

ANALYSIS OF HISTORICAL DATA TO DETERMINE EARLY SRI LANKAN PRINT TECHNOLOGIES

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Abstract

This research discusses the importance of historical research as it serves to determine ideas and helps to group historical facts into explanatory scientific systems. Thus, by systematically documenting this knowledge contributes to develop and improve the theory and practice of education. Since design education in Sri Lanka is nearly two decades old, subject areas such as Graphic design lacks the needed literature on early Sri Lankan graphic practices that determine and contribute towards clarifying current and future trends built on historical research. The historical data that contributes to these subject areas are found at archival locations, and the preservation process in such locations limits us from the opportunity to observe historical data (primary data); that is required to establish new knowledge; in this case graphic design.

Thus, this research aims towards documenting historical data towards building new knowledge. To achieve this, the historical data: specific to early book cover prints are compared with a literature survey on early printing technologies and on how they are identified. For this, the primary data (early book covers) from archival locations, were documented and visually observed with the use of a linen-prover magnifying glass with x4 enlarging capacity. The findings were compared with literature on different print technologies used during this era with the knowledge on how to identify them. The findings were compiled into stimuli for the analysis purpose. And finally, the gathered data was chronologically compiled as new knowledge.

In conclusion, we were able to determine the technology used in early prints, more specific to print technology used during the early book publishing and printing industry of Sri Lanka. Since the data is chronologically (1870-1920) compiled we were able to identify patterns that help build new knowledge into other subject areas. It opens up discussion on historical trends in book cover designs, parameters of each technology used in Sri Lanka that influence book layout, its typography and letter composition for further research.

Keywords: *Historical research, Book Cover design, Identifying Prints, Sri Lankan Graphic History*

1. Background and context

Historical research investigates, identifies and extracts optimal solutions to contemporary problems from the past time, and clarifies current and future global trends. Therefore by recording historical-data and by adopting historical research helps understand how our current education system was created and evolved and, on how this kind of knowledge can provide a solid foundation for further progress or change in the domain (Albulescu, 2018); In this case the domain of Design Education. The subject of typography is studied within the field of Graphic design and within this subject, we see the practice of collecting, observation and analysis of historical data (early print specimens), that had contributed towards building new knowledge: type classification theories. Classifying of typeface helps typographers and graphic designers just as plants need to be described and classified by botanists, in a universally accepted terminology (McLean,1980). The use of classification systems helps to fulfil a theoretical need and it also works as a pragmatic search function (Pohlen, 2010). These theories are based on the chronological order, or on the differences in form, tool, hand etc. Nevertheless, new classifications are built on a regular basis within the Latin Script but it is not the same with Sinhala Script/ Sinhala Typography discussed within the field of Graphic Design.

Graphic design is a diverse field of study that includes many fields such as illustration techniques, packaging design, brand identity design, layout design, and typography. Within this field, we see the influence of technology over centuries that discusses graphic design movements and styles due to social, cultural, and political change. Steven Heller and Seymour Chwast describe the appearance of visual styles in history with the influences of technology focusing on the industrial revolution and industrialisation (1994). Famous books by Phil Meggs 'A History of Graphic Design'(1983), Craig and Barton's book *Thirty Centuries of Graphic Design* (1987) explores the effect of technical and stylistic modifiers on graphic design and typography due to social, political, and cultural changes through a historical lens. Thus the exploration of historical data contributes to the practice and theories on

Graphic Design. And one that cannot neglect the technological changes within history. For example, the subject of typography is birthed with the invention of moveable type and the printing press in 1450. In comparison to natural science, this field is rather new and to Sri Lanka it can be considered very recent.

