THE LEGIBILITY OF SANS SERIF TYPEFACES, AN EXPERIMENTAL AND COMPARATIVE STUDY

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THE LEGIBILITY OF SANS SERIF TYPEFACES, AN EXPERIMENTAL AND COMPARATIVE STUDY.

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by
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ENGLISH ABSTRACT

THE LEGIBILITY OF SANS SERIF TYPEFACES, AN EXPERIMENTAL AND COMPARATIVE STUDY.

Typographers and printers often regard romans as a more legible and appropriate typeface for reading material than sans serifs. Authors contend that readers prefer romans above sans serifs, that it is read faster, and that the comprehension rate is possibly higher when text is set in a roman typeface.

The absence of satisfactory empirical data to prove these assumptions and the importance of legibility in academic reading material, motivated this study. The aim of this study was to determine the comparative legibility of sans serif and roman typefaces and to establish the typeface preference of the subjects that were used in the experiments.

Four hundred and sixty-nine primary school subjects from nine different schools were used in a control group pre-test, post-test research design where five different experiments were completed.

Romans and sans serifs were found to be equally legible as no significant statistical difference was found between the reading speed, scanning speed, accuracy and comprehension at the 0.05 level. A significant statistical preference for sans serifs at the 0.05 level was found for three groups in two of the experiments.

These results are in contrast to the assumption that romans are more legible than sans serifs. It can be interpreted as promising for graphic designers and typographers, as it appears that legibility will not necessarily be sacrificed when certain reading material is set in a sans serif typeface.

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AFRIKAANSE SAMEVATTING.

DIE LEESBAARHEID VAN SANS SERIF-LETTERTIPES, 'N EKSPERIMENTELE EN VERGELYKENDE STUDIE.

Tipograwe en drukkers beskou romeinse letters dikwels as 'n meer leesbare en toepaslike lettertipe vir teks as sans serifs. Outeurs is dikwels van mening dat romeinse letters vinniger kan lees, en dat teks wat geset is in romeinse letters, 'n beter begrip by lesers meebring.

Die afwesigheid van bevredigende empiriese data om hierdie teorie te staaf, asook die noodsaaklikheid van die leesbaarheid van akademiese leesstof het as motivering vir hierdie studie gedien. Die doel van hierdie studie is om die leesbaarheid van romeinse en sans serif-lettertipes met mekaar te vergelyk, asook om te bepaal welke lettertipe die proefpersone verkies.

Vierhonderd nege-en-sestig laerskoolkinders van nege verskillende skole is gebruik in 'n kontrolegroep voortoets natoets-navorsingsontwep. Vyf verskillende eksperimente is tydens hierdie studie voltooi.

Romeinse en sans serifs is as ewe leesbaar beskou omdat daar geen merkbare statistiese verskil tussen die leesspoed, soekleesspoed, akuraatheid en begrip op die 0.05 peil was nie. Daar was wel 'n merkbare statistiese voorkeur vir sans serif-lettertipes deur drie groepe leerlinge in twee eksperimente op die 0.05 peil.

Hierdie resultate is in teenstelling met die aanname dat romeinse letters meer leesbaar is as sans serif-lettertipes en kan as belowend beskou word vir ontwerpers en tipograwe, omdat dit blyk dat teks nie noodwendig minder leesbaar sal word wanneer sekere leesmateriaal in sans serifs geset word nie.

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Dedicated to my lovely wife
Meryl de Lange
who supported me
throughout this study.

A NOTE ON THE TYPOGRAPHICAL FEATURES OF THIS RESEARCH REPORT.

This dissertation is set in *Helvetica* 11 point, with 6 points of line space, which is slightly more than one and a half line space. The main headings are set in 20 point and all the sub-headings in a 13 point size.

Traditionally, academic research reports for higher qualifications are presented on one side of an A4 sheet, in double or one and a half line spacing. The typeface is normally *Courier* in a 12 point size, or a similar typewriter or computer printer generated typeface. Space occupied by these characters are equal, for example, the character **I** would occupy the same amount of space as the character **M**. The spaces between the characters are also generous. `This is an example of the Courier typeface, which is normally set with generous word and letter space.` When the *Courier* type of letter is compared to typefaces found in books and magazines, one of the differences is that the typefaces in books occupy less space, given characters of the same vertical size.

The advantages of setting this report in *Helvetica* is that the text occupies less space, and that there is an improvement in the visual appearance of the report. Chapters one to five and the bibliography occupies one hundred and forty-three pages of this report. If these chapters were set in the *Courier* typeface, with one and a half line space, then the length of the report would have been two hundred and twenty pages. It also duplicates better on a photocopier than the *Courier* typeface due to the bolder design. The researcher also believes that the legibility is enhanced, and regards it as appropriate to set this report in a sans serif, as the study investigated the legibility of sans serifs.

This report was printed with a three hundred dots per inch laser printer fitted with a postscript cartridge. *Microsoft Word version 5.0* was used for the main text. *Microsoft Word for Windows version 2* and *Coreldraw version 2.01* was used for the graphs and tables. Care has been taken to use high quality photographs for the illustrations, as well as all the material given in the back of this report. The duplication of these illustrations with a photocopier altered the final quality, particular the fine serifs of the roman typefaces.

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CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THIS STUDY.

CONTENT

1.1 INTRODUCTION.

Studies in the field of legibility research date back more than one hundred and ninety years. Typographers, psychologists, oculists, physiologists and educators are amongst those who have done research and have written about legibility and related fields of reading research. These researchers provided valuable information about factors of legibility. As early as 1878, Professor Javal of the University of Paris established that a reader's eyes move along a line of print in a series of quick jerks (Spencer 1969:13). This was contrary to the popular belief that a reader's eyes move along a line of print in a smooth sweep. Javal called these quick jerks saccadic movements.

Apart from eye movements, other factors viz. illumination, colour, heart rate, blink rate, visual fatigue and typographical factors were investigated. It is especially legibility studies involving typographical factors that are of interest to the designer and typographer. Research has provided guidelines concerning the legibility of telephone directories, newspaper headlines, backbone titles, line spacing, the length of a line of type and electronic text, to name but a few.

Graphic design is a discipline that is intrinsically linked to art, commerce and communication. It can cover everything from a simple image that conveys a single phonetic sound to a major component in a public relations programme or advertising campaign. In its simplest form the function of graphic design is to persuade, inform and to identify (Hurlburt 1981:22). Different techniques and mechanical processes are used in the design process to achieve a certain goal and are normally not seen as ends in themself. Photographs, letters, colour, and hand or machine generated images are all components used by designers in the design process. Typography, one of these components, can be regarded as the most used and sometimes misused element in the graphic design process. Typography is used in all aspects of visual communications, and in conjunction with appropriate images, can convey a very strong and precise message.

Gottschall (1989:1) defines typography as a vital element that makes electronic and printed communication more effective and efficient. Typography forms an integrating part in most facets of visual communication, whether it be purely functional or aesthetic in nature. Legibility research is, amongst others, involved in establishing how orthographic material can be designed and applied to solve typographical problems.

Miles A Tinker, an internationally recognised authority on legibility of print, discusses the findings of past studies as well as his own in his book: *Legibility of Print.* Some relevant aspects are:

* Italics are read somewhat slower than normal upright romans.
* Visibility and perceptibility at a distance does not show any agreement between the legibility of a type face and speed reading tests.
* Legibility is improved by more than seven per cent when indenting the first line of a paragraph (Tinker 1963:64+65+127).

Results of Tinker's studies have provided material for seven books and nearly two hundred publications. Tinker is also named by Zachrisson as one of the most prolific writers on the subject of legibility (Zachrisson 1965:34).

In another interesting study a computer was used to simulate the neurological structure of the human visual system. A digital computer model of human visual processing was applied to characters with and without serifs. In the discussion the researchers concluded that serifs were important and useful in the perception of small[1] individual characters (Robinson, Abbamonte & Evans 1971:359).

With the arrival of computers and electronic text, some of the legibility research shifted towards this field. Foster and Bruce (1982:145) conducted experiments to determine how easily upper cases should be read on a user's television screen compared with lower case characters. The field of legibility research has greatly been enlarged since the arrival of the microchip. Hartley (1987:13) argues that much of the research on printed text is relevant when designing electronic text. Owen (1991:224-230) speculates that the traditional rules of typography will become redundant in the design of electronic magazines. Type can move, change colour, or flash to emphasize a point or to get attention. Electronic magazines are designed with a computer, printed on compact disks, and read from a visual display. Text, animation, video, sound, photographs and illustrations are synthesized into a complex system, from which information can be retrieved to be printed, read, or listened to. Two major obstacles associated with electronic

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1 Small characters in this instance refer to upper and lower case letters between two and three millimetres in height.

magazines are the expensive hardware in delivering the magazine, and the poor legibility of visual display units especially with small[2] typefaces.

Researchers have calculated that an office worker must spend between sixty thousand and eighty thousand hours reading documents, books and instructions as part of his job during his career (Meyer 1987:7). Legible documents and books are not only important for office workers, but must be a priority in educational reading material. A tertiary student doing a three year course may have to read between three and ten million words[3], depending on the particular subjects during the study period. The personal preferences of the printer and other aesthetic reasons must thus be secondary to the legibility aspect of such material. Research findings of psychologists, educators and typographers have provided valuable information about factors of legibility. This information can now be used by publishers and printers to design and manipulate typographical matter to make reading material legible, inviting to read, and to communicate more effectively. Knowing the factors that diminish legibility, Graphic Designers can also decide how much legibility can be sacrificed for the sake of visual impact and aesthetic considerations.

Legibility for this study was defined as follows:

A typeface is regarded to be more legible than another when it provides the highest reading speed, is scanned with fewer errors, is recognised faster, and provides the highest comprehension.

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2 The size of small letters for visual display units are limited by the unit's resolution. A small 6 point letter can easily be distinguished when it is printed, but can be illegible on most computer screens.

3 The amount of words have been calculated as follows: A tertiary student, for example, doing a three year commercial degree at the University of South Africa could write a total of twenty-one different papers. Each paper represents a separate course, or a subject for a course. A handbook for a paper can contain between one hundred and six hundred pages, with two hundred to five hundred words per page. If a student only reads twenty-one handbooks once, each with four hundred pages containing four hundred words per page, then the student will read more than three million three hundred and sixty thousand words. The more inquisitive and diligent student will obviously read more during his study.

1.2 THE PROBLEM

Typographers and printers usually classify typefaces used by the Western World into two main categories, namely, roman and sans serif typefaces. Serifs or short terminal strokes at the end of each letter are the main feature that make romans different from sans serifs. Also, most sans serifs do not have a variation in the thickness of the horizontal and vertical strokes like roman typefaces. Different roman and sans serif typefaces are illustrated in figure 1.1.

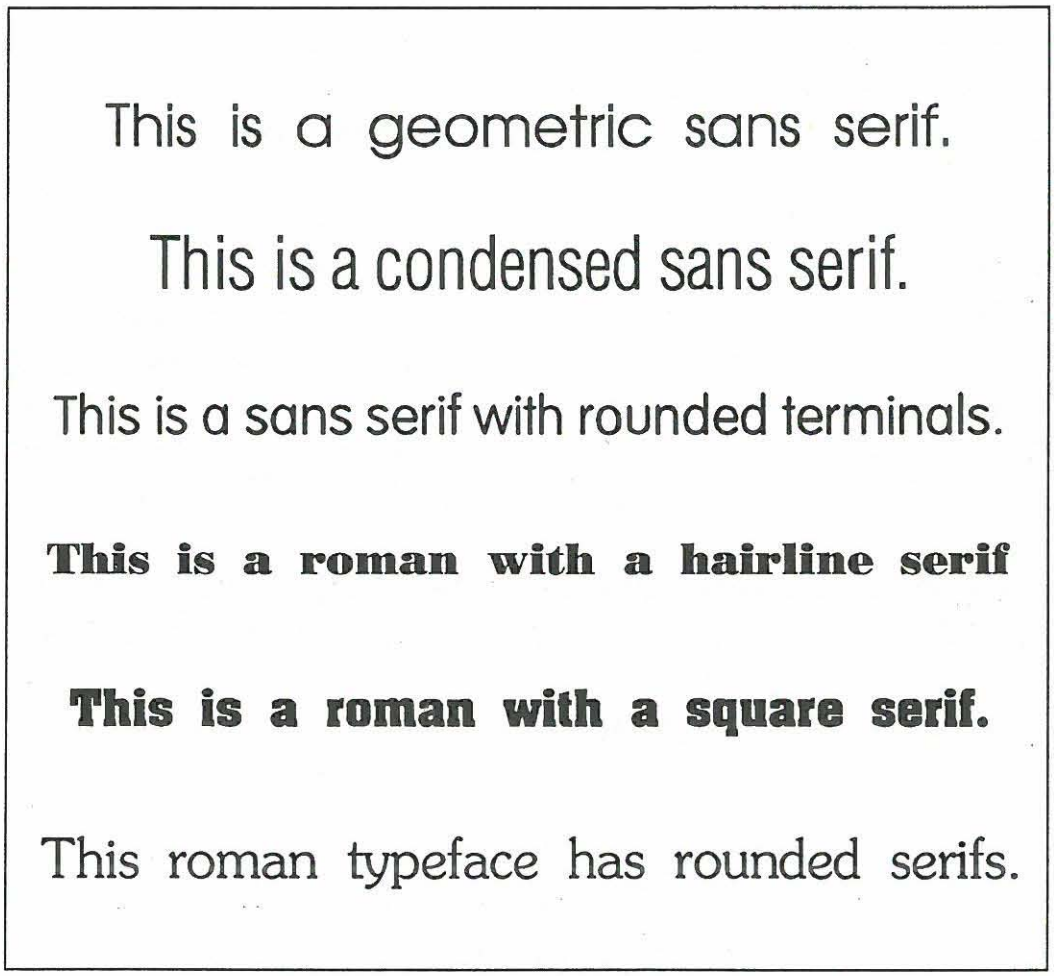

FIGURE 1.1

An assortment of roman and sans serif typefaces exhibiting varying serifs and type designs.

Referring to normal reading material, studies by North and Jenkins (1951:225-228) and Tinker (1945:217-229) have indicated that there is a correlation between comprehension, reading speed and legibility. Reading speed cannot necessarily be taken as an indicator of legibility, and an increase in comprehension cannot *per se* be attributed to the legibility of text. The correct use of typefaces and typographical matter can however make text easier and more inviting to read, and possibly increase reading speed and comprehension. Designing educational text[4], for example, will require decisions such as which typeface must be used, its size and weight. Other factors, namely, line spacing, column width, printing process, size and types of paper, and costs must all be considered in the design process. The size of the typeface will, for example, influence the line length. A reader might find it difficult to find the beginning of the next line with the return sweep if the typeface is small and the line length[5] is too long.

Traditionally and historically, it is roman typefaces that have been used mostly for textual reading matter. From a survey of existing literature it appears that different reasons are given why romans are regarded as more legible than sans serifs. Most of the opinions are, however, not based on any empirical evidence. See also chapter two, point 2.2 and chapter five, point 5.6.1 for the reasons why romans are regarded as more legible than sans serifs.

There are two conflicting opinions concerning the comparable legibility of sans serif and roman typefaces:

The traditional and most common view is that romans are more legible than sans serifs.

Authors of the majority of popular books on design and typography share this sentiment, (Binns 1989, Collier 1991, Craig 1981, and Gates 1973). There are also some authors of scientific literature who seem to support the belief that romans are superior to sans serifs. No convincing evidence, in the form of

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4 Educational material for the lower standards in the primary school will require larger typefaces than for example a statistics handbook for a tertiary course. A bolder and much larger typeface will, for example, be suitable for outdoor educational posters, aimed at passing pedestrians.

5 The ideal line length is traditionally regarded as between one and two alphabets in length, which is twenty-six to fifty-two spaces and characters in length.

scientific studies, was however found by the researcher to substantiate this popular belief.

The second opinion is that there is no significant difference between the legibility of roman and sans serif typefaces.

A limited amount of articles were found that could possibly indicate an equal legibility between these two groups of typefaces. The results of these studies are, however, not conclusive, and some errors[6] are present in these research designs. These two viewpoints are fully documented through a review of the literature in chapter two.

It can be argued that if romans are superior to sans serifs in instructional text, then all reading material should ideally be printed in romans. *If sans serifs are more legible than romans, then the practice of using romans for text must be regarded as a major error.* If there is no difference between the two typefaces, then it will provide designers and typographers with a wider variety of typefaces to choose from when specifying text.

1.3 THE PURPOSE OF THIS STUDY.

Are well designed[7] sans serifs more legible than well designed romans with regard to word recognition, comprehension, reading and scanning speed? Which typeface do readers prefer? These are the questions that were addressed in this study.

The aim of this study was two-fold, namely:

To determine the comparative legibility of sans serif and roman typefaces.

The researcher used quantitative methods in a controlled experimental situation to ascertain which typeface is the most legible. This approach was regarded as necessary in view of the subjective basis of the theory that romans are more legible.

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6 These errors are discussed in point 2.3.1 and 2.3.2 in chapter two.

7 *Helvetica* is regarded by the researcher as a well designed sans serif and *Palatino* is regarded as a well designed roman.

To establish the typeface preference of the readers used in the experiments.

If the typefaces were found to be equally legible, then the readers' preference would play a greater part in the designer's choice of a typeface.

1.4 DEFINITION OF TERMS.

Typographical terms used in this research report are defined as follows:

Ascender
The strokes of lowercase letters that extend above the x height of the letter.

Character.
The individual letters, numbers and punctuation marks of the alphabet, also called *type*.

Descender
The strokes of the lowercase letter that extend below the base line of the letters.

Legibility
The term *legibility* is a very wide concept and is defined by various authors as follows:

* *"Legibility will here be defined as the speed and accuracy of visually receiving and comprehending meaningful running text"* (Zachrisson 1965:25).

* Biggs, a typographer, mentions the aspect of familiarity as being one of the most important factors: *"... but familiarity, which might be called normality, is certainly one of the most important factors in legibility. In order that a type may be legible, in the sense that it may be easily read with the least fatigue on the part of the reader, it must be familiar in general shape and proportion"* (Biggs 1949:23).

* Hugh Williamson, a printer and publisher, states: *"Legibility may be defined as ability to be read continuously, by the kind of reader for whom*

the text is intended and in the kind of circumstance in which he may be expected to read, with the greatest possible speed, accuracy and pleasure, and with the least possible effort and distraction" (Williamson 1983:100).

* Another typographer, Tarr, describes legibility as: *"... that quality which enables words to be read easily, quickly, and accurately"* (Tarr 1951:21).

* Miles Tinker, states:
"Legibility, then, is concerned with perceiving letters and words, and with the reading of continuous textual material. The shapes of letters must be discriminated, the characteristic word forms perceived, and continuous text read accurately, rapidly, easily and with understanding" (Tinker 1963:7+8).

* One of the first comprehensive reports on legibility of print was compiled by Pyke and published by the British Medical Research Council in 1926. In this report Pyke refers to legibility as follows: *"For of two types read with equal accuracy, that which was read faster might claim to be the more legible, and of two read equally fast the one read more accurately likewise"* (Pyke 1926:26).

* *"Legibility represents those qualities and attributes inherent in typography that make type readable"* (Carter, Day & Meggs 1985:81).

* *"Readability [legibility] is the quality that makes the page easy to read, inviting, and pleasurable to the eye"* (Brackets mine) (Binns 1989:16).

* For the purpose of this study the following definition of legibility was used:

A TYPEFACE SET IN CONTINUOUS MEANINGFUL TEXT CAN BE CONSIDERED TO BE MORE LEGIBLE THAN ANOTHER WHEN IT PROVIDES THE HIGHEST OVERALL READING SPEED, COMPREHENSION AND ACCURACY.

Point size.
The measurement system used in typography. There are 72 points in an inch or 2.54 centimetres.

Roman.
The word *roman* is normally used when reference is made to an upright serifed typeface.

Sans Serif.
A typeface without serifs.

Serif.
The short cross-strokes at the terminals of letters.

Text type or text.
Also called *body type*. Normally type from six point to fourteen point in size.

Type face.
A complete set of alphabetic characters, punctuation marks, and numbers.

Work rate.
The same as work speed, reading speed. Measured in the amount of characters, lines or pages read per time unit.

x Height.
The size of the lower case character measured against the upper case character of the same type face.

1.5 THE HYPOTHESES.

A hypothesis was set for both aims of this study, namely one for the comparative legibility, and one for the subject's typeface preference.

1.5.1 TYPEFACE LEGIBILITY.

There is no significant difference between the mean legibility of roman and sans serif typefaces. The alternative hypothesis stated that there is a difference.

Mathematically the null and alternative hypothesis are expressed as follows:

H_o: $\mu R = \mu S$ $\quad\quad$ H_a: $\mu R \neq \mu S$

R and S are the legibility scores of roman and sans serif typefaces.

1.5.2 TYPEFACE PREFERENCE.

Readers equally prefer romans and sans serif typefaces. The alternative hypothesis stated that there is a particular typeface preference. Mathematically the hypothesis is expressed as follows:

H_o: $p_1 = p_2$ $\quad\quad$ H_a: $p_1 \neq p_2$

p Is the proportion of subjects that prefer a particular typeface.

1.6 MOTIVATION FOR THIS STUDY.

Different factors influenced the approach to this study and the manner in which it was carried out. The researcher considered it fitting to discuss these factors, as there is a lack of formal research[8] and established research procedures in graphic design departments at technikons.

1.6.1 MOTIVATION FOR THE APPROACH TO THIS STUDY.

Technikon requirements for higher academic qualifications, where a research project and dissertation are required, directed the approach to this project.

Research at technikons is still in its infant stage when compared to what is done at universities. The decade or so of the technikons' existence is also a factor in the limited research output of these institutions. The following guidelines on conducting research in a technikon environment were used to provide direction to the study:

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8 Formal research in this context is defined as a structured and objective investigation of a problem and where the investigation and result are disseminated through a form of publication, whether a dissertation or scientific article.

During the official opening of Technikon Northern Transvaal on 30 April 1987 Viljoen, with reference to technikons and research conducted at technikons stated the following:

* *"To advance human potential and natural resources by bringing about applied (practice orientated) research progress and developments."*

* *"Applied and developmental research and consultancy to help identify problems and to develop technological solutions have to become an essential part of the service provided by technikons."*

* *"...must be primarily concerned with the solving of problems in industry"* (Viljoen 1987:1-3).

Van Rensburg and Greyling (1985:1-4) expressed that:

* existing research techniques and methodology would be used in technikon research;

* that technikons were requested to restrict their research to developmental and applied research;

* the emphasis will be on practice directed research and innovation;

* there must be no difference between the research standards of technikons and universities.

A publication by the Committee of Technikon Principals was considered as the most informative document with guidelines on technikon research. In the preface it is stated that:

> *"In view of the unique character and philosophy of the technikon, one would expect research to be conducted accordingly.*
> *This document is the result of in-depth deliberations on the essential aspects of technikon research. It reflects the formal stance of technikon education and offers guidelines for managing and conducting future research"* (CTP 1989:ii).

Some of these guidelines are:

* *"As far as the research component of the M Dip Tech and Laureatus Diplomas is concerned, the technologist can be described as the "thinker within the technology," and should not only be skilled in identifying problems, but conversant with research methodologies that are part and parcel of problem-solving in industry"* (underlining mine) (CTP 1989:4).

* Referring to a technikon researcher it is stated: *"...will apply them [results from pure scientific research] in such a way that they would improve industrial operations and offer pragmatic solutions to existing industrial problems"* (underlining mine) (CTP 1989:5).

The researcher identified the controversy regarding the legibility of sans serifs as a relevant problem in graphic design and typography. Existing research methods were chosen to investigate this problem with the aim of possibly improving design and typographical practices.

1.6.2 MOTIVATION FOR THE CHOSEN TOPIC.

A literature study highlighted a theory and practice in typography lacking supporting proof. The assumption about the superior legibility of roman typefaces appears to be an untested generalisation. Many of the typographical practices have, and are still based on the belief that romans are the most legible typefaces to use for text. This unsubstantiated belief was considered a valid problem that warranted an investigation. The central part that typography plays in the graphic design process, and the importance of legible instructional text provided added motivation for this study. Typography is also an element that must be considered in other forms of visual communication.[9]

Josef Müller-Brockmann, a well-known typographer and designer is quoted by Carter *et al.* (1985:89) as saying:

> *"Information presented with clear and logically set out titles, subtitles, texts, illustrations, and captions will not only be read more quickly and*

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9 Examples of other forms of visual communication are the film industry, signage systems, television and electronic display terminals.

easily, but the information will also be better understood and retained in memory."

Although no reference is made to any empirical evidence to support such a statement, it does appear to be reasonable to assume that text that is typographically well presented, can aid the reading and comprehension process.

It can be argued that if romans are superior to sans serifs in instructional text, then all reading material should ideally be printed in romans. If sans serifs are more legible than romans, then the practice of using romans for text must be regarded as a major error. If there is no difference between the legibility of the two typefaces, then it will provide designers and typographers with a wider variety of typefaces to choose from, when designing text.

1.6.4 THE IMPORTANCE OF LEGIBILITY STUDIES.

The main objective of the printing industry is to transmit a message by using only visual material, for example printed photographs, or textual matter combined with visual images. Textual matter, as used by most of the Western world, consists of twenty-six basic characters or graphic images representing certain sounds. A further nine images are used to represent certain quantities. Legibility research provides information on how these images can be used and how they must be designed to make them communicate more effectively. *"Legibility research in printing is concerned with the efficiency of the visible word"* (Spencer 1969:6). *Word* in this instance refers to the printed letters of the alphabet. Speaking of typographers Zapf stated: *"Our objective should be a typography aimed at legibility and clarity, self-evident in disposition"* (Zapf 1987:49). It is legibility research that can add to the knowledge on how to design legible text and other graphic images.

Information provided by legibility research can guide the designer, printer and typographer to avoid factors that could diminish legibility. This is especially important when functional efficiency is important, for example, in academic textbooks. Spencer mentions that by knowing factors that diminish legibility, designers can now determine how *"... far reading efficiency should be reduced for the sake of providing initial impact, visual stimulus or 'atmosphere'"* (Spencer 1969:7).

Studies by North & Jenkins (1951:225-229), and Tinker (1945:217-229), indicated that there is a positive correlation between comprehension, legibility and speed of reading. From this it can be presumed that legible type in optimum typographical arrangements, as determined by legibility studies, can possibly result in a higher comprehension rate and an increased reading speed.

Research into the relative legibility of sans serifs, compared with romans, will provide the designer with the knowledge and freedom to choose not only from roman faces, but also from sans serifs for textual matter. Spencer has the following to say concerning legibility research and the designer: *"... legibility research is likely to provide the designer with greater rather than less real freedom - releasing him from many of his present inhibitions,..." (Spencer 1969:6+7)*. Although the statement was made in 1969, many of the factors that inhibited a typographer or designer then, are still present today. Computerised typesetting systems made designing text easier and faster, but assumptions, for example, the ideal line length, line spacing and best typefaces[10] to use for text, are still being applied.

With the invention and development of personal publishing systems and the increased use of electronic text, legibility research of sans serifs is of particular importance. According to Hartley, the choice of typefaces is far more restricted in electronic text than in printed text. Hartley also argues that sans serifs, which may seem more modern, is the more appropriate typeface to be used in electronic text (Hartley 1987:7-8). The resolution of type that appear on most electronic display terminals is lower than the resolution of type printed on paper. The researcher is therefore inclined to agree with Hartley that sans serifs is the more appropriate typeface for electronic text.

A conclusion why legibility studies are important, is the consideration of the time factor involved when reading text. Vanderplas and Vanderplas (1980:931) commenting on the choice of typefaces and other typographical factors, state:

> *"That these effects are not inconsiderable may be seen if one observes that a difference in average reading speed of approximately 1.0 line per second can result in a difference in average reading time of a book of 400 pages of more than 3 hours. Such a difference could have significant*

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10 Some of these assumptions, for example, that romans are the best typefaces for text is not scientifically verified.

influence on over all reading performance and possibly on understanding of the material as well."

1.6.5 MOTIVATION FOR THE RESEARCH TECHNIQUES USED.

The lack of formal academic research and the corresponding absence of an academic base in graphic design influenced the research techniques used in this study. It directed the researcher to other disciplines searching for appropriate research techniques.
The empirical methods used in the Human Sciences, and in particular those used in Educational research, were regarded as suitable for this study. Relevant comments are also made by the following authors:

Hurlburt, discussing the design process, creativity and research, refers to research as an analysis of the design assignment, a study of the client's intentions and consumer motivation, as well as using the results of market research (Hurlburt 1981:22-26).

Tufnell, discussing the thinking process in design states that:

> *"**Scientific** thinking is about accurate description leading to an explanation of why and how. In **art** you re-interpret the world through your own imagination and emotions, giving them external form in a range of media."* And also: *"Designers must use scientific methods to carry out research and set up experiments to discover the ground rules"* (underlining mine) (Tufnell 1989:7).

A full discussion of the research methods is given in chapter 3. Scarcity of empirical evidence, regarding the problem, provided the motivation for the experimental hypothesis-testing research design.

From a survey of existing literature it appears that very little research has been done, and is currently taking place in the field of graphic design in South Africa. Formal research in graphic design at technikons in South Africa was virtually non-existent at the beginning of this study. The researcher was only aware of two completed projects that were on master's diploma level. The Directors or Heads

of Graphic Design Departments of four of the bigger Technikon Art Schools[11] in South Africa could not provide any information of current or planned research projects at the beginning of this study. References to less than ten completed studies were found, which according to their titles, could possibly be studies in the field of graphic design. The titles of these studies are not always clear in what was done, as most of these studies were completed in a Fine Arts Department at a university. Only three studies could positively be identified, according to their titles, as research projects in graphic design.

Sauthoff, in an extensive study into the development of design and design education with special reference to the South African context, investigated design research as well. About research she stated the following:

> *"Art and Design as fields of practice have not had a long history of research, scientific or otherwise, comparable to the social or basic sciences. In fact, education in design has, in general, not tended to develop much understanding of scholarship, nor has it tended to develop analytic skills in the use of language and theory" (Sauthoff 1986:105).*

And:

> *"Yet there exists a range of research needing to be done - research both for designers and research about design. To reflect the unique character of design, this research must be in both the scientific and humanistic traditions" (Sauthoff 1986:110).*

The absence of documented graphic design research results from technikons, and the results of Sauthoff's study, seem to suggest that formal graphic design research in South Africa is virtually nonexistent.

In a publication by The Design Council (1990), *Design Courses 1991-92,* information on more than nine different design courses is published, which includes more than one thousand five hundred institutions in Britain alone. Some of these courses are photography, textiles, graphic design, weaving, foundation art courses, and engineering. Of the more than three hundred and fifty institutions offering graphic design, only sixteen were found to offer design research courses

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11 The four Art Schools which were consulted in 1990 were: Cape Town, Pretoria, Port Elizabeth and Durban Technikon.

on master's level or higher. Typographical research is also one of the directions offered for post diploma and post graduate studies.

The researcher believes that one of the reasons for the limited research in graphic design is the practical nature of graphic design and graphic design education.

Research in graphic design, however, does take place, and is needed by industry. David Maroni, director of *British Olivetti,* mentioned that for many years *Olivetti* has been committed to long-term design research not related to a specific project. One of these studies is readability research and the effect on the eyes and on environments (Maroni 1988:44). O'Brien refers to extensive research done by Jock Kinneir in designing the *British Rail Alphabet.* This sign posting system has been adopted by Australia, Denmark and Norway's state railway system, and British Airways. The success of this system is due to its maximum legibility in that letters of an x-height of fifty-five millimetres can be read at a distance of more than forty meters (O'Brien 1988:262). Similar research in the legibility of directional signage has been completed in South Africa. These projects were the legibility of letter types for road signs (Zator 1989) and the comprehensibility of overhead direction signs (Zator 1988).

In this chapter, the researcher presented the background to the study, the problem, purpose of the study, the hypotheses and the motivation for undertaking this study. Chapter two is a review of the literature and it provides the two opposing arguments, namely, that sans serifs and romans are equally legible, and that romans and sans serifs do not differ in legibility.

Chapter three covers the methods, subjects, procedures and a review of other legibility research methods. Chapter four provides the results. In this chapter, each experiment that was completed during the study is dicussed in detail. The conclusions, recommendations and summary are given in chapter five.

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Central University of Technology, Free State

CHAPTER 2

REVIEW OF THE LITERATURE.

CONTENT.

