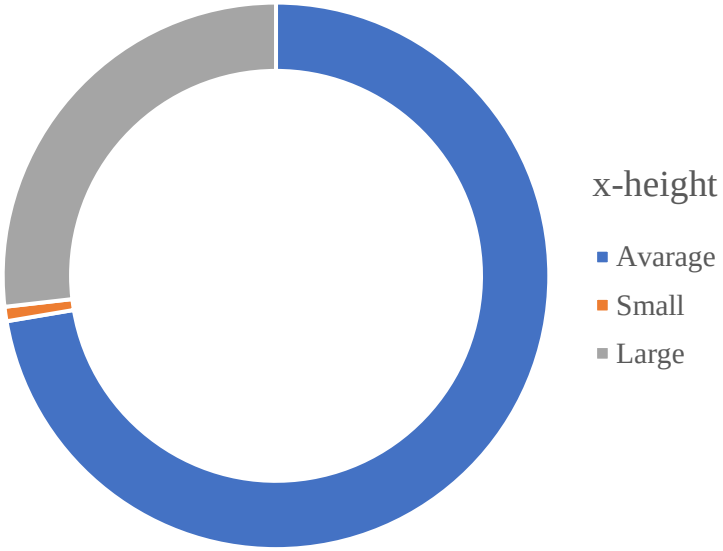
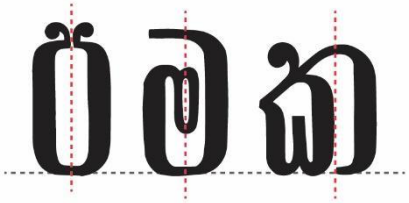
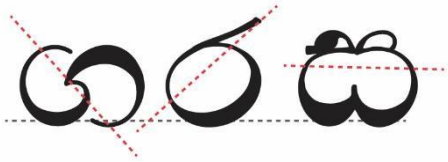


Table 11: x- height/ 'pa' height

Axis	
Definition: The direction of stroke emphasis within a letter. Letters with modulated strokes display thick and thin areas based on the angle of the writing tool used to create them.	
Identification: Thick and thin modulations of the flesh specifically along a curvature stroke.	
None 	No stroke emphasis within these typefaces. Third most prominent variation out of all the six variations. Number of titles increases gradually within the timeline.
Horizontal axis 	Thick strokes are created and emphasized horizontally. This is the second most noticeable variation.
Vertical axis 	A rare variation among the typefaces of book titles. Thirteen titles found, out of all the samples.
Left inclined axis 	Exceptional variation. Only one typeface was found. Even in that, the inclination is not very consistent within the letters.

Right inclined axis 	Very rare among the typefaces. Only four variations found.
Random / curvature based axis 	The stroke emphasis has no rules in this variation. It has a different axis for each letter. Widespread and the prominent variation.

Interpretations:

A large number of typefaces have been created with random axes. This axis depends on the shape of the curvature and its counter space maintaining a good visual balance. Consistency is lacking in the left and right inclinations of the axis.

Typefaces with no stroke emphasises (no axis) were also popular within the timeline.

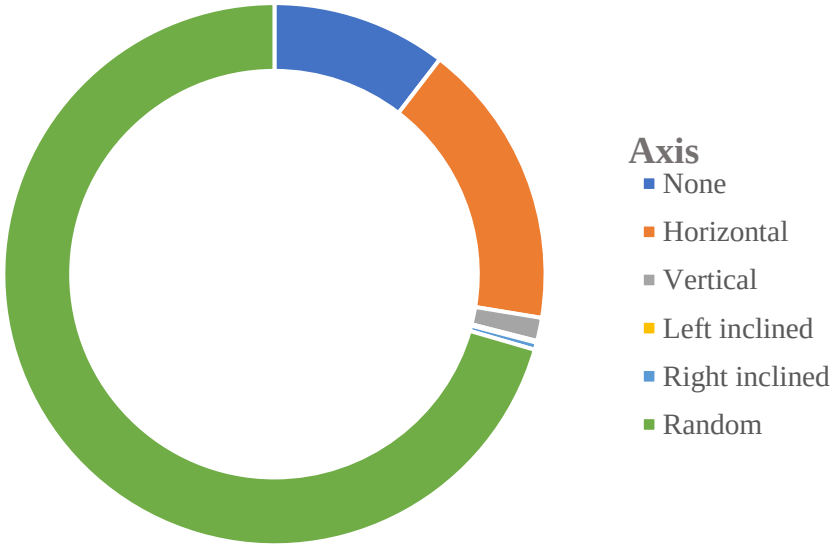
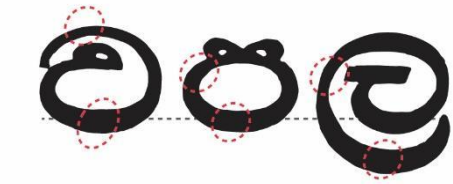
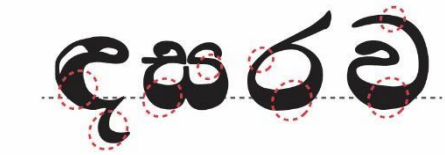
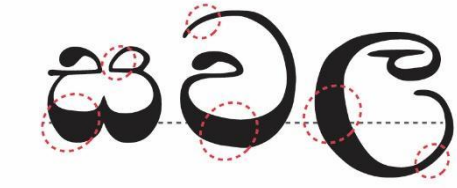


Table 12: Axis

<table>
<tr><td colspan="2">Contrast</td></tr>
<tr><td colspan="2">Definition:

The amount of variation from thick to thin within and between the strokes that form a character.</td></tr>
<tr><td colspan="2">Identification:

Ratio of the thick and thin strokes. difference between the thinnest and the thickest part of the stroke.</td></tr>
<tr><td>None
  </td><td>No thick and thin strokes. Typefaces with the same stroke thickness. least prominent contrast variation. but a considerable number of titles have this variation.</td></tr>
<tr><td>Low contrast
  </td><td>These typefaces have a slight thickness difference between thick and thin stroke.

third prominent variation among the typefaces with a contrast.</td></tr>
<tr><td>Medium contrast
  </td><td>These typefaces have more contrast than a slight contrast. but not an extreme contrast. This is the most prominent variation of all.</td></tr>
<tr><td>High contrast
  </td><td>These typefaces have an extreme stroke thickness difference. In some typefaces, the thinnest stroke is like a hairline.</td></tr>
</table>

Interpretations:

Majority of the typefaces lay around medium and high contrast. There is about 10% of typefaces with no contrast, with same stroke thickness.

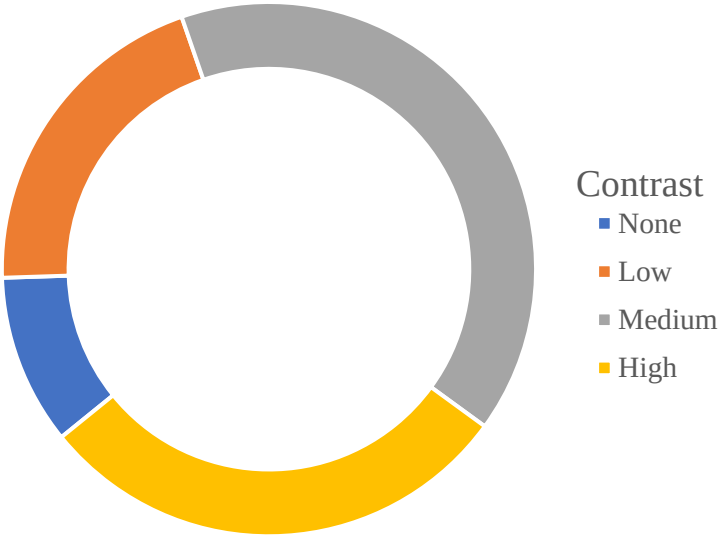
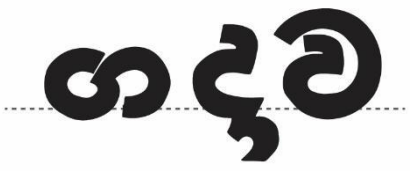
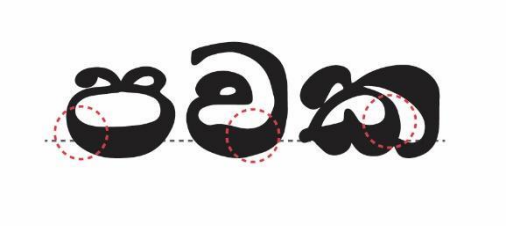
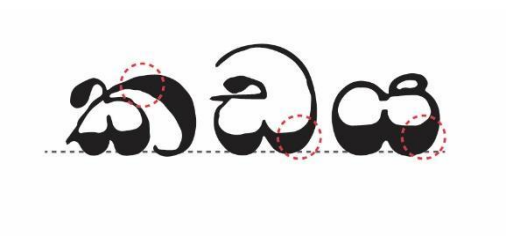
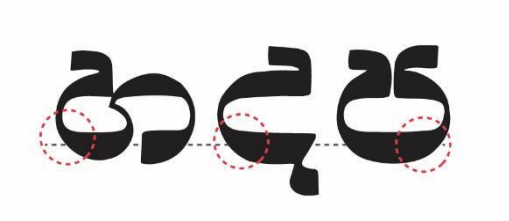


Table 13: Contrast

Stroke transition/ Stress	
Definition: Direction of a curve stroke and changes of the weight along the stroke.	
Identification: The changing behaviour of the contrast of the stroke. The stoke thickness may remain the same, may increase or decrease gradually, rapidly, or suddenly.	
None 	Stroke thickness remains the same, with no changes. This is the second least variation in the sample.

Gradual 	There is a gradual transition of the stroke thickness. This is the most prominent variation.
Rapid 	Stoke thickness is rapidly changing. This is the second most prominent variation of the stroke transition.
Instant 	Instant changes to the stroke thickness, creating high contrast in the stress. This is the least popular variation of the group.

Interpretations:

Majority of the sample contains typefaces with rapid and gradual stoke transitions.

There is a considerable amount of instant transitions that are more expressive. There is almost a similar percentage of typefaces with no stroke transition as well.

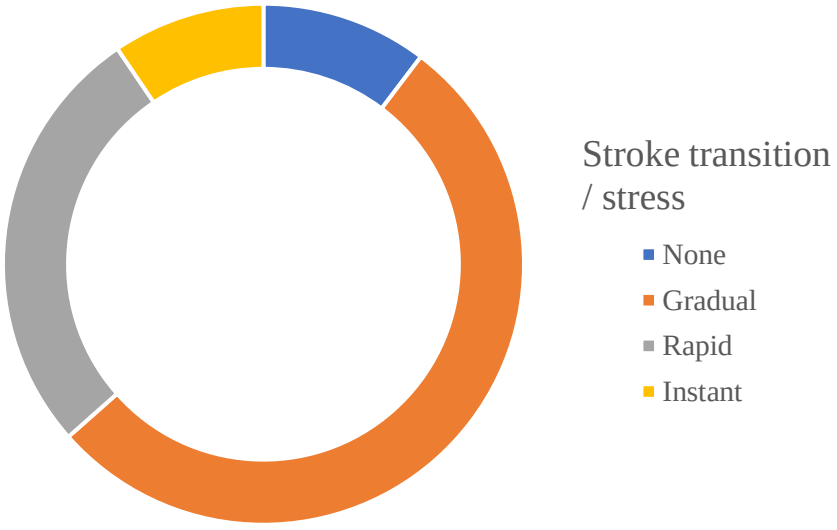


Table 14: Stroke transition/ Stress

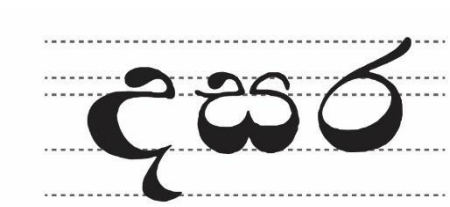
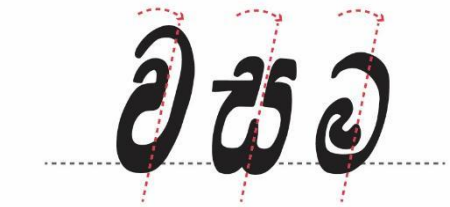
Inclination

Definition:

Degree of deviation from the vertical

Identification:

Letters are slated from their vertical line. Which means, the top of eh letter is positioned to the left or right of its bottom.