Sri Lanka records the introduction of the printing press to the Island in 1737 by the Dutch. Until it was taken over by the British in 1796. During the Dutch administration we record that printing was limited to pamphlets, bibles, and books towards achieving their objective of evangelization (Kularatne, 2006 & Samarawckrama, 2016). The growth and the variety of printing and print materials started to appear during the British period (1796-1948). It was during this time Sri Lanka was experiencing the arrival of several missionaries who had their own printing presses, resulting with a large number of printing presses in the Island. It was also during this period we experience the next turning point in relation to printing: the Buddhist revival (1860's), As part of the social and political change most printing presses were in the hands of the locals. This change resulted in a large number of newspapers, books, posters, pamphlets in circulation within the Island.

Today, most of these early prints are lost and the remaining are catalogued in archival locations such as British Museum, Colombo Museum Library, Department of the National Archives, National Library, Royal Asiatic Society Library, Sri Lanka etc. Therefore, to gather historical data such as type specimens, early typographic designs, graphic design layouts, book cover designs we need to access these primary data at these locations. By observing such data, we will be able to contribute towards a new understanding of the past and will highlight its relevance in shaping our present and future (Cohen, Manion and Morrison, 2000).

2. Early books at archival locations

To investigate past events in this case earliest books in a systematic way, is to identify a location where historical data is systematically stored; the National Museum Library of Colombo. Here the earliest printed books are located in a shelf dedicated as the 'shelf with the oldest books'. The books in this shelf are not chronologically placed but cataloged alphabetically. Unless you know the titles of these books, they are rarely referred to by readers. In general, the publications date back to the early 18th century, and they clearly show the growth of the publishing industry in Sri Lanka. The books range from 1870 to 1980 With most published in Sinhala, and the covers range from single color to multi colors proving the use of different printing technologies.

2.1 HOW BOOKS ARE PRESERVED:

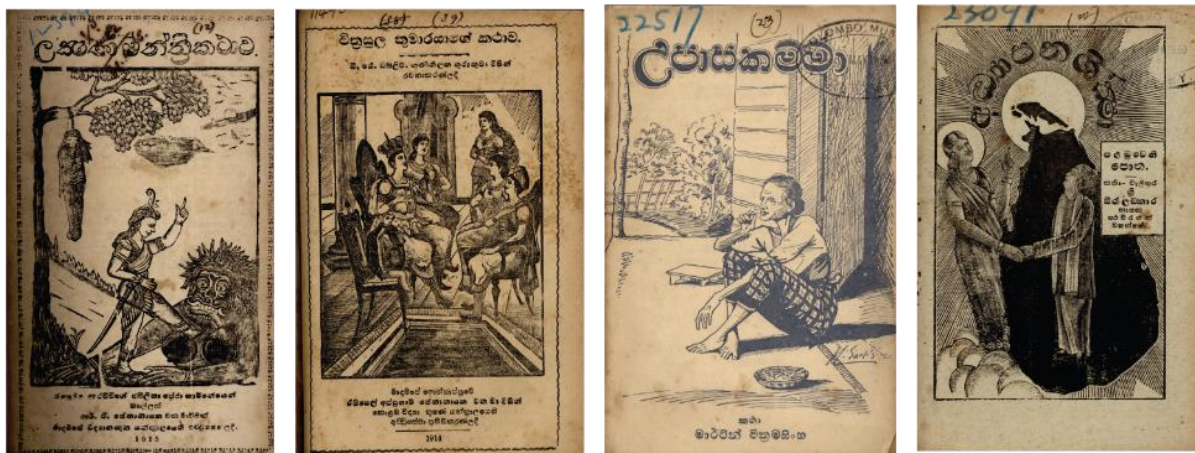


Image 01, samples of book cover design (Source: Colombo national museum library)

One of the notable factors when observing this shelf was that most books are in a usable condition as they are re-bound with an additional cover for protection. During this preservation process it was evident that the book covers are replaced with a plain cover board to preserve the content of the book. Thus, the original cover of the book is replaced resulting with a loss of historical data. In this case the early book cover (graphics layouts), its styles, practices, and the print technology used to produce these covers. We believe by observing these book covers and determining the technologies used to print them would help to document the early print practices that were commonly used within the book publishing industry of Sri Lanka.