2.1 INTRODUCTION.

Data bases from the Human Sciences Research Council, the Council for Scientific and Industrial Research and the University of the Orange Free State provided preliminary sources for the study. These data bases included indexes, dissertation abstracts, the Sabinet system as well as current and completed research in South Africa. Legibility, Sans Serif, Readability and Printing were the subject names used in these computerized searches. Primary sources from these lists consist mostly out of journals related to education and the behavioural sciences, as well as some scholarly books. These primary sources also provided additional references to other internationally completed legibility studies. The secondary sources were mostly popular books and a few scholarly textbooks. Information on legibility in the popular books reflects, in most cases, the personal opinion of the authors. These books are targeted at the practising designer and typographer. The scholarly books provide information on the results of legibility studies, as well as summaries of other empirical studies in this field. No references to relevant legibility studies, conducted in South Africa, were found in the preliminary sources. Some reports[1] were produced by the Division of Roads and Transport Technology of the CSIR, but these were not applicable to the study.

The greater part of legibility studies involving print, was conducted from the late 1940's to the early 1960's. These studies included amongst others comparative studies of roman typefaces, illumination, comprehension and legibility, different types of printing papers, and typographical factors. The trend of legibility studies shifted from basic research in the 1940's to applied research in the 1970's, involving learning disabled scholars, older readers and visual display units, to name but a few. Legibility research then moved towards the electronic media in the eighties and nineties.

In the literature study it became apparent that the problem as to which typeface, a roman or sans serif, is the most legible, has not been thoroughly[2] investigated.

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1 These reports include studies on the legibility of three styles of lettering, used in traffic signs, and the comprehensibility of overhead direction signs. (Zator 1988 & 1989)

2 The only relevant studies where sans serifs were involved are discussed in point 2.2.8, 2.2.9, 2.3.1, 2.3.2 and 2.3.5.

The limited studies that do exist on this topic, suffer from typographical errors[3] and the results are therefore questionable. It was only in the late fifties and thereafter that sans serifs were designed in greater numbers and most of these type faces were not included in the legibility studies.

A review of the most relevant sources is given under the argument that romans are more legible than sans serifs, and under the argument that romans and sans serifs are equally legible.

2.2 ARGUMENTS THAT SUPPORT THE THEORY THAT ROMANS ARE MORE LEGIBLE THAN SANS SERIFS.

The following authors prescribe to this point of view:

2.2.1 According to Turnbull and Baird (1980:86) typographers believe that:

* Standard roman faces increase legibility.
* Serifs assist in horizontal eye movement.
* Reading is impaired by the undifferentiated[4] design features of sans serifs.

2.2.2 McLean, a typographer gives three rules concerning the legibility of text type. The applicable rule[5] is:

* *" Sans serif type is intrinsically less legible than seriffed type."*

* *"... for all continuous reading matter, seriffed type, properly used, is likely to be more easily read than 'sans'"* (McLean 1980:44).

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3 See the discussions under point 2.3.1 and 2.3.2.

4 The undifferentiated design features of a geometrically designed sans serif is contrasted with a roman in figure 2.1.

5 The other rules are: *" Words should be set close to each other (about as far apart as the width of the letter 'i'); and there should be more space between the lines than between the words."* and *"Well-designed roman upper- and lower-case type is easier to read than any of its variants, e.g. italic, bold, caps, expanded or condensed versions."* (McLean 1980:44-45)

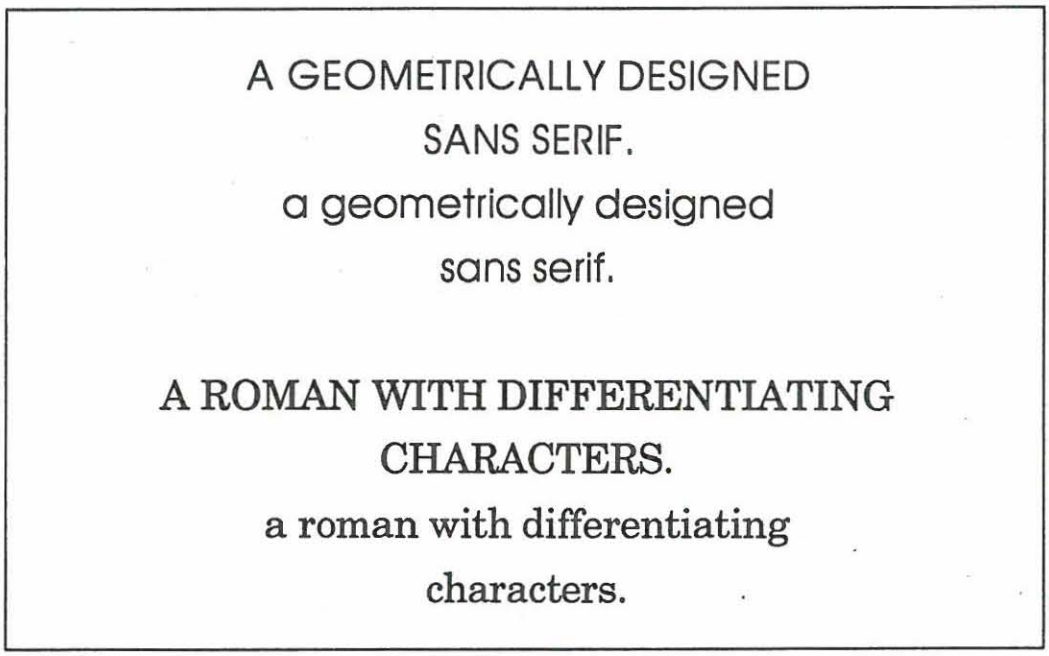

FIGURE 2.1

Undifferentiated design features of a geometrically designed sans serif contrasted with a roman typeface. The individual parts of the sans serif characters are made up from similar shapes whilst the individual roman characters consist of a unique design.

2.2.3 Both McLean, (1980:44) and Turnbull and Baird (1980:86) mentioned familiarity as well as the irregular design features of serif faces as reasons for improved legibility.

2.2.4 Zachrisson mentions that:

* It is the general belief in the graphic arts field that romans are more legible than sans serifs.
* Sans serifs are regarded as less legible than type with serifs in the printing trade (Zachrisson 1965:115).

The statements and viewpoints expressed by McLean, Turnbull and Baird, and Zachrisson are only the opinions of various typographers, printers and publishers. *No empirical evidence was given to support these views.*

2.2.5 Burt claims that serif typefaces help towards the horizontal movement of the eye and help to combine separate characters into *"... distinctive word-wholes"* (Burt 1959:9).

Burt's statement seems to agree with those of Turnbull and Baird.

2.2.6 Another statement by Burt, quoted by Hartley and Rooum, is as follows:

> *" ... Observations of eye movements show that with sans serif there are more fixations per line and more regressive eye movements. Attempts to test the reading efficiency of comparable batches of children indicate that those taught with non-serifed reading books read more slowly and are decidedly poorer in grasping the sense. The conclusions have since been confirmed by later American investigators, who also found 'serifed types more legible than unserifed'"* (Hartley and Rooum 1983:205).

According to Hartley and Rooum (1983:205), Watts and Nisbet (1974:32) many of Burt's statements are not supported by any empirical evidence. No documentation of his studies relevant to the quoted sections were found. Hartley and Rooum state that many of Burt's conclusions:

> *" were not out of line with current thinking although they often went beyond the data given. Indeed as one progresses through the reports and the accounts, it is hard-with the wisdom of hindsight-not to conclude that the data were used to support a predetermined position."* Hartley and Rooum also mention that there is *"... grounds for doubting the validity of the data presented by Burt, and many of the assertions lack support"* (Hartley and Rooum 1983:210).

2.2.7 *"... in general, serif faces are more easily read; and the whole aim of typography is to enable text to be read easily and quickly"* (Rawson 1987:213).

2.2.8 Robinson, Abbamonte & Evans (1971:359) applied a digital computer model of human visual processing to letters with and without serifs. In their discussion they stated:

" If the computer model has any validity as an imitation of the human visual system, then one may conclude that serifs are important in preserving the image of small[6] letters when they are represented in the neurological structure of the visual system."

The experiments of Robinson *et al.* (1971) determined the importance of serifs in individual letters and their perception, and not the legibility of continuous text.

2.2.9 In another experiment, Vanderplas and Vanderplas (1980:925-927) used twenty-eight older adults to test the legibility of romans and sans serifs. The results showed that the romans have an overall faster work rate than the sans serifs.

The average age of Vanderplas and Vanderplas's test group was seventy-two years. Only twenty-eight subjects were used. The same results would not necessarily be obtained with younger readers as test groups.

2.2.10 Daftuar and Jha (1981:108) using a tachistoscope device[7], found roman faces superior to sans serifs.

Daftuar and Jha tested the perceptibility of letters and not the legibility of continuous text. The individual letters of two roman typefaces and one sans serif were presented to fifty undergraduate students through a tachistoscope. Two different sizes, 10 and 12 point, were used as well as the upper and lower case letters. Apart from finding that the romans were significantly more legible, they found that uppercase letters were more legible than the lower case letters. This is in contrast with the theory[8] that lower case letters are more legible than upper case letters. A possible explanation for this is that the capital letters are physically bigger, and were therefore easier to recognise as individual characters than lower case letters.

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6 The small letters in this instance refer to upper and lower case characters, between two and three millimetres in height.

7 An instrument used to project or expose characters, words or sentences at varying times, normally used to improve reading speed.

8 Also see point 2.2.20.

A single letter of a particular typeface might be perceived faster and more accurately than a letter from another typeface, but it does not mean that it will provide the same results in continuous text.

When comparing legibility of text, visibility and perceptibility Tinker (1963:53) found a typeface, *American Typewriter*, very slow to read, but it was the third most visible at a distance out of ten typefaces. An example of *American Typewriter* taken from Studio Editions (1990:198) is given in figure 2.2.

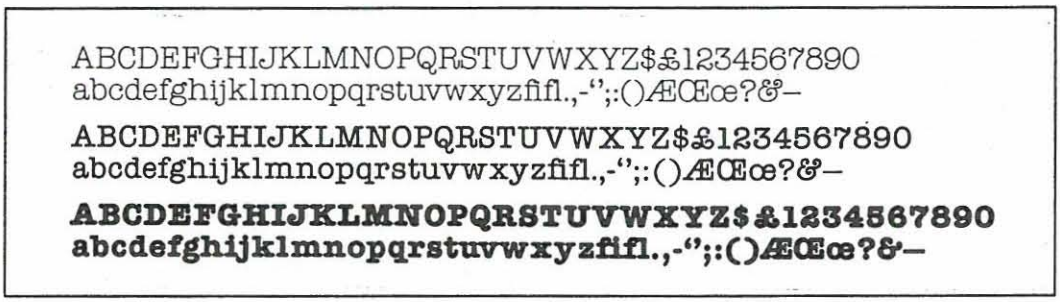

FIGURE 2.2

An example of American Typewriter.

2.2.11 Arnston, (1988:88) Brady, (1988:6) Brown, (1989:72) and Craig & Bevington (1989:69) are amongst the authors of popular books who indicate that seriffed type faces are more legible than sans serifs.

2.2.12 Gates states that:

> *" Because of their superior legibility, particularly in small sizes, Old Style typefaces are still the predominant choice for lengthy body copy applications, ..."* (Gates 1973:15).

This statement from Gates is one of those unsubstantiated generalisations.

2.2.13 Velarde mentions that: *" Tests have shown that sans serif is slightly harder to read on a book page ..."* (Velarde 1988:64).

The author does not provide any additional information on these tests.

2.2.14 A reference was made by Ernst (*s.a.*:139) to an experiment where the reading speed of sans serifs in newspapers was significantly lower than those of romans.

Reference to this experiment[9] is also made by Turnbull and Baird (1980:87) and they mention that in only three tests romans were read faster, but in the fourth test a sans serifs was read the fastest.

2.2.15 In a popular book that teaches the basics of typography Craig states:

> *" You will find that the serifs on a typeface facilitate the horizontal flow necessary to comfortable reading. As Sans serif does not have serifs, some readers find it difficult or uncomfortable to read"* (Craig 1981:123).

2.2.16 Hutt and James (1989:54) believe that old style type faces can be used for text and headlines, and that sans serifs are more suited for headlines. They, however, state that it can be used as a *"... useful rule of thumb, although not entirely reliable, ..."*

2.2.17 Anzovin, an author of a manual on how to use a popular computer graphics programme, seems to support the opinion that romans are more legible:

> *" Serif letters have short bases, caps, and tails on the letters to make them easier to read (though harder to create); sans-serif letters look clean and modern, but are harder to read"* (Anzovin 1989:140).

2.2.18 Newspapers generally appear to use romans for their body type. Romans in newspapers are normally different from the romans used in book or advertising typography. The ascenders and descenders are smaller, the serifs sturdier and the letters have open counters.

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9 Insufficient reference was given to this experiment, which prevented the researcher from obtaining a report about the experiment to make his own assessment.

Referring to newspaper typography Hodgson (1989:91) writes that:

" Serif type is more readable in small sizes (because it is less uniform than Sans) and has remained the standard book text in its various ranges, and also the standard body settings in newspapers,..."

2.2.19 Beaumont (1987:30) also uses the argument that serifs facilitate the horizontal flow that is apparently necessary for comfortable reading, and it is therefore romans that are the more legible type. This horizontal flow that is necessary for comfortable reading does not seem to concur with the saccadic[10] eye movements that really occur during reading.

2.2.20 Another popular argument that is used to demonstrate the superior legibility of romans over sans serifs is the upper-lowerhalf argument. A line of type set in sans serifs and romans with the lower half obstructed appears to diminish the identity of the words set in romans less than those set in sans serif. This alleged higher legibility or easier perception of romans is attributed to the individual uniqueness of each separate character as caused by the serifs. See figure 2.3.

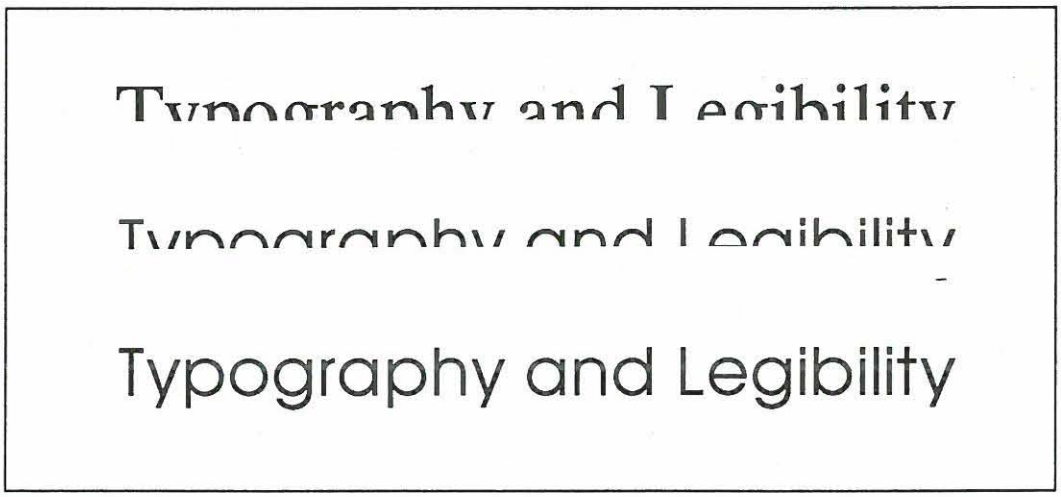

FIGURE 2.3

Partially covered words in a roman and sans serif typeface. The roman face appears to be easier to read due to the individual uniqueness of each separate character.

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10 See also the first paragraph in 1.1.

The researcher, however, disputes this particular argument because the majority of readers do not read letter-by-letter, and that reading material is usually not presented with the lower half obstructed. It is possible that this argument could apply when subjects are exposed to individual words and/or characters.

2.2.21 Gates (1969:55) argues that the thick and thin variation in the strokes of romans and relatively large enclosed white space makes them easier to perceive in small sizes.

Numerous developments in type design and reproduction processes have taken place since these comments were made in 1969. These arguments can, therefore, also apply to sans serifs that meet the criteria of contrast in the vertical and horizontal strokes combined with large enclosed white spaces. *Cosmos* and *Signa*, taken from Wallis (1990: 57&138) are two sans serifs that meet these criteria and are illustrated in figure 2.4.

FIGURE 2.4

Examples of Cosmos and Signa, sans serifs with variations in their vertical and horizontal strokes.

2.2.22 A great number of popular books on how to design and use text in desk top publishing also supports the belief that romans are easier to read (Parker 1989:30 & Durrant 1989:66).

2.2.23 Collier & Cotton (1989:34) provide a reasonable argument and state that: *"Serifs also modulate the spaces between letters, giving serif text a softer, more delicate appearance that is more suitable for continuous reading."*

2.3 ARGUMENTS THAT ARE IN FAVOUR OF EQUAL LEGIBILITY BETWEEN ROMAN AND SANS SERIF TYPEFACES.

2.3.1 Tinker, (1963:46) reporting on earlier studies conducted by Paterson and himself, tested ten different typefaces for legibility using a speed reading test. Only one sans serifs, *Kable light*, was included in this test. *Kable light* was read 2.2 % slower than their standard type and 2.6 % slower than the fastest type. The difference was not regarded as statistically significant. *Kable*, taken from *Studio Editions* (1990:306), is given in figure 2.5.

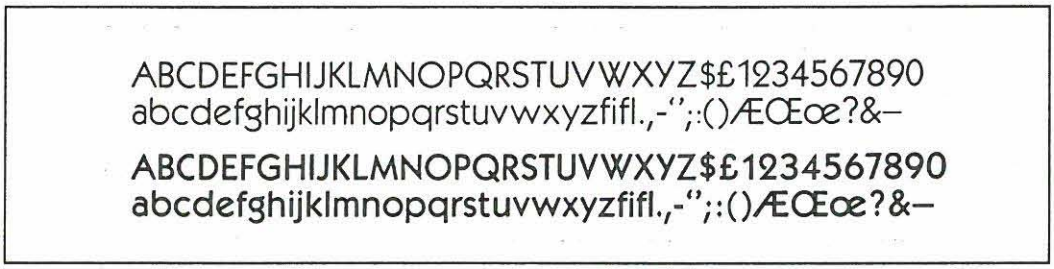

FIGURE 2.5
An example of the Kable typeface.

Tinker found no significant difference between the reading speed of type faces in common use. It is considered that his research design suffered, however, from the following errors:

* The typefaces used were of a 10 point size. The point size of a type face is not an accurate measurement of the physical size of a letter and Tinker's typefaces were, therefore, of different sizes. See the examples in figure 2.6.

* Would today's test groups, being more exposed to sans serifs and a bigger variety of sans serifs, give the same results? A small portion of books and magazines produced today are set in sans serifs. This was not the case when Tinker did his experiments.

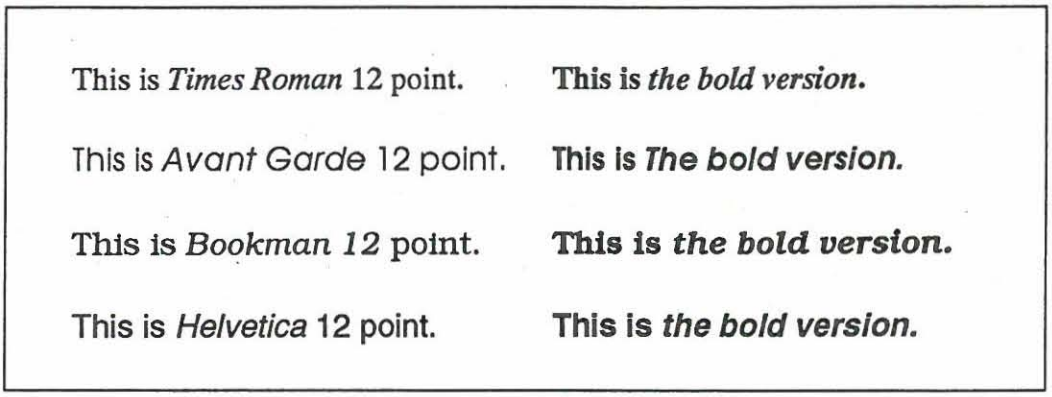

FIGURE 2.6

Different typefaces of the same point size.

* The typefaces used were only in a size intended for book typography. Would the same hold true for newspaper typography? Newspaper typography is normally set in a much narrower column, and in a smaller typeface than book typography.

* Only one sans serifs was used in the experiments. *Stone Sans* and *Univers*, sans serifs designed after Tinker's experiment could possibly be more legible than well-known roman typefaces. *Stone Sans* from Wallis (1990:141) and *Univers* from Studio Editions (1990:190) are given in figure 2.7.

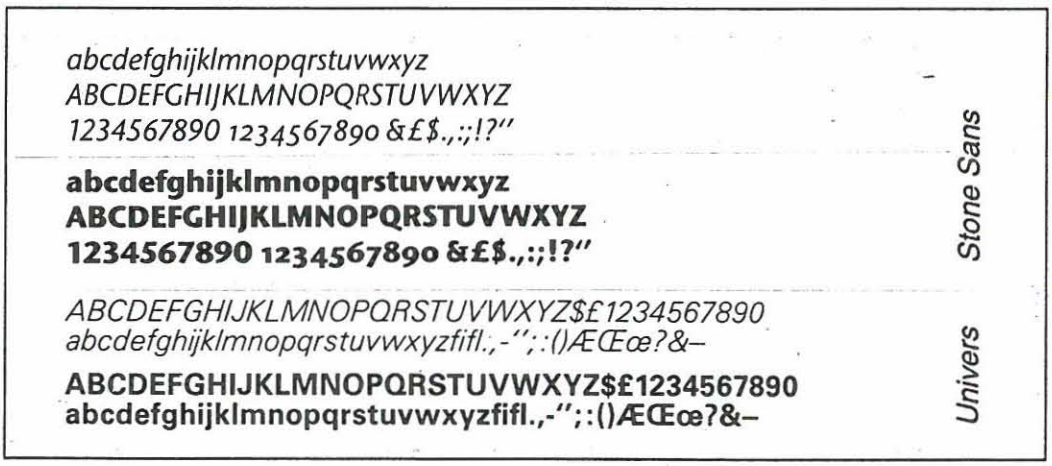

FIGURE 2.7

An example of the Stone Sans and Univers typeface.

* The papers and printing techniques used in Tinker's experiments are totally different from that which is being used today. Tinker used a relief printing process, while most books and magazines are now printed with the offset lithographic or intaglio process.

* The Chapman-Cook test used by Paterson and Tinker is criticized by Zachrisson (1965:46) as being an attention test and not a true speed reading test.

2.3.2 Zachrisson, (1965:114) in a series of experiments, used 48 children between ten and eleven years of age as a test group, and found no significant difference between romans and sans serifs in a silent speed reading comprehension test. He also stated:

> *" There is reason to assume that under normal conditions no significant difference exists between typefaces in common use by adults for running text"* (Zachrisson 1965:36).

Zachrisson found no difference between the legibility of romans and sans serifs, using children in his experiments. Although he assumed that the same will apply to adults, he also stated:

> *"... it is of interest to ascertain whether or not the assumption holds good that the legibility value for adults of San [sic] serif letters, in terms of speed, errors and other criteria, is significantly less than that of old face. The problem is different when applied to small children. They are slower readers and the nuances of letter design seem to play a comparatively small part in their combat with the text"* (Zachrisson 1965:36).

Zachrisson used research designs where he used the same subject, reading different texts set in a roman and sans serif typeface. The hypothesis testing was done by analysing the variance. Two romans and two sans serifs were used, set in two different texts. The experimental order was such that the one sans serif, for example, was tested against one of the romans only six times, using the two different texts. The weakness of this design lies in the equalization of the two texts that might create the risk of invalid results. The visual sizes of the typefaces varied and the sample size is regarded by the researcher as too small to make inferences to a wider population.

2.3.3 In a review of past studies, Zachrisson (1965:37) refers to Brachfield, who found that a page set in sans serif took only three seconds longer to read than a page set in a serif face.

2.3.4 Hartley (1987:8), in a paper discussing the role of print-based research in designing electronic text, mentions the following:

" Some investigators have argued that serifs in printed text increase the spacing between the letters slightly, and that this makes the text easier to read, but there does not seem to be any conclusive proof for such assumptions ..."

Sans serif characters are generally set closer to each other than roman typefaces. A small 4 point sans serif could be difficult to read when the characters are set close to each other. If spacing does affect legibility, then wider letter spacing would solve this problem. This theory of increased legibility because of the space between letters is in conflict with Burt's opinion that serifs bind the words in cohesive wholes as discussed in point 2.2.5.

2.3.5 In a related field of study, Poulton (1965:361) conducted an experiment to determine the comprehension rate of four sans serifs and three roman faces. No reliable difference was found between the comprehension rate of the roman and sans serifs. In his conclusion Poulton suggests: *"... It is not necessarily serifs, as has been claimed (Burt, 1959) which make typefaces readable."*

2.3.6 In contrast to the above mentioned results, Pyke (1926:5) experimentally compared the legibility of eight different typefaces with each other. A sans serif was judged the second most legible type.

2.3.7 Gray believes that sans serifs are acceptable for text, as long as the copy is not too long[11] (Gray 1989:42).

2.3.8 Turnbull and Baird (1980:86), discussing the opposing viewpoints, states that no tests have either refuted or confirmed the belief that romans are more legible.

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11 Gray does not specify the length of the text, but it is presumed that the *not too long* refers to introductory paragraphs and captions for tables and figures.

2.3.9 Binns refers to *" several experiments "* and reports that sans serifs do not seem to decrease legibility. (Binns 1989:17)

No further reference is, however, given to these experiments.

2.3.10 *Optima*, a sans serif typeface, is recommended by Haley (1990:79) as a typeface that *"... is ideal for short blocks of copy and unlike most sans serif faces, can be used with confidence in lengthy text composition."* He argues that it is not an ideal[12] typeface for text, but that it comes close to it. Optima, taken from Studio Editions (1990:140) is given in figure 2.8.

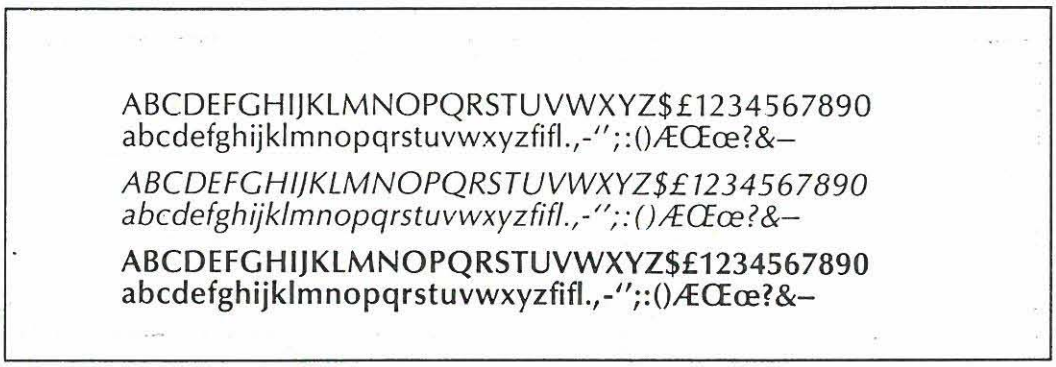

FIGURE 2.8

An example of the Optima typeface.

2.3.11 *Syntax*, a sans serif designed in 1968, was regarded as the most successful of four sans serifs, and a very legible text face (Bigelow, Duensing and Gentry 1989:25). This typeface, taken from Wallis (1990:144), is given in figure 2.9 .

2.3.12 Carter *et al.* (1985:84) refers to the controversy surrounding the comparative legibility of romans and sans serifs and concludes that relative legibility is negligible.

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12 Haley (190:79) appears to be of the opinion that romans are the ideal text as he states that the slight swelling at the end of *Optima's* terminals is an *"... alternative to serifs in guiding the eye across the page, ..."*

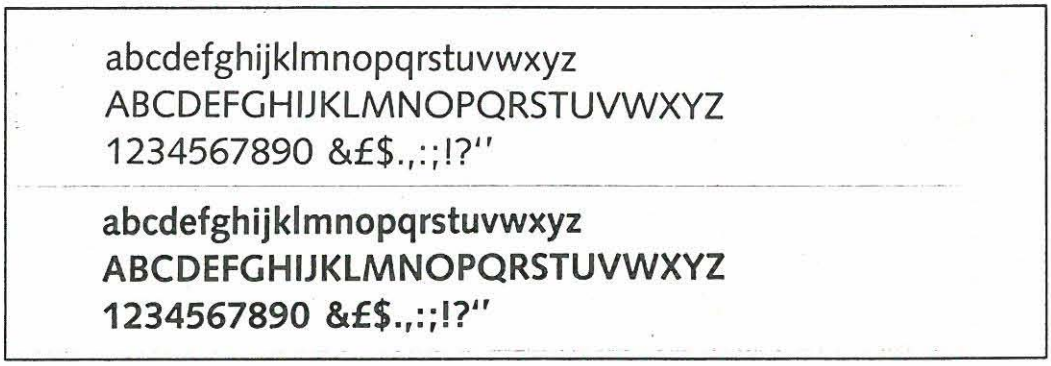

FIGURE 2.9

An example of the Syntax typeface.

2.3.13 A comprehensive discussion of this problem is given by White (1988:12-17). He concludes that it is impossible to make a clear-cut list of the advantages of each typeface. He also suggests that the reader must follow his own preference and that serifs are only one factor in the legibility of text. Also see the researcher's comments at the end of 5.6.1.

2.3.14 Bluhm, writing on the development of a new typeface, *Sassoon Primary Type* and the related *Sassoon Script Type* and *Sassoon Infant Type*, reports that it has been developed to make reading and writing easier. (Bluhm 1991: 29) This typeface is a sans serif that is slanted to the right. In personal correspondence with Sassoon (1991) longer ascenders, a slight slant to the letters, wider letter, word and line space were mentioned as factors that improved legibility. The researcher regarded Sassoon's study, and the subsequent development of the *Sassoon* typefaces as meaningful for this study, as the results produced a new sans serif, and not a roman as a legible typeface. Part of Sassoon's correspondence, with more information on the *Sassoon* typeface is given in Appendix H. An example of the *Sassoon* typeface is given in figure 2.10.

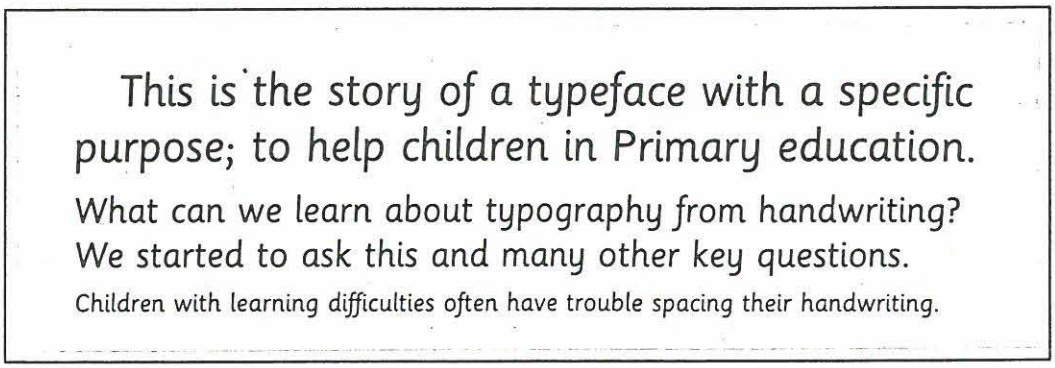

FIGURE 2.10
An example of the Sassoon typeface.

2.3.15 Arnston believes that sans serifs are highly legible in small amounts[13] of copy, but that the traditional romans are more suited for lengthier text (Arnston 1988:86-87).

The biggest criticism against the above-mentioned arguments, is that the majority of the references come from secondary sources. References to experiments are incomplete and are not fully discussed. It also appears that only certain aspects of experiments are taken to support a specific viewpoint, as in the case with Ernst in 2.2.14, where a sans serif was read the fastest in one of the experiments. After the literature study, the researcher was inclined to believe that sans serifs and romans are equally legible. There was also the possibility, although only the opinion of the researcher during the literature study, that a sans serif could prove to be more legible than a roman typeface.

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13 Also see 2.3.7.

CHAPTER 3

THE METHOD.