None 	This is the most prominent variation, as majority of the titles had no inclination.
Right Inclined 	There are only a few titles with right inclined letters.

Interpretations:

Inclination is a very rare practice among Sinhala type designers of the era. Nevertheless, there's a limited usage of right inclination in letterforms.

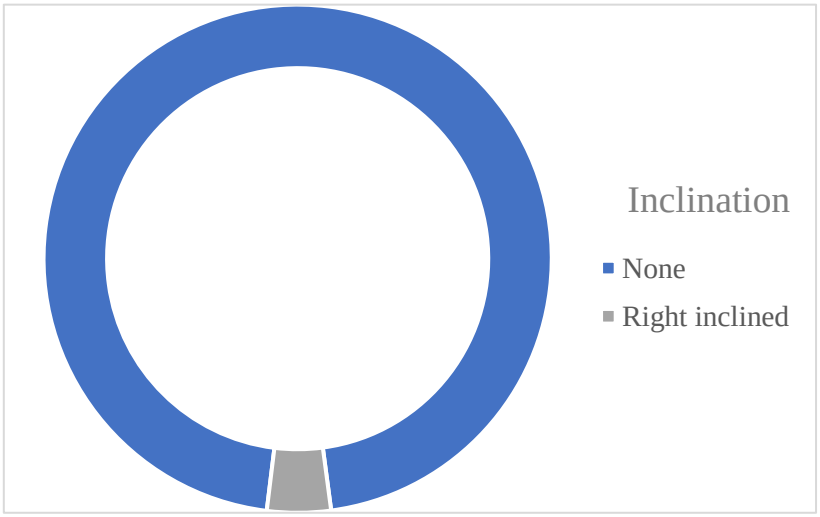


Table 15: Inclination

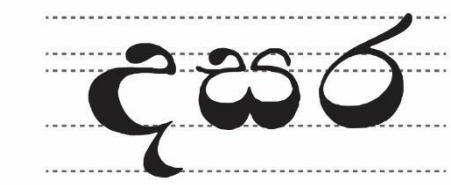
Stroke modulation

Definition:

A single mark or motion of the writing implement when applied to type or build-up lettering. In contrast we are referring to the difference between the thinnest part and thickest part of the stroke.

Identification:

Thickness of the flesh and its behaviour.

None / Monolinier 	Comparatively small, but a considerable number of typefaces are in this category.
Modulated 	This is the most prominent variation of the sample.

Interpretations:

All the typefaces with identified axis, stroke transitions, contrast differences are included in the modulated category. Monolinier typefaces are the ones with no axis, no contrast and no stroke transition. The larger number of samples remains as modulated, while a considerable number of titles has a monolinier practice.

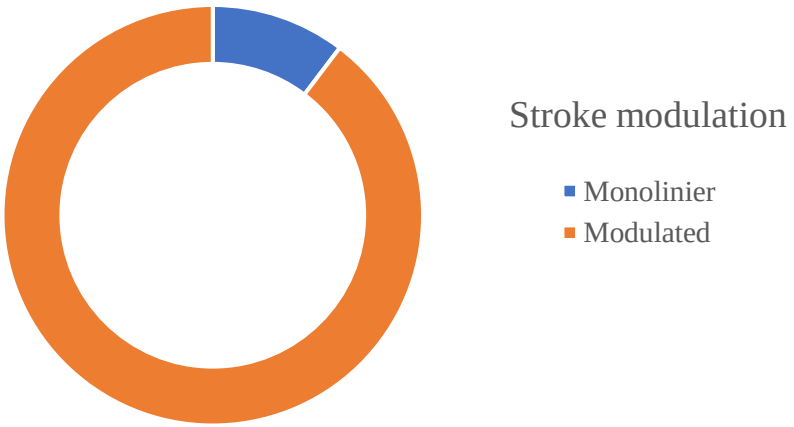
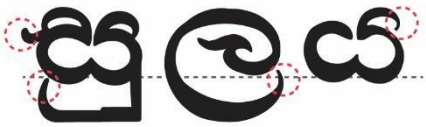


Table 16: Stroke modulation

Terminals	
Definition: The way in which the letters terminate.	
Identification: Stroke ends of the letters.	
Flat 	This is the thirds most prominent variation of the samples.
Swash 	There is a considerable amount of typefaces with swash terminals. This becomes the second most prominent variation of the samples.
Filled/ball 	This is the comparatively rare variation
Rounded 	Most prominent variation of the sample. Almost half of the total sample.

Interpretations:

Majority of the sample has typefaces with rounded terminals, while a considerable amount of typefaces with swash and flat terminals were also in the practice.

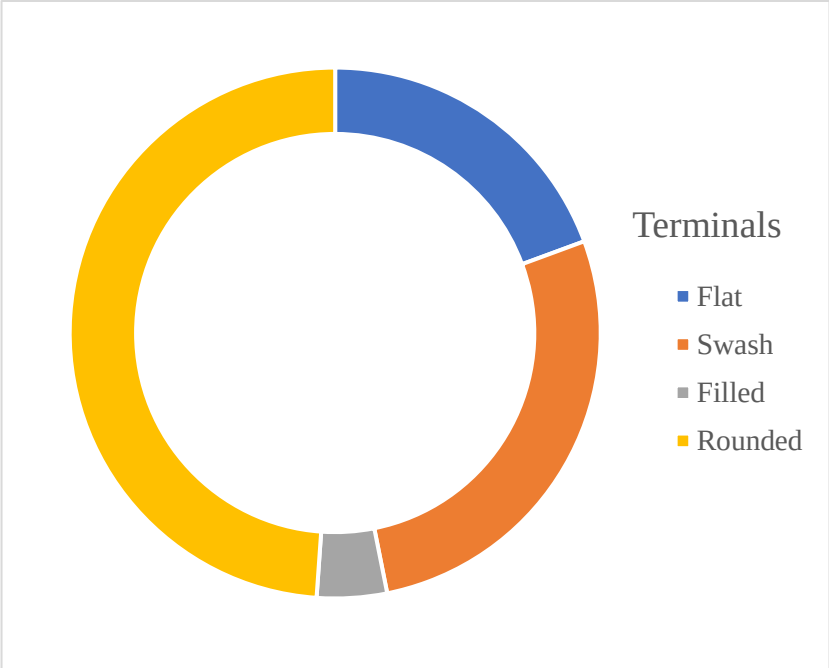
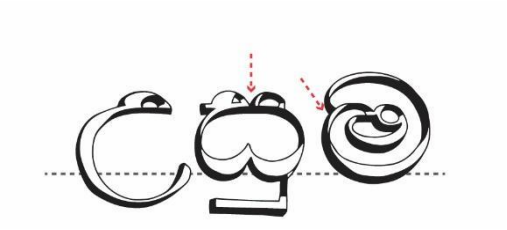
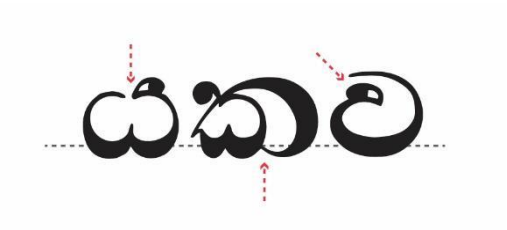


Table 17: Terminals

Counters	
Definition: A partially or fully enclosed area within a letter.	
Identification: Stroke and the negative spaces of the letter	
Open counters 	Typefaces with counters that are not fully enclosed. This is the most prominent variation.

Closed counters 	Typefaces with counters that are fully enclosed by the strokes of the typeface. There is substantial amount of typefaces with closed counters.
Combination 	The behaviour of the counter spaces is not consistent. These are not very common in the sample.

Interpretations:

Counter space is a prominent element in Sinhala typefaces. Open counters seem to be the most popular practice among type designers. There is a small amount of titles that couldn't fit either category, hence the inconsistence practice of the counter space.

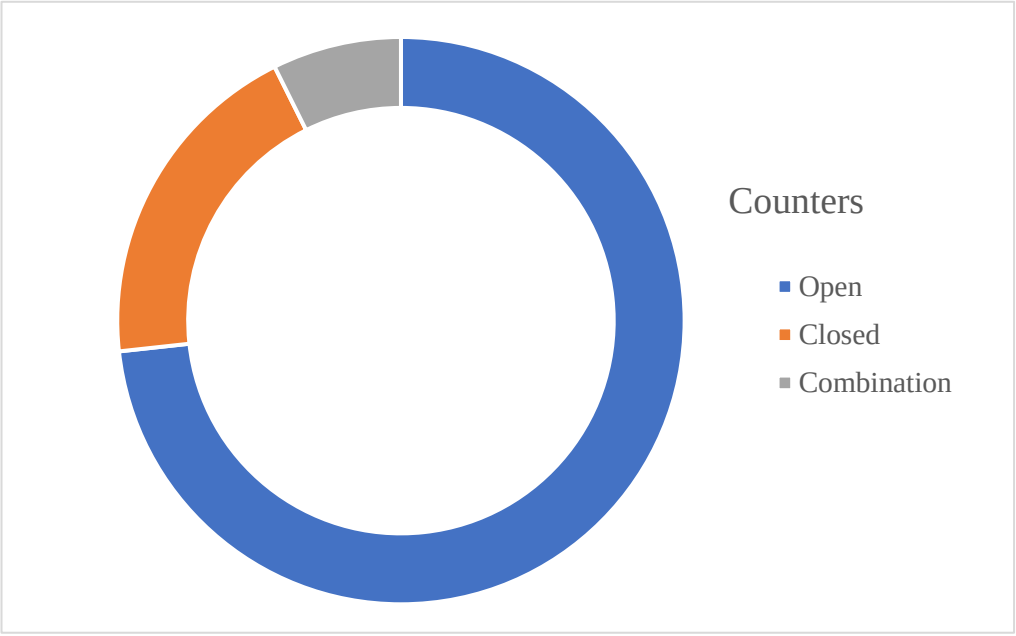


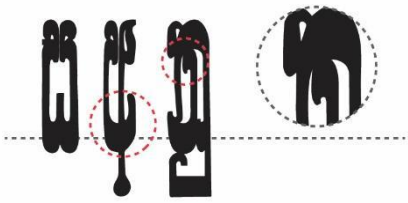
Table 18: Counters

<table>
<tr><td colspan="2">Intersections</td></tr>
<tr><td colspan="2">Definition:

The overlapping of two strokes is defined as an intersection.</td></tr>
<tr><td colspan="2">Identification: Stoke overlapping.</td></tr>
<tr><td>Overlapped

  </td><td>Two strokes are overlapping on top of each other. Two strokes on the intersection are indivisible. This is the most prominent variation.</td></tr>
<tr><td>Non- overlapped

  </td><td>The two overlapping strokes can be identified individually because one stroke is shifted from its overlap. Second prominent variation of the sample.</td></tr>
<tr><td>Broken

  </td><td>One stroke is broken from its overlap. And the other one is going through it. Not a rare variation but not very prominent.</td></tr>
<tr><td>Mixed

 
</td><td>There are several types of intersections in each letter. A rare variation.</td></tr>
<tr><td colspan="2">Interpretations:

There are three different practises derived from the default practice of the intersections. Which is non overlapped, broken and mixed. While common practice</td></tr>
</table>

remains as the default overlapped variation, letters with non-overlapped intersections takes the lead within other variations.