2.2 THE ERA

According to Samarawickrama's research on the development of the printing press within the Island, the above-mentioned books fall into the *Early newspaper era (1860-1980)*. As it records the start of the first newspaper and stops towards the latter part of the letterpress printing era. From the political point of view, this era documents the growth of Sri Lanka as an independent nation. It further describes the rising movement of nationalization of the printing press. From a print technology point of view, it was the era that experienced woodcuts, wood engravings, metal relief and phototypesetting within the Island. It documents the transition from hot metal to phototypesetting.

2.3 THE BOOK AND ITS COVERS

A printed book includes several anatomical features. The book jacket is the outer cover of the book. It protects the book cover from dust and damages. The set of internal pages is called a book block, which includes the content of the book. The book spine is where the papers are bound as a block. There are few other anatomical features, such as headband, tail band. The front cover is the first of the components of the book anatomy. It includes the necessary information about the book, including title, author's name, etc. It also gives the feel of the content using graphics, images, layout, illustrations, letterings, and many other graphic elements (Gallagher, 2015). Even if the bookbinding technology and process have changed over time, this basic structure of the book has remained the same, but what has changed over time is the cover due to the change of print technologies. Therefore, this research is focused on the cover of the book to determine its technology.

2.4 IMPORTANCE OF TECHNOLOGY IN HISTORY

Technology causes innovation in every aspect of society. It can be defined as the application of scientific knowledge for practical purposes, especially in industry. It is also defined as "Simply a body of knowledge about techniques" (Freeman, 1982). Technology is capable of changing almost everything in society. "Technology is...integrated into the lives of human beings; technologies of every conceivable kind are used everywhere by human beings in order to provide food, shelter, transportation and all other basic material appurtenances of life" (Baark and Svedin, 1988). Thus, we are able to identify certain time periods based on the technology used.

The more a society is aware of the history of technology, the more adaptable a society can become (Mesthene, 1970). Understanding the impact of technology on a particular subject area throughout history contributes to establishing a subject by creating a solid foundation. It can also formulate new ideas for further inventions (Graham, 1992). Technological advancements provide new opportunities to create new tools. Therefore, whatever the subject area that uses these tools can create opportunities to achieve new goals in each individual's creations. Mesthene elaborates this idea in his comment, "A new invention or technological development- a new tool, in short- generally creates a new opportunity, either to do something differently or better than before, or to do something for the first

time that simply was not possible at all before” (Mesthene 1970). New tools can be found within history in almost all subject areas such as medicine, geography, astrology, information technology, architecture, art, design, etc. in this case we focus on printing technology used in Graphic Design , discussed under the domain of Design and Design Education.

3. Identifying print technologies

Three main categories of printing technologies can be found in historical studies. Printing is defined as transferring of ink to a prepared printing surface/ paper or other material. There are three possible ways of transferring ink. If the ink is carried on a raised surface it is called ‘Relief Printing’. The second method carries the ink in a lowered groove and the transferring of this ink is called ‘Intaglio printing’. The third method is called “Planographic Printing” where the ink is carried on the surface (Gascoigne, 1995).

Inside every category, there are two subcategories. The first category is manual prints. When the artist or craftsman has worked out, the final printing surface is called a manual print, and if not, it is called a processed print. Processed print techniques are usually involved with photography. Therefore, as an example, there are manual relief printing methods and processed printing relief methods. Printing techniques used within this era can be tabulated as below.