CONTENT:

This chapter provides an introduction to the subjects and the materials used in the study. Detailed discussions of these points are given with the report of each experiment in chapter four. With this approach, a chronological discussion of each experiment is provided under the following headings: *subjects, materials, method, results, discussion and conclusion.* The procedures, which include the research design and the analyses of the data, are fully discussed in this chapter. A synopsis on past and existing legibility research methods is provided at the end of this chapter, to provide background information on research methods used in other legibility studies.

3.1 THE SUBJECTS.

3.1.1 INTRODUCTION.

The problem to be investigated required a clearly defined group of people to provide external validity to the study. This was regarded as an important criterion to apply the gained knowledge to design and typographical problems in this field. Several factors determined the choice of the population and the sampling procedures for this study.

The initial target population was designated as tertiary students enrolled at Technikon OFS. After three pilot studies, three problems were identified associated with samples drawn from this population. These problems were:

* The subjects were not always easily accessible.
* Some subjects were unwilling to participate in a test situation.
* A high variance in the reading scores was obtained, which was attributed to the diverse home languages, different educational backgrounds and study directions. This would make it more difficult to reject a null hypothesis when using the *t* test in hypothesis testing.

3.1.2 THE POPULATION.

The researcher chose[1] Afrikaans Primary School children as the population.

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1 The initial plan was to use tertiary students as subjects. Difficulties with the proposed subjects directed the researcher to use primary school children as the population for the study. Another reason for using primary school children is that there is the possibility that tertiary students' results could possibly be influenced by their long exposure to roman typefaces. Also see point 4.1.3.1.

Only normal[2] readers were included in the population. Subjects that wore glasses[3] and those that received remedial education were, with the aid of their class teacher, excluded from the sampling process. Inferences of this study can, thus, only be made to normal readers and those with normal vision. This group was chosen for the following reasons:

* The large number of Afrikaans Primary Schools in Bloemfontein from which the samples could be drawn.
* The scholars are reasonably homogeneous regarding their educational level and age, standard of education, home language, and cultural background. This also helped to provide external validity to the study.
* The easy accessibility to this population.
* It was anticipated that primary school children were going to be more willing to participate in the experiments than the tertiary students.
* The subjects were already grouped according to a particular age group and level of education. Subjects that were not regarded as normal readers could easily be excluded from the population. These factors also helped to keep the variance as low as possible.

Questions posed to the researcher by a psychologist from a child guidance clinic as to which is the best type face to be used in speed reading tests, word recognition tests and school handbooks, also provided added reason to use primary school children as subjects.

Primary school children are still in different stages of reading development. Results could possibly have a wider application than just solving potential typographical and design problems[4] in reading material.

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2 Normal readers are in this instance defined as readers without any learning difficulties, and those that are of the correct age for the standards that they are in.

3 The researcher excluded subjects with glasses, as it was unknown if it would have an effect on the subject's perception of the typeface.

4 An example of a design and typographical problem is when a certain amount of text and illustrations must fit into a predetermined space, for example, a technical brochure with a limited amount of pages. The designer must then find a compromise between the size of the illustrations, margins and a particular typeface. A typeface that is too condensed and too small might reduce legibility, and the illustrations might become difficult to discern if they are too small for some individuals.

The English Schools in Bloemfontein were not included in the population for the following reasons:

* There are five English Primary Schools in Bloemfontein. One is a private school, one is a boys' school, two are girls' schools and the last school contained a number of foreign students whose mother tongue was not English. A sixth school, a dual-medium boys' school, contained a smaller portion of English scholars. Obstacles in forming a balanced experimental and control group were anticipated when sampling potential subjects from these schools.

* A separate set of English tests had to be developed and it would have been incorrect to incorporate these results with those of the Afrikaans scholars. The difference in the two languages, the tests from different handbooks, and the possible difference in reading levels would all be uncontrollable factors with an influence on the test scores.

* Schools under the Department of Education and Training experienced political unrest at the beginning stages of the study. After an inquiry was made as to whether these scholars could be used, the researcher was informed that no permission would be granted to include these schools in a research project.

Approximately nine thousand primary school scholars studied at twenty-two Afrikaans and dual-medium Primary Schools in Bloemfontein during 1991. Regulations[5] are laid down by the local Education Department regarding the use of scholars in a research project. These regulations, as well as an in-depth discussion with the Education Department, determined the amount of subjects sampled, the standards used, and the duration of the experiments.

Systematic and random sampling techniques were used to form experimental and control groups for the experiments. These techniques are fully discussed with each experiment in the next chapter.

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5 Permission to do research at primary schools, as well as the regulations of the Free State Education Department are given in Appendix J.

3.2 THE MATERIALS:

3.2.1 INTRODUCTION.

The subjects completed a total of six experiments, which included the pilot study. No suitable standardised and graded Afrikaans reading tests were available that could be used in the experiments. A different research design[6], using standardised reading material, would have been easier to implement, but could have suffered from internal[7] validity. Although the U.C.T.[8] Diagnostic Reading Tests are standardised and graded, these could not be used as they were being used by the local Education Department and are regarded as restricted material. Words not commonly used today also appear in these diagnostic tests, and this was another reason why these tests were considered as unsuitable. A copy of the graded reading and speed reading tests developed by Smith (1945: 213-241), can be found in Appendix I. The basic design and methodology of these tests was considered suitable for two of the six experiments.

3.2.2 THE INSTRUMENTS.

Graded Afrikaans reading material was used in three of the six experiments. The material was obtained from a discontinued reading series. High frequency Afrikaans words and words taken from the U.C.T. tests were used for the Speed Reading and Word Recognition Tests. English text from a reading guide was used in the Pilot Study. This reading material is fully discussed with each experiment in the next chapter.

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6 Randomised groups, post-test only research design is a suitable research design where the experimental group receives the treatment variable. This type of design excludes a pre-test and would, thus, save a considerable amount of time. A matched subject, post-test only design, can also be used. This type of design is more sensitive, but would require a pre-test to determine the subjects' reading ability for matching the two groups.

7 See point 3.3.2.2.

8 The U.C.T. tests are part of a series of differential intelligence and scholastic tests devised and standardised for the Child Guidance Clinic of the University of Cape Town. These tests consist of a graded word recognition and a speed reading test in Afrikaans and English, and were developed by H W Smith in 1945 as part of a thesis for a Ph.D. in the Department of Psychology.

3.3 THE PROCEDURES:

3.3.1 INTRODUCTION.

The research methods used for this study were two-fold, namely, experimental and descriptive research.
The experimental design used a randomised pre-test, post-test control group design to investigate the legibility of sans serifs and roman typefaces. The particular randomisation process used in this study caused the research design to be correctly designated as a non-randomised group pre-test, post-test design.

Descriptive research methods were used to determine the typeface preference of the subjects. Data collected with a questionnaire during the experimental research, was later used in the hypotheses testing. Qualitative methods were also employed to find a possible reason for the subjects' typeface preference.

Data was collected on a ratio scale for the experimental research and on a nominal scale for the descriptive research. This data was analysed according to standard statistical procedures.

3.3.2 THE RESEARCH DESIGN.

3.3.2.1 MOTIVATION FOR THIS DESIGN.

In true experimental designs, the control and experimental groups are chosen carefully through appropriate randomisation procedures, so that the groups are equivalent concerning the variable. According to Leedy (1989:224), quasi-experimental designs are normally used in situations where true random selection and the assignment of subjects to the two groups are not feasible. The difference between experimental and quasi-experimental designs lies in the randomisation of its subjects. True random sampling is defined by Groninger (1990:23) as a method, *"... such that each member of a population has an equal chance of being chosen for any designation or grouping."*

The factors that made it impossible to make use of a true random sampling process in this study are as follows:

* Each member of the population did not have an equal chance of being included in the study. According to figures supplied by the Orange Free State Education Department, more than nine thousand pupils were enrolled in Afrikaans Primary Schools in Bloemfontein during 1991. Time and financial constraints made it impossible[9] to include all the subjects of the population group in a selection process.

* True random assignment of subjects to the different groups was not considered to be the most effective[10] method of forming a control and experimental group. To match these groups on as many variables as possible, a quasi-randomisation process was used in the sampling process. The selection process is fully discussed with each experiment in chapter four.

It is for these reasons that the research design can accurately be described as a quasi-experimental, rather than an experimental design.

The particular quasi-experimental design used for all the experiments, was the non-randomised control group pre-test, post-test design. According to Leedy (1989:221), this design is ideal to use in a situation where true random assignment and selection is not possible. It is also described as one of the most widely used and strongest quasi-experimental designs.

The reasons for using this research design are as follows:

* It is ideally suited for noting the degree of change that an independent variable would have on a dependent variable in a control group situation. An indication of the degree of equivalency between the two groups can also be observed. The varying ability of the two groups, if any difference does exist, will become apparent when the pre-test results of each group is compared with each other.

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9 A true random sample is when each member of the population is listed and provided with a number. The pre-determined size of the sample is then drawn from this list, using a set of random numbers. Limited time and financial constraints prevented such a procedure.

10 Although the subjects were randomly assigned to the control and experimental groups in the Pilot Study, a significant difference was found between the pre-test scores of the two groups. Also see point 4.3.4.

* This design is regarded to be free from extraneous variables that pose a threat to internal validity.

* This method, like most other experimental designs, attempts to control the research situation, except for the influence of the independent variable.

Paradigm of the design:

The paradigm for the non-randomised control group pre-test post-test design used in this study is as follows:

CONTROL GROUP = (QR) O_1 – O_2
EXPERIMENTAL GROUP = (QR) O_3 X O_4

QR = Quasi-randomisation process
O = Observations of the dependent variable with the subscripts denoting separate observations. Each group first received a pre-test and then the post-test.
X = Indicates where the experimental group received the independent variable together with the post-test.

3.3.2.2 INTERNAL VALIDITY.

The validity of a test instrument is defined by Hopkins and Antes (1990:173-175+466) as the most important single attribute associated with test instruments. Such an instrument, or test, is only valid to the degree of accuracy with which it measures that characteristic that it is supposed to measure.

Borg (1981:179-182), regards the pre-test, post-test control group design as an excellent design that is not subjected to extraneous variables that can pose a threat to internal validity. The research design that is used for this study is in all respects the same as the pre-test, post-test control group, apart from the randomisation of the subjects. This difference in the selection process was not regarded by the researcher as a threat to internal validity, as it does not alter the basic design of the pre-test, post-test control group.

The validity of any experiment is of the utmost importance, in that the method must be effective in measuring the variable that it is designed to measure.

Leedy states that internal validity attempts:

> *"... to ascertain that the changes in the dependent variable are the results of the influence of the independent variable rather than the manner in which the research was designed" (Leedy 1989: 27).*

It is obvious that the results of any experiment are partly owed to known and unknown extraneous variables and the treatment variables. Unknown extraneous variables, namely, anxiousness about a test to be written, or tiredness, could affect the subjects' performance during the experiments. It was regarded that the influences of some of these variables were mostly eliminated through:

* The research design.
* The immediate follow up of the post-test after the pre-test.
* Completing an experiment at a school within two hours with a group of subjects of the same age group.

The freedom from known extraneous variables, the adequate control of unknown extraneous variables, and the positive results from the second scanning test[11], was regarded as sufficient evidence to consider the research design as a valid method to measure the legibility of typefaces.

3.3.2.3 EXTERNAL VALIDITY.

External validity is concerned with generalising the results from the sample to the population. The question that must be answered is: *Can the samples that were used be regarded as typical of the designated population?* The researcher believes that there is a strong possibility that this is so for the following reasons:

* The Afrikaans Primary Schools in the Bloemfontein area are homogeneous in respect of the following:
* The same syllabus is followed by all the schools.
* The same readers and prescribed school handbooks are used.
* The same reading methodology is taught in all the schools.
* The schools all fall under the same Education Department that requires certain minimum qualifications for teachers and sees to it that certain academic standards are maintained.

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11 See point 4.5.2.

* The subjects were regarded are fairly homogeneous in respect of cultural and religious background.
* All the subjects spoke the same language at home.

A correct randomly selected sample from all the Afrikaans speaking primary scholars in Bloemfontein would normally reflect the characteristics typical of the population. This study did, however, not use all the schools nor all the classes in the selected schools for sampling purposes. Restrictions from the local Education Department, economic and time factors prevented such a sampling procedure. Based on the homogeneity of the schools and scholars, the researcher believes that similar conclusions would have been reached if different Afrikaans schools in Bloemfontein were used in the experiments. It is obvious that different scores would have been obtained if different standards or even different schools were used in the experiments. This would, however, not change the conclusion of the experiment, as it is on the difference between the gain scores of the control and experimental group that a conclusion is made.

3.3.3 ANALYSES OF THE DATA.

3.3.3.1 INTRODUCTION.

Descriptive statistics were used to describe the collected data values. Inferential statistics were used to make inferences of the designated population based upon the samples.

The independent *t* test on gain scores was used to test the research hypothesis of equal legibility. The *z* test for proportions was used to test the hypothesis that readers have a particular typeface preference.

Data was processed with a personal computer and a program[12] written for the *Lotus 123* software. This program not only provided various *t* and *z* values, but also gave all the required descriptive statistics, confidence intervals, test for variances and correlations. Results of this program were compared with the same data results of a statistical software program, SPSS-X[13] release 2.0A-UW1.0 for a Sperry 1100 computer. Small differences were found after the decimal point.

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12 This program is not a program as understood in computer terms, but formulas written in certain cells of the spreadsheet software. Data of the experiments, imported from another spreadsheet, are then used by these formulas to calculate means, *t* values, *z* values, variances and other statistics.

13 SPSS stands for Statistical Packages for Social Sciences, a program used at the end of 1991 by the University of the Orange Free State.

These differences were attributed to the method in which the two programs processed numbers with decimal points. The SPSS program supplied decimals rounded to the nearest whole number, whilst the program written for the *Lotus* software used values with three decimal points. Exercises provided by Chase and Brown (1986:276-278+354-360), and Huysamen (1989:70+116-137), were also used to ensure that correct answers were obtained, and that the formulas in the program were correct. The answers obtained by the researcher were the same as supplied by Huysamen, and Chase and Brown.

3.3.3.2 THE *t* TEST.

The *t* test is a statistical test used to ascertain whether there is a significant difference between the mean scores of two groups.

The data analysis for a pre-test, post-test design consists of comparing the gain scores of the experimental and control group. Two statistical tests, namely, the *t* test on the gain scores, or an analysis of covariance is recommended to test the null hypothesis. (Hopkins & Antes 1990:322) The *t* test on the gain scores (difference between the pre-test and the post-test scores) was used as the appropriate statistical test. This test is simple to use, and the results easy to understand and to interpret, when compared with the analysis of covariance. In all the experiments, the null hypotheses of equal legibility were tested against the alternative hypotheses that there is a difference in legibility.

3.3.3.3 THE *z* TEST.

The *z* test for a population proportion is a test that is based upon a large sample, and where the samples must come from a normally distributed population. The samples used in this test fulfilled these criteria.
Subjects were asked to make one of three choices in the experiments where their typeface preference was established. The choices were roman, sans serif or no particular preference for a typeface. Text can only be set in one typeface and, therefore, only the data from subjects that made a choice either for romans or sans were used in the *z* test. This statistical test was used to determine whether the proportion of subjects favouring romans is significantly different from the proportion of students favouring sans serifs. In all the experiments, the null hypotheses of equal preference were tested against the alternative hypotheses that there is a typeface preference.

3.3.3.4 CONFIDENCE INTERVALS.

A confidence interval provides an interval where a population parameter will fall a certain percentage of the time. The percentage used was 95%. Confidence intervals for the means of all the experiments were calculated and are tabulated with each experiment's descriptive statistics in chapter four.

3.4 A BRIEF REVIEW OF OTHER LEGIBILITY RESEARCH METHODS.

Various experiments were used in legibility research. Pyke (1926:29-30), Tinker (1963:9-31), and Zachrisson (1965:44-71) provide comprehensive discussions on some of these methods. The most generally used methods are:

Visibility measurement.
Two photographic filters of different densities are rotated in front of the subject's eyes while performing a visual task. This method is used in studies involving the contrast between print, paper and background, as well as isolated characters.

Distance testing method.
This is one of the earliest and most simple tests used. Isolated characters, symbols or words are tested for recognition at variable distances.

Speed of Visual Perception.
A tachistoscope is used to project or expose characters, words or symbols for a short period. Both Tinker (1963:13) and Zachrisson (1965:66) mention that the results from this method cannot be generalised, and no conclusions can be drawn from this method concerning the legibility of continuous text.

Variation of focus.
In this method the image is presented as an out of focus image. It is then brought into focus and the point of recognition is recorded. It is used to determine how quick a word, character or image can be recognised.

Blink rate.
This testing method is based on the assumption that any factor that reduces the ease of seeing will increase the amount of eye blinks per minute. The validity of

this method is, however, questioned by Tinker (1948:39). The physical condition of the subject's eyes can also be a factor that cannot be controlled, especially if prolonged reading causes strain on the eyes of one subject, and not on the eyes of another subject.

Heart rate.

Even measuring the heart rate in experiments was used as a measure of legibility. As the duration and difficulty of the visual task increased, so did the heart rate (Spencer 1969:22).

Binocular rivalry.

In this experiment, a stereoscope is used to test the ocular preference for a certain typeface. Test cards containing identical words, one in a sans serif and the other in a roman, are placed inside the machine, so that when they are seen they overlap exactly. The subject is given two timers, one for the roman and the other for the sans serif typeface. He is then asked to press the timer corresponding to the typeface that he is seeing. When the other typeface is perceived then the timer for the other typeface is pressed. The timer records the length of time that there is an ocular preference for a particular typeface. The typefaces are placed in equal amounts in the left and right hand side of the stereoscope. Zachrisson (1965:130), using this method found that *"... there is a strong old face predominance in a situation of binocular rivalry."*

Eye movements.

Eye movements[14] are recorded during a visual task using electric, photographic or direct observation techniques. Valuable information is obtained concerning fixations, saccadic movements, regressions and return sweeps. This is according to Tinker (1963:25) and Zachrisson (1965:48), a valid and reliable method in measuring reading speed.

Rate of reading or speed reading tests.

Speed reading tests seem to be the most frequently used method in legibility tests. The speed by which material is read, can be measured in three ways:

* The amount read in a certain time.

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14 Also see point 4.6.2.2 and 4.6.2.3 where the eye movement machine that was used in this study is discussed, as well as Burt's comments as quoted in point 2.2.6.

* The time it takes to read a certain quantity.
* A speed reading test where a word that does not fit in must be crossed out.

Tinker (1963:22) and Spencer (1969:23) mention speed reading tests as the most satisfactory and the most adopted method used as a criterion of legibility in print. This method of measuring legibility was used for one experiment in this study. The researcher, after the completion of all the experiments, is however of the opinion that a scanning[15] test is a better method than speed reading, when measuring legibility.

Subjective measures of legibility.

Readers' opinions concerning the legibility and pleasantness of typefaces are recorded with the aid of interviews and questionnaires. Sassoon (1991) used interviews to determine which typeface read the easiest and which typographical factors are regarded by the readers as helpful in reading. Also see the discussion of Sassoon's work under point 2.3.14 and in Appendix I.

Comprehension and speed reading tests

Various authors, Carlson (1949:500-511), Letson (1958:49-53) and Tinker (1939:81), investigated the relationship between comprehension and reading speed. From their results it can be seen that comprehension is an important factor in speed reading tests.

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15 Also see 4.5.1.4 and 4.5.2.4.

CHAPTER 4

THE EXPERIMENTS AND THE RESULTS

CONTENTS.

The researcher conducted five different experiments, namely, a Word Recognition Test, a Speed Reading Test a Scanning Test, a Reading Marathon Test, as well as an experiment involving an eye movement reading machine. The aim of using different experiments was to compare the legibility of sans serifs and roman typefaces under varying reading conditions. A pilot study was conducted before the beginning of the final experiments to identify procedural difficulties.

To provide continuity to the discussion of each experiment, the method, the results, conclusion and discussion for each experiment are discussed in this chapter under separate headings.

Chapter five contains the conclusion, recommendations and summary of the study as a whole.

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4.1 THE PILOT STUDY.

4.1.1 INTRODUCTION.

A pilot study was conducted in the preparatory stage of the study. The primary aim of this pilot study was to identify procedural difficulties and to evaluate the planned research design, as well as the length and type of reading material envisaged for the major study. The secondary aim was to determine if there is a difference in the legibility of book typography[1] and the traditional academic format[2] of presenting reading material.

A pre-test, post-test research design was used and the gain scores were used in the statistical tests. Chapter three, point 3.3.2.1, contains the motivation for this research design.

4.1.2 THE METHOD.

4.1.2.1 THE SUBJECTS.

Thirty willing Tertiary Art and Design students participated in this study. These subjects declared themselves willing, after the purpose of the experiment was explained to a bigger group of students. The willing subjects were randomly divided into a control and experimental group of fifteen subjects each. The

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1 Book typography refers to the typographical practices found in magazines and books. These publications make use of a wider variety of type faces, type sizes, margins, line and letter spacing. This variation is made possible through the use of sophisticated typesetting equipment, traditionally restricted to printers and publishers.

2 Educational and research institutions traditionally publish a sizeable amount of their research reports and other academic documents in a particular format. These documents are partly characterized by wide margins, generous line spacing, and limited type size and styles. The *Courier* and similar-looking letters are normally used in these documents. These typefaces can occupy as much as thirty percent more space than the traditional typefaces used in books and magazines. The limited size, weight and variation of the *Courier* typeface makes it difficult to emphasize different sections of a text.

control group contained eight female students and seven male students. The experimental group consisted of ten female students and five male students.

4.1.2.1 THE MATERIALS.

Two stories, taken from a reading study guide by Taylor, Frackenpohl, Schleich, & Dramer (1963:10-15) were used for the two tests. Both legends were of the same degree of difficulty and length. The reading material in this reading guide contained graded passages of text as well as the comprehension questions. This material was used as it was readily available, and was regarded as suitable for the experiment, given the aim of the pilot study.

Examples of the post-test typefaces are given in figure 4.1 and the typographical attributes are given in table 4.1. The reading material and the comprehension tests are in Appendix A.

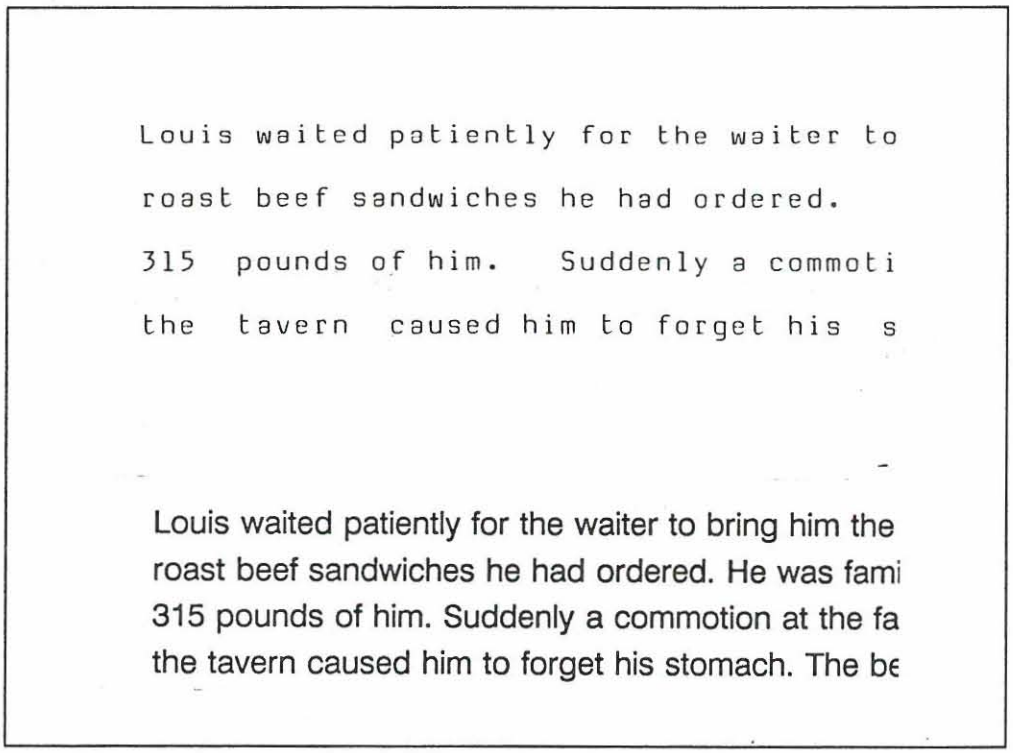

FIGURE 4.1

Examples of the typefaces used in the Pilot Study.

TABLE 4. 1
The typographical attributes of the Pilot Study.

	Typeface used in the pre-test	Typeface used in the post-test
Typeface name	Courier *	Helvetica
Point size	12	12
Height of capitals (millimetres)	2.7	3.4
Height of lower case "o" (millimetres)	1.8	2.45
Height of lower case "d" (millimetres)	2.7	3
Width of lower case "o" (millimetres)	1.7	2.15
Maximum line length (millimetres)	150	119
Characters per centimeter	4	5.5
Line spacing (millimetres)	8.35	6.15

* Not the true Courier typeface, but a similar looking typeface produced with a typewriter.

4.1.2.3 THE PROCEDURES.

Two tests were conducted; a Speed Reading Test coupled to comprehension questions, and a Scanning Test where the subjects located and counted a given word.

The tests were conducted in an empty classroom during the students' lunch break and took between forty and fifty minutes to complete. The researcher

tested between two and four students at the same time, with the subjects seated behind desks opposite the researcher. No difficulty was experienced either with controlling the students or with timekeeping.

Subjects in both the control and experimental group first received one story, set in an academic format by a typewriter in double spacing, followed by a comprehension test. A second story with its matching comprehension test followed immediately afterwards. The experimental group received their second story set in *Helvetica*, a sans serif typeface. The control group's story was again set in an academic format. Reading times were recorded with a stop watch. The reading guide by Taylor *et al.* (1963:148+150) provided ten multiple choice questions for the comprehension tests.

The subjects received the Scanning Test only after the last subject had completed the comprehension questions of the second story. The subjects received instructions on how to scan the material, and were then asked to locate and count a specific word. The name *Louis* in the one story and the name *Mary Celeste* in the other story were the two specific words. The two groups received the same reading material in the same format and sequence as in the Speed Reading Test. The researcher recorded the scanning times with a stopwatch and used the amount of words located and counted as the scanning score. This scanning score was expressed as a percentage, for example, if a subject located and counted half of the given words, then the scanning score would be fifty percent.

The reading and scanning speed of the subjects were converted to an index by multiplying their speed with their score obtained in the comprehension questions and their accuracy score in the Scanning Test. The gain scores of these indices were used in the statistical analysis of the Pilot Study.

The null and alternative hypotheses for this experiment were formulated as follows:

H_0: There is no difference between the mean legibility of book typography and reading material set in an academic format.

H_a: There is a difference between the mean legibility of book typography and reading material set in an academic format.

H_o: μAD = μBT, H_a: μAD ≠ μBT.

AD represent academic documents and BT book typography. Level of significance = 0.05.

Legibility in this instance is defined as an increase in reading speed for the Speed Reading Test and an increase in scanning speed combined with accuracy, for the Scanning Test.

4.1.3 THE RESULTS.

The results of the Pilot Study are graphically represented in figure 4.2 and tabulated in table 4.2.1, and table 4.2.2.

The results of the Pilot Study fall into two categories:

* Procedural difficulties.
* The experimental results.

4.1.3.1 PROCEDURAL DIFFICULTIES.

The biggest problem during the Pilot Study was the unwillingness of some of the solicited students to participate in the reading experiments. From their comments it appeared that one of the reasons for refusal was that they felt that their intellectual or other abilities were going to be tested, and that they felt threatened to a certain extent.

* Not all the subjects that agreed to the study reported for the experiment, and other[3] students had to be used in their place.
* The experiment was considered to be too long. Some subjects were anxious not to miss too much of their lunch break.
* These difficulties were considered in the design of the final experiments, and the choice of an alternative population for the sampling process.

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3 The other students were also Tertiary Art and Design students, who agreed to participate after the researcher explained the problem to them.

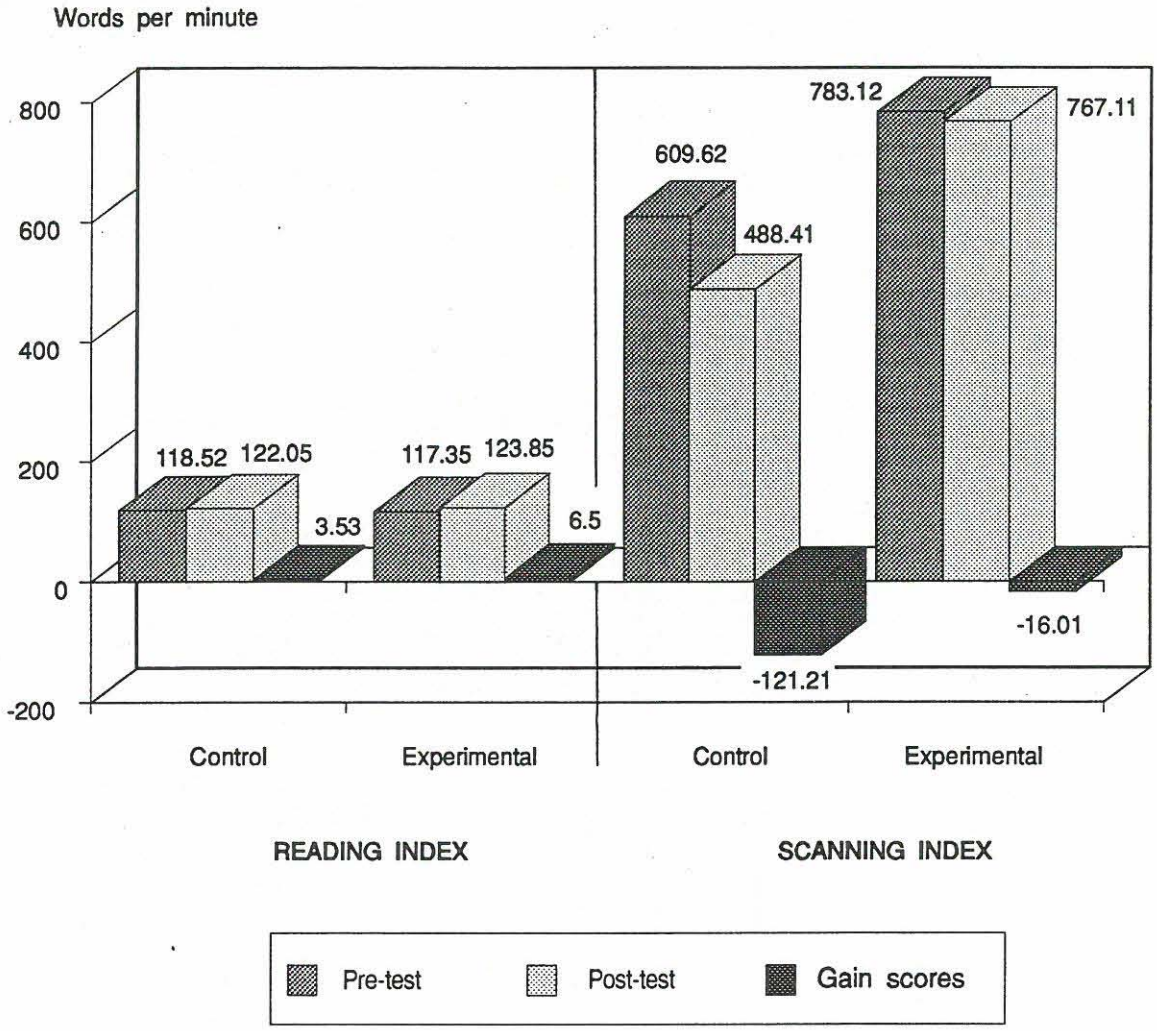

FIGURE 4.2

A graphical representation of the means and gain scores of the Pilot Study.