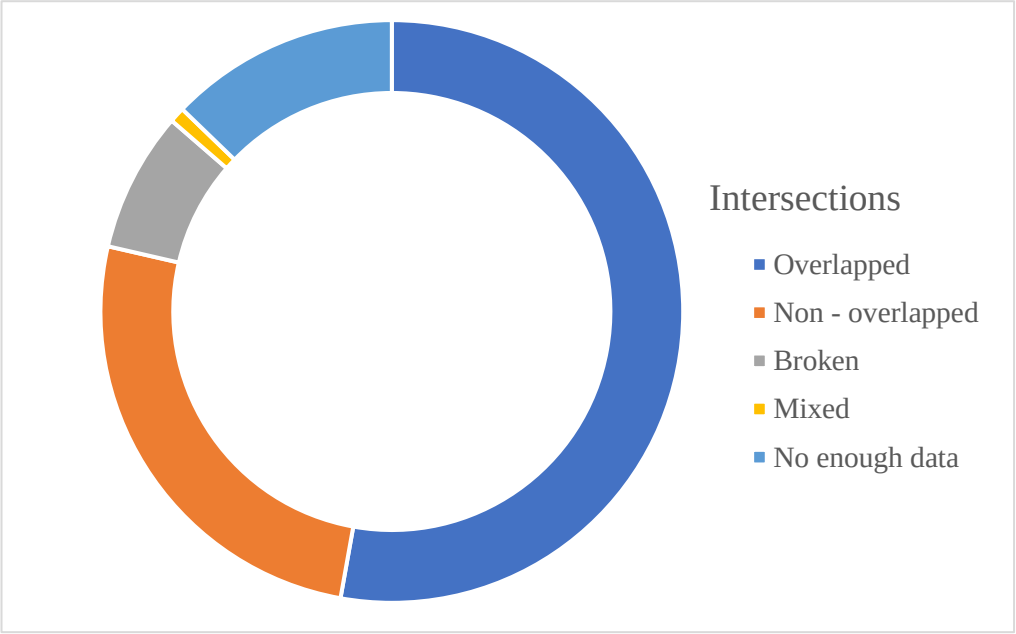
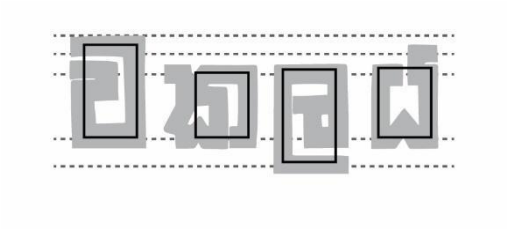
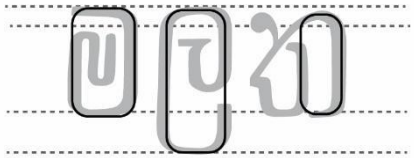
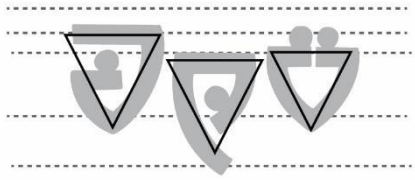


Table 19: Intersections

Curves/ Bowls	
Definition: The manner in which the curves are treated throughout the font.	
Identification: Curvature strokes of the letter	
Circular 	The curves of the letters are in a circular shape. This is the most prominent variation in the sample.

Square 	The curves of the letters are in a square shape. Apart from the triangular. This is an uncommon variation.
Rounded square 	The curves are in a square shape but with rounded corners. This is the second prominent variation and same as the oval.
Oval 	The curves are in an oval shape. As common as the rounded square version.
Triangular 	The curves are in a triangle shape. This is a very rare version.

Interpretations:

Sinhala typefaces has a circular grid and lot of circular shapes. In the sample, most of the curves are closer to its default grid shape which is circular. Nevertheless, we can see the practice of slightly derived variations from circle which is rounded square and oval variations as the second most common variations. In addition, Square and triangular shapes were also in practice. Among these using triangular shape for curve is a rare but interesting approach.

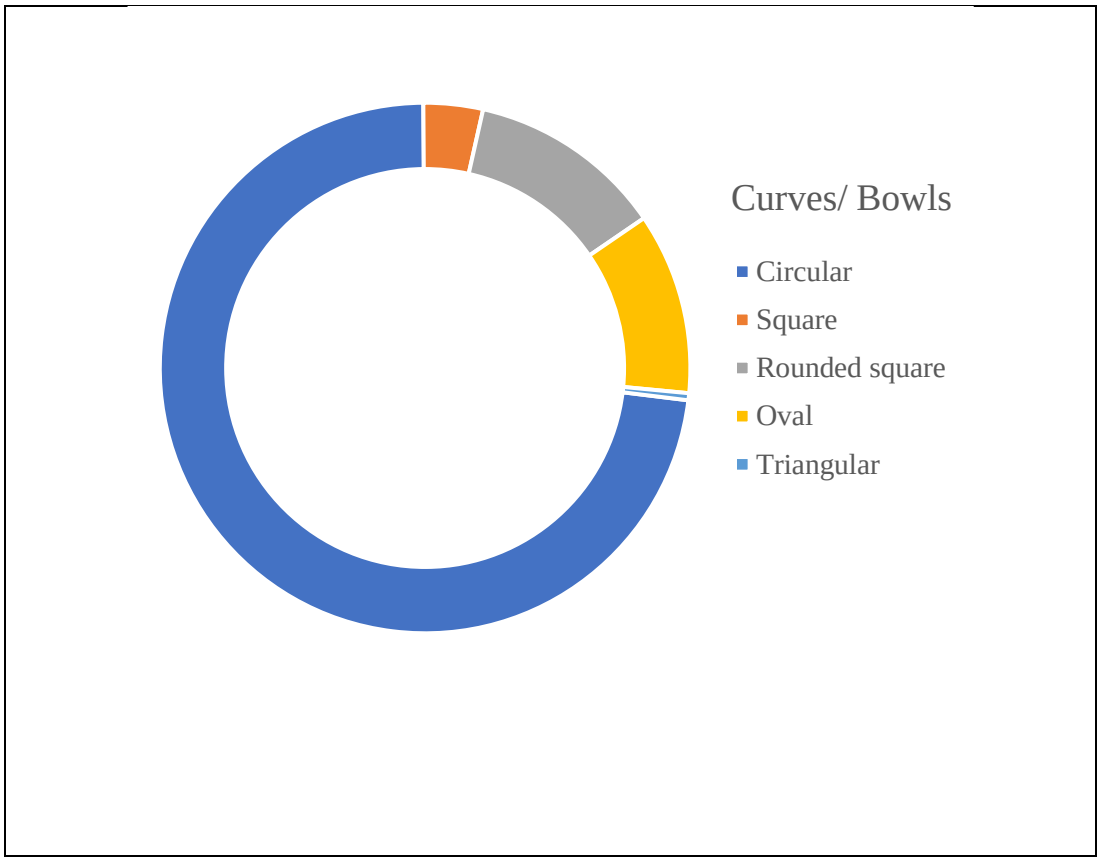
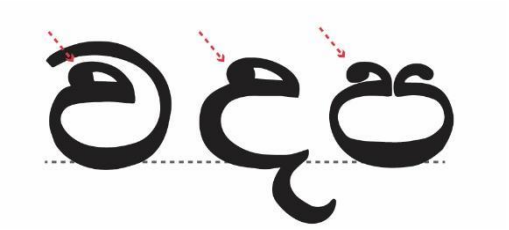
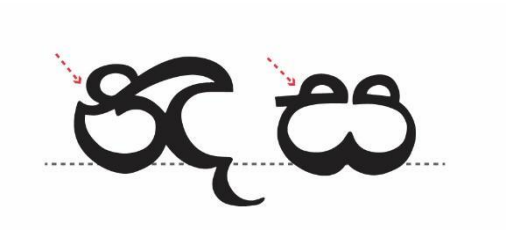


Table 20: Curves/ Bowls

Eye	
Definition: Eyeball/ an enclosed full circular stroke on the eye line.	
Identification: Eye of the letter. Stroke beginning point. Eye line	
Open eye 	Eye has a small counter space on its terminal. This is the most uncommon variation.

Filled eye 	Eye has a filled circle on its terminal. This is the most common variation.
Omitted 	Eye doesn't have any treatment on its terminal. This is the second most prominent variation.

Interpretations:

Use of filled eye is very common as a practice while omitted eye remain as a comparatively uncommon practice within the letters. The most anatomically accurate and the default practice in writing which is the open eye remains as a rare practice in the sample.

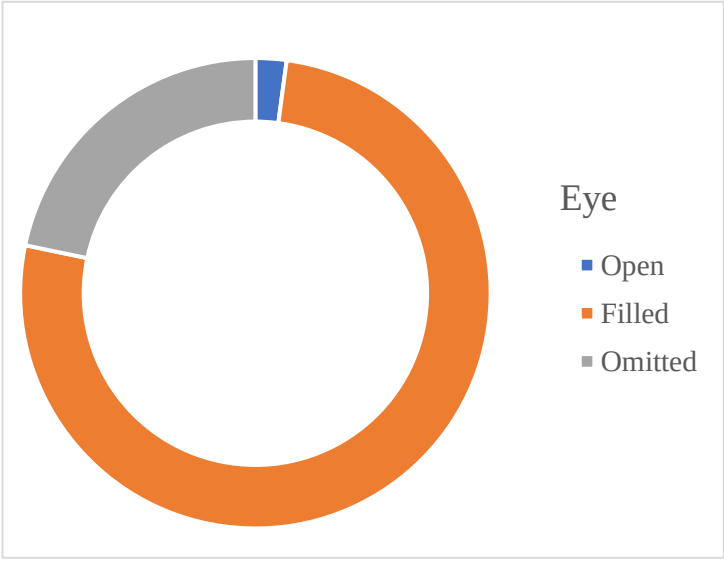


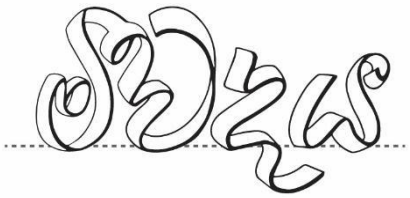
Table 21: Eye

<table>
<tr><td colspan="2">Ligatures</td></tr>
<tr><td colspan="2">Definition:

Two or more letters tied into a single character.</td></tr>
<tr><td colspan="2">Identification:

Combined letterforms, a letter combined into another with an extended stroke.</td></tr>
<tr><td>Standard

  </td><td>Sinhala letters have combined letterforms in default. This is not for the aesthetical purpose but as a way of writing. The prominent variation among the typefaces with ligatures.</td></tr>
<tr><td>Contextual

  </td><td>Letters are connected with each other combining stroke ends of each letter for aesthetical purposes. Use of these type of variations are relatively uncommon but there is a considerable amount of titles from this variation.</td></tr>
<tr><td colspan="2">Interpretations:

Use of ligatures is evident within Sinhala letterforms even if it is not a very common practice.