Table 01, Print Technologies

	PRINTING TECHNOLOGY		
	RELIEF PRINTING	INTAGLIO PRINTING	PLANOGRAPHIC PRINTING
Manual Printing	Woodcut	Engraving	Lithographs
	Wood engraving	Etching	Transfer Lithographs
	Metal relief prints	Dry points	
	Modern relief printing	Line Engraving	
		Steel Engraving	
		Crayon Manner Engraving	
		Soft Ground Etching	
		Mezzotints	
Processed Printing		Aqua Tints	
	Line blocks	Nature Prints	Collotypes
	Relief Halftones	Photogalvanographs	Photolithographs
		Line Photogravures	
		Tone Photogravures	
	Gravures		

3.1 RELIEF PRINTING

The oldest and simplest printing method among these is relief printing. The ink is transferred to a paper from the printing surface under pressure. This method is similar to present-day rubber stamps. Usually a block is made with hard materials like wood, and it is called as the relief block. The ink is then applied to this surface by dabbing, only to the raised parts of the blocks. Then the ink is transferred to the paper by pressing on it.

This printing process leaves certain evidence on the printed material. The pressure leaves an embossed mark on the other side of the paper, which can be felt with the tip of the finger. It further

causes an ink squashed effect and a rim around effect of ink on the paper. Six types of relief printing methods can be listed under the relief printing method, including woodcut printing, as the most common method. Each printing method holds an identical set of characteristics, including above mentioned common relief characteristics.

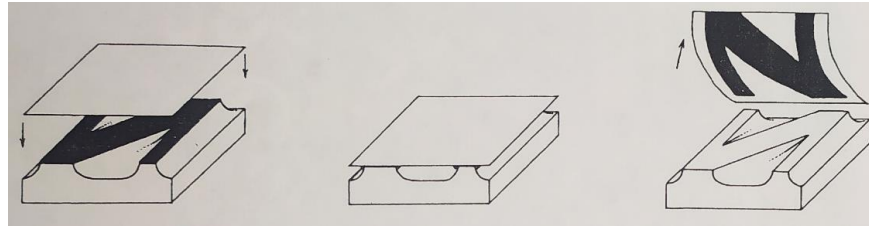


Image 02, Stages of relief printing (Source: Gascoigne B)

3.2 INTAGLIO PRINTING

In this method, A paper was placed on a prepared printing surface and transferred the ink from the printing surface to paper. However, it is similar to relief printing but differs from the making of the printing surface. Unlike in the relief method, the image has been achieved by the recessed areas below the flat surface of a metal plate. These recesses have been manually cut away from the plate with an engraving tool. The ink was first applied to these recesses, grooves, and transfer to the paper with great pressure. In processed intaglio printing methods, the image on the metal plate could be achieved by photographs, and the rest of the process was the same.

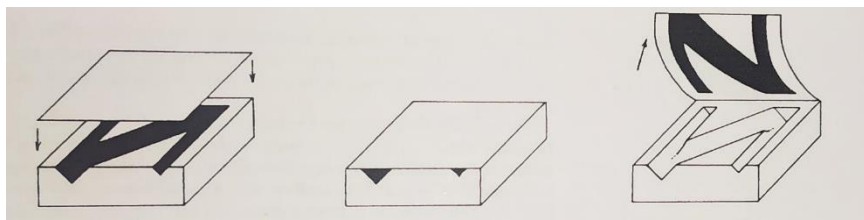


Image 03, Stages of intaglio printing (Source: Gascoigne B)

In an intaglio print, the lines can be darker or lighter and thinner and thicker due to the grooves' uneven depths that hold different amounts of ink. This pressure was greater than the pressure in a relief method. Therefore, it leaves an identical plate mark on the paper. Intaglio methods can achieve greater physical depth in ink and images with perfectly straight edges and unbroken lines. Furthermore, these darker lines often appear as visible ridges of ink. These identical features help to identify an intaglio print. There are fourteen different intaglio printing methods with a set of identical features for each method.

3.3 PLANOGRAPHIC PRINTING

This is the most recent method of all three printing methods. Opposed to a raised surface or a surface with grooves, this method uses a flat surface to hold the ink. The image has been created on a lithographic stone in the form of greasy marks. A chemical process serves to make these marks fully receptive to grease and full resistance to water. Then a rolled charged with ink passed over the surface. The ink was only transferred to the stone whenever it encounters grease. The next step was to apply this ink on the paper. A paper was laid on the stone with sufficient backing material above it. The downward pressure on the stone transfers the ink from stone to paper.