TABLE 4.2.1

Results of the Pilot Study. *(N = 15 in each group)*

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
READING SPEED: (Words per minute)						
$\bar{x}$	183.00	188.27	188.47	198.80		
s	39.11	43.15	37.09	37.14		
Confidence Interval	161.96 to 204.04	165.05 to 211.49	168.51 to 208.42	178.81 to 218.79		
READING SCORE: (%)						
$\bar{x}$	66.67	49.33	65.33	62.67		
s	19.88	27.12	9.90	13.135		
Confidence Interval	55.97 to 77.36	34.74 to 63.92	60.00 to 70.66	55.49 to 69.85		
READING INDEX: (Words per minute)						
$\bar{x}$	118.52	117.35	122.05	123.85	3.53	6.50
s	27.27	31.37	26.35	29.96	9.98	12.33
Confidence Interval	103.85 to 133.19	100.48 to 134.23	107.87 to 136.23	107.72 to 139.97	-1.84 to 8.90	-0.14 to 13.13
SCANNING SPEED: (Words per minute)						
$\bar{x}$	679.20	872.93	591.28	923.67		
s	142.71	239.15	144.60	272.40		
Confidence Interval	602.41 to 755.99	744.25 to 1001.62	513.46 to 669.07	444.09 to 1070.24		
SCANNING SCORE: (%)						
$\bar{x}$	89.60	90.53	81.93	82.40		
s	12.52	13.86	12.52	12.91		
Confidence Interval	82.86 to 96.34	83.08 to 97.99	75.20 to 88.67	75.46 to 89.34		
SCANNING INDEX: (Words per minute)						
$\bar{x}$	609.62	783.12	488.41	767.11	-121.21	-16.01
s	167.14	228.62	155.25	284.60	109.82	290.49
Confidence Interval	519.68 to 699.55	660.11 to 906.14	404.88 to 571.95	613.97 to 920.24	-62.11 to 180.29	-172.33 to 140.29

TABLE 4.2.2

Results of the Pilot Study. (Statistical Tests)

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

	READING INDEX	SCANNING INDEX
F test for variance =	1.53	6.99
Confidence interval (95%) =	-11.49 to 5.57	-272.29 to 61.92
Computed *t* value (α = 0.05) =	-0.72	-1.31

(Critical t = 2.048 df = 28)

4.1.3.2 THE EXPERIMENTAL RESULTS.

The speed reading experiment:

The two groups' mean speed reading indices were almost equal as indicated by the pre-test of the reading index. There was less than two words per minute difference between the experimental and control group. See table 4.2.1. In the post-test the mean of the experimental group's reading index improved with six and a half words per minute whilst the control group's score improved with four and a half words per minute. The difference in the mean gain scores of three words for the two groups was not regarded as statistically significant. The observed value of t = -0.72 does not fall in the critical region, $t(0.05)$ = 2.048.

The null hypothesis is not rejected. There appears to be no difference between the legibility of book typography and reading material set in an academic format when reading speed coupled to comprehension is used as the criterion.

The scanning experiment:

The control group's scanning index decreased with one hundred and twenty-one words and the experimental group's mean with only sixteen words. The difference between the two groups' means was not regarded as statistically significant at the 0.05 level. The *Behrens-Fisher statistic*[4] of -1.31 < $t(0.05)$ = 2.048 when $df = 14$.

The null hypothesis is not rejected. There appears to be no difference between the legibility of book typography and reading material set in an academic format when scanning speed combined with accuracy, is used as the criterion.

4.1.5 DISCUSSION OF THE RESULTS.

The experimental group showed an increase in the Scanning Experiment, but not in the Speed Reading Experiment. The necessity to read with comprehension could have been one of the factors that prevented the experimental group from a faster reading speed. The shorter line length and the more proportional typeface used in the post-test most probably contributed the most to the experimental group's improvement in scanning speed.

The following conclusions were reached concerning the procedures and the type of material that was used:

* The time that the subjects used for completing the experiments was regarded as too long. Some of the subjects, when questioned afterwards, stated that they did not enjoy the length of the experiments. The length of subsequent experiments was reduced, not for this reason, but to comply with a request from the Orange Free State Education Department not to occupy the scholars for longer than fifteen minutes.

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4 According to Chase and Brown (1986:353), the *Behrens-Fisher* statistic must be used if the variances are not equal. The difference in the variance of the two groups' scanning index is statistically significant. The observed value of $F = 6.99 > F(0.05) = 3.05$. The degrees of freedom for a *Behrens-Fisher statistic* is the smaller of $n_1 - 1$ or $n_2 - 1$. The degrees of freedom is therefore 14, and not 28. Huysamen (1989:115), however, states that some textbooks recommend that the homogeneity of variance must be tested before the decision is made to proceed with the *t* test, but adds that *"In terms of current statistical practice this procedure seems to be out-dated."*

* The need of this research design was realised with the results of the scanning experiment where the two groups differed significantly in the pre-test.

* Testing four subjects at one time during the Pilot Study did not pose a problem in recording their scores and exercising proper control over the subjects.

* Tertiary students were not regarded as the ideal subjects for the proposed study, as it appeared that some were unwilling to participate. Also see the discussion in chapter three, point 3.1.1 and 3.1.2.

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4.2 THE WORD RECOGNITION TEST.

4.2.1 INTRODUCTION.

The design of this experiment is based on the assumption that romans are easier to recognise in text than sans serifs, and could possibly provide a higher score in a word recognition test. See 2.2.1, 2.2.3 and 2.2.8 for a discussion of this theory. Sans serifs are normally used for reading material in the lower standards in South African schools and there is even the possibility that sans serifs could be just as, or even more legible, than roman typefaces. The alternative hypothesis, therefore, stated that there is a difference between the legibility of romans and sans serifs, instead of romans being more legible than sans serifs.

The null and alternative hypotheses for this experiment were formulated as follows:

H_o: There is no difference between the legibility of sans serif and roman typefaces as measured by the amount of correctly recognised words in a reading test.

H_a: There is a difference between the legibility of sans serif and roman typefaces as measured by the amount of correctly recognised words in a reading test.

H_o: $\mu R = \mu S$, H_a: $\mu R \neq \mu S$

R and S are the legibility scores of roman and sans serif typefaces.

4.2.2 THE METHOD.

The methods followed in this experiment were very similar to the procedures used in the U.C.T.[4] Diagnostic Reading Tests. See 4.2.2.2.a for a discussion of these tests.

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4 U.C.T. stand for the University of Cape Town where these tests were developed.

4.2.2.1 THE SUBJECTS.

Four different primary schools, systematically selected from a total of twenty-one primary schools in the Bloemfontein area, provided the population for the sampling process. These schools were selected in such a way that they would provide subjects from a wide range of socio-economic backgrounds. One school was situated in an upper socio-economic suburb, two in middle class suburbs and one in a poorer suburb. The selection process was performed after consultation with an official of the Orange Free State Education Department.

One hundred and sixty-eight primary school scholars participated in this experiment. There were fifty-six subjects each in a Sub-Standard B, a Standard Two, and a Standard Four group. Each group was made up from an experimental and a control group of twenty-eight subjects each, which included an equal number of boys and girls.

The subjects were systematically selected from an alphabetical class list supplied by the principal of each school, and were then randomly divided into an experimental and control group. A set of random numbers was used to determine the first subject on the class list. The remaining subjects were determined by a process of dividing the required amount of subjects into the amount of pupils on the class list, and then choosing every consecutive scholar. Two extra subjects were selected and used as substitutes when a subject was absent from school. Learning disabled scholars and those without normal[5] eyesight were not included in the population and were deleted from the class list before the selection took place. All the subjects used Afrikaans as their mother tongue and were of normal age for their particular standard.

4.2.2.2 THE MATERIALS.

4.2.2.2.a THE READING TESTS.

Smith (1945:211-214) developed graded and standardised reading tests as part of a study for his Ph.D. degree. These tests are known as the U.C.T.

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5 The researcher was not able to determine the possible influence that glasses or other eye problems could have on a reader's perception of typefaces with or without serifs. Excluding these subjects eliminated an unknown factor that could have influenced the results.

Diagnostic Tests and copies of these tests are included in Appendix I. His Word Recognition Test consisted of one hundred and ten carefully graded and empirically selected words arranged from the easiest to the most difficult. A child's reading vocabulary is measured by this test and the score consists of the number of correctly read words. The local Education Department still uses this test and it can be used on children from Sub-Standard B to Standard 6.

The researcher adapted these tests for use in this study. Additional words were added and some removed to give a total of one hundred and eighteen words. The word *naturel*, for example, was a word not known to the scholars, and was one of those removed. Additional words were obtained from a list of high frequency words by Barnard (1973:121-122). The test was then systematically divided into two parts, each consisting of fifty-nine words. These words were arranged from words with two characters per word, steadily increasing to the longer words. The words have also been arranged in such a way that the physical shape of the words in each test correspond with each other. In the pre-test the first three words are: *so, in, af* and in the post-test the corresponding words are: *se, is, of*. The word *stop* in one test corresponds with the word *skop* in the other test. The aim of this experiment was to determine the legibility of a typeface and not to determine the reading ability of the subject, and it was therefore not important to use a standardised test. The statistical test used in analysing the results, took into account differences that might exist between the pre-test and the post-test as a result of less-known words.

4.2.2.2.b THE TYPOGRAPHIC ASPECTS OF THE TESTS.

A valid comparison between a roman and sans serif typeface can only be made if all the physical attributes can be controlled and kept the same, except for those elements that make a roman different from a sans serif.
The words were set using a laser printer[6] and a typographical software program, *Coreldraw*. The advantage of this program is that it is possible to control the weight of a character by changing the outline width for any given size. The horizontal or vertical dimensions of a word or character can also be changed whilst keeping the other dimension constant. Manipulating these

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6 The printer was a three hundred dots per inch *Hewlett Packard IIP* laser printer fitted with a postscript cartridge.

elements made it possible to produce words where the weight, letter and line space were similar.

The researcher used *Avalon*[7] for the sans serif and *Brooklyn*[8] for the roman typeface. Both faces are wide in design when compared with more well known typefaces, for example, *Times Roman* and *Helvetica*. The advantage of *Avalon* above the more popular *Helvetica*, is that the lower case **a** and **g** are similar in design to the letters that are taught in writing in South African primary schools. The lower case **t** lacks the curve at the bottom and the ascenders and descenders are much shorter than in other popular sans serifs. *Brooklyn's* lower case **g** and **a** are, however, different from the letters taught in primary schools.

The two reading cards given to the control group were set in *Brooklyn.* The first reading card given to the experimental group was set in *Brooklyn* and the second card, which was the post-test, in *Avalon.* Examples of the typefaces that were used are given in figure 4.3 and the typographical attributes of the two typefaces are given in table 4.3. The complete set of reading cards are given in Appendix B.

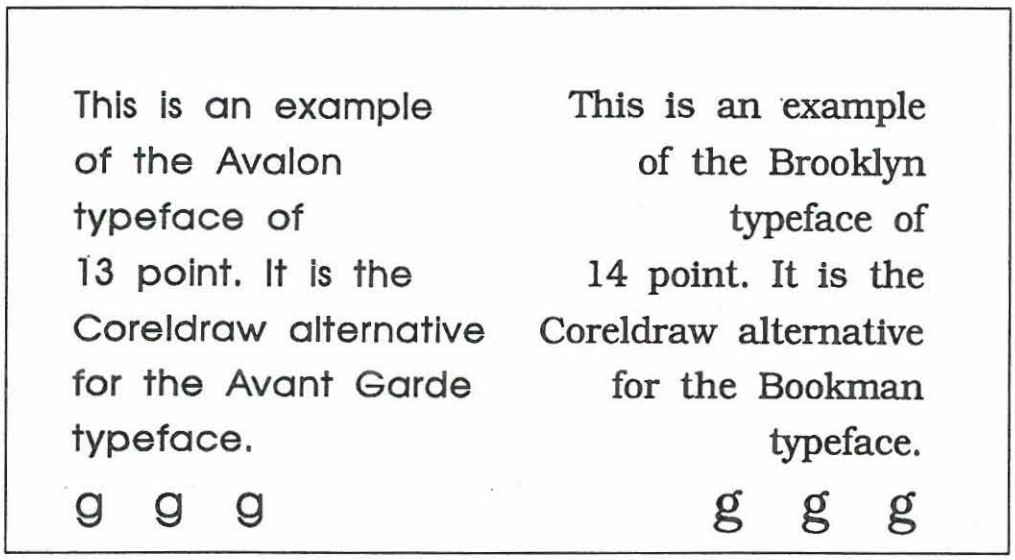

FIGURE 4.3

Examples of the typefaces used in the Word Recognition and Speed Reading Tests.

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7 *Avalon* is *Coreldraw's* alternative for *Avant Garde.*
8 *Brooklyn* is *Coreldraw's* alternative for *Bookman.*

TABLE 4. 3

The typographical attributes of the Word Recognition and Speed Reading Tests.

	Typeface used in the pre-test	**Typeface used in the post-test**
Typeface name	Brooklyn *	Avalon **
Point size	14 ***	13 ***
Height of lower case "o" (millimetres)	2.75	2.85
Size of acender "d" (millimetres)	3.8	3.6
Width of lower case "o" (millimetres)	2.65	2.85
Line length (millimetres)	104 (Speed Reading test) 122 (Word Recognition test)	102 (Speed Reading test) 116 (Word Recognition Test)
Characters per centimeter	3.43	3.6
Line spacing (millimetres)	8.15	8.15

* *Coreldraw* alternative for the *Bookman* typeface.

** *Coreldraw* alternative for the *Avant Garde* typeface.

*** Approximate size only. The original size was set in sixteen points and photographically reduced to this size.

4.2.2.3 THE PROCEDURES.

The Word Recognition and Speed Reading Tests were conducted with the same subjects in one session. The subjects also received a series of reading cards during this session on which they were questioned to determine their typeface preference. The whole procedure took eight minutes for the average reader and slightly longer for the younger and slower readers. The researcher administered the tests individually in an office or empty classroom located at each school. The rooms were illuminated with natural light and supplemented with electrical light bulbs or fluorescent tubes.

The Word Recognition Test was administered as follows:
The researcher put the subjects at ease by emphasising that they were not being tested and could not fail the reading cards. The subjects were placed at a table opposite the researcher with a reading card in front of them. The card was covered with a piece of paper. The researcher removed the piece of paper when the test began. Subjects in the control and experimental group first received an identical reading card that was set in a roman typeface. The experimental group then received the second card in a sans serif typeface while this card was given to the control group set in a roman typeface. The subjects were restricted to thirty seconds for each reading card.

The subjects received the following instructions:

> *"Op 'n kaart onder hierdie papier is daar 'n paar woorde wat jy vir ons moet lees. Jy moet dit hardop en so goed as moontlik vir ons lees. As jy sukkel sal ons vir jou help. Is jy gereed? Begin."*
>
> An English translation of this would read:
>
> *"There is a card underneath this paper, with a few words that you must read for us. You must read it aloud and as well as you can. We will help you if you are struggling. Are you ready? Start."*

The scoring was as follows:
Each correct response scored one mark. Words, vowels and syllables had to be read, pronounced and emphasised correctly. The subject was helped by giving the correct word after he or she had attempted unsuccessfully to

pronounce the word three times. This was then not regarded as a correct response. A spontaneous correction by the subject was accepted.
The researcher recorded the scores for each subject on a duplicate reading card by marking the incorrectly read words as well as the last word read by the subject in thirty seconds.

The *t* test was used as the statistical test on the mean differences between the pre-test and post-test of the control and experimental groups.

4.2.3 THE RESULTS

The results are given in table 4.4 and graphically represented in figure 4.4.

In the Sub-Standard B group, the control group recognised 2.14 words less in the post-test and the experimental group 1.96 words less. Only 0.68 and 1.07 less words were recognised respectively by the Standard Two control and experimental group in the post-test. There was even a smaller difference between the pre-test and post-test of the Standard Two group. The control group recognised 0.68 word less and the experimental group 1.07 words less in the post-test. The Standard Four control and experimental groups recognised respectively 1.14 words and 0.61 words less in the post-test.

The difference in the gain scores for the three standards are not regarded as statistically significant. The observed *t* values are as follows:

Sub-Standard B: $t = -0.2$, Standard Two: $t = 0.47$, Standard Four: $t = -0.75$.

These values do not fall in the critical region, $t(0.05) = 2.02$. The null hypothesis is not rejected. *There appears to be no significant statistical difference between the legibility of a roman and sans serif typeface when a word recognition test is used as a measure of legibility.*

TABLE 4.4

Results of the Word Recognition Test.

SUB-STANDARD B

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	28					
$\bar{x}$	23.46	19.71	21.32	17.75	-2.14	-1.96
s	8.32	8.27	7.66	7.80	3.19	3.39
Confidence Interval	20.29 to 26.64	16.55 to 22.87	18.40 to 24.25	14.77 to 20.73	-3.36 to -0.92	-3.26 to -0.67

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.13
Confidence interval (95%) = -1.96 to 1.60
Computed *t* value ($\alpha = 0.05$) = **-0.20** (Critical *t* = 2.02 *df* = 54)

STANDARD 2

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	28					
$\bar{x}$	35.00	36.14	34.32	35.07	-0.68	-1.07
s	6.26	7.07	7.42	7.60	3.03	3.21
Confidence Interval	32.61 to 37.39	33.44 to 38.84	31.49 to 37.16	32.17 to 37.97	-1.84 to 0.84	-2.30 to 0.15

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.12
Confidence interval (95%) = -1.29 to 2.08
Computed *t* value ($\alpha = 0.05$) = **0.47** (Critical *t* = 2.02 *df* = 54)

STANDARD 4

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	28					
$\bar{x}$	39.82	43.86	38.68	43.25	-1.14	-0.61
s	4.94	5.58	5.03	4.98	2.70	2.63
Confidence Interval	37.33 to 41.71	41.73 to 45.99	36.76 to 40.60	41.35 to 45.15	-2.18 to -0.11	-1.61 to 0.40

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.06
Confidence interval (95%) = -1.98 to 0.91
Computed *t* value ($\alpha = 0.05$) = **-0.75** (Critical *t* = 2.02 *df* = 54)

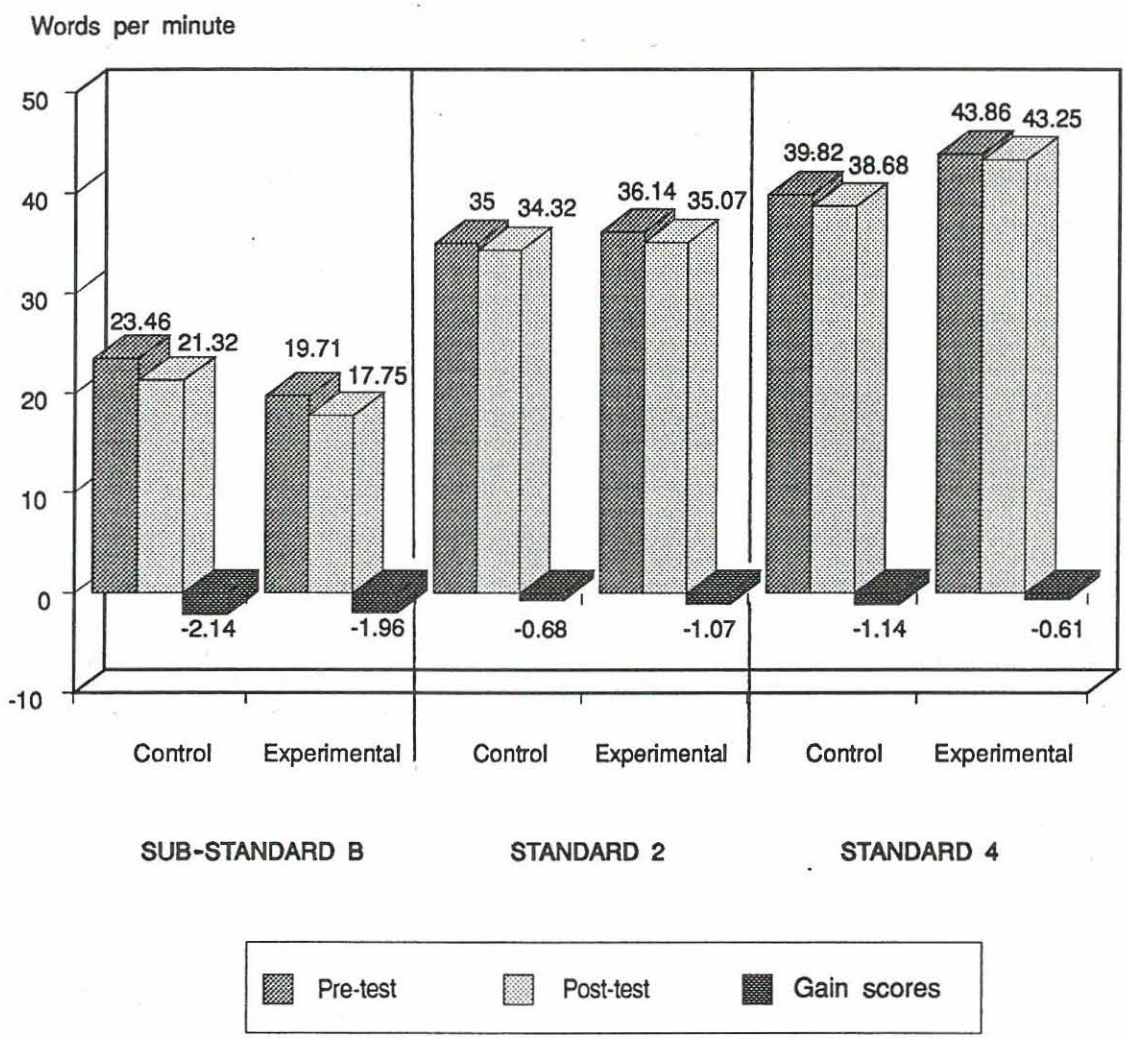

FIGURE 4.4

A graphical representation of the means and gain scores of the Word Recognition Test.

4.2.4 DISCUSSION OF THE RESULTS.

Both the experimental and control groups in all three standards obtained a lower score with the second test than with the first. The decreased scores of the experimental groups cannot be attributed to the sans serif typeface in the second test, as the same trend was shown by the control group. These lower scores can rather be attributed to unknown factors that equally affected the performance of the control and experimental groups. The second test could have been more difficult, or the carry-over effect of the first test could have influenced the subjects.

The researcher believes that the experiment was not sensitive enough to record a significant statistical difference at the 0.05 level in the legibility of the two typefaces, that is if a difference existed at all. The time subjects took to pronounce words and the time difference between word recognition and audible expression could have had a bigger influence on the scores than the difference between a roman and sans serif typeface. A subject that can read well might appear to be a poor reader due to a lack of verbal fluency. The subjects were judged more according to their verbal fluency, and how fast they were able to express a printed word, rather than their real reading skill. *The researcher, after this experiment, is of the opinion that a reading test, where a subject is judged according to audible speech, is a poor measure in legibility testing.*

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4.3 THE SPEED READING TEST.

4.3.1 INTRODUCTION.

This experiment was conducted directly after the Word Recognition Test and is based upon the assumption that romans are quicker to read and recognise than sans serifs.

The null and alternative hypotheses for this experiment were formulated as follows:

H_o: There is no difference between the mean legibility of sans serif and roman typefaces as measured by the amount of words correctly read in an audible speed reading test.

H_a: There is a difference between the mean legibility of sans serif and roman typefaces as measured by the amount of words correctly read in an audible speed reading test.

H_o: $\mu R = \mu S$, H_a: $\mu R \neq \mu S$

R and S are the legibility scores of roman and sans serif typefaces.

4.3.2 THE METHOD.

The same procedures used in the Word Recognition Test were observed in the Speed Reading Test.

4.3.2.1 THE SUBJECTS.

The subjects used in the Word Recognition Test also participated in the Speed Reading Test. The subjects are fully discussed in 4.2.2.1.

4.3.2.2 THE MATERIALS.

The U.C.T. Speed Reading Test, one of the graded and standardised reading tests by Smith (1945:211-214), was adapted for use in this experiment. High frequency words from a list by Barnard (1973:121-122) were added and some unfamiliar words were deleted. Also see 4.2.2.2.a. The final Speed Reading Test consisted of two hundred and four words. Each word consisted of either three or four letters. These words were then systematically divided into two groups of one hundred and two words each. The words were selected in such a way that the words in the two groups were similar in length and typographical construction. The words *arm, niks,* and *gat* in the one group correspond to the words *aan, nuut* and *gek* in the other group.

The typographical attributes of the Speed Reading Test are the same as those of the Word Recognition Test and can be found in table 4.3. Examples of the typefaces used in the Speed Reading Test are given in figure 4.3. The reading cards used in the Speed Reading Tests are given in Appendix B.

4.3.2.3 THE PROCEDURES.

The researcher administered the Speed Reading Test directly after the Word Recognition Test as follows:

The reading card was again placed in front of the subject, underneath a piece of paper. This paper was removed when the tests began. Subjects in the control and experimental group first received an identical reading card that was set in a roman typeface. The experimental group then received the second card in a sans serif typeface while this card was given to the control group set in a roman typeface. The subjects were restricted to thirty seconds for each reading card.

The subjects received the following instructions:

> *"Op 'n kaart onder hierdie papier is daar 'n paar woorde wat jy vir ons moet lees. Jy moet dit hierdie keer so vinnig as moontlik lees. Jy moet dit weer hardop vir my lees. Die woorde is nou korter as die vorige twee kaarte. As jy sukkel sal ons vir jou help. Is jy gereed? Begin."*

An English translation would read:

"There is a card underneath this paper with a few words on that you must read for us. You must read it this time as fast as you can. You must read it again out aloud. The words are now shorter than in the previous two cards. We will help you if you are struggling. Are you ready? Start."

The scoring was as follows:
Each correct response scored one mark. Words, vowels and syllables had to be read, pronounced and emphasised correctly. A spontaneous correction by the subject was accepted as correct if a mistake was made. The researcher recorded the scores for each subject on a duplicate reading card by marking the incorrect words as well as the last word read by the subject in thirty seconds.

The *t* test was used as the statistical test on the mean differences between the pre-test and post-test of the control and experimental groups.

4.3.3 THE RESULTS.

The results are given in table 4.5 and graphically represented in figure 4.5.

The difference between the experimental and control groups' gain scores for the three standards ranged between 0.89 and 1.85 words per minute. These small differences in the gain scores are not regarded as statistically significant at the 0.05 level. The observed *t* values are as follows:

Sub-Standard B: $t = -0.73$, Standard Two: $t = -0.76$, Standard Four: $t = 0.8$.

These values do not fall in the critical region, $t(0.05) = 2.02$. The null hypothesis is not rejected. The sans serif and roman typeface is regarded as equally legible in a speed reading test.

TABLE 4.5

Results of the Speed Reading Test.

SUB-STANDARD B

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	28					
$\bar{x}$	24.86	17.18	21.18	14.39	-3.68	-2.79
s	13.50	10.60	11.90	8.88	5.23	3.86
Confidence Interval	19.70 to 30.01	13.13 to 21.23	16.63 to 25.72	11.00 to 17.79	-5.68 to -1.68	-4.26 to -1.31

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.83
Confidence interval (95%) = -3.38 to 1.59
Computed *t* value ($\alpha = 0.05$) = **-0.73** (Critical *t* = 2.02 *df* = 54)

STANDARD 2

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	28					
$\bar{x}$	46.54	47.75	41.07	43.39	-5.47	-4.36
s	14.84	15.65	12.76	14.39	5.67	5.24
Confidence Interval	40.87 to 52.20	41.77 to 53.73	36.20 to 45.95	37.90 to 48.89	-7.63 to -3.30	-6.36 to -2.35

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.17
Confidence interval (95%) = -4.05 to 1.84
Computed *t* value ($\alpha = 0.05$) = **-0.76** (Critical *t* = 2.02 *df* = 54)

STANDARD 4

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	28					
$\bar{x}$	55.36	66.54	50.21	59.54	-5.15	-7.00
s	12.78	14.96	13.02	14.99	6.75	10.26
Confidence Interval	50.48 to 60.23	60.82 to 72.25	45.24 to 55.19	53.81 to 65.26	-7.27 to -2.56	-10.92 to -3.08

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 2.31
Confidence interval (95%) = -2.84 to 6.54
Computed *t* value ($\alpha = 0.05$) = **0.80** (Critical *t* = 2.02 *df* = 54)

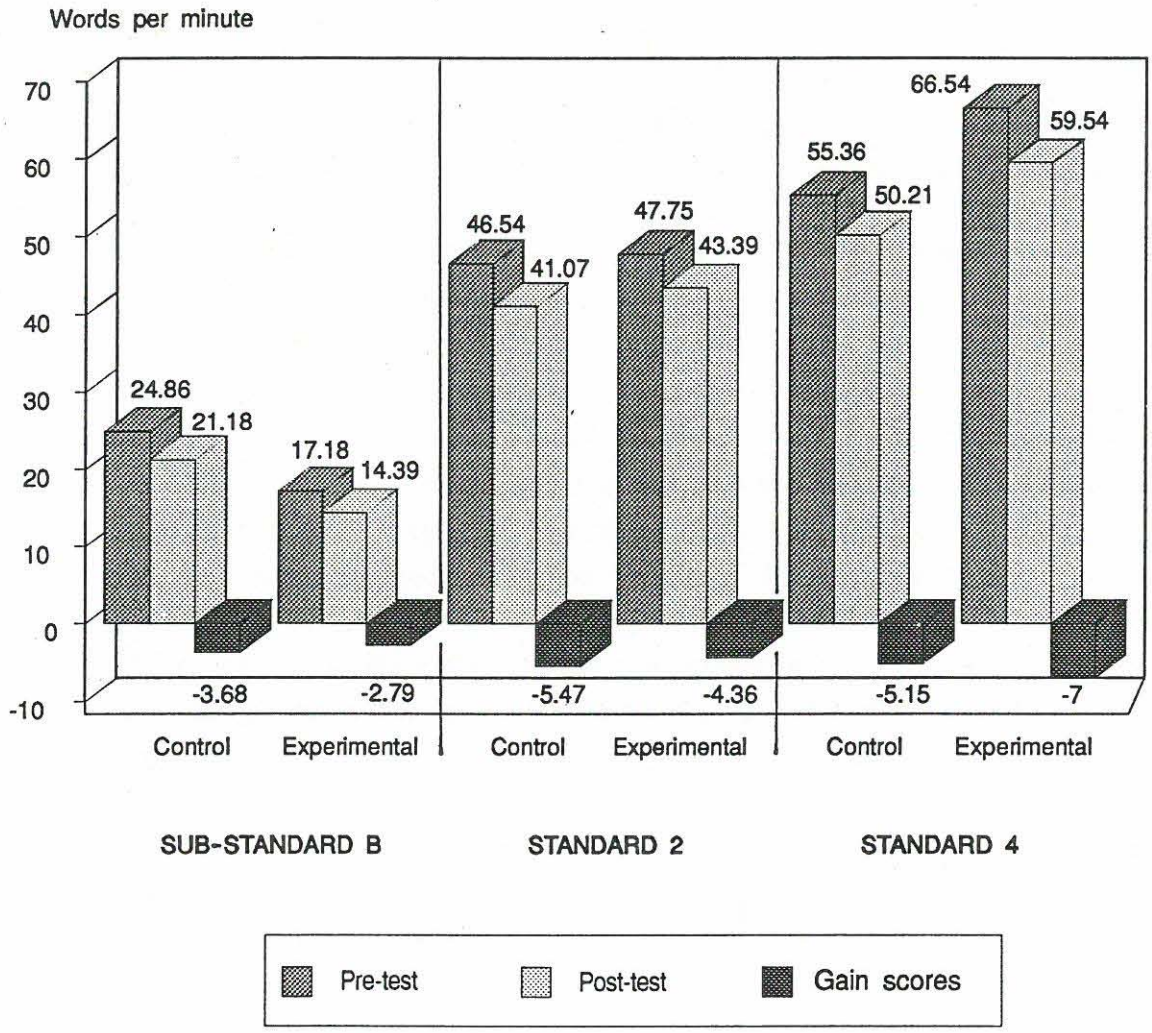

FIGURE 4.5

A graphical representation of the means and gain scores of the Speed Reading Test.

4.3.4 DISCUSSION OF THE RESULTS.

The same trend shown by the three standards in the Word Recognition Test was displayed in the Speed Reading Test. The control and experimental groups' performance diminished in the post-test of the Word Recognition and Speed Reading Tests. This trend can be seen when figure 4.4 and figure 4.5 are compared with each other. Also see the discussion in 4.2.4

There was a noticeable difference in the performance of the two Sub-Standard B groups in the pre-test of the Speed Reading Test. The control group's score was 7.68 words per minute faster than the experimental group. This difference in scores in the pre-test, could indicate that, even with random sampling, groups must not necessarily be regarded as equivalent. The normal assumption is that two sufficiently large and randomly selected groups from the same population, will reflect the characteristics typical of the population. The larger these two groups become the closer their means will come together.