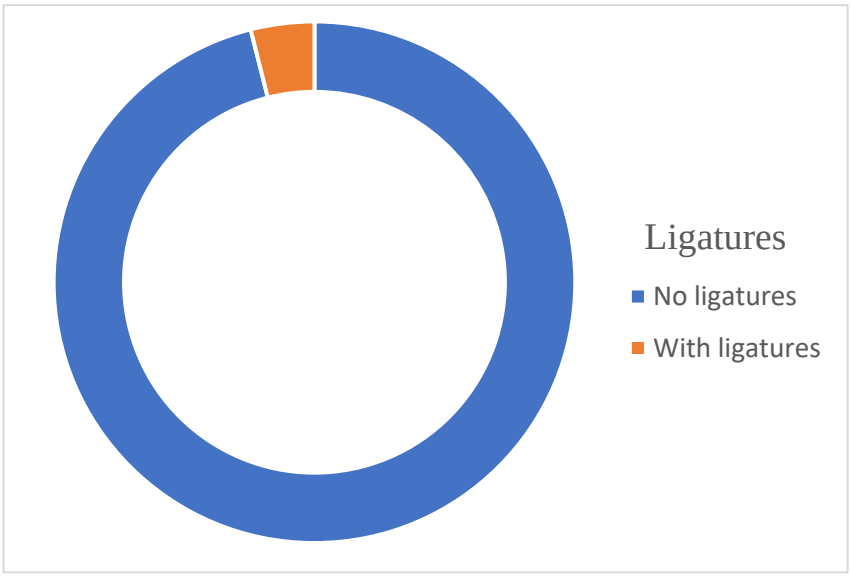
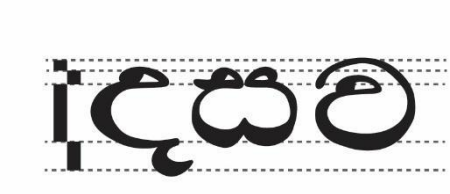
 
</td></tr>
</table>

Table 22: Ligatures

Overall proportion	
Definition: Vertical and horizontal proportions, ratio of the “pa” height and the ascender/ descender heights.	
Identification: “pa” height, ascender, and descender heights, middle line of the flesh and five lines of Sinhala letters.	
Condensed 	Letter looks stretched vertically. In this variation, letters have a narrow width. This variation is a bit common than the expanded variation.
Regular 	This is the usual proportionate letter variation. We find this variation as the prominent variation.
Expanded 	Opposite of the condensed variation. Letter looks stretched horizontally.
Interpretations: While most typefaces remain in its regular proportions, condensed, and expanded versions also being tested. Specially we see a relatively common practice in condensed variation.	

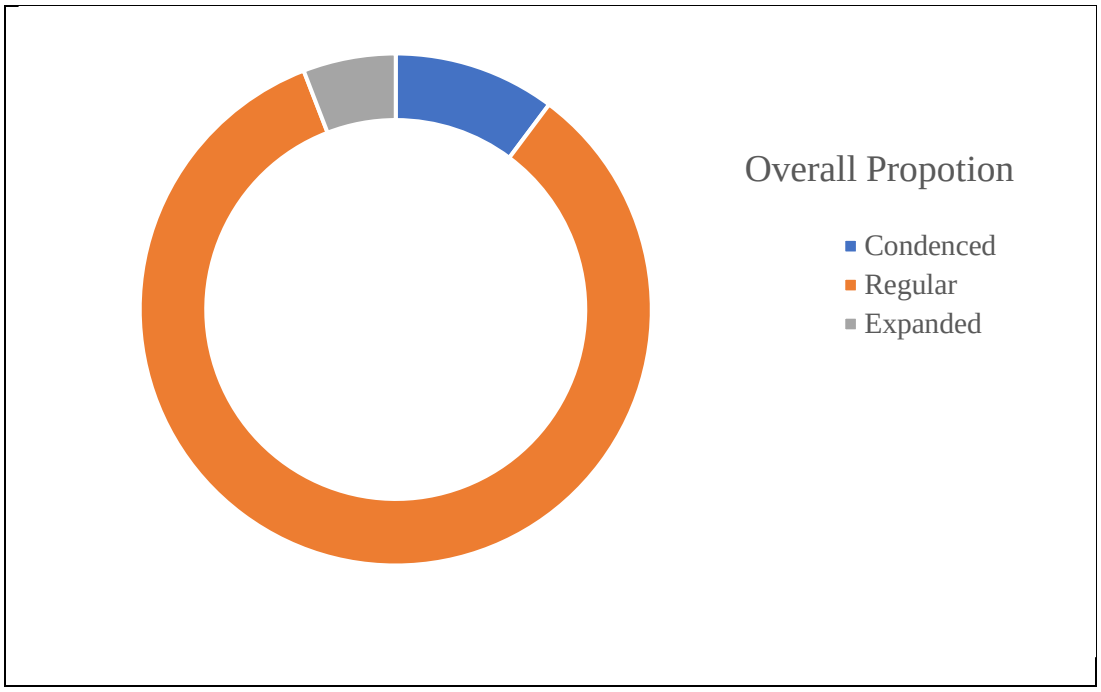
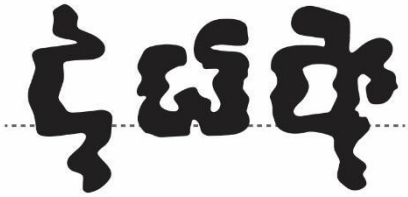
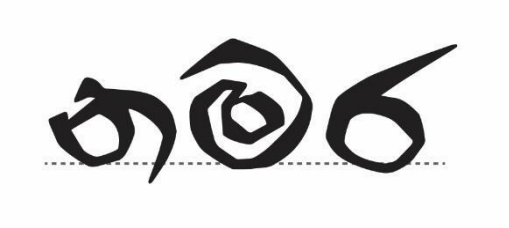


Table 23: Overall proportion

Flesh structure	
Definition: The appearance of the exterior boundaries of the stroke.	
Identification: Shape of the flesh along with the anatomical structure of the letter. Structural articulations of the letter.	
Solid 	Flesh has solid, uninterrupted boundaries and smooth continuity. This is the most prominent variation.
Distorted 	Flesh has distorted boundaries.

Broken/interrupted 	Flow of the flesh is interrupted by broken down or irregular formations of the stroke. Second most common variation.
Illustrated flesh 	Flesh is constructed out of an illustration.

Interpretations:

The practice of flesh structure and the construction of the letters are solid constructs within the titles. Nevertheless, attempts have been made to create typefaces with broken, interrupted flesh and even with illustrations.

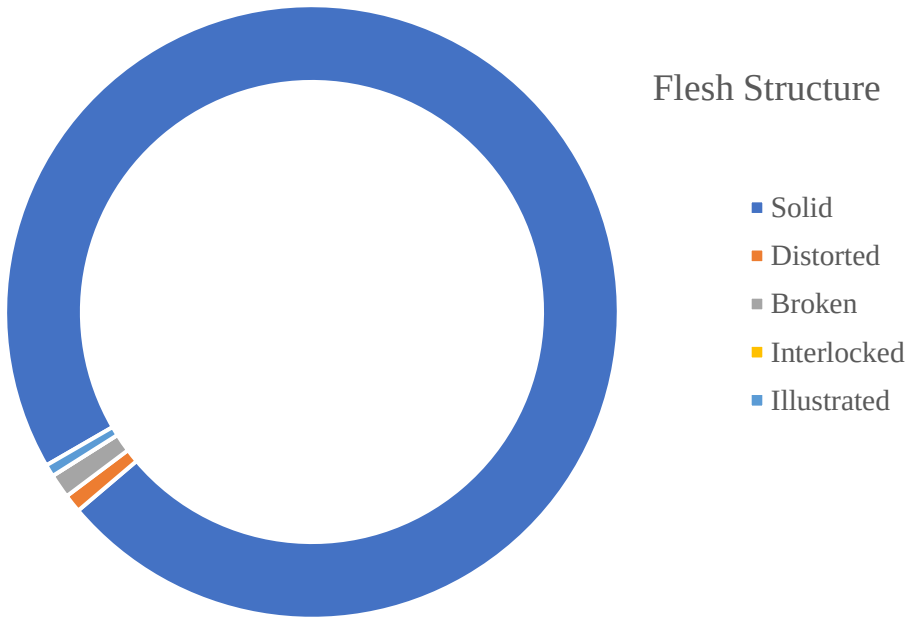
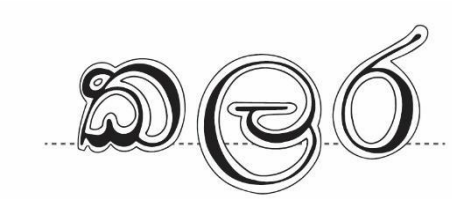


Table 24: Flesh structure

Flesh treatments	
Definition: Flesh is the appearance of the exterior boundaries of the stroke in a typeface. Treatments created by the additional elements applied into the flesh/ surface of the flesh.	
Identification: Surface of the flesh.	
None 	No treatments applied to the flesh. This is the most common variation.
Textured 	Textures added as an extra treatment to the flesh. Small amount of titles found same as the carved ones.
Carved 	carvings added as an extra treatment to the flesh. Small amount of titles has this.
Illustrated/motif based 	Small, illustrated motifs added to the flesh. This is the rare variation.

Inline 	A thin line added on to the flesh. This is the second most prominent variation of the titles with flesh treatments.
Outline 	A single line wraps around the flesh. This is the most prominent variation within the treated flesh.

Interpretations:

Majority of the titles has created without flesh treatments. Within treatment added titles, outline and inline are the common treatments and textured and carved takes the next place. The rare illustrated, motif base version is also an innovative and interesting practice among the titles.