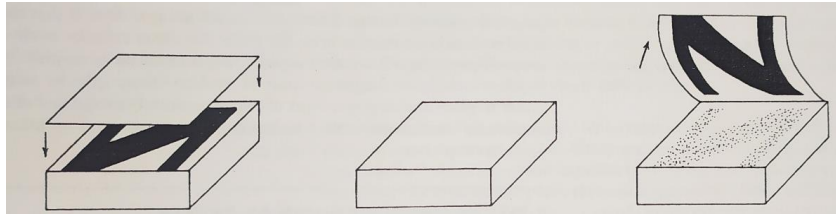


Image 04, Stages of planographic printing (Source: Gascoigne B)

The ink either adheres fully to the printing surface or fully rejected by it. Therefore, it has the evenness of tone and, as a result, the flatness of the image: the original and the most usual form of planographic printing. There are four types of planographic printing methods, including processed planographic methods, which involve photography in the process. Each of these planographic methods has its own set of identical features, including common planographic printing features.

4. Methodology

The methodology was conducted under four stages. The first stage was collecting data samples, second was compiling literature data on how to identify print technique into stimuli. The third stage was the summing up of the samples observed based on the knowledge gained in stage two (identifying print technologies) and the fourth stage analyzed and categorized data across a timeline. The details of these stages are as follows:

4.1 COLLECTION OF PRIMARY DATA/ SAMPLES

The collection of primary data was gathered from The National Museum Library, Colombo. It is the first legal deposit library in Sri Lanka, which owns a valuable collection of historical materials, including manuscripts, rare books, and donations of private book collections. It also records over 12 million book titles, including the shelf dedicated to the oldest published books in Sri Lanka, ranging from 1870 to 1925. This shelf included nearly 1500 Books. For this research, books with original Sinhala book covers published in Sri Lanka were selected as primary data. A total of 400 book covers were taken in for this research using the random sampling method.

All the samples were then tabulated with the title of the book, author’s name, publisher’s name, place, and date, including its physical dimensions such as the width, height, and thickness. The samples were then scanned at 600dpi for visual reference and further analysis. All the scanned images were sorted into folders to present each year.

L.No	Book Title	Author's Name	Publisher
C9-3	104 J20	සම මහර	සම මහර සහ සමානම
C9-10	104 J20	කඩ පුදු සම මහර	සම මහර ශ්‍රී ධර්මාලංකාර සමිතියේ මහරගේ
C9-13	104 J20	සම මහරගේ මහරගේ කාව්‍යය	සම මහරගේ මහරගේ මහරගේ (සම)
C11-9	104 B4	සම මහරගේ	සම මහරගේ සම මහරගේ
C11-10	104 B4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C11-22	104 B4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C11-29	104 B4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-14	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-3	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-7	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C19-5	104 V10	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C9-7	104 J20	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C9-35	104 J20	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C9-37	104 J20	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C11-42	104 B4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-19	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-23	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-2	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-15	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-16	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ
C50-17	104 K4	සම මහරගේ මහරගේ මහරගේ මහරගේ මහරගේ	සම මහරගේ සම මහරගේ

Image 05, A section of book cover detail table (Source: author)



Image 06, Screen shot of selected folder representing each year (Source: author)

4.2 DEVELOPMENT OF STIMULI BASED ON LITERATURE SURVEY

Based on a thorough literature survey, an initial list of print technologies available during the selected era was listed and grouped into two: Manual and processed printing. The manual printing techniques included four types of relief prints, nine types of intaglio printing, and two types of planographic printing. Processed printing included two for relief printing, five for intaglio printing, and two for planographic printing.