Words in the Speed Reading Test were on average shorter and easier to recognise and pronounce than in the Word Recognition Test. The Sub-Standard B subjects did, however, not score higher in the Speed Reading Test than the Word Recognition Test. This was not expected, and it could possibly indicate that typographical factors and even the length of words play a secondary role in the reading skills of very young readers. The experimental group scored between two and a half to just more than three words lower in the pre-test and post-test. Any possible difference in legibility, caused by serifs, would therefore be clouded out by the limited reading skills of Sub-Standard B scholars. It was for this reason that the researcher excluded Sub-Standard B scholars from subsequent experiments.

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4.4 THE READING MARATHON.

4.4.1 INTRODUCTION.

One of the schools, who participated in the Word Recognition and Speed Reading Tests, conducted a reading marathon as part of a fund raising programme. This fund raising programme was in progress during the experimental work at the particular school. For this reading marathon, the scholars were given a portion of text, taken from one of their handbooks, and were required to answer a set of comprehension questions. Parents and friends sponsored the children according to the scores obtained. The researcher offered to set some of the text with a laser printer as a service to the project, if some of the results could be used for this study.

The research design was the same, as for all the other experiments, with randomly assigned control and experimental groups. The scores of the comprehension questions were taken as the criterion for legibility.
The null and alternative hypotheses for this experiment were formulated as follows:

H_o: There is no difference between the mean legibility of sans serif and roman typefaces as measured by comprehension in a reading test.

H_a: There is a difference between the mean legibility of sans serif and roman typefaces as measured by comprehension in a reading test.

H_o: $\mu R = \mu S$, H_a: $\mu R \neq \mu S$

R and S are the legibility scores of roman and sans serif typefaces. The level of significance was set again at 0.05.

4.4.2 THE METHOD.

The same methods used in the previous two experiments were also employed for this experiment.

4.4.2.1 THE SUBJECTS.

Sixty-five Standard Four subjects and fifty-seven Standard Five subjects from one school participated in this experiment. The two standards consisted of all the Standard Four and Standard Five scholars of the school. The average age of the Standard Four group was eleven years and seven months, and twelve and a half years for the Standard Five group.

4.4.2.2 THE MATERIALS.

Reading material from the subjects' prescribed Afrikaans reading books was taken as the test material. These portions came from the back of the readers and had not been covered by the teachers at that stage. The reading material for the Standard Four group consisted of three hundred and ten words, whilst the Standard Five reading material consisted of five hundred and thirty-two words. The material was printed on an A4 sheet of paper with a laser printer and duplicated on a high quality photocopier. The text for the two control groups was set in *Palatino* eleven point. The two experimental groups' text was divided into two equal parts. The first section was set in *Helvetica* ten point and the second section again in *Palatino* eleven point. Examples of the typefaces used in the Reading Marathon are given in figure 4.6. The typographical attributes are given in table 4.6 and the complete set of reading material is given in Appendix C.

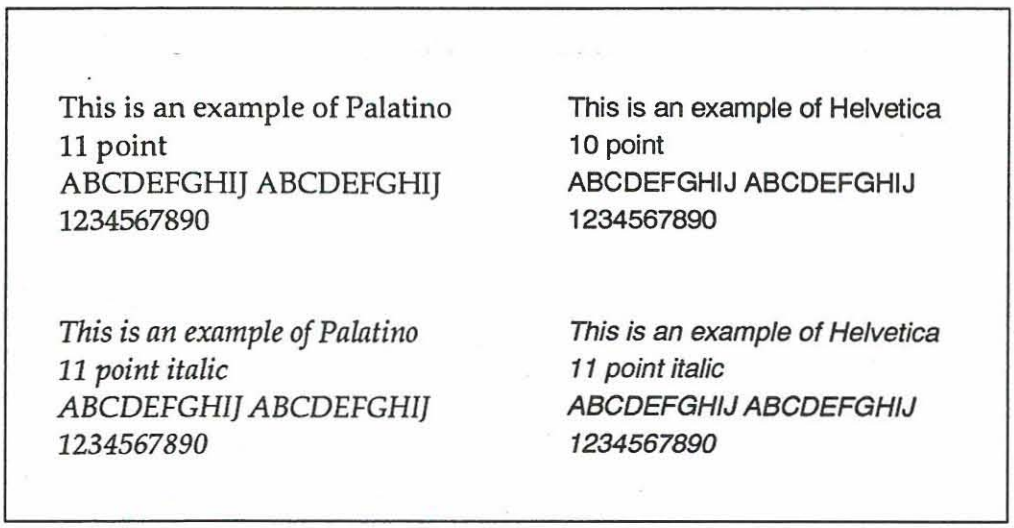

FIGURE 4.6
Examples of the typefaces used in the Reading Marathon.

TABLE 4.6

The typographical attributes of the Reading Marathon.

	Typeface used in the pre-test	Typeface used in the post-test
Typeface name	Palatino	Helvetica
Point size	11	10
Height of capitals millimetres)	2.8	2.7
Height of lower case "o" (millimetres)	1.95	2.05
Height of lower case "d" (millimetres)	2.9	2.7
Width of lower case "o" (millimetres)	1.85	1.9
Maximum line length (millimetres)	177	177
Characters per centimeter	5.23	5.8
Line spacing (millimetres)	4.7	4.7

4.4.2.3 THE PROCEDURES.

The subjects in each standard were systematically divided into a control and experimental group with similar academic performance. This was done in an attempt to obtain two equivalent groups in terms of academic ability. These abilities were calculated from the mean of the subjects' Afrikaans marks and their total average of the previous term. This index was then used to divide a standard into two groups that were similar in academic performance. A teacher

from the school calculated the indices, and divided the subjects into experimental and control groups. It was accepted that the teacher was objective and accurate in determining the two groups. The teacher also chose the portion and length of the text, set the questions, marked the answer papers and then supplied the final individual scores.

The subjects were situated in four different classrooms. The experimental and control groups as well as the different standards were separated from each other. The subjects received fifteen minutes to read the given material and to complete the associated questions. Teachers allocated to the four classrooms read the instructions pertaining to the experiment, to the scholars before the Reading Marathon started. Each standard's control group received ten questions on the text, whilst the experimental groups received five questions on the first portion of the text set in a roman, and five questions on the text set in a sans. The comprehension questions are given in Appendix C.

The *t* test was used as the statistical test on the mean differences between the pre-test and post-test of the control and experimental groups. The confidence level was set at 0.05.

Each subject also received an additional sheet of paper with two sections of text, taken from the Reading Marathon, after the completion of the marathon. One section was set in a roman face, the other in a sans serif. Subjects were requested to indicate which typeface reads the easiest for them. Space was left for them to provide a reason why. The request for a reason was not compulsory.

4.4.3 THE RESULTS.

The results of the Reading Marathon are tabulated in table 4.7 and graphically represented in figure 4.7. The mean scores in table 4.7 are given as a score out of five.

The Standard Four group.

The mean of the experimental group increased from 3.61 to 3.71, which is seventy-two percent to seventy-four percent. The control group's mean decreased from 3.32 to 3.26, which is sixty-six percent to sixty-five percent. This difference between the increase of two percent for the experimental group

and the decrease of one percent for the control group is not regarded as significant at 0.05.

The observed value *of t* = -0.489 and does not fall in the critical region, *t*(0.05) = 2.00. The null hypothesis is not rejected.

The Standard Five group.
The experimental group's score increased by 0.66, which is thirteen percent, whilst the control group's mean increased with only 0.29, which is six percent. The difference of seven percent in favour of the control group is not regarded as a significant difference at the 0.05 level.

The value of $t = -1.38 < t(0.05) = 2.02$. The null hypothesis is not rejected. Sans serifs and romans are regarded as equally legible when comprehension is used as a measure of legibility.

4.4.4 DISCUSSION OF THE RESULTS.

Supervision during the experiment with the Standard Five group was not adequate. The supervisors left the classroom whilst the subjects were completing the questionnaire. From the results of the questionnaire on type preference it seems that the instructions were ignored and the subjects were told to choose one of the two faces and the no-preference option was not fully explained. There was, thus, no time limit imposed on the subjects' reading speed and searching for answers in the given reading material. A matter of seriousness could have been lacking with this group as a result of the mentioned lack of supervision. The results of the Standard Five group must be interpreted with the above-mentioned problems in mind. Supervision with the Standard Four group was satisfactory.

A comprehension experiment is not considered as a reliable method of measuring legibility. Too many variables that cannot be controlled can influence the results. Comprehension of a portion of text can, for example, be influenced by the interest that the material holds for the reader, which will be difficult to measure and control.

TABLE 4.7

Results of the Reading Marathon.

The means are given as a score out of ten.

STANDARD 4

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	34	31	34	31	34	31
$\bar{x}$	3.32	3.61	3.26	3.71	-0.06	0.1
s	1.04	1.23	1.39	1.35	1.16	1.47
Confidence Interval	2.97 to 3.68	3.17 to 4.05	2.76 to 3.71	3.23 to 4.19	-0.46 to 0.34	-0.43 to 0.63

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance: = 1.6
Confidence interval: (95%) = -0.81 to 0.49
Computed *t* value: (α= 0.05) = **-0.489** (Critical *t* = 2.00 *df* = 63)

STANDARD 5

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	28	29	28	29	28	29
$\bar{x}$	4.46	4.03	4.75	4.69	0.29	0.66
s	0.84	1.27	0.64	0.60	0.85	1.14
Confidence Interval	4.14 to 4.78	3.56 to 4.51	4.44 to 5.06	4.46 to 4.92	-0.03 to 0.61	0.22 to 1.10

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES ON THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance: = 1.79
Confidence interval: (95%) = -0.91 to 0.17
Computed *t* value: (α= 0.05) = **-1.38** * (Critical *t* = 2.02 *df* = 55)
-1.39 **

* *t* statistic.
** Behrens-Fisher statistic.

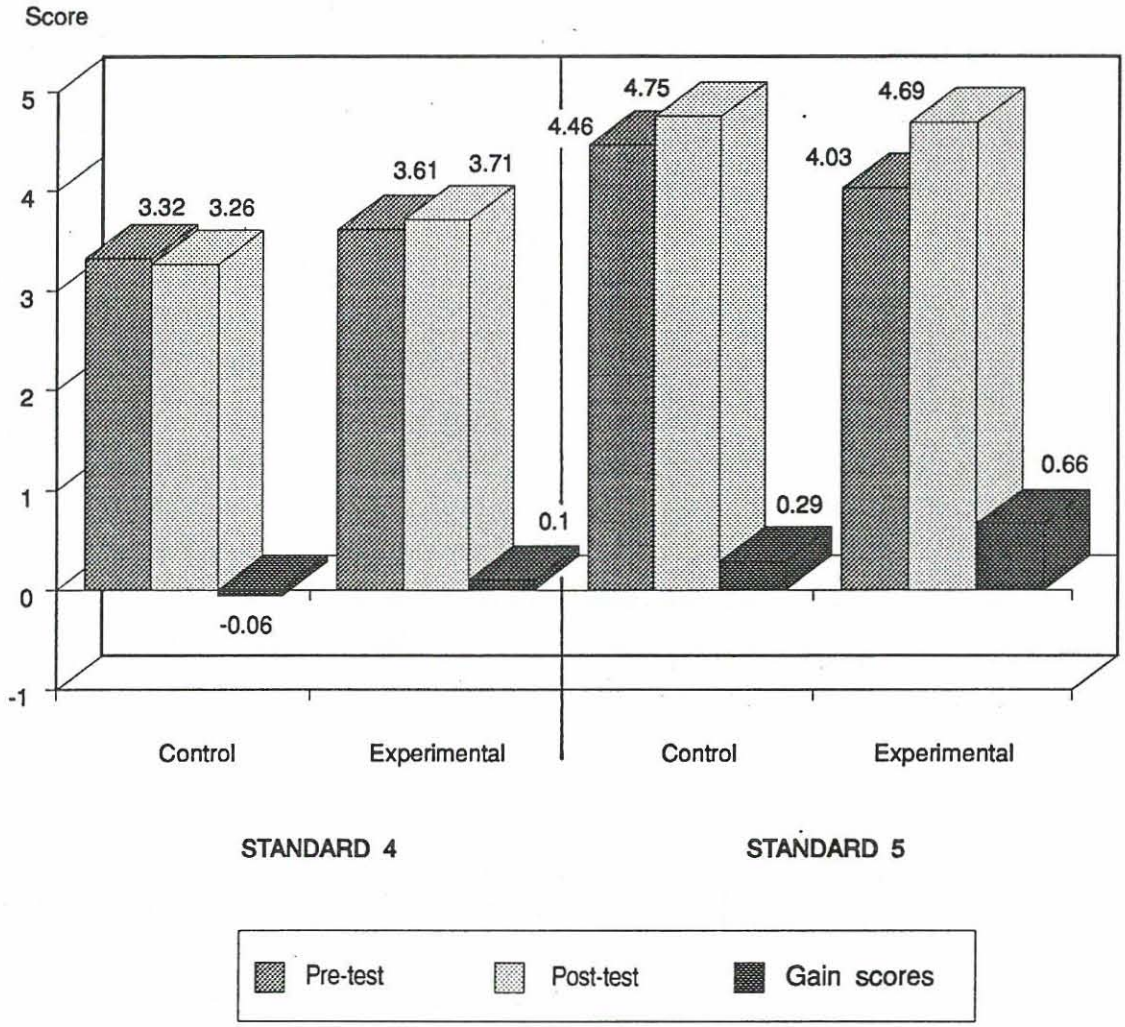

FIGURE 4.7

A graphical representation of the means and gain scores of the Reading Marathon.

4.5 THE SCANNING TESTS.

4.5.1 A ROMAN TYPEFACE COMPARED WITH A SANS SERIF TYPEFACE.

4.5.1.1 INTRODUCTION.

Scanning for a certain word or phrase does not require the reader to comprehend the text, that is, if the purpose of the scanning is to locate a particular section in the text, and not to grasp the meaning of the text. Scanning is also a silent process and subjects' reading abilities are not influenced by their lack or competence in verbal fluency. It seems to be reasonable to contend that the physical structure of the text and typeface would play the major part in a legibility experiment when scanning is used as a measure. If all the extraneous variables are controlled then it is only the typographical attributes of the text that a reader must contend with whilst scanning. The alternative hypothesis stated that there is a difference between the two typefaces as there was the possibility that sans could be more legible. Also see the discussion in 4.2.1.

The null and alternative hypotheses for this experiment were formulated as follows:

H_o: There is no difference between the mean legibility of sans and roman typefaces, when finding and counting a specific word in a Scanning Test is used as the criterion.

H_a: There is a difference between the mean legibility of sans and roman typefaces, when finding and counting a specific word in a Scanning Test is used as the criterion.

H_o: $\mu R = \mu S$, H_a: $\mu R \neq \mu S$

R and S are the legibility scores of roman and sans serif typefaces.

This experiment was conducted a few weeks after the completion of the Word Recognition and Speed Reading Tests and the Reading Marathon.

4.5.1.2 THE METHOD.

4.5.1.2.a THE SUBJECTS.

Four primary schools were systematically selected in conjunction with an official of the Orange Free State Education Department. One school is situated in a higher socioeconomic suburb, one in a lower, and two in middle class suburbs.

Only Standard Two and Standard Four scholars were used and no Sub-Standard B scholars were used in this experiment. Impressions gained during the first experiments were that their limited reading ability could possibly cloud the results and pose a threat to the internal validity of this experiment. It appeared that subjects at this age found it difficult to increase their reading speed from a Word Recognition Test to a Speed Reading Test, and speed plays a major part in a scanning test. The Scanning Tests that were designed were regarded as too advanced for most of this group, and their average reading speed was too slow to complete the Scanning Test in the allocated time.

From the results of the Word Recognition and Speed Reading tests, it appeared that the chosen selection process can provide a control and experimental group that are not equivalent. Although certain statistical tests, an independent *t* test on the gained scores or an analysis of covariance, would to a great extend eliminate these differences, the ideal would be to have two groups whose abilities are as close as possible. An adapted sampling method was used in an attempt to provide two equivalent groups for this experiment.

All the scholars in the Standard Two and Standard Four classes were first systematically divided into two groups based upon their academic performance. Their academic performance was determined by the mean of their first language and their term average of the previous term. Scholars with scores in the upper half formed one group, and those in the lower half, the other group. Ten subjects (five boys and five girls) were then randomly selected from the upper half and ten (five boys and five girls) from the lower

half from each standard and from each school. A set of random numbers, and an alphabetical class list provided by the schools, were used for this purpose. Eighty Standard Two and eighty Standard Four subjects were in this way randomly selected from the four schools. The subjects were then randomly divided into a control and experimental group. This method was followed in an attempt to match the experimental and control group more evenly, and possibly increase the experiments' sensitivity.

4.5.1.2.b THE MATERIALS.

Reading material for scanning experiments was taken from discontinued school readers, graded for the particular standards. *Times Roman* was used for the roman typeface and *Helvetica* for the sans serif typeface in this experiment. Type size, weight, line and letter and spacing of the two faces were again matched closely. All the material was set with a laser printer.

Reading material for the Standard Two group was taken from Blanckenberg and Ferreira Blanckenberg ([*s.a.*] (c):47-53), a discontinued school reading book for Standard Two. A discontinued school reader for Standard Four by the same authors provided the reading material for the Standard Four group (Blanckenberg & Ferreira Blanckenberg [*s.a.*] (e):73-77). All the material used in this experiment can be found in Appendix D. Examples of the typefaces used in the Scanning Tests are given in figure 4.8 and the typographical attributes are given in table 4.8.

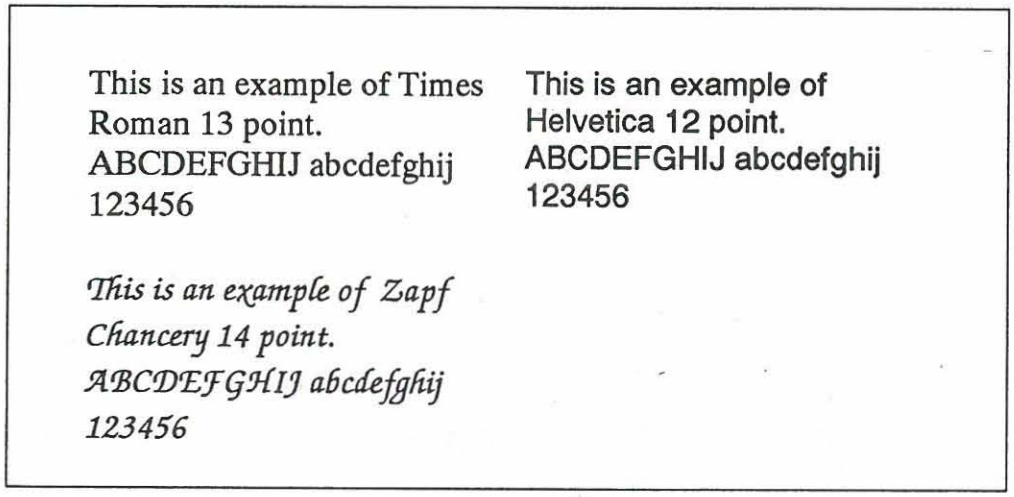

FIGURE 4.8
Examples of the typefaces used in the Scanning Tests.

TABLE 4.8

The typographical attributes of the Scanning Tests.

	Typeface used in the pre-test	Typeface used in the first post-test	Typeface used in the second post-test
Typeface name	Times Roman	Helvetica	Zapf Chancery
Point size	13 *	12 *	14 *
Height of capitals millimetres)	3.3	3	3.2
Height of lower case "o" (millimetres)	2.3	2.35	2.45
Height of lower case "d" (millimetres)	3.25	3	4
Width of lower case "o" (millimetres)	2.15	2.05	1.6
Maximum line length (millimetres)	14.38	14.38	14.55
Characters per centimeter	5.3	5.4	4.45
Line spacing (millimetres)	5.15	5.15	5.15

* Approximate size only. The original characters were set one point larger and photographically reduced to this size.

4.5.1.2.c THE PROCEDURES.

The subjects were informed that they were chosen to participate in an experiment with the aim of seeing how fast they could locate a particular word in a portion of text. The researcher provided the subjects with a full explanation of the scanning process. They did not have to comprehend the text, but were only required to find a particular word and mark this with a pencil.

The subjects first completed a Trial Scanning Test to ensure that the correct procedures were followed and that they did not waste time in underlining or regressing after they have scanned the text. Each subject received a pencil and a small portion of text. Two or three subjects were tested at a time and were seated in front of the researcher at a table. The experiments were conducted in empty classrooms or offices at the chosen schools. The following instructions were given.

> *" Voor jou is daar 'n bladsy met 'n gedeelte van 'n storie. Hou die potlood in jou hand waarmee jy skryf. Ek sal vir jou 'n woord gee wat jy vir my moet soek en dan met 'n potlood moet merk. Jy moet dit so vinnig as moontlik doen. As jy klaar is, sit dan jou potlood neer. Moet nie weer begin lees as jy aan die einde van die storie kom nie. Is julle gereed? Die woord is* **altyd,** *begin."*
>
> An English translation would read:
>
> *"In front of you is a page with a portion of a story. Hold the pencil in your hand that you normally write with. I will give you a word that you must find and mark with the pencil. You must do it quickly. Place your pencil down when you have finished. Do not start to read again when you reach the end of the story. Are you ready? The word is* **altyd,** *begin."*

Their progress was monitored and each subject was commended if he or she followed the correct procedure. When the trial was completed, they were informed that it was only a trial and the position of the word *altyd* was pointed out to them. A demonstration was given to show how a word must be marked with a pencil, as it was found that some of the subjects took great care in underlining the whole word, which took up unnecessary time.

The pre-test was then placed in front of the subjects. Subjects were asked to find and to mark the word *stoep* in the text and to complete the task quickly. The researcher used the trial run instructions, except for the word *stoep* that had to be located. The word in the post-test was *speel*. Scanning times were recorded with a stopwatch. An index consisting of the percentage of correctly recognised words was multiplied with the scanning time and was taken as the score. The experimental group first received the pre-test set in a roman face

(Times Roman), then the post-test set in a sans serif *(Helvetica)*. The control group received their pre-test and post-test in *Times Roman.*

A section of the scanning material was also used to determine the subjects' typeface preference. Subjects also provided reasons why they preferred a certain typeface. The subjects' typeface preference is fully discussed in 4.7.

4.5.1.3 THE RESULTS.

The results of this Scanning Test are tabulated in table 4.9 and graphically represented in figure 4.9.

The gain score of the Standard Two control group increased to just more than twenty-seven words, whilst the experimental group's score increased to nearly thirty-five words. With the Standard Four group there was an increase of just more than thirteen words for the control group and twenty words for the experimental group. These higher scores for the experimental groups were not regarded as statistically significant at 0.05.

The computed *t* values are as follows:
The Standard Two group: $t = -0.69$, the Standard Four group: $t = -0.567$.
These values do not fall in the critical region, $t(0.05)$ 2.00.

The null Hypothesis is not rejected. There is no difference between the legibility of a sans serif and a roman typeface, when finding and counting a specific word in a scanning test is used as the criterion.

4.5.1.4 DISCUSSION OF THE RESULTS.

The lack of serifs for the experimental groups did not appear to influence the subjects' scanning abilities. Comprehension of the text was excluded, so it was only the typographical aspects of the text that a subject had to contend with. There was only one page in the pre-test and post-test and this eliminated possible time differences between subjects, when turning a page. Subjects' scores were penalised if they missed out a word, as accuracy and speed were required. Unknown factors, which could influence the scanning indexes, were the same for both groups by nature of the research design.

TABLE 4.9

Results of the Scanning Test. (Roman compared with a sans serif)

The means are given as the amount of words scanned per minute.

STANDARD 2

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	40					
$\bar{x}$	173.39	182.05	201.25	216.96	27.86	34.91
s	54.51	51.96	60.52	58.74	51.96	39.09
Confidence Interval	156.15 to 190.62	165.62 to 198.48	182.11 to 220.39	198.38 to 235.53	18.40 to 51.34	15.51 to 40.23

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.77
Confidence interval (95%) = 13.52 to -27.60
Computed *t* value ($\alpha = 0.05$) = **-0.69** (Critical *t* = 2.00 *df* = 78)

STANDARD 4

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	40					
$\bar{x}$	211.37	210.94	225.20	231.82	13.83	20.88
s	54.53	60.24	53.97	56.71	57.23	53.76
Confidence Interval	194.12 to 228.61	191.89 to 229.99	208.14 to 242.27	213.89 to 249.75	-4.26 to 31.93	3.87 to 37.88

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE CONTROL AND EXPERIMENTAL GROUP:

F test for variance = 1.13
Confidence interval (95%) = -31.87 to 17.79
Computed *t* value ($\alpha = 0.05$) = **-0.567** (Critical *t* = 2.00 *df* = 78)

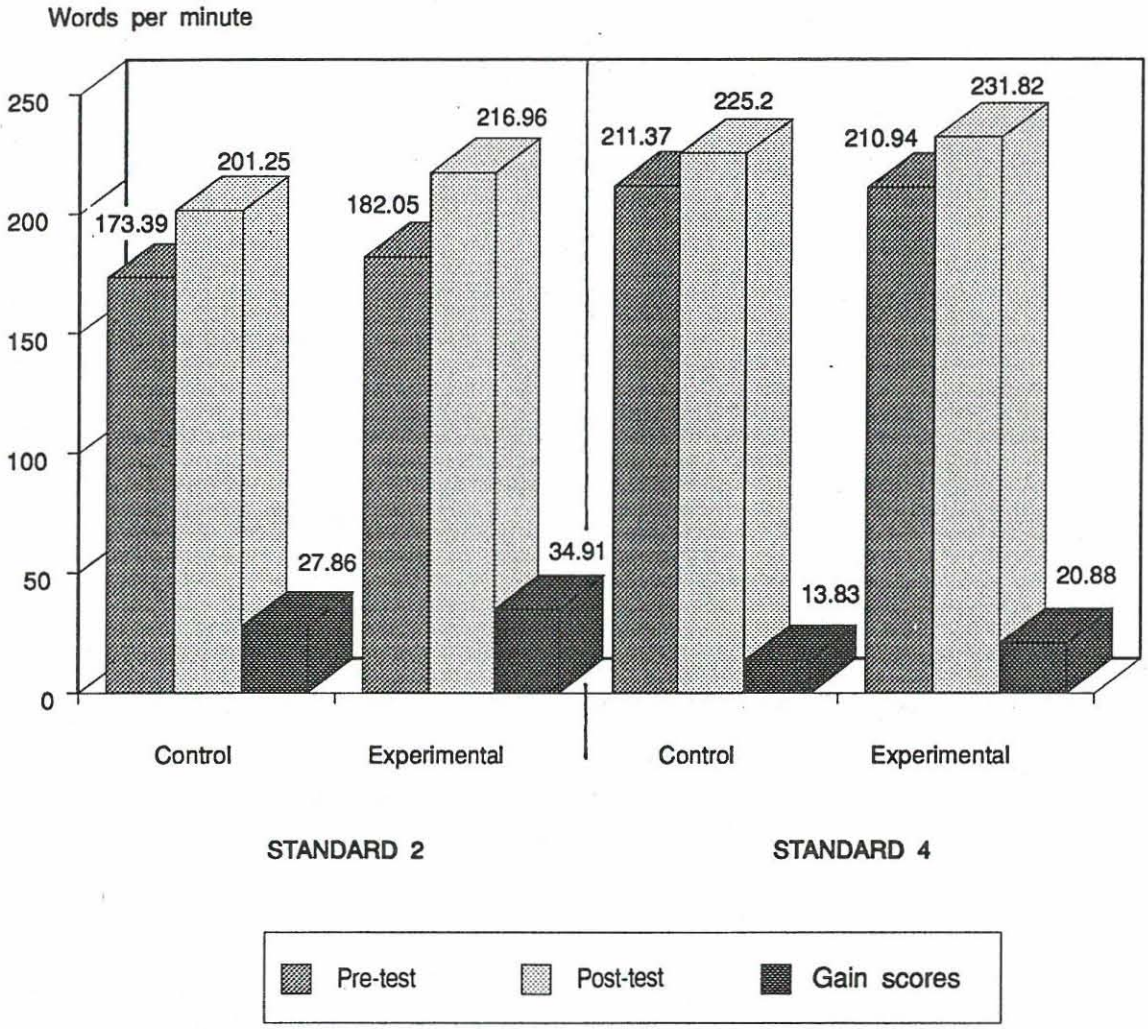

FIGURE 4.9

A graphical representation of the means and gain scores of the Scanning Test. *(Roman compared with a sans serif)*

In this case it appears to be reasonable to conclude that there is no significant difference between the legibility of romans and sans as measured by a scanning process. Another conclusion than can be made is that there is a difference, but that the experimental design is not sensitive enough to measure the small difference between the two typefaces. The outcome of this experiment and the two possible conclusions was envisaged and a second post-test was, therefore, incorporated into the experiment. This second post-test is fully discussed in 4.5.2.

4.5.2 A ROMAN TYPEFACE COMPARED WITH A SCRIPT TYPEFACE.

4.5.2.1 INTRODUCTION.

The researcher included this experiment in his study to verify the sensitivity of a scanning process in legibility testing. Added motivation for this experiment were the non-significant results of the Word Recognition, Speed Reading and Reading Marathon. These non-significant results were interpreted that sans serif and roman typefaces are equally legible, or there could be a possible deficiency in the experimental design. Possible reasons for the non-significant results are fully discussed in 5.2.

The rationale behind this second scanning experiment was that, if the result of a scanning experiment, using a roman and sans, are non-significant, two possible conclusions can be made, namely:

* There is no difference in legibility between romans and sans.

* Scanning is perhaps not a valid measure of legibility, as unknown factors could influence the results.

A satisfactory answer to the question of legibility would not have been obtained, based on the possibility of using a method without internal validity. It was therefore decided to include a second scanning experiment, but using a typeface that is unfamiliar to the subjects and is obviously less legible than a roman. A significant difference in legibility, between an apparent less legible typeface and a roman in a scanning test, would rule out a conclusion that scanning is not a valid measure of legibility. In this experiment the legibility of a roman face was compared with the legibility of a script face using scanning

speed and accuracy as the criterion for legibility. It was believed that a script typeface would significantly reduce scanning speed.

This experiment was conducted directly after the experiment involving a roman and sans serif typeface.

The null and alternative hypotheses for this experiment were formulated as follows:

H_o: There is no difference between the mean legibility of a script and a roman typeface, when finding and counting a specific word in a scanning test, is used as the criterion.

H_a: A roman typeface is more legible than a script typeface, when finding and counting a specific word in a scanning test, is used as the criterion.

H_o: $\mu R = \mu S$, H_a: $\mu R > \mu S$

R and S are the legibility scores of roman and script typefaces. Level of significance: 0.05.

4.5.2.2 THE METHOD.

4.5.2.2.a THE SUBJECTS.

The same subjects used in the scanning experiment involving a roman and sans serif participated in this scanning experiment.

4.5.2.2.b THE MATERIALS.

The same reading materials used in the previous scanning experiment were also used in this experiment and are found in Appendix D. This scanning test consisted only of a third post-test. The control groups' post-test was set again in a roman typeface, *Times Roman*, whilst the experimental groups' post-test was set in a script typeface, *Zapf Chancery*. An example of *Zapf Chancery* can be found in figure 4.8. The typographical attributes are listed in table 4.8.

4.5.2.2.c THE PROCEDURES.

Subjects received the second post-test directly after the first post-test. Subjects were again asked to find and to mark a given word in the text and to complete the task as quick as possible. Times were recorded with a stopwatch. An index consisting of the percentage of correctly recognised words combined with the scanning time was taken as the scanning scores. The scores of the first scanning pre-test was used to calculate the gain scores between the second post-test and the pre-test. The same procedures and instructions used in the first scanning experiment were also used for this experiment.

4.5.2.3 THE RESULTS.

The results of the scanning experiment are given in table 4.10 and are graphically illustrated in figure 4.10.

A significant statistical difference was found between the legibility of the script and the roman typeface for both standards. The script typeface reduced the scanning index of the Standard Two experimental group from one hundred and eighty-two words per minute to one hundred and sixty-six words per minute. The control group's mean increased from one hundred and seventy-three to one hundred and eighty-eight words per minute in the post-test. There was a total difference of thirty one words per minute in the gain scores of the two groups. The Standard Four experimental group's mean decreased with nine words per minute, whilst the control group's mean increased with twenty-three words per minute. This is a difference of thirty-three in the gain scores of the experimental and control groups. The null hypothesis of equal legibility was tested at the 0.05 level against the alternative hypothesis that a script is less legible than a roman typeface.