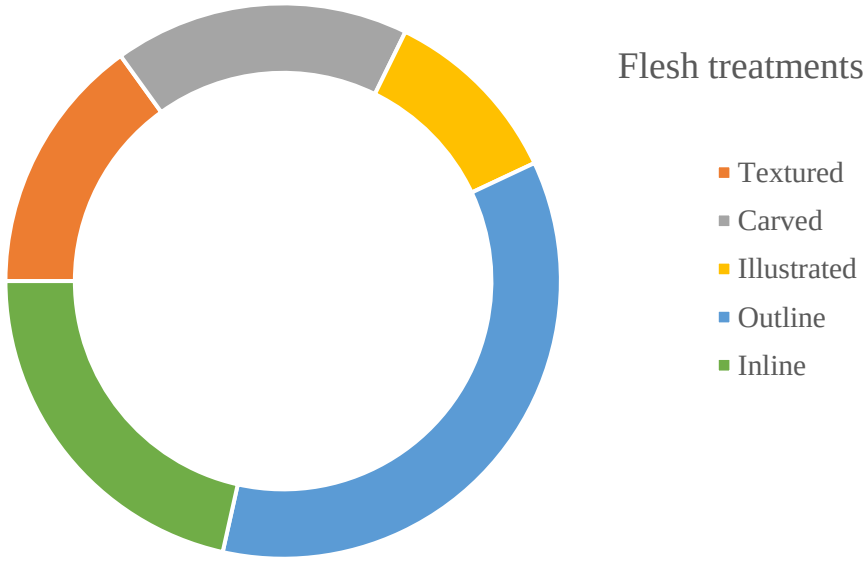
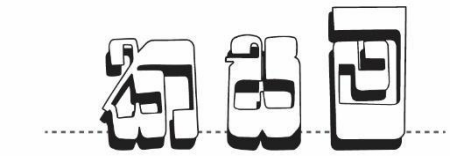
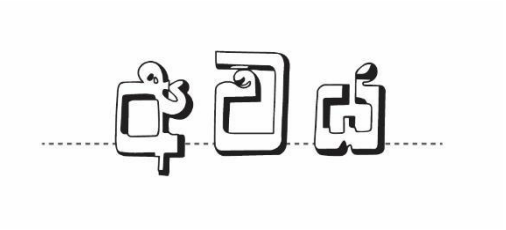
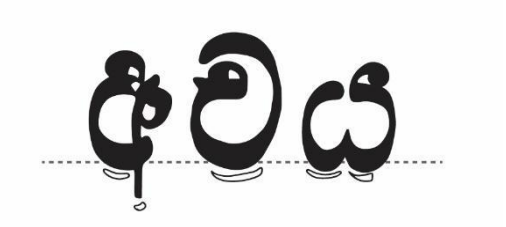
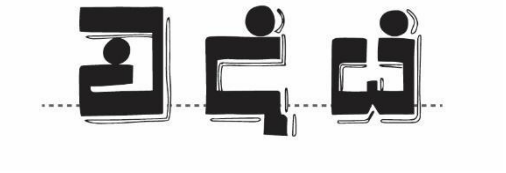


Table 25:Flesh treatments

Ambient treatments	
Definition: The treated immediate surrounding combined with the letterform including counter spaces.	
Observations: Immediate surrounding of the typeface. counter spaces.	
Filled 	The counter spaces are treated as filled spaces. A rare variation.
Illustrated 	Immediate surrounding of the typefaces treated with illustrations including counter spaces. This is also a very rare variation.
Solid shadows. light direction-up 	These are the typefaces with ambient lighting treatments. Direction of the light is coming from the above. Shadow is created as a solid shape.
Solid shadows. light direction-down 	Direction of the light is coming from the below. Shadow is created as a solid shape.

Solid shadows. light direction-side 	Direction of the light is coming from the side. Shadow is created as a solid shape.
Line shadows. light direction-up 	Direction of the light is coming from the above. Shadow is created as a solid line.
Line shadows. light direction-down	No titles found
Line shadows. light direction-side 	Direction of the light is coming from the side. Shadow is created as a solid single line.
Textured shadow 	Shadow is created with an added texture

Interpretations:

Most variations have been created with the ambient lighting, casting shadows in the opposite directions. Shadows has two different formations. One is solid and other one is a single line. Among these, typefaces with light direction comes from the above are the prominent ones. Typefaces with light direction comes from the side are the second prominent variation. Filled, textured, and illustrated ones are the rare variations but interesting practices.

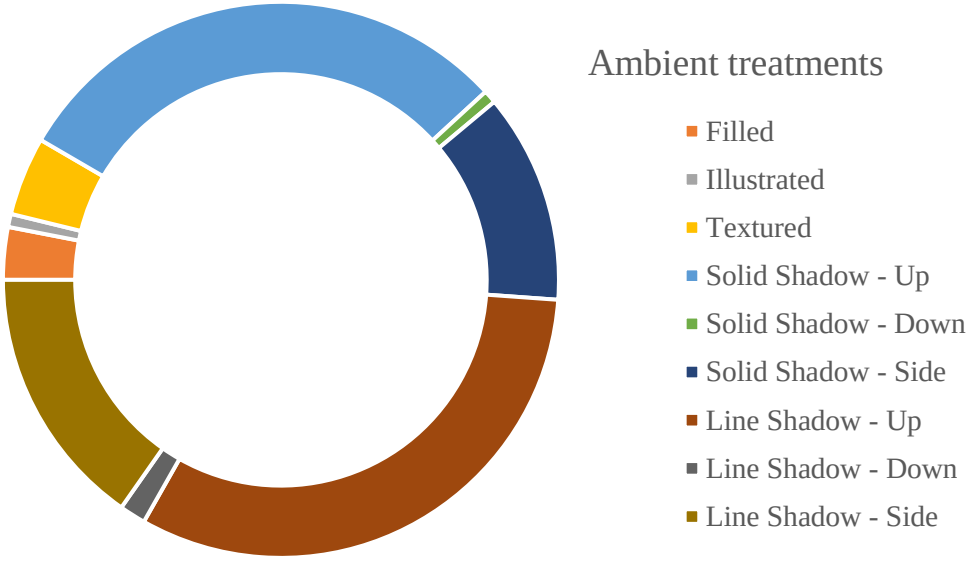
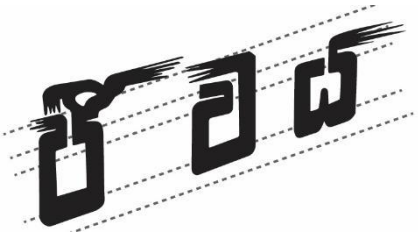
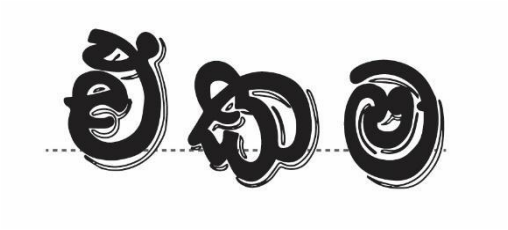
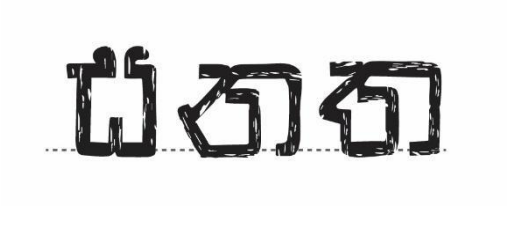


Table 26: Ambient treatments

Visual effects	
Definition: A special effect added to the typeface in order to create a particular visual impact on the typefaces' appearance.	
Observations: Type anatomy and the immediate surrounding.	
Single plane/2D/ flat 	Effects with a 2D appearance.
3D effect/ embossed 	Embosses effect with a 3D appearance
Perspective 	Letterform is aligned as a perspective
Motion - speed 	This effect has a motion impact on the letterform. In this case it is a sense of speed.

Motion - wavy 	This effect has a motion impact on the letterform. In this case it is a sense of waves.
Motion - floating 	This effect has a motion impact on the letterform. In this case it is a sense of floating.
Material made/ tactile 	Typefaces has a material finish. This is achieved by numerous techniques such as textures and shadings.

Interpretations:

Most of the titles doesn't have these effects. From the rest of the titles prominent variation is the 2D effects and next common practice is the embossed variation. Motion variations, perspectives and materials effects are rare practices.