The above data on the print technologies and techniques were included into three individual checklists. Each checklist included literature on how to identify these techniques into rows and empty column were added to be filled at the observation process. A sample of the stimuli for relief print technology is found below.

Table 02: Checklist of identical features in relief printing

Printing method	Identical features			
Relief printing				
	Rim round of the ink is visible			
	Ink squash is visible on the corners			
	Stamped look of the prints			
Woodcut	In a crosshatching	A single line has a sweep		
		A single line has an excrescence		
		A single line has sudden change of width		
		A single line has sudden change of direction		
	Lines are visible			
	Lines have more arbitrary variations			
Wood Engraving	In a crosshatching	A single line has a sweep		
		A single line has an excrescence		
		A single line has sudden change of width		
		A single line has sudden change of direction		
	Lines are visible			
	Lines have more arbitrary variations			
	Stipple effect (Large or small squares of wood which prints as large or small dots)			
Line blocks	No intermediate tone. Only pure black or nothing			
	Lines are more like drawing			
	Freely drawn lines			
Relief halftone	Ink squeeze out, ink squash is visible			
	Firm edge, squashed ink rim of each dot is visible			
Metal relief	Solid black areas with patterns of white			
	Small decorative stamped look			
	Dotted white patterns			

Thereafter, the data from the checklist was converted into visual stimulus for easy reference. A sample of the stimuli for relief print technology is found below.

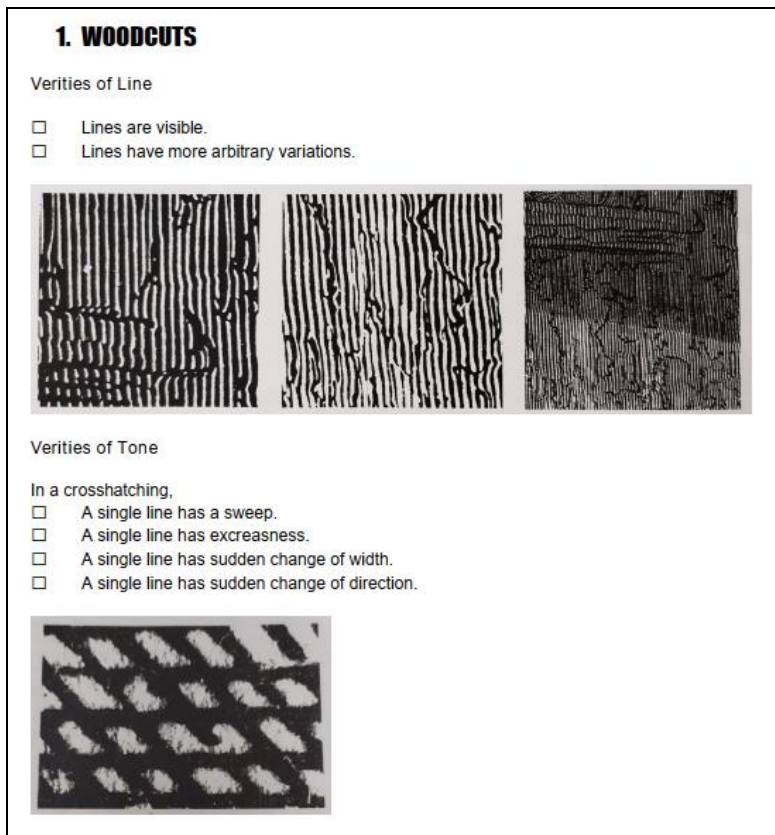


Image 07, Stimuli card for woodcut (Source: author)

4.3 OBSERVATION OF THE SCAN AND THE PRIMARY DATA

Observation of the primary data was conducted in two stages. First, we observed the scanned copies of book covers at 600dpi resolution. All the scans were magnified digitally by Adobe Photoshop’s zoom tool to avoid the quality reduction of the scanned image. It observed the available images from the year 1870 and then moved into 1871, 1872, and continued through the folders until 1925. Some years had more images, and some had fewer images of the scans. Therefore, images had to be taken into an observation with random sampling according to the availability.