The computed *t* values are as follows:
The Standard Two group; $t = 2.54$, the Standard Four group; $t = 2.58$. These values fall inside the critical region, $t(0.05)$ 1.671. The null hypotheses are rejected in favour of the alternative hypotheses. It does appear that a script typeface is more difficult to scan than a roman typeface and that a scanning test can be regarded as a valid instrument in measuring the comparative legibility of two typefaces.

TABLE 4.10

Results of theScanning Test. (Roman compared with a script)

The means are given as the amount of words scanned per minute.

STANDARD 2

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	40					
$\bar{x}$	173.39	182.05	188.93	166.53	15.54	-15.52
s	54.51	51.96	65.53	52.94	55.94	53.32
Confidence Interval	156.15 to 190.62	165.62 to 198.48	168.21 to 209.65	149.79 to 183.27	0.77 to 30.32	-29.60 to -1.44

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.10
Confidence interval (95%) = 10.64 to 51.47
Computed *t* value ($\alpha = 0.05$) = **2.54** (Critical *t* = 1.67 *df* = 78)

STANDARD 4

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
N	40					
$\bar{x}$	211.37	210.94	235.00	201.35	23.63	-9.59
s	54.53	60.24	64.96	44.21	63.89	50.66
Confidence Interval	194.12 to 228.61	191.89 to 229.99	214.45 to 255.54	187.37 to 215.33	6.75 to 40.51	-22.98 to 3.79

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

F test for variance = 1.59
Confidence interval (95%) = 11.69 to 54.77
Computed *t* value ($\alpha = 0.05$) = **2.58** (Critical *t* = 1.67 *df* = 78)

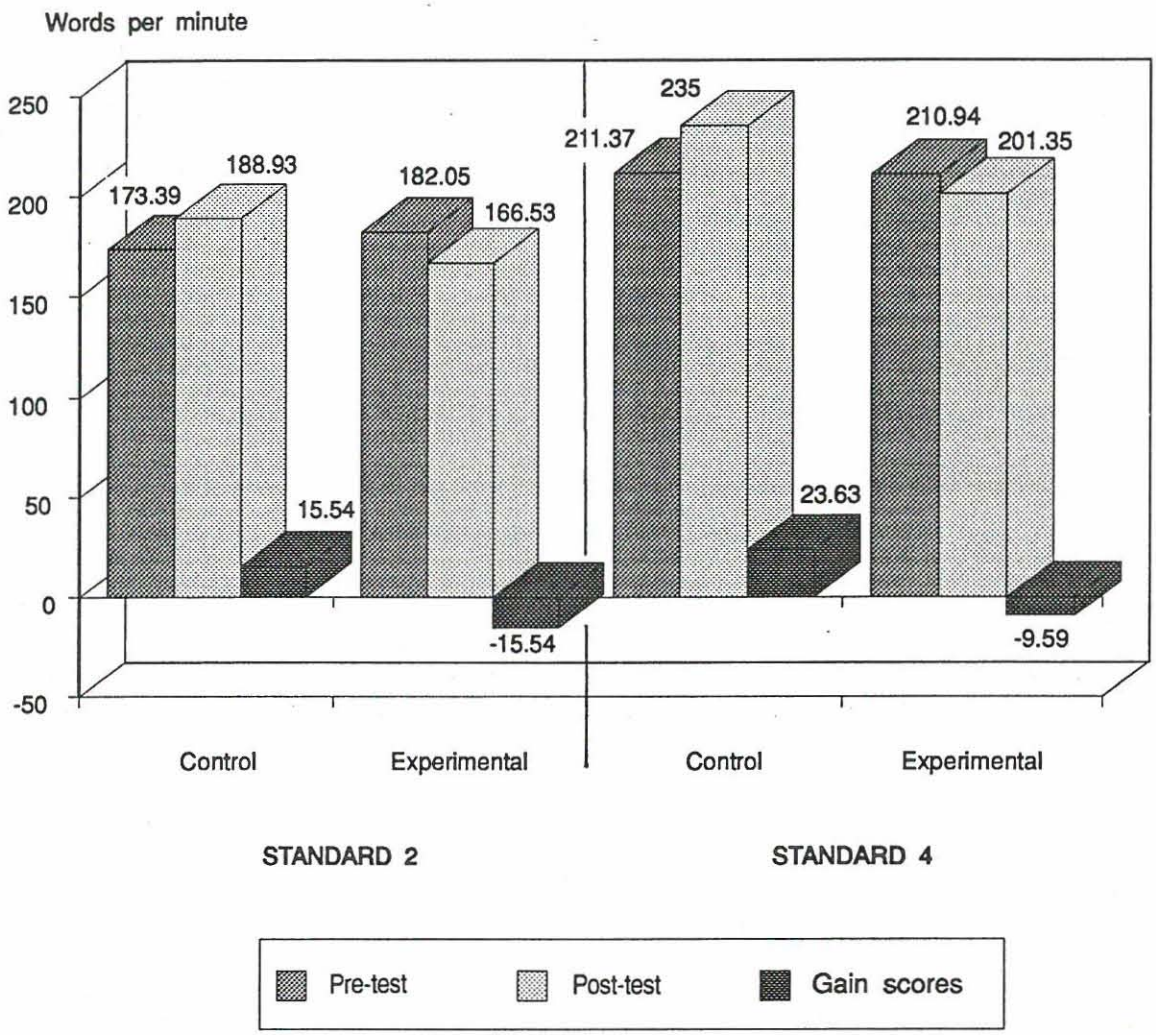

FIGURE 4.10

A graphical representation of the means and gain scores of the Scanning Test. *(Roman compared with a script)*

4.5.2.4 DISCUSSION OF THE RESULTS.

Subjects in this experiment were exposed to major typographical differences between two typefaces during a visual task. From the results it appears that subjects reduced their time in executing a visual task when confronted with unfamiliar characters and a typeface that is apparently less legible.

The scanning experiment is considered as a valid and sensitive measuring instrument in legibility testing.

The conclusion that there is no significant statistical difference between the legibility of romans and sans, as discussed in 4.5.1.4 appears to be reasonable, and is therefore accepted.

-oo0oo-

4.6 THE EYE-MOVEMENT TEST.

4.6.1 INTRODUCTION.

Factors outside the researcher's control restricted the scope of this experiment and inferences that can be made.

The following limitations apply to this experiment:
Initial permission was granted to the researcher to use an optomograph at the University of the Orange Free State for his studies. The instrument was then later transferred back to the owners, the Bloemfontein College of Education. This was before the researcher was able to start with this experiment. Permission was granted by this institution to use the equipment only on their premises and only in one particular room. The researcher was granted nine weeks access to this instrument. The current academic load of the researcher was such that he was only able to test subjects on one afternoon per week. The researcher only used subjects supplied by the institution, as it was regarded impractical to transport subjects from their home or school to the testing venue and back after the experiment. Financial restraints also prevented the purchase of such an instrument.

The null and alternative hypotheses for this experiment were formulated as follows:

H_o: There is no difference between the mean legibility of sans serif and roman typefaces when eye movements are taken as the criterion for legibility.

H_a: There is no difference between the mean legibility of sans serif and roman typefaces when eye movements are taken as the criterion for legibility.

H_o: $\mu R = \mu S$, H_a: $\mu R \neq \mu S$

4.6.2 THE METHOD.

As with the other experiments, a pre-test post-test control group research design was used. The exception is that a true random sampling method was not possible and was not used.

The researcher familiarised himself with the procedures and operations of the eye-movement machine by using tertiary students as preparatory subjects before the primary school subjects were tested.

4.6.2.1 THE SUBJECTS.

The eye movement reading machine was situated in the Remedial Department of the Bloemfontein College of Education. Student teachers in this department did some of their practical teaching with primary school scholars with learning difficulties. These scholars were then used for this experiment and the Remedial Department, in turn, used the results, for their remedial programme.

The subjects were Afrikaans-speaking boys and girls and ranged from Sub-Standard B to Standard Five. No information was supplied to the researcher concerning their learning difficulty. The researcher did not regard the subjects as homogeneous, because of the difference in age and educational level.

The potential group of subjects was discussed beforehand with a lecturer and randomly divided into an experimental and control group, so that each group contained a balance of subjects concerning age and level of education. Not all the subjects arrived on the particular testing dates, which resulted in unequal numbers in the control and experimental groups. This resulted in there being only eight subjects in the control group and eleven in the experimental group.

4.6.2.2 THE MATERIALS.

The instrument used in this study is known as the *Eye-tract Movement Monitor.* It uses optical and electronic techniques to measure objective and quantitative measurements of eye movements during reading. This instrument is normally used in diagnostic studies of oculmotor functions and the evaluation of reading performance. The instrument is limited in that it records

horizontal movement only, and the subject's head must be kept still in a headrest whilst reading. Excessive head movements would prevent the instrument recording the relevant eye movements. A graph is drawn on heat sensitive graph paper, one for the left eye and one for the right eye as the eye movements occur. From these graphs a complete record of eye movements can be obtained namely the amount of fixations, regressions, the average span of recognition, the average duration of fixation, and the reading speed.

A graph drawn by this instrument, with its explanation, is given in figure 4.11.

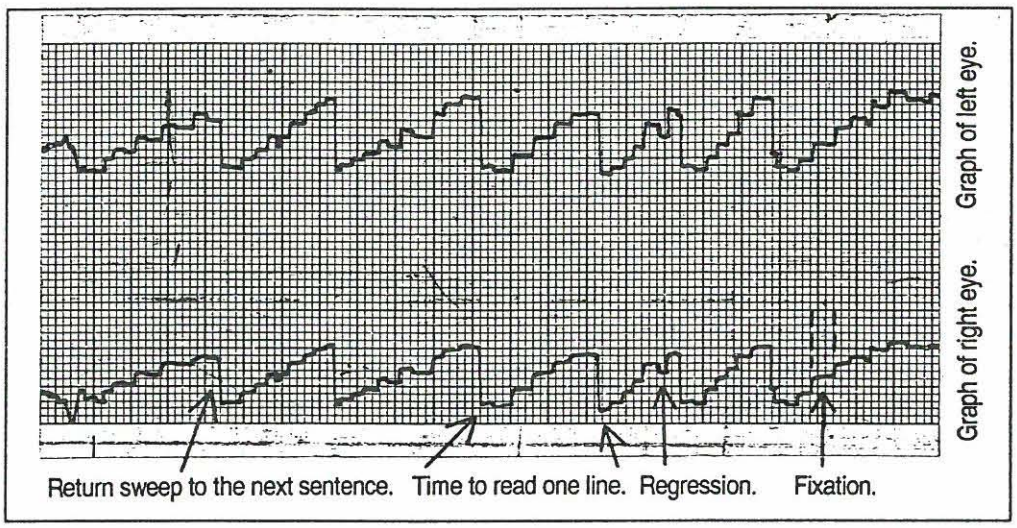

FIGURE 4.11
An example of a graph drawn by the Eye Movement Machine.

The reading material consisted of two graded passages of approximately one hundred words each, which were taken from discontinued school readers. Material for the Sub-Standard B subjects was taken from Blanckenberg & Ferreira Blanckenberg ([*s.a.*] (a):3). Reading material for the Standard 1 subjects came from Blanckenberg & Ferreira Blanckenberg ([*s.a.*] (a):1), for the Standard 2 subjects from Blanckenberg & Ferreira Blanckenberg ([*s.a.*] (a):1). The Standard 3 subjects received material from Blanckenberg & Ferreira Blanckenberg ([*s.a.*] (a):1), the Standard 4 subjects from Blanckenberg & Ferreira Blanckenberg ([*s.a.*] (a):1) and the Standard 5 subjects from Blanckenberg & Ferreira Blanckenberg ([*s.a.*] (a):1). The one passage was set in a roman typeface; *Times Roman*, and the other in a sans

This material was set with a phototypesetter. Three reading cards were prepared for each standard, one for the pre-test and one post-test card each for the control and experimental groups.

Examples of the typefaces used in the Eye movement Tests are given in figure 4.12. All the material used in this experiment is given in Appendix E.

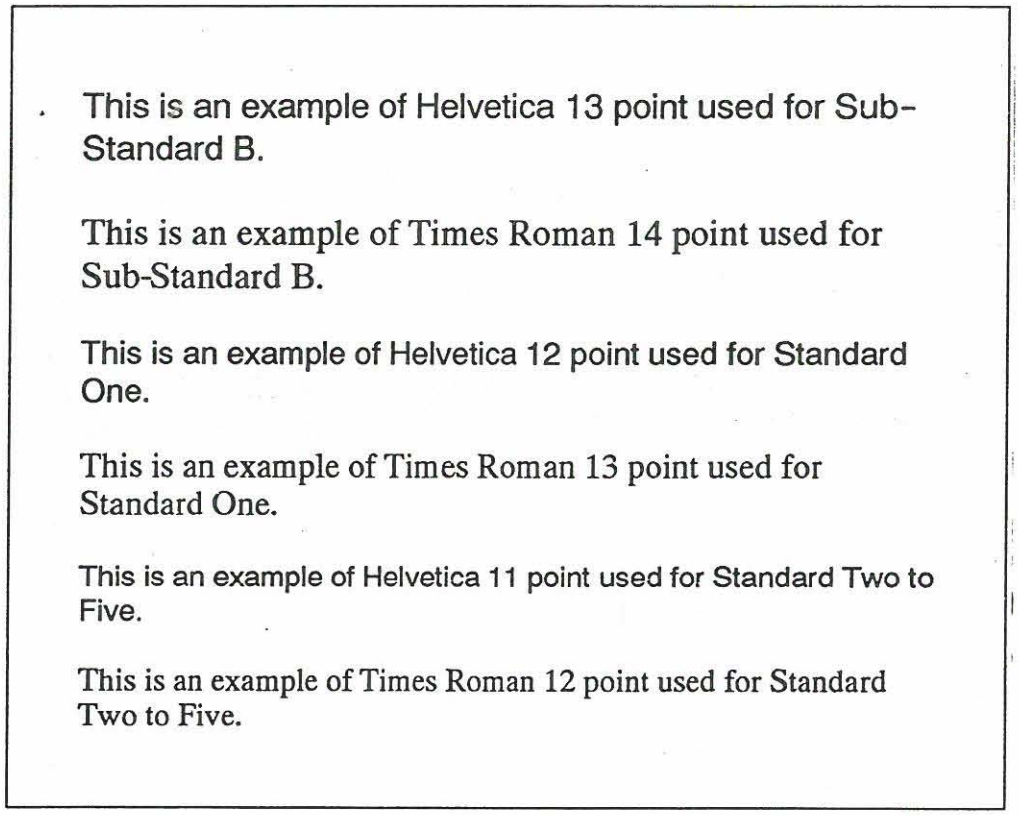

FIGURE 4.12
Examples of the typefaces used in the Eye Movement Tests.

4.6.2.3 THE PROCEDURES.

The researcher put the subjects at ease by explaining the working of the eye-movement machine and assuring them that they were not being tested or evaluated. The instructions to the subjects were that they had to read the card with comprehension and were going to be asked a few questions on the content of the reading card. The subject's head was then placed on the chin rest with stabilisers on either side of his head to minimise head movement.

The first card was placed in front of the subject to read. The subject replied to the comprehension questions and then received the post-test reading card. Comprehension questions were again given to the subject.

The *t* test for independent samples and the Behrens-Fisher statistic were used on the gain scores of the control and experimental groups. A significance level of 0.5 was used to test the null hypothesis.

4.6.3 THE RESULTS.

The results of this experiment are given in table 4.11.

4.6.3.1 READING SPEED.

The gain score of the control group increased with nearly eleven words per minute and the mean of experimental group increased with nine words per minute.

The computed value of t is $0.098 < t(0.5) = 2.11$. Since $0.098 < 2.11$, insufficient evidence was found to reject the null hypothesis.

The comprehension level expressed as a percentage, is eighty-five for both groups in the pre-test. There was an eleven percent lower comprehension for the control group in the post-test. The aim of the comprehension questions was only to control that the subjects read the given material.

4.6.3.2 EYE FIXATIONS.

Two subjects in the control group had such erratic head movements that it was impossible to determine the fixations and regressions, as their eyes moved constantly out of the infra red beam. The data for the control group consisted, therefore, only out of six instead of eight subjects.

The mean fixations per minute for the control group decreased by thirteen, from one hundred and sixteen to one hundred and three, and the mean fixations stayed the same for the experimental group.

The computed value of t = -1.121 < t(0.05) 2.131. The null hypothesis that romans and sans serifs are equally legible is not rejected.

4.6.3.3 REGRESSIONS.

It was regarded that if sans does affect the reading process, that it would also increase or decrease the amount of regressions that a reader would make during reading. No noticeable changes in the amount of regressions were found with the experimental group who received the second reading card in a sans serif typeface. There was a mean decrease of half a regression per hundred words for this group, whilst the control group's mean increased with only one and a half words.
The computed value of t = 0.547 < t(0.05) 2.131. The null hypothesis that romans and sans serifs are equally legible is not rejected. There was insufficient evidence to conclude that sans serif typefaces decrease or increase legibility as measured by the amount of regressions per minute.

4.6.4 DISCUSSION OF THE RESULTS.

The subjects that were available for this experiment, namely subjects with learning difficulties, which included reading problems, differed considerably from normal readers that were initially planned for the study. The researcher decided to complete this experiment, as the reading materials for the experiment were completed, and results from this experiment could possibly help future studies when this type of instrument is used in legibility studies.
This particular experiment is regarded by the researcher as unsatisfactory due to the poor sampling method, the small sample and the lack of homogeneity of the subjects regarding age and educational level. These subjects can also not be regarded as normal readers when compared with the other experiments. The unique characteristics of these subjects placed this experiment outside the objective of the study of using normal readers to test the legibility of roman and sans serif typefaces. Care must be taken in the interpretation of these results and no generalisation should be made to any population of scholars with learning difficulties.
This experiment can rather be considered as a small pilot study for a future study when an eye reading machine is used in legibility studies.

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TABLE 4.11

Results of the Eye Movement test.

	PRE-TEST		POST-TEST		GAIN SCORES	
Group	Control	Experimental.	Control	Experimental	Control	Experimental
READING SPEED: (Words per minute)						
N	8	11	8	11	8	11
$\bar{x}$	155.86	151.55	166.38	160.82	10.52	9.27
s	82.51	88.93	94.07	106.74	22.33	29.72
Confidence Interval	94.32 to 217.43	94.97 to 208.12	96.20 to 236.55	92.91 to 228.72	-6.16 to 27.16	-9.63 to 28.18
COMPREHENSION: (%)						
N	8	11	8	11	8	11
$\bar{x}$	85.00	85.00	73.75	84.55	-11.25	-0.45
s	14.14	14.66	24.46	15.73	11.26	20.79
Confidence Interval	74.45 to 95.55	75.67 to 94.33	55.50 to 92.00	74.54 to 94.55	-19.65 to -2.85	-13.68 to 12.77
REGRESSION: (100 words)						
N	6	11	6	11	6	11
$\bar{x}$	12.00	15.82	13.50	15.27	1.50	-0.55
s	8.88	9.14	9.73	12.59	7.23	7.44
Confidence Interval	4.28 to 19.72	9.94 to 21.69	5.03 to 21.97	7.19 to 23.36	-4.79 to 7.79	-5.32 to 4.23
FIXATION: (100 words)						
N	6	11	6	11	6	11
$\bar{x}$	116.33	113.27	103.50	113.91	-12.83	0.64
s	21.43	27.38	21.50	45.37	15.77	26.76
Confidence Interval	97.69 to 134.97	95.68 to 130.87	84.79 to 122.21	84.76 to 143.06	-26.55 to 0.88	-16.55 to 17.83

RESULTS OF THE STATISTICAL TESTS ON THE MEAN GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUP:

	READING SPEED	FIXATION	REGRESSION
F test for variance =	1.77	2.88	1.057
Confidence interval (95%) =	-25.17 to 27.62	-39.07 to 12.13	-5.92 to 10.01
Computed *t* value ($\alpha = 0.05$) =	0.098	-1.121	0.547
Critical *t* =	2.11	2.131	2.131
df =	17	15	15

4.7 THE SUBJECTS' TYPEFACE PREFERENCE.

4.7.1 INTRODUCTION.

The aim of this section of the study was to determine whether the proportion of subjects favouring romans is different from the proportion of students favouring sans serifs.

Subjects were required to indicate their typeface preference in four of the experiments. The subjects' typeface preference is discussed under the heading of each experiment. A conclusion and discussion, for all the experiments, is given under 4.7.5. The results are given in table 4.12 and are graphically illustrated in figure 4.13, figure 4.14, and figure 4.15. The typographical attributes are given in table 4.13. All the material used in determining the subjects' typeface preference can be found in Appendix G.

Subjects that participated in the Reading Marathon and Scanning Tests, were also requested to give their reasons why they preferred a certain typeface. These reasons, as the subjects wrote them down, are given in Appendix F,

The *z* test for proportions, discussed in 3.3.3.3 was used as the statistical test to determine whether there is a significant difference in the proportion of subjects that prefer romans and the proportion of subjects that prefer sans serifs. As text can only be set in sans or serifs, the subjects' choice of *no preference* was interpreted in that they are indifferent to the typeface used. This *no preference* choice was, therefore, not included in the statistical tests. The results in table 4.12 therefore provides not only the no preference, romans and sans choice of the subjects, but also just the preference for romans or sans serifs. The preferences are expressed as a percentage.

The null hypotheses of equal preference were tested against the alternative hypotheses that there is a typeface preference at the 0.05 level.

$H_o: p_1 = p_2 \quad H_a: p_1 \neq p_2$

TABLE 4.12

The subjects' typeface preference and the results of the z test for proportions.

		Subjects' typeface preference during the experiments. (%)			Subjects' preference for roman or sans serif. (%)		
	N	Sans serif	Roman	No preference	Sans serif	Roman	*Calculated z statistic*
Word Recognition and Speed Reading test.							
Sub-Standard B	56	54.4	21.6	23.7	71.3	28.7	5.59 ***
Standard 2	56	37.1	20	42.9	64.8	35.2	3.56 ***
Standard 4	56	27.2	19.2	53.6	58.7	41.3	1.77 *
Reading Marathon.							
Standard 4	65	27.9	30.9	41.2	47.5	52.5	0.32
Standard 5	57	42.1	57.9	not obtained †	42.1	57.9	1.19
Scanning test.							
Standard 2	80	23.8	27.4	48.8	46.3	53.7	0.47
Standard 4	80	38.8	20	41.2	66	34	2.19 **

Critical value for $Z_{1-(\alpha/2)}$ when $\alpha = 0.05$ is 1.96. ($Ho: p1 = p2$ $Ha: p1 \neq p2$)

* Significant at 0.1

** Significant at 0.05

*** Significant at 0.01

† See the third paragraph in 4.7.5.2

TABLE 4. 13

The typographical attributes of the reading cards used in the Word Recognition and Speed Reading Tests to determine typeface preference.

	Card one		Card two			Card three		
* Typeface name	Avalon	Brooklyn	Homeward Bound	Gatineau	Switserland	Nebraska	Ottawa	Memorandum
** Point size	13							
Height of capitals (millimetres)	3.55	3.6	3	3.5	3.4	3.45	3.45	3.1
Height of lower case "o" (millimetres)	2.9	2.75	2.4	2.55	2.55	2.4	2.5	2.6
Height of lowercase "d" (millimetres)	3.55	3.7	2.9	3.65	3.4	3.55	3.7	3.2
Width of lower case "o" (millimetres)	2.9	2.7	2.7	2.3	2.3	2.6	2.55	2.7
Maximum line length (millimetres)	8.46	8.64	6.13	6.67	6.6	7.55	7.42	7.64
Characters per centimeter.	3.2	3.1	4.6	4.1	4.22	3.8	3.84	3.85
Line spacing (millimetres)	7.95	7.95	6.8	7.5	7.5	7.75	7.75	6.8

* Coreldraw alternatives for the following:
Avalon = Avant Garde, Brooklyn = Bookman, Homeward Bound = Hobo, Gatineau = Garamond, Nebraska = Baskerville, Ottowa = Optima, Memorandum = American Typewriter.

** Approximate size only. The original characters were set three points larger and photographically reduced to this size.

4.7.2 THE WORD RECOGNITION AND SPEED READING TESTS.

4.7.2.1 THE METHOD.

Subjects received three reading cards after the completion of the Speed Reading and Word Recognition Test. One card contained two paragraphs containing ten words each. The one paragraph was set in a roman and the other in a sans serif. The other two cards were the same, except that a third paragraph was added and set in a display typeface. This typeface was furthermore outlined in such a way that it formed an extra bold typeface and was regarded by the researcher as a difficult typeface to read. The open spaces of the *"a"* and *"e"* for example, filled in with ink which changed the basic form of the letters. Also see the cards in Appendix G. The display typefaces on two of the reading cards were introduced as a control mechanism to ensure that the subjects understood and interpreted the request to indicate which typeface they read the easiest. It was expected that the subjects would point to the display typefaces when asked which typeface they read with the most difficulty. The paragraph in the sans serif was placed on top of the first card, in the middle of the second card and at the bottom of the third card. Different romans and sans serifs were used on each card. The typographical attributes are given in table 4.13.

The first card was placed in front of the subject with the following instructions:

> *" Hier is 'n kaart met 'n klomp woorde daarop. Elke paragraaf het dieselfde woorde, maar verskillende soorte letters is gebruik om dit te druk. Watter tipe letter lees vir jou die maklikste? Is dit in hierdie een..., of hierdie een..., of lees hulle ewe maklik?"*
>
> An English translation would read as follows:
>
> *" Here is a card with a few words. Each paragraph contains the same words, but different letters were used to print them. Which type of letter reads the easiest for you? Is it this one..., Or this one..., or do they read equally easy."*

The researcher pointed to the different paragraphs whilst giving the instructions. No negative or positive response was given by the researcher

after an answer was received. The same procedure was followed with card number two and three, except that they were first asked to point out the letter type that they read with the most difficulty and then the one they read most easily.

4.7.2.2 THE RESULTS.

The subjects' preferences for romans were reasonably constant. For this typeface, 21.9% of the choices came from the Sub-Standard B group, 20.1% from the Standard Two group, and 19.2% from the Standard Four group. The no preference choice grew from 23.7% for the Sub-Standard B group to 42.9% and 53.6% for the Standard Two and Standard Four group, respectively. The choice for sans serif was 54.5% for the Sub-Standard B group, decreased to 37.1% for the Standard Two and 27.2% for the Standard Four group. Sans serifs were preferred above romans by all the groups.

The z test for a single population proportion was used to test the null hypothesis at the 0.05 level. The critical value for $z = 1.96$. The value of the test statistic is as follows: Sub- Standard B; $z = 5.59$, Standard Two; $z = 3.56$, Standard Four; $z = 1.77$.

The null hypotheses that $p_1 = p_2$ is rejected in favour of the alternative hypotheses for the Sub- Standard B and Standard Two group. The preferences by two of the class groups, for sans serifs were regarded as significant at 0.05. It does appear as if the lower standards prefer sans serifs above romans. *A possible reason is that the books in the lower standards are printed in a sans serif and that familiarity played a role in the subjects' choice.*

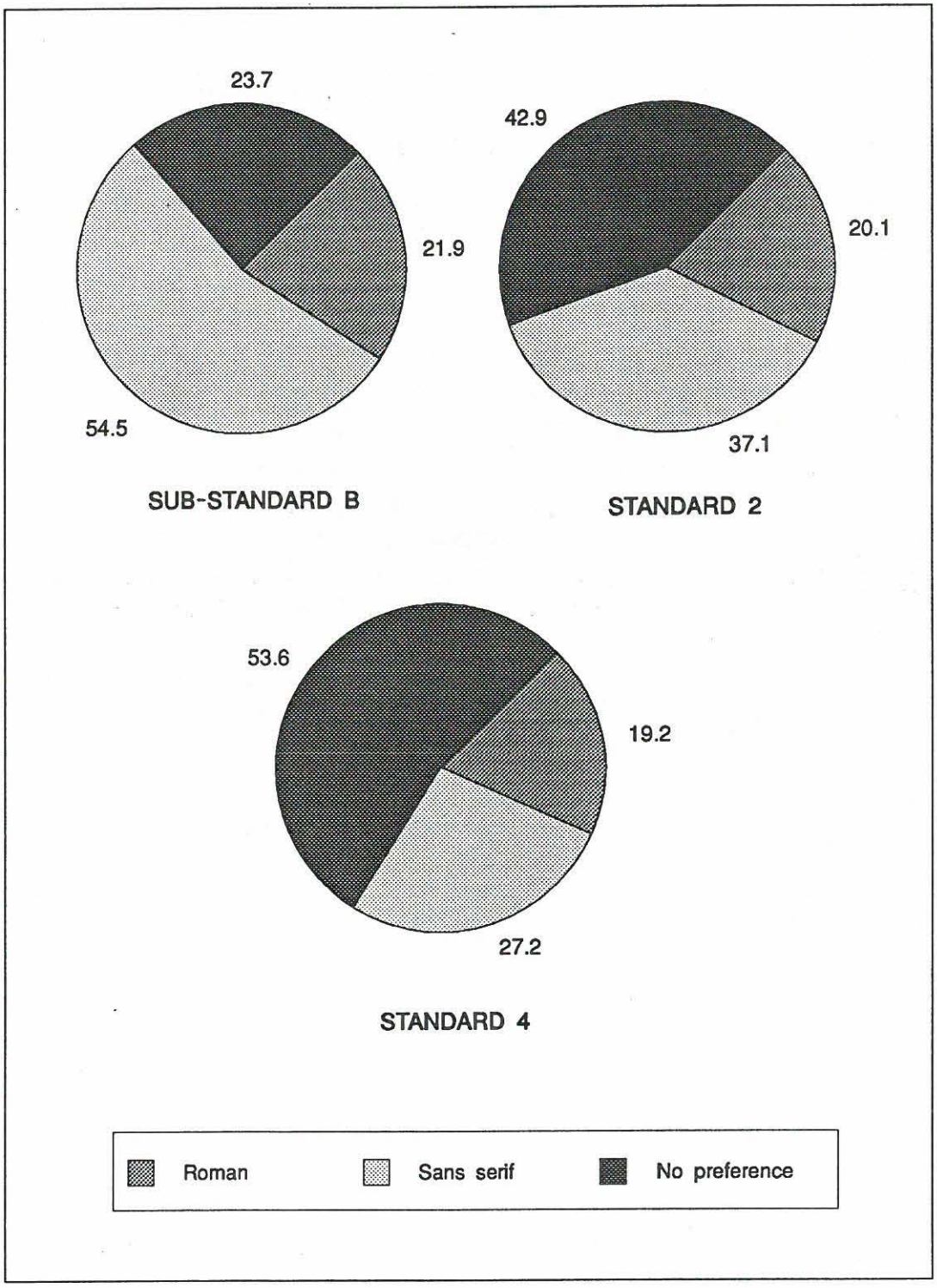

FIGURE 4.13

The subjects' typeface preference in the Word Recognition and Speed Reading Tests expressed as a proportion.

4.7.3 THE READING MARATHON.

4.7.3.1 THE METHOD.

The subjects' typeface preference was determined directly after the completion of the Reading Marathon. All the subjects received an A4 sheet of paper with a portion of text set in a roman and a portion of text set in a sans serif. These portions of text were taken from the text used in their reading marathon. The differences between the two typefaces were pointed out to them. They were then asked to indicate, by marking the block of text, which typeface read more easily to them. Space was provided for reasons why they preferred a particular typeface. Teachers in the classes read the full instructions to the students after they received their A4 sheet of paper with the printed samples. The material of this experiment is given in Appendix G. The subjects' reasons for their typeface preference are given in Appendix F.

4.7.3.2 THE RESULTS.

The Standard Four group.

In this group, 27.9% of the subjects indicated the roman typeface as their preferential typeface, 30.9% chose the sans serif and 41.2% indicated an equal preference. The higher no preference choice seems to agree with the results of the typeface preference of the Standard Four group in the Word Recognition and Speed Reading Tests.

The value of the test statistic is $z = 0.32$ and the critical value of $z(0.05) = 1.96$. The null hypotheses that there is no typeface preference is not rejected.

The Standard Five group.