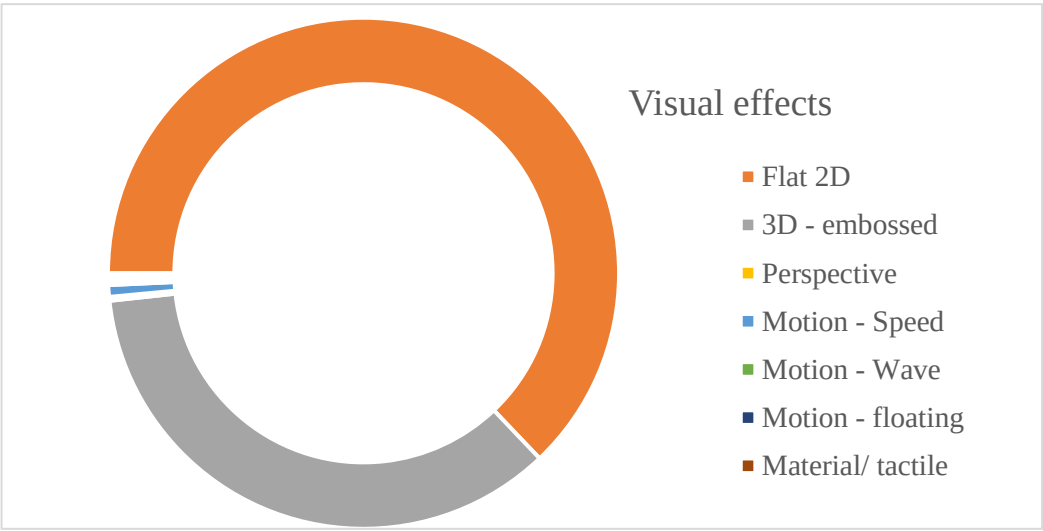


Table 27: Visual effects

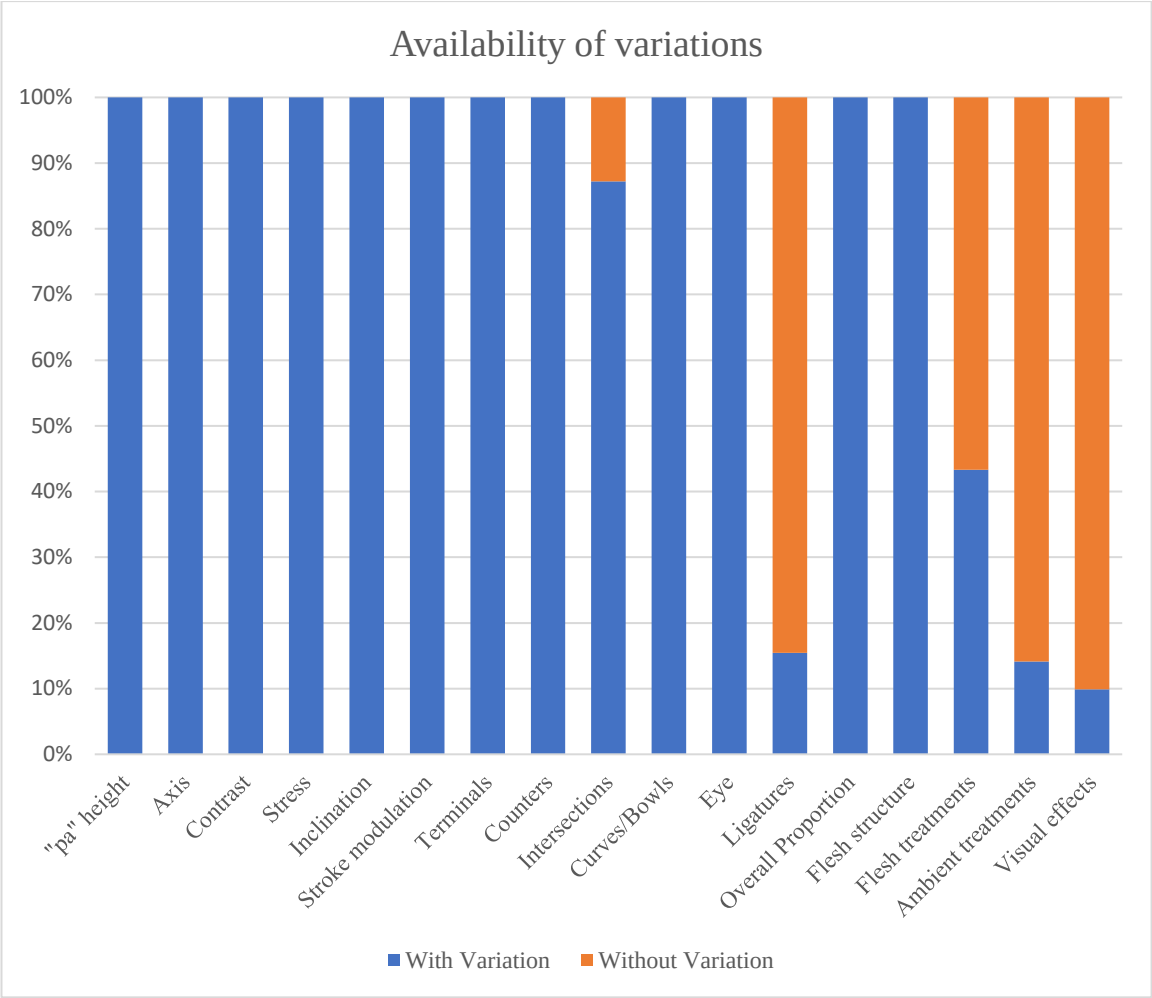


Figure 46: Availability of variations

This chart is to get an overall idea about the availability of variations compared to the total sample size. Hence some variations are not applicable for all the titles in the sample group.

5. CONCLUSION

5.1. Summary of the findings

This thesis was initiated as finding answers to specific research questions to document and expand the knowledge within Sinhala typography, particularly Sinhala display typography. Therefore we define our research gap with the focus of the study in our first research question; What is the role of historical research and primary data in establishing graphic design knowledge for typography, and why is it important to preserve and document this data for future research in Sri Lanka?.

Addressing this question first, we understood the significance of historical research in any subject domain. Furthermore, it was evident that historical research on the fields of graphic design and typography; in both Devanagari and Latin, have contributed to the substantial growth of both disciplines. Afterwards, Exploring the existing knowledge and historical research in Sinhala typography we confirmed the requirement for historical investigation and documentation in Sri Lankan typography and graphic design.

In the second part, We introduced classification as a systematic way of documenting history and highlighted the importance of primary data as a major component of it. Furthermore we introduced early Sinhala printed books; specially its cover with typography, illustrations, layouts etc. as a source of primary data. We explored Sri Lankan archival locations and identified the Colombo National Museum Library as the collection of the largest number of early printed Sinhala books. With observations and a series of interviews we confirmed the lack of preservation and conservation of early printed books in archival location and the need of documenting and classifying these historical data specifically under graphic design and typography. We addressed the question by identifying the gap of the knowledge and established the significance of this study.

Secondly, We addressed the question; What does the literature say about classification systems, book covers, book titles, display typefaces, and Sinhala typography, and how can this information be used to identify relevant variables for the main methodology, particularly in terms of how to classify historical data and what is the role of parameters in classification systems?. We began the study by outlining that variables are necessary

to document and construct a classification system. We confirmed this by observing the process, structure and formation of other classification systems.

Next we investigated the book and the significance of its cover. We presented a brief historical overview of the book in the local context and then moved towards the defining book cover and its elements. Afterwards we confirmed the significance of the title in terms of display typefaces. A literature survey has been conducted within display typography, its applications and the characteristics in Latin typography and later expanded into Devanagari as well. This study provided a basis for understanding Sinhala display typography. We gained insights into the characteristics of Sinhala display typography by surveying existing literature on Sinhala typography. We concluded this section with a list of relevant variables defined via literature.

Considering the next research question; What are the letterform variations found in early Sinhala book titles, and how can they be documented and classified using identified variables? We explored the historical research method and under that content analysis as our main analysis method. We confirmed the relevance of content analysis for studies with a large data set and the significance of this analysis method for documenting data and forming classifications. We discussed our data collecting and sampling methods for the study. Then we organized our data and proceeded with a pilot experiment in classifying letterforms based on observations. This experiment has revealed the scope of the visual variations. It confirmed the relevance of the samples towards the research questions. Then we moved to the main methodology which is the content analysis. We transformed all the data into a researchable, observable form. We identified variables for the analysis within three different sources; theories and previous related studies from the literature survey, within the sample using pilot visual survey. We identified 17 categories (variables) and 77 sub categories (values) under that. Following this framework we analyzed all the data based on observations. Finally we classified all the book cover titles into these variables. As a conclusion we understand the frequency of each value of each variable. We understand the practices of display type in early book cover titles in Sri Lanka. We conclude the research by communicating the results in a set of tables and charts with findings and interpretations.

5.2. Contribution and the future research

Even though Sri Lanka had a typography practice for many years, Sinhala typography is a relatively new subject in the country. Sinhala typography is a relatively new field of study in Sri Lanka. Therefore, constructing base knowledge for the subject is vital. Therefore, this research primarily contributes to the subject of typography and graphic design in Sri Lanka by fulfilling a crucial requirement for the subject's development: the documentation of historical data.

Systematically documenting nearly 1500 book covers as primary data and providing insight into Sinhala display typefaces, this study leads the way for a series of future investigations. Furthermore, these insights can help inform future design decisions and contribute to a deeper understanding of the role of typography in Sri Lanka. The potential future works are listed below.

- Research for patterns or relationships between variables. For example, do certain genres tend to use certain typographic elements? Are there particular color schemes or font styles that are associated with specific themes or subject matter?
- Further studies can develop a chronological timeline for graphic design in Sri Lanka by identifying design movements, exploring relationships between typography and other graphical elements..
- Research can further expand towards understanding social, cultural impact on typography, graphic design, and other elements used in book cover design.

LIST OF REFERENCES

Berg, B. L. (2001). *Qualitative research methods for the social sciences* (4th ed). Allyn and Bacon.

Brienza, C. (2011). Nicole Howard: The Book: The Life Story of a Technology. *Publishing Research Quarterly*, *27*(3), 298–299.

Carter, R., Day, B., Meggs, P. B., Maxa, S., & Sanders, M. (2015). *Typographic design: Form and communication* (6th edition). John Wiley & Sons, Inc.

Dalvi, G. (2010). *Conceptual model for Devanagari typefaces* [PhD Thesis]. Indian Institute of Technology.

Drew, N., & Sternberger, P. (2005). *By its Cover*. Princeton Archit.Press. https://doi.org/10.1007/1-56898-633-5

Fernando, P. E. E. (2008). *Origin and Development of the Sinhalese Script*. Sri Lanka National Book Development Council.

Gunawardhana, S., & Samarawickrama, S. (2020). *Analysis of historical data to determine early Sri lankan print technologies*.

Hsieh, H.-F., & Shannon, S. E. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, *15*(9), 1277–1288. https://doi.org/10.1177/1049732305276687

Jacob, E. (2004). Classification and Categorization: A Difference that Makes a Difference. *Library Trends*, *52*.

Junilla, J. (2015). *HISTORICAL RESEARCH: A QUALITATIVE RESEARCH METHOD*. https://www.academia.edu/24276932/HISTORICAL_RESEARCH_A_QUALITATIVE_RESEARCH_METHOD

Kularatne, T. (2006). *History of printing and publishing in Ceylon 1736-1912*. Sridevi printers.

Kumbhar, R. (2012). 10 - Classification: Theories, research trends and personalities. In R. Kumbhar (Ed.), *Library Classification Trends in the 21st Century* (pp. 137–141). Chandos Publishing. https://doi.org/10.1016/B978-1-84334-660-9.50010-2

Luck, S. E., Lamp, J. W., Craig, A., & Coldwell-Neilson, J. (2016). The book: Production and participation. *Library Review*, *65*(1/2), 2–19. https://doi.org/10.1108/LR-02-2015-0018

Lupton, E. (2004). *Thinking with type: A critical guide for designers, writers, editors, & students* (1st ed). Princeton Architectural Press.

Mcdowell, B. (2013). *Historical Research: A Guide*. Routledge. https://doi.org/10.4324/9781315841601

Meggs, P. B., Purvis, A. W., & Meggs, P. B. (2006). *Meggs' history of graphic design* (4th ed). J. Wiley & Sons.

Samarawickrama, S. (2016). *The Anatomy and historical Development of Sinhala Typefaces*. University of Moratuwa, Sri lanka.

Seddon, T. (2014). *20th Century Design: A Decade-by-Decade Exploration of Graphic Style*. Quid publishing.

Triggs, T. (2009). Designing Graphic Design History. *Journal of Design History*, *22*(4), 325–340.

Willen, B., & Strals, N. (2009). *Lettering & type: Creating letters and designing typefaces* (1st ed). Princeton Architectural Press.

Yampbell, C. (2005). Judging a Book By Its Cover: Publishing Trends in Young Adult Literature. *The Lion and the Unicorn*, *29*, 348–372. https://doi.org/10.1353/uni.2005.0049

BIBLIOGRAPHY

25 Systems For Classifying Typography: A Study In Naming . PDF document. (n.d.). *Documentsn.Com*. Retrieved February 16, 2022, from https://documentsn.com/document/8b57_25-systems-for-classifying-typography-a-study-in-naming.html

Albulescu, I. (2018). *The Historical Method in Educational Research*. https://www.semanticscholar.org/paper/The-Historical-Method-in-Educational-Research-Albulescu/30c9db43bd8a74f78c0c10e88875484f668204ee

Amarakoon, A. (2017). *Sri Lankan Commercial Artists of the Pre-Digital Era: A Case Study of the History of Graphic Design in Sri Lanka*. http://repository.kln.ac.lk/handle/123456789/18778

Anilkumar, P. (2014). *Historical Method of Research*. https://www.academia.edu/22583546/Historical_Method_of_Research

Anura. (2011). *Vintage posters of Ceylon* (First edition). W.L.H. Skeen & Company.

Arangala, R. (2004). *Emergence of Modern Sinhala Literature*. S. Godage and Brothers.

Arnold, D. (2002). *Reading Architectural History*. Routledge. https://doi.org/10.4324/9780203164471

Barnes, P. (n.d.). *The Story of the Guardian Typefaces 2003–2005*.

Benson, J. H., & Carey, A. G. (1950). *The Elements of Lettering.* (2nd ed.). McGraw-Hill Book Co.

Berg, B. L. (2001). *Qualitative research methods for the social sciences* (4th ed). Allyn and Bacon.

Bierut, M. (Ed.). (1999). *Looking closer. 3: Classic writings on graphic design*. Allworth Press.

Brienza, C. (2011a). Nicole Howard: The Book: The Life Story of a Technology. *Publishing Research Quarterly*, *27*(3), 298–299.