In the second phrase, Original physical book covers were observed through an eyeglass with x4 magnification in the library. It confirmed the observation results of scanned images and updated the checklist data.

4.4 CATEGORIZING DATA CHRONOLOGICALLY

Every book cover was identical to certain printing technology. It can be identified through the marked checklist. A section of a marked checklist is as below.

Printing method	Key Identical points	1872	1873	1876	1877	1883	1884	1887	1887	1888	1888	1889	1889	1890	1890	1890	1897	1900	1901	1901	
		RELIEF																			
	Rim round of the ink is visible	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Ink squash is visible on the corners	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Stamped look of the print	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Woodcut	In a cross hatching	A single line has a sweep					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
		A single line has a excreasness					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		A single line has sudden change of width					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		A single line has sudden change of direction					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Lines are visible	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Lines have more arbitrary variations.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Wood Engraving	Lines are visible	Lines are visible									✓							✓	✓		
		Lines have more arbitrary variations.									✓		✓					✓	✓	✓	
	In a cross hatching	A single line has a sweep										✓									
		A single line has a excreasness										✓									
		A single line has sudden change of width										✓									
	A single line has sudden change of direction										✓										
	Stipple effect (Larger or small squares of wood which print as large or small dots)										✓		✓					✓	✓	✓	
Line Blocks	No intermediate tones. Only pure black or nothing																				
	Lines are more like in a drawing																				
	Freely drawn lines (Not like in a wood engraving)																				
Relief	“Ink squeeze out” (Ink squash) is visible																				
Halftone	Firm edge and the squashed ink rim of each dot printed																				
Metal relief	Solid black areas with patterns of white.		✓	✓	✓																
	Small decorative stamped look		✓	✓	✓																
	Dotted white patterns visible		✓	✓	✓																

Image 08, A section of a marked checklist (Source: Author)

This table is horizontally continued until the year 1925 and vertically continued till planographic printing methods. Since we have completed the checklist chronologically in the observation stage, it has been automatically categorized chronologically to achieve the final analysis stage.

5. Results and Discussion

Tabulating the primary data helped to identify the number of books and to place them chronologically. Then it categorized the data across the timeline. In this study, we have chronologically identified printing technologies in Sri Lanka within 1870 and 1925.

We found relief printing as the dominant printing technique used during this time period. The first decade (1870-80) contained books with metal relief and these book covers contained texts only (mostly the same body typeface was used) and as a decorative element it; borders were used. The following decade (1880-90) noticed the appearance of woodcut printing and wood engraving printing methods in the covers with the practices of the earlier decade; metal. Thereafter from 1890-1920s, we see developments of wood engraving and woodcut and even a combination of metal and wood. The significant development was that during the early 1890s prints were limited to small illustrations in the middle of the book, and by the late 1890s illustrations occupy majority of the cover. Meanwhile, by 1900’s refined wood engravings and woodcut prints are evident proving the improvement of skill while the continuation of text-based cover designs continues throughout this timeline.

6. Conclusion

This study observed primary data in this case original printed books cover designs in Sri Lanka between the early newspaper era. This era also demonstrates the rising of the local book publishing industry where numerous publishers and authors had come together. By observing these early cover designs we were able to document historical data that contributes to historical research and, it is with such research we are able to identify and differentiate a problem or a field of study that sometimes

help generate hypothesis. Testing such hypotheses lead to new understanding of the past and highlights the need and its relevance in shaping our present and future.

Thus, to achieved this, the research discussed early printing techniques used around the world and how the physical prints can be identified and categorized. The comparison of this knowledge and the primary data led us towards building a hypothesis such as *what were the trending technologies of this era?*. To test such hypotheses this research documents how and when the technology was used as contribution towards establishing new knowledge within the practice of historical research.

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