In the Standard Five group, 57.9% of the subjects preferred the roman typeface and 42.1% the sans serif. Not one choice was given for the no preference option. It is presumed that the supervising teachers with the Standard Five group did not follow the prescribed instructions, and that this is the reason for the lack of choices in the no preference option.

The value of the test statistic is $z = 1.19$ and the critical value of $z(0.05) = 1.96$. The null hypothesis is not rejected since $1.19 < 1.96$, and does not fall in the critical region. There is insufficient evidence to conclude that there is a preference for a particular typeface.

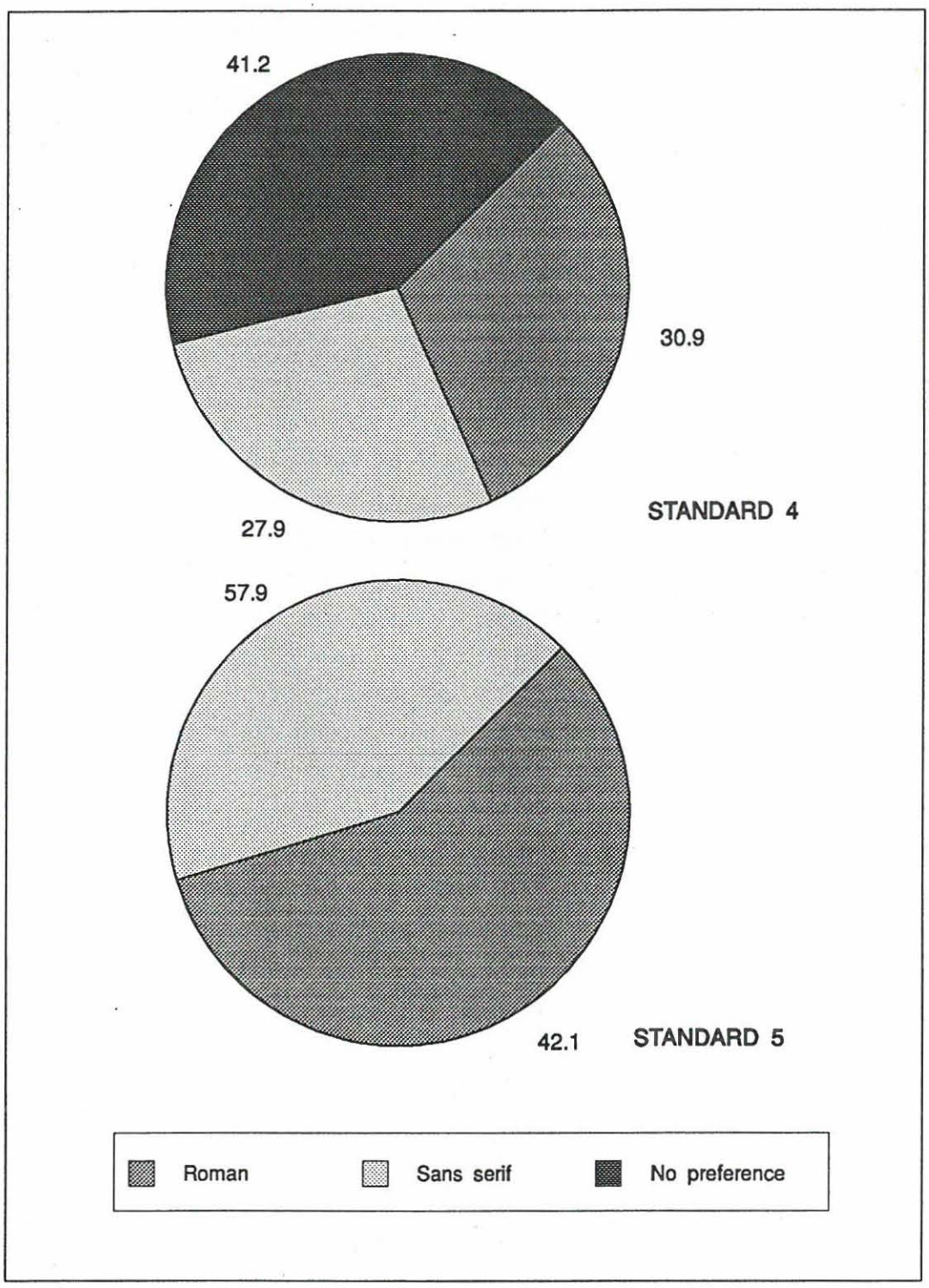

FIGURE 4.14

The subjects' typeface preference in the Reading Marathon expressed as a proportion.

4.7.4 THE SCANNING TESTS.

4.7.4.1 THE METHOD.

The subjects' typeface preference was determined after they had completed their pre-test and two post-tests. Each subject received an A4 sheet of paper with two portions of text taken from their scanning experiment. One portion was set in a sans serif and the other in a roman typeface. The following instructions were given to the subjects:

> *" Voor jou is daar twee gedeeltes van die storie. Twee verskillende lettertipes is gebruik om dit te druk. Die boonste lettertipe noem ons lettertipe s, en die onderste lettertipe r. Kan jy sien dat daar 'n verskil in die lettertipe is?* (Time was given to the subjects to notice the difference. The difference was pointed out when a subject indicated that the typefaces appeared the same).
> *Watter lettertipe lees vir jou die maklikste? Of lees altwee ewe maklik vir jou? Onthou daar is nie 'n verkeerde antwoord nie. Ons wil net bepaal watter lettertipe lees die maklikste vir jou. Maak 'n merkie langs die blokkie wat vir jou die maklikste lees. As altwee lettertipes ewe maklik lees maak dan 'n merkie langs altwee blokkies. Jy kan vir ons 'n rede gee vir jou keuse. Skryf dit dan vir ons onderaan die bladsy."*

An English translation would read:

> *"In front of you are two sections of the story. Two different types of letters were used to print it. The top section is called letter s, and the bottom section letter r. Can you see that there is a difference between them?* (Time was given to the subjects to notice the difference. The difference was pointed out when a subject indicated that the typefaces appeared the same).
> *Which type of letter reads the easiest to you? Or do they read the same to you? Remember you cannot give a wrong answer. We only want to determine which type of letter you read the easiest. Make a mark next to the section that reads the easiest to you. If both letters read equally easy, then mark both sections for us. You can provide a reason for your choice. Write it at the bottom of the page.*

4.7.4.2 THE RESULTS.

The Standard Two group.

No significant statistical preference for sans serif or romans was found in the Scanning Test. In this group, 27.5% of the subjects chose the roman and 23.8% the sans serif typeface. The rest chose the no preference option.

The value of the test statistic is $z = 0.47$ and the critical value of $z(0.05) = 1.96$. The null hypothesis of equal preference is not rejected since $0.47 < 1.96$ and does not fall in the critical region.

The Standard Four group.

A significant statistical preference in favour of sans serif was found in this experiment. In this group, 38.8% of the subjects chose the sans serif, whilst only 20% chose the roman typeface. This was not expected, as there was no typeface preference in the Reading Marathon as well as with the Standard Two group in the Scanning Test. Although there is a significant statistical preference for a sans serif, more subjects, namely 41.3% chose the no preference option than the sans serif option.

The value of the test statistic is $z = 2.19$ and does fall in the critical region, $z(0.05) = 1.96$. The null hypothesis of equal preference is rejected in favour of the alternative hypothesis that readers do have a typeface preference. In this instance it is the sans serif that is preferred.

Reasons provided by the subject for their typeface preferences did not always refer to the typographical attributes that distinguish romans from sans serifs. Only six reasons that could possibly be interpreted as a preference for serifs in letters and eight reasons against the use of serifs were provided by the subjects in the scanning and comprehension experiments. Other reasons for their preference included aspects of the story, the relative position of the text on the page, and even the letters that appeared to them to be in different sizes. Some subjects found the roman faces appeared visually larger and others found this to be true of the sans serif. The subjects' reasons for their typeface preference are given in Appendix F.

4.7.4.2 THE RESULTS.

The Standard Two group.

No significant statistical preference for sans serif or romans was found in the Scanning Test. In this group, 27.5% of the subjects chose the roman and 23.8% the sans serif typeface. The rest chose the no preference option.

The value of the test statistic is $z = 0.47$ and the critical value of $z(0.05) = 1.96$. The null hypothesis of equal preference is not rejected since $0.47 < 1.96$ and does not fall in the critical region.

The Standard Four group.

A significant statistical preference in favour of sans serif was found in this experiment. In this group, 38.8% of the subjects chose the sans serif, whilst only 20% chose the roman typeface. This was not expected, as there was no typeface preference in the Reading Marathon as well as with the Standard Two group in the Scanning Test. Although there is a significant statistical preference for a sans serif, more subjects, namely 41.3% chose the no preference option than the sans serif option.

The value of the test statistic is $z = 2.19$ and does fall in the critical region, $z(0.05) = 1.96$. The null hypothesis of equal preference is rejected in favour of the alternative hypothesis that readers do have a typeface preference. In this instance it is the sans serif that is preferred.

Reasons provided by the subject for their typeface preferences did not always refer to the typographical attributes that distinguish romans from sans serifs. Only six reasons that could possibly be interpreted as a preference for serifs in letters and eight reasons against the use of serifs were provided by the subjects in the scanning and comprehension experiments. Other reasons for their preference included aspects of the story, the relative position of the text on the page, and even the letters that appeared to them to be in different sizes. Some subjects found the roman faces appeared visually larger and others found this to be true of the sans serif. The subjects' reasons for their typeface preference are given in Appendix F.

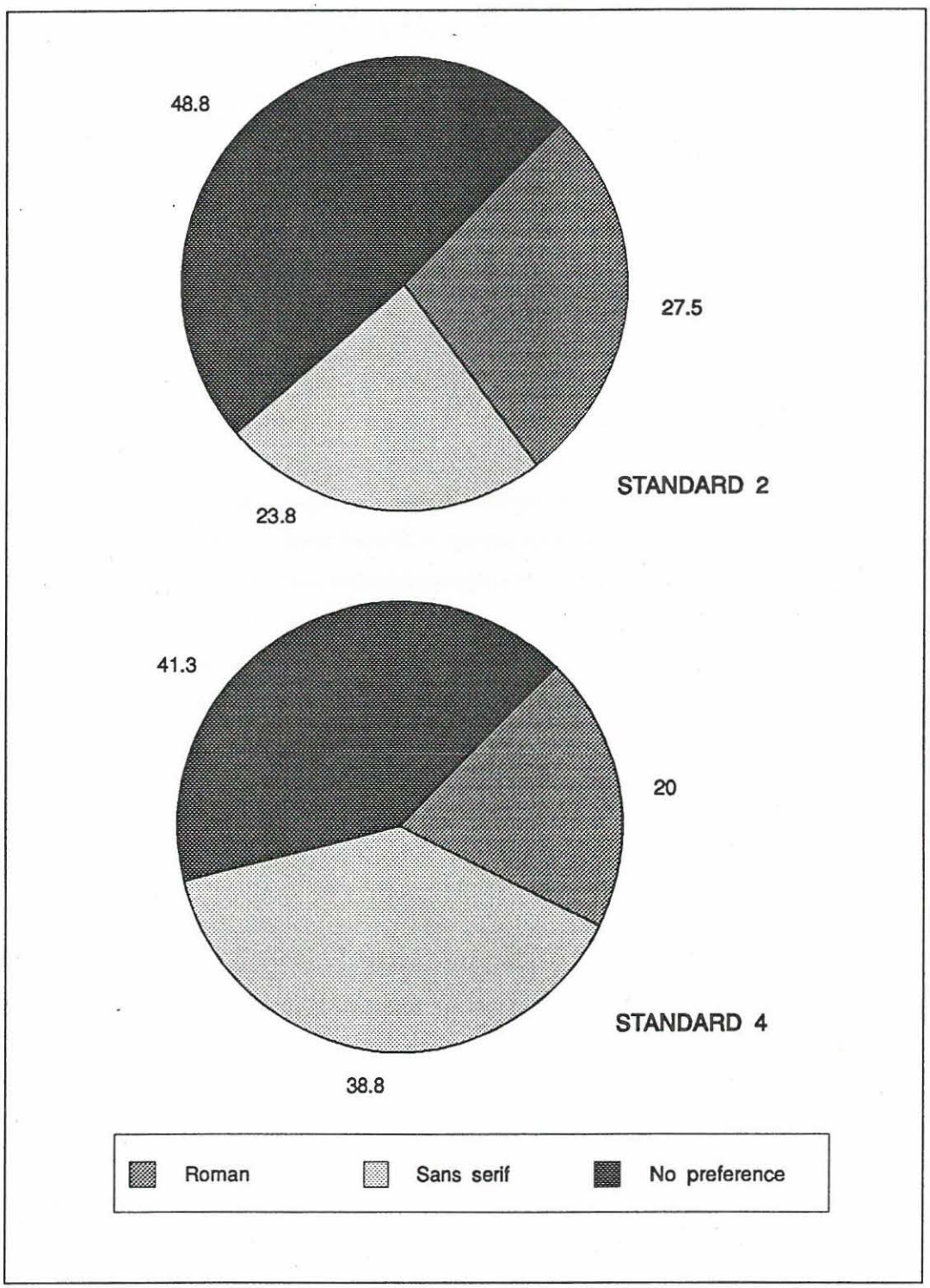

FIGURE 4.15

The subjects' typeface preference in the Scanning Test expressed as a proportion.

4.7.5 DISCUSSION OF THE RESULTS.

From the results the following conclusions can be deduced:

4.7.5.1. Subjects in the lower classes of primary schools appear to prefer sans serif above romans when text is bigger than normal and viewed as isolated words.

4.7.5.2. Primary school subjects do not necessary prefer romans for normal running text. The presence or absence of serifs seems to have a negligible effect on their typeface preference.

4.7.5.3. The typefaces that the subjects are accustomed to, appear to affect their typeface preference more than the typographical difference between romans and sans serifs.

There was a significant preference for sans above romans by two class groups in the first two experiments. The conclusion in 4.7.5.1, that sans are preferred above romans, is, however, made with caution. Analysing the subjects' comments regarding their typeface preference, during the Scanning Tests and reading marathon, indicated that typographical differences between romans and sans did not play a meaningful part. No reasons were, however, asked for the subjects' typeface preference during the first two experiments. It was wrongly assumed that their typeface preference would reflect a preference based on typographical attributes, excluding familiarity, perceived visual size and other factors. If the reasons given by the subjects during the Reading Marathon and Scanning Tests are implied, then a conclusion that sans are preferred above romans *because* of typographical differences, might not be valid. However, the bigger size and isolated words in the first two experiments could have made the typographical difference between the two typefaces more distinct. On this assumption the conclusion in 4.7.5.1 would be more acceptable.

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CHAPTER 5

CONCLUSIONS, RECOMMENDATIONS AND SUMMARY.

CONTENTS.

5.1 INTRODUCTION.

Two aims were set for this study, namely:
To determine the comparative legibility of sans serif and roman typefaces, and to establish if readers do have a typeface preference.

Sufficient evidence was obtained during the study not to reject the research hypothesis of equal legibility between roman and sans serif typefaces.

Significant statistical evidence was found for three groups in two experiments to reject the research hypothesis that readers equally prefer roman and sans serif typefaces.

This chapter will discuss the obtained evidence in not rejecting the one hypothesis, and in rejecting the other hypothesis. A full discussion and conclusion of each experiment is given in chapter four. This chapter provides a summation of the discussions and the conclusions for the study as a whole. A table with a condensed outline of the results is given in table 5.1 to aid the discussion process.

5.2 THE COMPARATIVE LEGIBILITY OF ROMAN AND SANS SERIF TYPEFACES.

The study used quantitative methods to measure the legibility between roman and sans serif typefaces. Five different reading processes were used as the criterion for legibility in six different experiments. A total of four hundred and sixty-nine subjects from four different standards participated in these experiments.

No significant statistical difference was found between the legibility of romans and sans serif typefaces in all the experiments. *The results of this study are in contrast to the assumption that romans are more legible than sans serif typefaces.*

TABLE 5.1

A condensed outline of the results.

Experiment.	The comparative legibility of roman and sans serif typefaces.	The subjects' typeface preference.
Word Recognition and Speed Reading Tests.		
Sub-Standard B	Romans and sans serifs equally legible.	Significant preference for sans serifs at the 0.01 level.
Standard 2	Romans and sans serifs equally legible.	Significant preference for sans serifs at the 0.01 level.
Standard 4	Romans and sans serifs equally legible.	Significant preference for sans serifs at the 0.1 level.
Reading Marathon		
Standard 4	Romans and sans serifs equally legible.	No particular typeface preference.
Standard 5	Romans and sans serifs equally legible.	No particular typeface preference.
Scanning Test		
Standard 2	Romans and sans serifs equally legible. Romans significantly more legible than a script at the 0.01 level.	No particular typeface preference.
Standard 4	Romans and sans serifs equally legible. Romans significantly more legible than a script at the 0.01 level.	Significant preference for sans serifs at the 0.05 level.
Eye Movement Experiment.	Romans and sans serifs equally legible.	

The following conclusions are made:

* Sufficient evidence was found to conclude that with normal primary school readers, and under normal reading conditions, sans serifs and romans can be regarded as equally legible.

* Serifs do not appear to have a noticeable effect on legibility, as measured by the tests employed in this study. The subjects did not read words with serifs faster, their comprehension did not increase, and they were also not able to find a word in a portion of text easier, when the text was set in a roman typeface.

* The scanning process is regarded by the researcher as a reliable and strong measuring instrument in legibility studies. Also see the discussion in 4.5.1.4 and 4.5.2.4.

* Comprehension tests, as conducted in the reading marathon, are regarded as a poor instrument in measuring legibility. Also see the discussion in 4.4.4. Uncontrollable factors cloud out the dependent variable in comprehension tests and make it difficult to determine the effect of the independent variable.

* Young readers that lack the ability to read fluently, are not suitable for quantitative reading experiments where speed and verbal skills are required. Also see the last paragraph in 4.3.4. The difficulty in verbally expressing a visual task, does not provide accurate results regarding the true observation of the given task. Uncontrollable factors could cloud out the effect of serifs on legibility. Subjects' concern about comprehension and correct pronunciation could, for example, have influenced reading speed more than the presence or absence of serifs in letters.

* There is also the possibility that one of the typefaces is more legible, and that older and more fluent readers will be able to adapt their scanning and reading speed when exposed to the more legible typeface.

The researcher believes that it is not necessarily serifs, or the lack thereof, that increase or decrease legibility. It is rather a complex interaction of known and unknown factors that affect a subject's reading performance and the legibility of reading material. Subject matter, the readers' interest in the material, intellectual ability, and their emotional and physical condition, can all play a role in reading performance.

Goudy (1989:5-21 & 37-47) provides a detailed discussion of the development of the Latin alphabet. From his discussion and the comments by Meggs (1983:44-46), it is more reasonable to assume that serifs came about as a result of aesthetic and practical considerations, and not as a design feature to assist the reading process. White states that:

> *" Serifs originated from chisel marks while cutting letters into marble monuments in Rome two thousand years ago. Similar-looking marks were left by the quills of medieval scribes, lettering on parchment. If you are a violent partisan of sans serif, you could even say that serifs are the untidy mistakes of poor workmanship petrified into a traditional form!"* (White 1988:12).

The early roman letters designed for printing were based upon the early handwritten manuscripts and the roman capitals carved on the buildings of the Roman Empire (Meggs 1983:104). It seems, therefore, logical to reason that traditional and historical factors played a major part in the custom of using typefaces with serifs. The legibility theory of roman typefaces was developed after romans were used a considerable time for text, and not because they are presumably superior in legibility.

5.3 READERS' TYPEFACES PREFERENCE.

There was a significant preference for sans above romans by two standards in the first two experiments, and by one standard in the Scanning Test. Rejecting the hypothesis that there is no typeface preference is, however, made with reservation. If the subjects' comments regarding their typeface preference is analysed, it appears that typographical differences between roman and sans serifs did not play a meaningful part in their choice. Out of the one hundred and sixteen comments received, only seven comments referred to serifs, and these

subjects regarded the serifs as a negative factor. Also see Appendix F where all the comments are given. These comments were given during the scanning tests. Ten out of the sixty-two comments from the Reading Marathon stated that the roman letters appeared bigger, and this is the reason they preferred the roman letters. If the reasons given by the subjects during the Reading Marathon and Scanning Tests are accepted for the first two experiments, then a conclusion that sans serifs are preferred above romans *because* of typographical differences, might not be valid. However, the bigger size and isolated words in the first two experiments could have made the typographical difference between the two typefaces more distinct. On this assumption, a conclusion that younger readers prefer sans serifs, can be acceptable.

The preference for sans serifs in the speed and word recognition tests differs from the results of the scanning and comprehension tests. In the first two experiments, two of the three groups preferred sans serifs, and in the Scanning and Reading Marathon, only one of the four groups showed a preference for the sans serifs. A possible explanation for this is that the Word and Speed Reading Tests were presented in bigger typefaces and as individual words, and not as continuous text. Subjects were, therefore, possibly able to discriminate better between these two typefaces. Most of the school handbooks used by readers in the first two years of schooling are printed in a sans serif typeface. From a discussion with the Orange Free State Education Department, it appears that the choice of which typeface to use is left at the discretion of the printer or publisher. It is assumed that the printer uses sans serifs, because it is the letter that resembles the letters taught in writing, during the first year of school. This factor of familiarity had most likely the biggest influence on the subjects' preference of a typeface. The lack of a typeface preference in the scanning and comprehension tests could possibly be explained by the smaller type size and the faster reading situation in which the differences are less noticeable. The reasons provided by the subjects for preferring a certain typeface, creates the impression that serifs, or the absence thereof, was not a major factor in their decision.

Sans serifs were only designed in a greater variety after the First World War. The absence of a variety of sans serif typefaces would prevent printers from using these type faces for text. This in turn would not expose the public to sans serifs, but mainly to roman type faces. *Familiarity could, therefore, play a role in readers' preference for romans.*

From the study the following is concluded:

* Subjects in the lower standards of primary schools appear to prefer sans serif above roman typefaces when text is set larger than normal and viewed as isolated words.

* The typefaces that the subjects are accustomed to appear to affect their typeface preference more than the typographical difference between romans and sans serifs.

* Primary school subjects do not necessarily prefer romans for normal running text. The presence or absence of serifs does not seem to affect their typeface preference. Also see the discussion in 4.7.5.1, 4.7.5.2 and 4.7.5.3.

5.4 LIMITATIONS.

Political unrest at the schools under the Department of Education and Training, at the time of the experiments, prevented the researcher from using subjects from these schools. This restriction is not regarded as relevant, as the study investigated primarily a typographical aspect, and not the reaction of a particular population to a given problem. Neither was the mother tongue or level of education critical for the experiments, as long as the subjects came from an identifiable homogeneous population. The population from which the samples were eventually drawn, fulfilled this criterion.

The researcher also excluded English-speaking schools from the population for sampling purposes, as English was not the mother tongue of all the pupils at these schools. The reading ability of subjects whose mother tongue is not English, can be negatively affected and can provide incorrect results. Language was also not regarded as a factor in this study, as it was typographical aspects and not the effect of different languages on legibility that was investigated. The Afrikaans schools were consequently regarded as sufficient to supply all the subjects.

Restricted access to equipment during the eye movement experiment was the only relevant limitation during the study. The results of a correctly drawn sample

from normal readers would have helped to support or reject the conclusions of this study. The researcher is inclined to believe that the same conclusion would have been reached even if no restrictions were encountered.

5.5 THE CONCLUSION OF THIS STUDY AND THOSE OF OTHERS.

The conclusions of this study agree in part with the work of Sassoon (1991). Her work consisted of a project where a new typeface was developed to make reading easier (Bluhm 1991:29). Her research methods differ from the method in this study in that it relied primarily on comments of primary school readers to develop the typeface. Sassoon's correspondence is included in Appendix H and provides additional information on her project.

The only experimental works that came to similar conclusions are the work of Zachrisson (1965:114), and Poulton (1965:361). Turnbull and Baird (1980:86) also stated that no tests have either refuted or confirmed the belief that romans are more legible.

The comments from Carter *et al.* (1985:84), and White (1988:12-17) agree with the results of this study, although their comments are not based upon an investigation, but appear to be personal opinions. Lewis (1978:74) believes that a bold sans serif can be just as legible as a roman typeface because *"... we do not read by letters or even words, but by groups of words."*

The researcher is inclined to accept the evidence of this study and those of Zachrisson and Sassoon as valid reasons to refute the belief that romans are more legible than sans serif typefaces.

5.6 RECOMMENDATIONS FOR GRAPHIC DESIGNERS, PRINTERS AND TYPOGRAPHERS.

Primary school handbooks for the first two standards in South African primary schools are normally set in a large sans serif. Smaller roman typefaces are normally introduced from Standard One, and the researcher believes that the typographical approach to primary school handbooks is appropriate.

Diagnostic reading tests for younger readers could be set in an appropriate sans serif, as this will be the typeface that they are accustomed to. There is, however, the trend in type design to limit the length of descenders. This differs from the teaching practice where descenders are the same length as the x height of a letter. To make typography in school handbooks during the first two years of schooling comparable to that which is taught, typefaces with longer descenders could possibly be used in these handbooks. *Stone Sans* is one of the typefaces with longer descenders and where the lower case a and g resembles the form of handwritten letters. See this typeface illustrated in figure 2.7. *Sassoon Primary,* a recently designed sans serif, intended to make reading easier, also came out with longer descenders. The researcher doubts that longer descenders would improve reading, if measured in quantitative terms, but could possibly make the reading task easier for beginner readers.

Roman typefaces, with their fine serifs and thinner horizontals, lose definition and quality more than sans serifs when they are duplicated on low quality paper and copied several times. Definition of sans serif compared to roman letters will also be higher when reading material is set on printers with a lower resolution than laser printers. Schools often produce their own study and reading material, apart from the handbooks supplied by the education departments. It seems, therefore, appropriate to set this type of reading material in a sans serif and not in a roman typeface. This effect of multiple duplication is demonstrated in figure 5.1 where lines of text set in *Helvetica* and *Times Roman* were duplicated several times.

This is *Helvetica* 13 point, duplicated five times.

This is *Times Roman* 14 point, duplicated five times.

This is *Helvetica* 13 point, duplicated ten times.

This is *Times Roman* 14 point, duplicated ten times.

FIGURE 5.1

Lines of text set in Helvetica and Times Roman that were duplicated several times on a photocopier.

5.6.1 SPECULATIVE GENERALISATIONS.

The results of this study cannot be generalised to a wider population than that from which the samples were drawn. This following discussion is therefore only speculative, and can possibly be used to develop further research in this field. The researcher believes that readers older than the subjects, will not find romans necessarily more legible than sans serifs. Arguments, taken from the literature study in chapter two, that support the theory that romans are more legible than sans serifs, are contradicted with opposing arguments. *The opposing views are printed in italics.*

* Roman typefaces are more legible because serifs assist in the horizontal flow of reading and eye movements.

* *Results from experiments using eye movement machines have shown that a reader's eyes do not flow but move in small steps. Serifs are therefore not required to assist in the reading process.*

* Serifs increase spacing between letters and words and therefore aid perception and legibility.

* *It is possible to increase the letter space of any type style with modern typesetting equipment. Readers do not read by perceiving individual letters, but by recognising individual words or portions of words.*

* Serifs create a bigger irregularity in characters which helps to distinguish them from one another and are therefore more legible.

* *Readers do not read individual characters, but rather fixate on words or portions of words when they read. Serifs are, therefore, not necessary to create irregularities in characters.*

* Serifs are strokes that bind characters into cohesive patterns and make it easier to recognize and read words set in a roman typeface.

* *Sans are normally set closer to each other and serifs are not required to bind the characters into a cohesive pattern.*

* Romans are predominantly used in reading material and it is because of the familiarity aspect that serif faces are more legible.

* *The above argument is possibly one argument with some validity. The researcher, however, doubts if readers are consciously aware of the typographical difference between romans and sans serif when reading a book or newspaper. Ernst believes that serifs serve no useful purpose in the discernment of type, and that which a person is accustomed to, plays a bigger role (Ernst s.a.:40).*

* The old style roman faces are less uniform in their proportions than some sans, and it is argued that these uneven proportions aid legibility.

* *Some sans serifs are also based on old style[1] proportions, for example, Optima. If uneven proportions increases or aids legibility, then old style sans serifs could be just as legible as old style romans.*

* A strong argument that seems to support the theory of the superior legibility of romans is that the upper parts of words set in a roman typeface are easier to recognise than when they are set in a sans serif typeface.

* *Text is, however, never presented with the lower half of the letters obscured and words in text are also read in context with other words. An argument that seems to be convincing with one word cannot be generalised to text.*

* The lack of serifs is said to contribute to a vertical stress in sans serifs. This vertical stress is supposed to compete with the horizontal flow of reading. It is therefore argued that romans are the more legible type, and that increased line spacing is required when sans are used for text type (Craig 1981:129).

* *Reading is not a flowing movement and sans serifs based on old style proportions have an oblique stress and not a vertical stress. Serifs are*

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1 Old style proportions refer to the proportions of the earliest roman typefaces used in the fourteenth and fifteenth century.

therefore not necessary to counteract this vertical stress. The increased x height in most sans serifs is the reason for an increased line spacing.

From the results of the second scanning test, it appears that there must be a substantial deviation in letter shape before it will reduce a readers' scanning speed. Readers tend to adapt their speed during visual tasks appropriate to the visual difficulty. Visual differences between sans serifs and romans, especially in smaller sizes, are not as excessive as the differences between a script and a roman. Readers older than the subjects used in the study would most likely read romans and sans serif equally fast.

Sans serifs also seem to maintain their character and letterform better than romans when they are duplicated numerous times. The more uniform thickness of the letter strokes and lack of thin serifs are, in this instance, an advantage for sans serifs.

White (1988:13) believes that the phrase *"sans serif is harder to read"*, is an oversimplification, and that even if it is true, is questionable. Discussing some factors that influence legibility he states:

> *" All these (and many more technical minutiae) affect the ease of reading, resultant comprehension, and subsequent retention. Yet it is the poor little serif that is singled out as the main culprit. It isn't fair, is it?*
>
> *The argument about serifs cannot be resolved: both pro- and anti-serif partisans are right. The decision depends on what you need"* (White 1988:13).

The researcher believes that other typographical and uncontrollable factors, for example, line spacing, the interest shown by the reader, and the quality of print, plays a bigger role in legibility than the typographical differences between sans serifs and roman typefaces.

5.7 RECOMMENDATIONS FOR FUTURE STUDIES.

A small study, using older readers, could be undertaken to test the hypothesis that romans and sans serifs are equally legible. The researcher is inclined to believe that the hypothesis of equal legibility for this group will also not be rejected.

Using romans for newspaper text is based upon the unsubstantiated superior legibility theory of roman typefaces. The use of the narrow columns is also in conflict with the theory that the optimum line length must be between one and two alphabets in length. Sans serifs can be spaced closely together, because of the absence of serifs, and could result in saving space without reducing legibility. Wider columns will allow more words per line, which will reduce the rivers of space running through justified columns. The reduction of the empty space between words will result in additional space saving. The use of sans serifs, and increasing the width of newspaper columns can, therefore, be a constructive study with application value. The visual appearance of newspaper text in a sans serif and customer acceptance, is an area that will have to be investigated as well.

Using type to help reading disabled subjects, could be undertaken in co-operation with specialist teachers.

With the invention and development of personal publishing systems and the increased use of electronic text, legibility research of sans serifs is of particular importance. According to Hartley (1987:7-8), the choice of typefaces is far more restricted in electronic text than in printed text. Hartley also argues that sans serifs, which seems more modern, is the more appropriate typeface to be used in electronic text.

Problems in typography and design will increase as the growing need for more information and education develops. Zapf (1987:59) believes that there are many problems that remain to be solved by typographers. One of these problems is that a large portion of the world's languages cannot be expressed with the Latin alphabet and this is a field still to be explored by designers and typographers.

5.8 SUMMARY.

An experimental study that investigated the comparative legibility of roman and sans serif typefaces in a variety of reading experiments.

Traditionally and historically roman typefaces are regarded as more legible typefaces than sans serif typefaces. It is being argued that romans can be read faster, are easier to recognize, are preferred by readers, and that there could possibly be a higher comprehension with material printed in roman typefaces. There is also the belief that serifs assist in a horizontal movement whilst reading, and that it helps to distinguish different letters from each other. These assumptions about the superior legibility of roman typefaces, appear to be an untested generalisation. No supporting evidence was found during the literature study to confirm this belief. There are also some authors who seem to suggest an equal legibility between romans and sans serifs. Most of these opinions are, however, not based on any satisfactory empirical evidence, but appear to reflect the personal opinion of the authors.