Brienza, C. (2011b). Nicole Howard: The Book: The Life Story of a Technology. *Publishing Research Quarterly - PUBL RES Q*, *27*, 298–299. https://doi.org/10.1007/s12109-011-9228-1

Bringhurst, R. (1996). *The elements of typographic style* (2nd ed). Hartley & Marks.

Bringhurst, R. (2002). *The Elements of Typographic Style.: Vol. 2.5*. Hartley and Marks.

Brown, F. Chouteau. (1921). *Letters & Lettering.* Davis Press.

Buckley, P. J. (2016). Historical Research Approaches to the Analysis of Internationalisation. *Management International Review*, *56*(6), 879–900. https://doi.org/10.1007/s11575-016-0300-0

Carr, E. H. (2002). What is history? In *Reading Architectural History*. Routledge.

Carter, H. (2002). *A View of Early Typography: Up to about 1600.* (Reprint with minor corrections and changes, with an introduction by James Mosley.). Hyphen Press.

Carter, R., Day, B., Meggs, P. B., Maxa, S., & Sanders, M. (2015). *Typographic design: Form and communication* (6th edition). John Wiley & Sons, Inc.

Changes in Letterforms Due to Technical Developments—ProQuest. (n.d.). Retrieved February 17, 2022, from https://www.proquest.com/openview/fb5960e9d85b9d836ac5ced83696d289/1?pq-origsite=gscholar&cbl=1821103

Changes in Letterforms Due to Technical—ProQuest. (n.d.). Retrieved February 17, 2022, from https://www.proquest.com/docview/1297964890?pq-origsite=gscholar&fromopenview=true

Cheng, K. (2020). *Designing type* (Second edition). Yale University Press.

childers, traylor, Griscti, J., & Leben, L. (2013). 25 Systems for Classifying Typography: A Study in Naming Frequency. *THE PARSONS INSTITUTE FOR INFORMATION MAPPING*.

Clark, H., & Brody, D. (2009). The Current State of Design History. *Journal of Design History*, *22*(4), 303–308.

Consuegra, D. (2004). *American type: Design & designers*. Allworth Press.

Dalvi, G. (2010a). *Conceptual model for Devanagari typefaces* [PhD Thesis]. Indian Institute of Technology.

Dalvi, G. (2010b). *Conceptual model for Devanagari typefaces*. Industrial Design Centre, Indian Institute of Technology ,Bombay.

De Silva, H. (1972). Printing and publishing in Ceylon. *Sri Lanka National Commission for UNESCO, Sri Lanka.*

Dean, J. (2003). Digital Imaging and Conservation: Model Guidelines. *Library Trends*, *52*, 133–137.

Di Pietro, A. (1999). A Database of typeface classification systems. *Theses*. https://scholarworks.rit.edu/theses/3847

Dilevko, J., & Gottlieb, L. (2009). The relevance of classification theory to textual analysis. *Library & Information Science Research*, *31*(2), 92–100. https://doi.org/10.1016/j.lisr.2009.01.001

Disanayaka, J. B. (2006). *Sinhala Graphology*. Sumathi Publications.

Diulio, M. de la P., Mercader-Moyano, P., & Gómez, A. F. (2019). The influence of the envelope in the preventive conservation of books and paper records. Case study: Libraries and archives in La Plata, Argentina. *Energy and Buildings*, *183*, 727–738. https://doi.org/10.1016/j.enbuild.2018.11.048

Drew, N., & Sternberger, P. (2005). *By its Cover*. Princeton Archit.Press. https://doi.org/10.1007/1-56898-633-5

Drucker, J. (1995). *The alphabetic labyrinth: The letters in history and imagination*. Thames and Hudson.

Eisenstein, E. L. (1982). *The Printing Press as an Agent of Change: Communications and Cultural Trans*. Cambridge University Press.

Elena, T., Katifori, A., Vassilakis, C., Lepouras, G., & Halatsis, C. (2010). Historical research in archives: User methodology and supporting tools. *International Journal on Digital Libraries*, *11*(1), 25–36. https://doi.org/10.1007/s00799-010-0062-4

Fernando, P. E. E. (2008). *Origin and Development of the Sinhalese Script*. Sri Lanka National Book Development Council.

Fitzmaurice, S. M., & Taavitsainen, I. (Eds.). (2007). *Methods in historical pragmatics*. Mouton de Gruyter.

Franz, M. (2021, April 19). *Vox Classification | PDF | Sans Serif | Serif*. Scribd. https://www.scribd.com/document/90113265/Vox-Classification

Froese, M. D. (2011). *Historical Research Methods in the Social Sciences: Critical Security Studies* (SSRN Scholarly Paper ID 1937964). Social Science Research Network. https://doi.org/10.2139/ssrn.1937964

Godfrey, D. G. (Ed.). (2006). *Methods of historical analysis in electronic media*. Lawrence Erlbaum Associates.

Graham, L. M. (1992). *Typography and graphic arts technology: A discourse of selected historical interrelationships* (p. 12485107) [Master of Science, Iowa State University, Digital Repository]. https://doi.org/10.31274/rtd-180813-8403

Graver, A., & Jura, B. (2012). *Best practices for graphic designers: Grids and page layouts: an essential guide for understanding & applying page design principles*. Rockport Publishers.

Gray, N. (1986). *A history of lettering: Creative experiment and letter identity*. Phaidon.

Gudinavičius, A., & Suminas, A. (2017). Choosing a book by its cover: Analysis of a reader's choice. *Journal of Documentation*, *74*. https://doi.org/10.1108/JD-09-2016-0111

Gunawardhana, S., & Samarawickrama, S. (2020). *Analysis of historical data to determine early Sri lankan print technologies*.

Haley, A. (1998). *Alphabet: The History, Evolution, and Design of the Letters We Use Today*. Diane Pub Co.

Hamilton, D. B. (1993). The Idea of History and the History of Ideas. *Image: The Journal of Nursing Scholarship*, *25*(1), 45–48. https://doi.org/10.1111/j.1547-5069.1993.tb00752.x

Hemapala, N. (1998). *Sinhala Mudranaya Ha Puwathpath (Sinhala Printing and Newspapers)*. Thisara Prakashakayo.

Henderson, K., Haley, A., Saltz, I., Tselentis, J., Poulin, R., Leonidas, G., Seddon, T., & Alterman, T. (2012a). *Typography, Referenced: A Comprehensive Visual Guide to the Language, History, and Practice of Typography* (0 edition). Rockport Publishers.

Henderson, K., Haley, A., Saltz, I., Tselentis, J., Poulin, R., Leonidas, G., Seddon, T., & Alterman, T. (2012b). *Typography, Referenced: A Comprehensive Visual Guide to the Language, History, and Practice of Typography* (0 edition). Rockport Publishers.

Hill, W. (2010). *The complete typographer: A foundation course for graphic designers working with type* (3rd ed). Thames & Hudson.

Hjørland, B., & Pedersen, K. (2005). A substantive theory of classification for information retrieval. *Journal of Documentation*, *61*, 582–597. https://doi.org/10.1108/00220410510625804

How Are Book Covers and Their Components Represented in the Digital Market? (2019). *Interscript*. https://doi.org/10.14324/111.444.2398-4732.004

Hox, J.J. & Boeije, H.R. (2005). Data collection, primary versus secondary. In *Encyclopedia of social measurement* (Vol. 1, p. 593null). Elsevier. https://dspace.library.uu.nl/handle/1874/23634

Hsieh, H.-F., & Shannon, S. E. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, *15*(9), 1277–1288. https://doi.org/10.1177/1049732305276687

Icoglu, O., Gunsel, B., & Sariel, S. (2004). *Classification and indexing of paintings based on art movements*.

International Conference on the Conservation of Library and Archive Materials and the Graphic Arts. (n.d.).

Jacob, E. (2004a). Classification and Categorization: A Difference that Makes a Difference. *Library Trends*, *52*.

Jacob, E. (2004b). Classification and Categorization: A Difference that Makes a Difference. *Library Trends*, *52*.

Jacob, E. K. (1991). Classification and Categorization: Drawing the Line. *Advances in Classification Research Online*, *2*(1), 63–80. https://doi.org/10.7152/acro.v2i1.12548

Jacob, E. K. (2001). The everyday world of work: Two approaches to the investigation of classification in context. *Journal of Documentation*, *57*(1), 76–99. https://doi.org/10.1108/EUM0000000007078

Jobling, P. (2008). Graphic Design, A New History. *Journal of Design History*, *21*, 296–298. https://doi.org/10.1093/jdh/epn019

Junilla, J. (2015). *HISTORICAL RESEARCH: A QUALITATIVE RESEARCH METHOD*. https://www.academia.edu/24276932/HISTORICAL_RESEARCH_A_QUALITATIVE_RESEARCH_METHOD

Kelly, R. R. (2010). *American wood type: 1828 - 1900 ; notes on the evolution of decorated and large types and comments on related trades of the period* (Reissued). Liber Apertus Press.

Koh, H., & Herring, S. (2016). Historical insights for ebook design. *Libr. Hi Tech*. https://doi.org/10.1108/LHT-06-2016-0075

Kompatscher, K., Kramer, R. P., Ankersmit, B., & Schellen, H. L. (2019). Intermittent conditioning of library archives: Microclimate analysis and energy impact. *Building and Environment*, *147*, 50–66. https://doi.org/10.1016/j.buildenv.2018.10.013

Kreuzer, W. (1975). Ecological observation of the 137Cs-contamination in beef of animals from the southern-Bavarian area. *Environmental Quality and Safety*, *4*, 24–36.

Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (2nd ed). Sage.

Kularatne, T. (2006). *History of printing and publishing in Ceylon 1736-1912*. Sridevi printers.

Kulkarni, S. (n.d.). *Title: Issues with Devanagari Display Type*. 9.

Kumar, U. D. (2010). *Transformation of Tamil letterforms from Palm leaf manuscripts to early Letterpress printing* [PhD Thesis]. Industrial Design Centre, IIT, Bombay.

Kumbhar, R. (2012a). 10 - Classification: Theories, research trends and personalities. In R. Kumbhar (Ed.), *Library Classification Trends in the 21st Century* (pp. 137–141). Chandos Publishing. https://doi.org/10.1016/B978-1-84334-660-9.50010-2

Kumbhar, R. (2012b). 10 - Classification: Theories, research trends and personalities. In R. Kumbhar (Ed.), *Library Classification Trends in the 21st Century* (pp. 137–141). Chandos Publishing. https://doi.org/10.1016/B978-1-84334-660-9.50010-2

Landoni, M., Wilson, R., & Gibb, F. (2000). From the Visual Book to the WEB Book: The Importance of Good Design. In *Electronic Library, The* (Vol. 18, p. 314). https://doi.org/10.1007/3-540-45268-0_28

Langacker, R. W. (1988). Review of Women, Fire, and Dangerous Things: What Categories Reveal about the Mind [Review of *Review of Women, Fire, and Dangerous Things: What Categories Reveal about the Mind*, by G. Lakoff]. *Language*, *64*(2), 384–395. https://doi.org/10.2307/415440

Lankage, J. (1996). *Sinhala warna malawe wikashanaya (Evolution of the Sinhala alphabet)*. S. Godage and Brothers.

Laudon, C. (2021, April 27). *ATypI de-adopts Vox-ATypI typeface classification system*. ATypI. https://atypi.org/2021/04/27/atypi-de-adopted-the-vox-atypi-typeface-classification-system/

Lloyd, G. E. R. (1961). The Development of Aristotle's Theory of the Classification of Animals. *Phronesis*, *6*(1), 59–81.

Lombardi, T. (n.d.). *The Classification of Style in Fine-Art Painting*.

Luck, S. E., Lamp, J. W., Craig, A., & Coldwell-Neilson, J. (2016). The book: Production and participation. *Library Review*, *65*(1/2), 2–19. https://doi.org/10.1108/LR-02-2015-0018

Lupton, E. (2004). *Thinking with type: A critical guide for designers, writers, editors, & students* (1st ed). Princeton Architectural Press.

Lupton, E. (2010). *Thinking with type: A critical guide for designers, writers, editors, & students* (2nd rev. and expanded ed). Princeton Architectural Press.

Makaveeva, V. (n.d.). *Anatomy of Typeface by Alexander Lawson*. Retrieved April 27, 2022, from https://www.academia.edu/10156277/Anatomy_of_Typeface_by_Alexander_Lawson

Malviya, A., & Dalvi, G. (n.d.). *Designing an Interlocking Devanagari Display Font*. 21.

Mcdowell, B. (2013). *Historical Research: A Guide*. Routledge. https://doi.org/10.4324/9781315841601

McGrew, M. (1993). *American metal typefaces of the Twentieth Century* (2nd, rev. ed ed.). Oak Knoll Books.

Meggs, P. B., Purvis, A. W., & Meggs, P. B. (2006). *Meggs' history of graphic design* (4th ed). J. Wiley & Sons.

Middendorp, J. (2018). *Dutch type* (Original 2004 edition reprinted). Druk Editions.

Miller, C. (2002). Review of Sorting Things Out: Classification and Its Consequences, by Geoffrey C. Bowker and Susan Leigh Star. *Technical Communication Quarterly*, *11*, 113–115. https://doi.org/10.1207/s15427625tcq1101_14

Mireles, E. (n.d.). *CLUSTERING AND CLASSIFICATION OF ANALYTICAL DATA Clustering and Classification of Analytical Data*. Retrieved February 16, 2022, from https://www.academia.edu/32439111/CLUSTERING_AND_CLASSIFICATION_OF_ANALYTICAL_DATA_Clustering_and_Classification_of_Analytical_Data

Nath, N., & Poovaiah, R. (2015). *Simulating the appearance of painted and digital display type on shop signs in India*. 9.

Nath Phd, N., & Dalvi, M. (2013). *Display Typography of House Names in Mumbai's Residential Buildings: A Semiotic Intervention*.

neeru. (2015, July 20). *Anatomy of Letters* [Text]. D'Source. https://www.dsource.in/resource/history-devanagari-letterforms/anatomy-letters

New Trends and Issues Proceedings on Humanities and Social Sciences. (n.d.). Retrieved February 17, 2022, from https://un-pub.eu/ojs/index.php/pntsbs/

Nilsson, J. (2010). *In search of scientific methods for conservation of historic silk costumes*. University of Gothenburg, Acta Universitatis Gothoburgensis.

Noordzij, G., & Enneson, P. (2005). *The stroke: Theory of writing*. Hyphen press.

O'Connell, K. C. (2010). *YOUNG ADULT BOOK COVER ANALYSIS*.

Online Journal Publication | Publish Your Research Paper. (n.d.). Retrieved February 16, 2022, from https://www.ajhssr.com/

Pektas Turgut, O. (2014). Calligraphic Forms in Contemporary Typographic Design. *Procedia - Social and Behavioral Sciences*, *122*, 40–45. https://doi.org/10.1016/j.sbspro.2014.01.1300

Petherbridge, G. (Ed.). (1987). Series Editors' Preface. In *Conservation of Library and Archive Materials and the Graphic Arts* (pp. v–vi). Butterworth-Heinemann. https://doi.org/10.1016/B978-0-408-01466-3.50004-0

Petherbridge, G., Institute of Paper Conservation, & Society of Archivists (Great Britain) (Eds.). (1987). *Conservation of library and archive materials and the graphic arts*. Society of Archivists ; Butterworths.

Pietro, D., & Kllc, A. (1999). A Database of typeface classification systems. *Undefined*. https://www.semanticscholar.org/paper/A-Database-of-typeface-classification-systems-Pietro-Kllc/f9d816b98552a97461d5315e553636f4ba62c6a8

PJIM 25 Systems For Classifying Typography: A Study in Naming Frequency | PDF | Calligraphy | Notation. (n.d.). Retrieved February 16, 2022, from https://www.scribd.com/document/390826004/PJIM-25-Systems-for-Classifying-Typography-A-Study-in-Naming-Frequency

Polo Pujadas, M. (2015). *The Book as an artefact*.

Puškarević, I., Nedeljković, U., & Pušnik, N. (2018). *CHARACTERIZATION OF LETTERFORM COMPLEXITY* (p. 611). https://doi.org/10.24867/GRID-2018-p73

Rahgozar, A., & Inkpen, D. (2016). *Bilingual Chronological Classification of Hafez's Poems* (p. 62). https://doi.org/10.18653/v1/W16-0207

Reddy, G. S., & Nath, N. (n.d.). *The Cultural underpinnings of the Scripts from two Royal Cities of India*. 17.

Rodgers, Z. (Ed.). (2007). *Making history: Josephus and historical method*. Brill.

Rothenstein, J., & Gooding, M. (Eds.). (2018). *A2Z+: Alphabets & signs*. Princeton Architectural Press.

Rouhan, G., & Gaudeul, M. (2014). Plant Taxonomy: A Historical Perspective, Current Challenges, and Perspectives. In P. Besse (Ed.), *Molecular Plant Taxonomy* (Vol. 1115, pp. 1–37). Humana Press. https://doi.org/10.1007/978-1-62703-767-9_1

Rüsen, J. (2006). *Meaning and Representation in History*. Berghahn Books.

Ryan, D. (2001). *Letter perfect: The art of modernist typography, 1896-1953*. Pomegranate.

Samarawickrama, S. (2016). *The Anatomy and historical Development of Sinhala Typefaces*. University of Moratuwa, Sri lanka.

Samarawickrama, S. (2017). Anatomy of the Sinhala Letter. *Journal of Engineering and Architecture*. https://doi.org/10.15640/jea.v5n1a9

Sannella, J. J. (1976). Plasma potassium measurement. *Journal of the Tennessee Medical Association*, *69*(7), 486, 494.

Seddon, T. (2014). *20th Century Design: A Decade-by-Decade Exploration of Graphic Style*. Quid publishing.

Sharma, O. P. (1993). *Plant Taxonomy*. Tata McGraw-Hill Education.

Simões, M., Vieira de Freitas, M., & Rodriguez-Bravo, B. (2016). Theory of Classification and Classification in Libraries and Archives: Convergences and Divergences. *Knowledge Organization*, *43*, 530–536. https://doi.org/10.5771/0943-7444-2016-7-530

Smeijers, F., & Kinross, R. (1996). *Counterpunch: Making type in the sixteenth century, designing typefaces now*. Hyphen Press.

Stepiński, J., & Angielski, S. (1975). Bicarbonate inhibition of rat kidney aconitate hydratase isoenzymes. *Current Problems in Clinical Biochemistry*, *4*, 65–69.

Studtmann, P. (2021). Aristotle's Categories. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Spring 2021). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/spr2021/entries/aristotle-categories/

Stuessy, T. F. (2009). *Plant Taxonomy: The Systematic Evaluation of Comparative Data*. Columbia University Press.

Swanson, G. (Ed.). (2000). *Graphic design & reading: Explorations of an uneasy relationship*. Allworth Press.

Taia, W. (2005). Modern Trends in Plant Taxonomy. *Asian Journal of Plant Sciences*, *4*. https://doi.org/10.3923/ajps.2005.184.206

Torou, E., Katifori, A., Vassilakis, C., Lepouras, G., & Halatsis, C. (2009, January 1). *Capturing the historical research methodology: An experimental approach*.

Tortora, P. G., & Marcketti, S. B. (2015). *Survey of historic costume* (Sixth edition). Fairchild Books, an imprint of Bloomsbury Publishing Inc.

Tracy, W. (1986). *Letters of credit: A view of type design* (1st U.S. ed). D.R. Godine.

Triggs, T. (2009). Designing Graphic Design History. *Journal of Design History*, *22*(4), 325–340.

Triggs, T. (2011). Graphic Design History: Past, Present and Future. *Design Issues*, *27*(1), 3–6.

Typography, Referenced: A Comprehensive Visual Guide to the Language, History, and Practice of Typography | Emerald Insight. (n.d.). Retrieved February 16, 2022, from https://www.emerald.com/insight/content/doi/10.1108/09504121211278052/full/html

Udaya Kumar, D. (2010). *Transformation of Tamil letterforms from Palm leaf manuscripts to early Letterpress printing* [PhD Thesis]. Indian Institute of Technology.

Vijay, V., U Kharat, M., & V Gumaste, S. (2018). Study of Different Features and Classification Techniques for Recognition of Handwritten Devanagari Text. *International Journal of Engineering & Technology*, *7*(4.19), 1055. https://doi.org/10.14419/ijet.v7i4.19.28285

Vox Classification—[PDF Document]. (n.d.). Retrieved February 16, 2022, from https://cupdf.com/document/vox-classification.html

Wang, D., & Srihari, S. N. (1989). Classification of newspaper image blocks using texture analysis. *Computer Vision, Graphics, and Image Processing*, *47*(3), 327–352. https://doi.org/10.1016/0734-189X(89)90116-3

Waters, S. (2018). *Foundations of calligraphy*. John Neal Bookseller.

Weber, R. P. (n.d.). *BASIC CONTENT ANALYSIS*.

Welsh, T., & Wright, M. (2010a). *Library literacy: Information sources, classification systems* (pp. 39–52). https://doi.org/10.1016/B978-1-84334-515-2.50004-4

Welsh, T., & Wright, M. (2010b). *Library literacy: Information sources, classification systems* (pp. 39–52). https://doi.org/10.1016/B978-1-84334-515-2.50004-4

Wilkinson, A. (2005, December 5). Man of Letters. *New Yorker*, 56.

Willen, B., & Strals, N. (2009). *Lettering & type: Creating letters and designing typefaces* (1st ed). Princeton Architectural Press.

Yampbell, C. (2005). Judging a Book By Its Cover: Publishing Trends in Young Adult Literature. *The Lion and the Unicorn*, *29*, 348–372. https://doi.org/10.1353/uni.2005.0049

Young, D. (1999). *Fonts & logos: Font analysis, logotype design, typography, type comparison, and history* (1st ed). Delphi Press.

Zhang, Y., & Kudva, S. (2014). E-books Versus Print Books: Readers' Choices and Preferences Across Contexts. *Journal of the American Society for Information Science and Technology*, *65*. https://doi.org/10.1002/asi.23076

Zhang, Y., & Wildemuth, B. M. (n.d.). *Qualitative Analysis of Content*.

Zou, Q., Cao, Y., Li, Q., Huang, C., & Wang, S. (2014). Chronological classification of ancient paintings using appearance and shape features. *Pattern Recognition Letters*, *49*, 146–154. https://doi.org/10.1016/j.patrec.2014.07.002