The primary aim of this study was to determine the legibility of roman compared with sans serif typefaces. A word recognition test, speed reading test, comprehension test, and a scanning test were used to test the null hypotheses that romans and sans serifs are equally legible. Accuracy, speed and comprehension were used as the criterion for legibility. An eye movement machine was also used to determine if there is a difference in the eye movements of subjects whilst reading text in a roman or sans serif typeface. The secondary aim was to determine the readers' typeface preferences during the experiments. The null hypothesis that the majority of readers do not prefer a particular typeface was tested against the alternative hypothesis that there is a typeface preference.

Many of the typographical practices have been based, and are still based on the belief that romans are the most legible typefaces to use for text. This unsubstantiated belief, the importance of legible instructional text, and the central part that typography plays in the graphic design process motivated this study. Research into the legibility of sans serifs will provide the designer with the knowledge and freedom to choose not only from roman faces, but also from sans serifs for textual matter. Information provided by legibility research can guide the designer, printer and typographer to avoid factors that could diminish legibility. This is especially important when functional efficiency is important, for example,

in academic textbooks. Legibility research provides information on how these images can be used and how they must be designed to make them communicate more effectively.

A systematic and random sample of four hundred and sixty-nine primary school subjects from nine different schools was used in the Word Recognition, Speed Reading, Reading Marathon and Scanning Tests. The subjects were regarded as homogeneous regarding educational level and the language spoken at home. Only subjects with normal eyesight and those that did not receive remediation at the time of the study were included in these experiments. Twenty-nine primary school subjects, that received remediation at a clinic, were used in the eye movement experiment. Thirty tertiary students participated in the pilot study.

A pre-test post-test control group research design was used for all the experiments. The level of significance was set at 0.05. The *t* test was used as the statistical test on the mean gain scores between the pre-test and the post-test to test the hypotheses that romans and sans serifs are equally legible. The *z* test for proportions was used as the statistical test to determine if the proportion of subjects that prefer a particular typeface, is significantly different at the 0.05 level from the proportion of subjects favouring the other typeface.

Sufficient evidence was obtained during the study not to reject the research hypothesis of equal legibility between roman and sans serif typefaces. Significant statistical evidence was found to reject the research hypothesis that readers equally prefer roman and sans serif typefaces. There was a preference for sans serifs by the Sub-Standard B and Standard Two groups during the Word Recognition and Speed Reading tests. The Standard Four group also preferred a sans serif during the Scanning Test.

With normal primary school readers, and under normal reading conditions, sans serifs and romans can be regarded as equally legible. Serifs do not appear to affect legibility, as measured by the tests employed in this study. The researcher believes that it is not necessarily serifs or the lack thereof that increase or decrease legibility. It is rather a complex interaction of known and unknown factors that affect a subject's reading performance and the legibility of reading material. Subject matter, the readers' interest in the material, intellectual ability, and their emotional and physical condition, can all play a role in reading performance. The typefaces that the subjects are accustomed to appear to affect

their typeface preference more than the typographical difference between roman and sans serif typefaces.

The results of this study differ from the opinion of most authors on the subjects of typography, legibility and printing. These results can be interpreted as promising for designers and typographers as it appears that legibility will not necessarily be sacrificed when sans serif typefaces are used for textual matter under the conditions of this study.

The results of this study cannot be generalised to a wider population than that from which the samples were drawn. In a speculative generalisation the researcher, however, believes that readers older than the subjects, will not find romans necessarily more legible than sans serifs. The unsubstantiated arguments that support the theory that romans are more legible than sans serifs can be opposed with satisfactory counter arguments to support the researcher's opinion. The researcher believes that other typographical and uncontrollable factors, for example, line spacing, the interest shown by the reader, and the quality of print, plays a bigger role in legibility than the typographical differences between sans serifs and roman typefaces.

Diagnostic speed reading and word recognition tests could possibly be set in an appropriate sans serif to accommodate the preferences of the younger readers.

Problems in typography and design will increase as the growing need for more information and education develops. There are many problems that remain to be solved by typographers. One of these problems is that a large portion of the world's languages cannot be expressed with the Latin alphabet and this is a field still to be explored by designers and typographers.

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APPENDIX A

THE MATERIAL USED IN THE PILOT STUDY.

CONTENTS.

Bundled against the damp, biting cold of that early November in 1872, Captain Benjamin Briggs barked orders to the helmsman as the Mary Celeste moved slowly down the channel toward the open sea. When the last buoy marking the Narrows between Staten Island and Brooklyn had been passed, he joined his wife and small daughter at the rail, to watch the cost disappear astern. Then he set course for Gibraltar. His ship, the Mary Celeste, was a brigantine. For eleven years she had plied the trade routes of the North Atlantic, bringing profit to her owners and satisfaction to the men who sailed her. In October, 1872, with Briggs, of Marion, massachusetts, in command, the Mary Celeste had sailed into New York to take on 1,700 barrels of alcohol for Genoa, Italy. By coincidence, she was docked next to the brig Dei Gratia and on the evening of November 6, Captain Briggs invited her master, Captain Morehouse, to dine with him, his wife, and their small daughter. Early the next morning, with an icy mist hanging over the Hudson, the Mary Celeste cleared New York Harbor. A month later, on the afternoon of December 5, the Gibraltar-bound Dei Gratia was sailing easily before the northerly wind, some 380 miles off the coast of Portugal. Shortly after two o'clock the lookout shouted, "Sail ho!" As the Dei Gratia drew nearer, Captain Morehouse turned to his mate. "Looks like the Mary Celeste." he said. The other ship was acting very strangely. Although running on a port tack, several of her sails were set for a starboard tack, and whenever the wind shifted she came about to run before it. When the two ships were less than half a mile apart, Morehouse hailed her. He

received no answer. Repeated hailings failed to raise an answering voice. "Something is wrong over there," he said to Oliver Deveau, his first mate. "Maybe the crew is sick. You'd better lower a boat and investigate." With two seamen, Deveau rowed to the silent vessel. Approaching het, he saw the name Mary Celeste painted in an arc on her stern, and beneath it the words "New York." Her davits were swung out, her lifeboat gone. He grabbed a line and swung aboard. Deveau found no hand at the helm; the deck was deserted but appeared normal except for the mainhatch cover lying partly off the hatch opening. A quick glance in the cabins assured him that the Mary Celeste was a derelict. But why? She seemed perfectly sound; her rigging was in good shape. Thoroughly puzzled, Deveau signaled Captain Morehouse to join him. Together they began a complete search. In the captains's cabin the bunks were made, though one of the pillows bore the imprint of a child's head. A few pieces of Mrs. Briggs' ornate jewelry lay on a wardrobe. The Mary Celeste's log lay open on Captain Briggs' desk. The last entry was dated November 24, placing the ship a little over one hundred miles west of the Azores. Other ship's papers were missing, and the ship's chronometer could not be found. The main cabin gave further evidence of hasty abandonment, but yielded no clues as to why. At one end of a large table was a sewing machine with part of a child's dress in it, several spools of thread, and a thimble. At the other end was an unfinished letter beginning, "My dear wife," which later was proved to be in the mate's handwriting. Unable to perceive any reason for abandonment, and mindful of his salvage rights, Captain Morehouse decided to tow the Mary

Celeste to Gibraltar. Arriving at the Rock, Captain Morehouse hustled to the admiralty office to claim salvage. He told his story to Solly Flood, who bore the impressive title, "Her Majesty's Advocate-General and Proctor for the Queen in Her Office of Admiralty, and Attorney-General for Gibraltar." Mr Flood, realizing he had a first-class puzzler on his hands, ordered the Mary Celeste fully surveyed. The results merely deepened the already dark mystery. On both sides of her bow, three feet above the waterline, was a gash of recent origin about seven feet long and nearly half an inch deep. Several naval officers, plus an engineer, inspected this gash. They conceded that this defacement had been made intentionally; that there was no possible way for it to be accidental, but that it no way affected the boat's seaworthiness. Except for that curious gash, the ship was in excellent condition. There were plenty of provisions aboard and an adequate supply of fresh water. There was no indication of fire or explosion; no sign of trouble from any cause. As the survey report stated, the Mary Celeste "was thoroughly sound, staunch, strong and in every was seaworthy and wellfound." Furthermore, weather reports showed the ship had encountered no storms or heavy weather. The board of inquiry decreed the captain and crew of the Dei Gratia should be awarded $8,500 for salvage services, one fifth the total value of ship and cargo. Mr. Flood promptly forwarded a report to London, stating that no logical explanation of the strange affair could be arrived at, although it was his personal opinion that the crew had mutinied, murdered Captain Briggs, his wife Sarah, their daughter, and the mate, then sailed off in

the small boat, probably to be lost at sea. This theory was semi-officially endorsed by the United States Government when the Treasury Department alerted its customs officers to apprehend the mutineers, should they try to re-enter the country. On that note, official interest in the enigma of the Mary Celeste ended. The case was tucked away in admiralty files and left there to gather dust. At Gibraltar a new crew was signed aboard the ship and she finished her voyage to Genoa, delivering her cargo of alcohol with no further ado. But from that day on, the Mary Celeste was a jinxed ship. During the following years she was sold several times, each sale leaving the new owner destitute. In 1884 she sailed on her last voyage, which ended when she was wrecked on Roshell's Reef, off the coast of Haiti. The crew was saved, but seemed to be cursed by the Mary Celeste, for every one of them died or suffered some affliction soon afterward. Meanwhile, the mystery of why her crew had abandoned her and what had happened to them was not allowed to die. Periodically, nautical experts came forth to offer their theories, and right on their tails came other experts to prove them wrong. One of the first with a solution was no less a personage than Sir Arthur Conan Doyle, creator of Sherlock Holmes. He believed that two of the seamen mutinied, dispatched the remainder of the crew by dumping them overboard, and were taken off the ship by accomplices. Unfortunately, Sir Arthur further obscured the riddle by calling the ship the Marie Celeste, and saying that her lifeboat had been found aboard. Both errors have persisted to the present. Among the more feather-brained theories was one that linked Captain Briggs and Captain Morehouse in a

gargantuan conspiracy to defraud the owners. Another claimed the owners arranged the whole thing for their own malicious purposes. A third theory named Morehouse and Deveau as the real culprits. A fourth, wishing to settle the case for all time, deemed that the Mary Celeste had never even existed, that the entire story was a myth. Was it mutiny, as expressed in so many theories? More than likely not. It is difficult enough to overpower a ship at night, let alone in broad daylight, and there wasn't the slightest evidence of violence. Piracy is also ruled out. No pirate worth his salt would capture a ship, murder its crew, and then leave behind such booty as valuable jewelry. Many people, Captain Briggs' relatives included, believed that the solution to the mystery lay in the Mary Celeste's cargo. Under normal conditions, if properly stowed, alcohol is not dangerous. However, in certain circumstances the alcohol might generate gas, and given sufficiently high temperature, the gas might explode. Perhaps, as the Mary Celeste sailed under a cloudless sky that warm morning long ago, an odor of gas was detected. A hatch cover was removed to let the gas escape, and until the danger was past, the crew took to the lifeboat. Then, while they waited, the breeze freshened. The Mary Celeste picked up speed and left them far behind. They may have perished of hunger, or died in the surf off a lonely beach. This explanation accounts for most of the facts. It explains the hatch cover lying on deck, and the haste of abandonment. The gash in the bow might not have had any connection with the mystery.

Louis waited patiently for the waiter to bring him the eight roast beef sandwiches he had ordered. He was famished, all 315 pounds of him. Suddenly a commotion at the far end of the tavern caused him to forget his stomach. The beer drinkers were all gathering around a mustached giant. "I can lick any man in the house," roared the Goliath. There was a nervous titter from everyone but Louis. He was just too hungry to laugh. "The drinks are on John L. Sullivan, the greatest fighter in the world," boomed the Boston Strong Boy. Soon everyone was drinking to the health of the great John L. - everyone, that is, but Louis. "Hey-fat man! When the great John L. drinks, everybody drinks." "Merci, Monsieur John, but I'm afraid that I must decline the offer. You see, I'm hungry and I await my food." Arrogantly, the great fighter strode up to Louis' table and ordered him to stand up. Good-natured Louis did so and extended a hand in friendship. Instead of clasping it, John L. shifted his left foot forward and brought up a clenched right fist that traveled less than twelve inches and exploded like a mule kick squarely in Louis stomach. Nothing happened! The crowd and John L. gawked in amazement. Louis hadn't even blinked. Pudgy as he was, Louis could move swiftly when the occasion manded it. He reached out two hands, picked up the open-mouthed heavyweight boxing champion of the world and flung him twenty feet across the room. Sullivan gingerly picked him-self up and walked back to Louis. Johan L. said respectfully, "Your'e not a fighter, are you?" "No! I do not fight. I am Louis Cyr, the strongest man in the world." Louis Cyr was without question the strongest man in history. Who else could lift eighteen men on a platform - an official

total of 4,300 pounds? Louis accomplished this memorable feat, among many others, during his colorful days as professional strong man. Louis Cyr was born in a tiny French-Canadian village near Montreal. He was known as the local strong boy, and his first test came when he was about sixteen. While walking home from a nearby town one winter afternoon, he came upon a neighbor who was coaxing his two draft horses to pull a sled loaded with logs, out of a ditch. "Can I help?" asked the good natured Louis. "No-I need either two more horses or a half dozen strong men to get me out of here. Run and get your father." "But no, my friend. I, Louis Cyr am one strong fellow. I will help you." He jumped into the gully and braced himself. Straining his muscles, he eased the great load of logs until the sled runners were close to the road. " Now coax the horses," roared Louis. The dumbfounded man slapped the animals into tugging once more. Within seconds, the whole load was back on the icy road. Louis' first official trial of strength came after he had exhibited his prowess at a local county fair. The fair manager took Louis aside and said, "Cyr, you are the strongest man in Canada." "Oh, no! David Michaud holds that honor. They say he can stop a charging bull with a single blow of this fist." "That makes a good newspaper story, no? I have seen this Michaud - you are stronger than he." Louis shook his head doubtfully. Could it be that he was stronger than the great Michaud? With the aid of the fair manager, Louis sent out a challenge to David Michaud. When a newspaperman tossed Louis' challenge at him, Michaud turned purple. "How dare he, a sniveling 18-year-old farm boy, challenge my championship?"

The meet took place in Quebec City. At that time, there were no balanced Olympic bars and weights, for this was an ordeal of sheer animal strength; instead, horses tugged huge boulders out of the mountains and brought them to the fair grounds. Michaud was not distressed at the sight of Louis, who by now had eaten his way up to over 250 pounds and resembled a ball of lard. Michaud was truly a strong man and looked the part. He stepped forward and gracefully lifted the first stone. Eager and overanxious, Cyr grabbed the stone and duplicated Michaud's feat, although he almost tripped in doing so. The crowd went wild. Michaud, realizing he was in for a bitter test of strength, passed the next boulder and approached the largest rock, which weighed well over 500 pounds. Straddling it, he bent forward and began to tug. Nothing happened. Again he struggled, water streaming from his straining face. But it was no use; he could not lift it. He went to the second largest rock and with a mighty effort lifted it. The crowd cheered. Michaud turned to Louis and gave him a look which said, "Try to equal this lift, my young fool." Louis, never one to refuse a challenge, went to the largest stone and straddled it. He wiped his perspiring hands on his pants, and his thick fingers searched the underside of the rock for a good gripping place. Then he strained. The rock didn't budge. He quivered, his big body trembling in a mighty effort. Slowly, up the boulder went. The judges could see more than six inches of daylight under it as the crowd began to shriek. Just in case there might be any questions, Louis gnashed his teeth and continued to struggle until he straightened out; then he swung the stone

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two chickens, a small ham, a whole loaf of bread, and two quarts of stout or ale. Soon Louis became the most-talked-about strong man in the country. His one ambition was to defeat Sandow, world-renowned strong man. On January 19, 1892, Louis made his debut at the Royal Aquarium in London. Unknown to Louis, Sandow was in the audience. Louis began to exhibit his prowess. Here are a few of his more spectacular tests of strength: lifting 273 1/4 pounds with two arms to shoulder height, then with one arm, over his head; lifting with his back sixteen men on a platform (total weight - 3,635 pounds) and holding the weight for twenty seconds; holding two pairs of draft horses in check. Lines attached to the horses' harness ended in loops that fitted around Louis' arms. His arms were crossed over so that the horses on the left pulled his right arm and vice versa. If he lost his grip, his arms would be torn from their sockets. It was a magnificent show as he sucessfully held back the full hauling strength of the four horses. Eugene Sandow, having witnessed these feats, slipped quietly out of the hall and never challenged or even met Cyr during his stay. In 1866 Louis retired to his farm. He came out of retirement just once, to beat Hector Decarie in 1906. It was great exertion for the then flabby-fat, 350-pound man. On Novermber 10, 1912, as a result of too much eating and years of overexertion, 48-year-old Louis died.

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UNSOLVED MYSTERIES

Check the best answer.

1. The last time the crew of the *Mary Celeste* was seen was
   .....a. in Genoa, Italy.
   .....b. in New York Harbor.
   .....c. in Gibraltar.
   .....d. off the Azores.

2. Captain Morehouse suspected trouble aboard the *Mary Celeste* when
   .....a. he received no answer when he hailed.
   .....b. he saw that the lifeboat was missing.
   .....c. his crew boarded her.
   .....d. he saw that the ship was far off course.

3. All the evidence pointed to the fact that the ship was abandoned
   .....a. after a short but vigorous fight.
   .....b. in a hurry.
   .....c. because of dangerous gas on board.
   .....d. because of a mutiny.

4. Captain Morehouse towed the ship to Gibraltar
   .....a. because he was interested in the fate of the crew.
   .....b. so that he could claim the ship for his own.
   .....c. to help solve the mystery of the crew's disappearance.
   .....d. in order to claim salvage rights.

5. The man from the admiralty office came to the conclusion that
   .....a. the ship had been abandoned because of a plot by the owners.
   .....b. the ship had drifted away from the crew accidentally.
   .....c. there was a mutiny aboard the ship.
   .....d. there had been piracy at sea.

6. During the years that followed the mysterious disappearance
   .....a. the ship brought disaster to everyone who owned her.
   .....b. the ship made a fortune for her owners.
   .....c. the ship's mystery was proved to be a hoax.
   .....d. the ship was involved in two other mysteries.

7. When the *Mary Celeste* was brought to port, the cargo was
   .....a. found to be stolen.
   .....b. found to be damaged.
   .....c. put up for auction.
   .....d. found to be intact.

8. The author thinks
   .....a. that most of the theories are highly improbable.
   .....b. that mutiny was the most logical explanation.
   .....c. that the captain of the *Mary Celeste* was involved in a plot.
   .....d. that the cargo forced the crew to abandon ship.

9. The finding that did not fit into any of the theories mentioned was the
   .....a. ship's cargo.
   .....b. open hatch.
   .....c. gash along the bow.
   .....d. missing lifeboat.

10. The main idea for this selection is that
    .....a. the *Mary Celeste* was a ghost ship that killed many men.
    .....b. the disappearance of the *Mary Celeste's* crew is a mystery that has never been solved.
    .....c. the owners of the *Mary Celeste* never made money with her.
    .....d. the disappearance of the *Mary Celeste* is a mystery that has never been solved.

Think about: Based on the facts given, what do you think is the most logical explanation of the mystery? Why?

Rate in w.p.m.		Comprehension		Index	
	×	%	=		*Enter scores on Progress Chart*

MIGHTY BUTTERBALL

Check the best answer.

1. John L. Sullivan was irritated when Louis
   .....a. claimed to be stronger.
   .....b. made fun of him.
   .....c. wouldn't drink with him.
   .....d. wouldn't fight with him.

2. The largest amount Louis was known to lift was
   .....a. 1800 pounds.
   .....b. 3600 pounds.
   .....c. 3900 pounds.
   .....d. 4300 pounds.

3. Louis' first feat of strength was
   .....a. restraining a charging bull.
   .....b. lifting a sled of logs from a ditch.
   .....c. lifting a railroad car.
   .....d. lifting a three-hundred-pound boulder.

4. Which of the following was *not* a characteristic of Louis Cyr?
   .....a. Quick temper
   .....b. Self-confidence
   .....c. Courtesy
   .....d. Persistence

5. At the peak of his career Louis' chest, unexpanded, measured
   .....a. four feet.
   .....b. five feet.
   .....c. six feet.
   .....d. seven feet.

6. In addition to Louis' strength, which of the qualities below contributed most to his success?
   .....a. His speaking voice
   .....b. His eating ability
   .....c. His quick wit
   .....d. His showmanship

7. Louis never met the great Sandow because
   .....a. he was afraid Sandow would defeat him.
   .....b. Sandow became ill.
   .....c. Sandow knew he couldn't defeat Louis.
   .....d. Sandow wanted to be paid for the match.

8. During his later life, Louis spent most of his time
   .....a. on his farm.
   .....b. traveling with a circus.
   .....c. challenging strong men.
   .....d. performing on the stage.

9. According to the selection, Louis was defeated
   .....a. not at all.
   .....b. once.
   .....c. twice.
   .....d. three times.

10. The main idea of this selection is that Louis Cyr
    .....a. was a Canadian farm boy who became world famous.
    .....b. worked hard to become one of the world's most outstanding weight lifters.
    .....c. gained fame as one of the world's strongest men and was also a champion eater.
    .....d. became world famous for his spectacular eating ability.

Think about: Why are people interested in great feats of strength?

Rate in w.p.m.		Comprehension		Index	
	×	%	=		*Enter scores on Progress Chart*

APPENDIX B

THE MATERIAL USED IN THE WORD RECOGNITION AND SPEED READING TESTS.

CONTENTS.

so in af om ja by ry na as op
huis skop trek haar altyd bring groot
mense speel stuur slaap nuut onder gekom
moenie vertel wanneer stadig gesels gevind
gegee verniet probeer vanself bietjie
daarvan telegram prokureur hopelik poging
tariewe omgewing argivaris nomineer
departementele meerderes formule verordening
vereistes mediese harmonium netelige
winsgewende trigonometrie unaniem genealogie
amendement psigoanalise chauvinisme

The reading card used in the pre-test for the control and experimental group during the Word Recognition Test.

se is of ou jy bo sy en al my
hier stop tand hoor almal begin gister
motor slaap staan speel nooit omdat gehad
meneer verder waarom spring gestel gereed
gegaan vandag polisie vanaand baadjie
daardie telefoon pastorie sekere sowel
begroting oorweging aarselende munisipaliteit
deklarasie parodiek verveling miserabel
vergesel suspisieus gaoties karikatuur
wysgerige indiwidueel metodiek isometries
monargie pseudoniem paleontologie

The reading card used in the post-test for the control group during the Word Recognition Test.

se is of ou jy bo sy en al my
hier stop tand hoor almal begin gister
motor slaap staan speel nooit omdat gehad
meneer verder waarom spring gestel gereed
gegaan vandag polisie vanaand baadjie
daardie telefoon pastorie sekere sowel
begroting oorweging aarselende munisipaliteit
deklarasie parodiek verveling miserabel
vergesel suspisieus gaoties karikatuur
wysgerige indiwidueel metodiek isometries
monargie pseudoniem paleontologie

The reading card used in the post-test for the experimental group during the Word Recognition Test.

aan baie daar gee had kon lei min
nuut reg soek van was bly weer deur
gek hard ken lid moet ons rus seer
vra weg bed dan een groen huil kar
lam maar ook rol toe vas wie bou
dis end gaan heel kies land nie oop
sal tot vol wou bad dag ewe het
jou klim lang nog pad sou tog vyf
wel bak dáe eis hom kan lig met
net per ses tel vee wees blom dik
ete hoe kyk lug mos nee pos sin
twee voor boom dak huil hek kry los
mag neem pluk sag uit wat

The reading card used in the pre-test for the control and experimental group during the Speed Reading Test.

arm berg drie gou hol kou lui mis
niks rug saam vir wys bes woon doen
gat hand kos lae maak oor ryk sewe
ver wag bok dam eie groei haal kis
las mens oud ruk ten vet wis bos
dus eet gooi hele keer lank nou oog
sak tyd vel wol bid dag eer hul
jas kant loop nag pak sit tye vry
wal bek dra ere hen kom lag man
nat pas son tak vou weet blou dig
elk hou kat lyn mee nes pyp see
teen vuur been dek haal hoof kop lus
myl naam plek sny uur wil

The reading card used in the post-test for the control group during the Speed Reading Test.

arm berg drie gou hol kou lui mis
niks rug saam vir wys bes woon doen
gat hand kos lae maak oor ryk sewe
ver wag bok dam eie groei haal kis
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jas kant loop nag pak sit tye vry
wal bek dra ere hen kom lag man
nat pas son tak vou weet blou dig
elk hou kat lyn mee nes pyp see
teen vuur been dek haal hoof kop lus
myl naam plek sny uur wil

The reading card used in the post-test for the experimental group during the Speed Reading Test.

APPENDIX C

THE MATERIAL USED IN THE READING MARATHON.

CONTENTS.

Central University of Technology, Free State

DIE FLUKSSTE DIERTJIE

Dit was die wyse Salomo wat gesê het: "*Gaan na die mier, jou luiaard, en word wys.*"

Op die oomblik het Suid-Amerika met 'n splinternuwe probleem te kampe. Miere wat self "*boer*" e hul eie voedsel kweek, hou 'n gevaar vir die boer in. Die ergste van alles is **dat** daar geen metode om hierdie plaag doeltreffend te bestry nie. Daar word geskat dat hierdie miere, die sambreelmier jaarliks skade ten bedrae van R1 000 miljoen aanrig.

Hierdie miere is eienaardige diertjies. Die miere van een kolonie kan ál die blare van 'n vrugteboord i een nag afstroop en na hul nes terugdra. Hulle sny halfmaanvormige stukkies uit die blaar **en** dra d hoog bokant die kop nes toe. Vandaar hulle naam.

Die blare word egter nie vir voedsel gebruik nie, **want** hulle lê 'n tuin daarmee aan. Die blare wor eers gekou en met 'n spesiale vloeistof bedek. Hierop groei dan swamme, of die kos, waarvan hierdi miere lewe.

Hierdie "*tuin*" is gewoonlik so groot soos 'n sokkerbal en kan duisende miere van voedsel voorsie Honderde neste word deur ondergrondse gange verbind en een mierkolonie kan 'n halwe hektaa beslaan.

Die sambreelmier val nooit bome of landerye naby hul neste aan nie. Spoorsnyers word gestuur om ' geskikte weiveld te soek. **Sodra** hulle dit vind, word die pad daarnatoe aangedui deurdat elke mier ' geurstof agterlaat. Ander miere ruik dit; **dus** kan hulle die spore baie ver volg. As die spoo sirkelvormig is, sal die flukse miere ure lank in die rondte loop **voordat** hulle moeg word, **maar** hull gooi nie gou tou op nie.

Volgens skatting kan in Brasilië byna 'n miljoen meer beeste aangehou word **as** hierdie mierplaag ne met welslae bestry kan word.

The reading material used for the Standard 4 control group.

Central University of Technology, Free State

DIE FLUKSSTE DIERTJIE

Dit was die wyse Salomo wat gesê het: "*Gaan na die mier, jou luiaard, en word wys.*"

Op die oomblik het Suid-Amerika met 'n splinternuwe probleem te kampe. Miere wat self "*boer*" en hul eie voedsel kweek, hou 'n gevaar vir die boer in. Die ergste van alles is **dat** daar geen metode is om hierdie plaag doeltreffend te bestry nie. Daar word geskat dat hierdie miere, die sambreelmiere, jaarliks skade ten bedrae van R1 000 miljoen aanrig.

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Die blare word egter nie vir voedsel gebruik nie, **want** hulle lê 'n tuin daarmee aan. Die blare word eers gekou en met 'n spesiale vloeistof bedek. Hierop groei dan swamme, of die kos, waarvan hierdie miere lewe.

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The reading material used for the Standard 4 experimental group.

Central University of Technology, Free State

BRASILIë

Brasilië is die vyfde grootste land op aarde. Dit lê in die romp van Suid-Amerika en bestaan uit berge en bergreekse, vlaktes, graslande, warm reënwoude en oerwoude. In Brasilië vind ons seker die grootste verskeidenheid van mense, klimate, lewenswyses en toestande ter wêreld. In groot stede soos Rio de Janeiro en Sao Paulo is daar weelderige wolkekrabbers van beton, glas en staal. In die afgeleë dele leef die mense egter in armoedige, agterlike toestande. In die stede is mooi blink, nuwe motors die algemene vervoermiddel, terwyl oskarre nog in die binneland gebruik word.

Onder die inwoners van die land kry ons Rooi Indiane, Portugese, Negers, Japanners (Japannese), Duitsers en Italianers. Die amptelike taal is Portugees. Veral in die stede is dit opvallend dat die groepering van verskeie volke behoue bly. Hiervan is die Japannese die beste voorbeeld. Ten spyte hiervan beskou alle inwoners van Brasilië hulleself as Brasilianers, en elkeen aanvaar die ander as sulks.

Die gesinne is groot. Die gemiddelde gesin bestaan uit sewe of agt lede. Die man is hoof van die gesin, en as hy sterf, neem die oudste seun sy plek. Daar is baie min vrouens wat werk, want in Brasilië hoort die vrou by die huis. Vrouens het ook nie dieselfde wetlike regte as mans nie. As gevolg van die groot bevolking is werk skaars en goedkoop arbeid, soos huisbediendes, volop.

In die winkels kan 'n mens enigiets koop. Pryse is hoog, maar 'n gekibbel oor die prys word as goeie sake beskou. By kleurryke straatmarkte kan 'n mens enigiets koop van 'n voëltjie in 'n kou tot by handwerk en voedsel. 'n Groot verskeidenheid maak dit soms moeilik om te besluit wat om te koop. Groente en vrugte is daar altyd in oorvloed. Die grootste winskopies lê egter in die inheemse edelstene.

Die Brasiliaanse kus strek oor 'n afstand van 6 500 km. 'n Strand is 'n gewilde plek en word gebruik deur skoliere wat huiswerk doen, studente wat studeer, sakelui wat sake doen, winkeliere wat handelsware verkoop en vakansiegangers. Dit word ook gebruik vir sokkerwedstryde.

Daar is nie genoeg skole in Brasilië nie. Daar is ongeveer 20 miljoen mense wat nie kan lees of skryf nie. Skoolopleiding duur agt jaar en begin vanaf die kind se sewende jaar. Daarna kan 'n student drie jaar lank aan 'n universiteit verder studeer.

Brasiliane is gek na sport. Hulle hou van perderesies, motorresies, tennis, boks en die meeste van sokker. Hulle is van die beste sokkerspelers in die wêreld, en sokker is vir hulle belangriker as eet en drink of werk.

Brasiliane is lief vir eet. Daar is geen vaste stapelvoedsel nie. Kos word van streek tot streek volgens beskikbaarheid en eie keuse voorberei. Vrugte, groente, vis, vleis en rys is die algemeenste voedselsoorte. Sterk kruie word ook gebruik.

Brasilië is 'n groot koffieproduserende land.

Die Amasonerivier, die grootste rivier ter wêreld, vloei deur Brasilië. Dit is bykans 6 500 km lank. Die mond van die rivier is 320 km wyd. Twintig persent van die wêreld se vars water kom uit die opvanggebied van die Amasonerivier. Die Amasonegebied is die boomrykste gebied in die wêreld - elke tiende boom van die wêreld groei hier. Die rivier is 3 218 km die binneland in bevaarbaar.

The reading material used for the Standard 5 control group.

BRASILIë

Brasilië is die vyfde grootste land op aarde. Dit lê in die romp van Suid-Amerika en bestaan uit berge en bergreekse, vlaktes, graslande, warm reënwoude en oerwoude. In Brasilië vind ons seker die grootste verskeidenheid van mense, klimate, lewenswyses en toestande ter wêreld. In groot stede soos Rio de Janeiro en Sao Paulo is daar weelderige wolkekrabbers van beton, glas en staal. In die afgeleë dele leef die mense egter in armoedige, agterlike toestande. In die stede is mooi blink, nuwe motors die algemene vervoermiddel, terwyl oskarre nog in die binneland gebruik word.

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The reading material used for the Standard 5 experimental group.

LEESMARATON

The com… or the two Standards.

NAAM:

OUDERDOM: SEUN\DOGTER:

1. Waar lê Brasilië? .....
.....
2. Watter taal is Brasilië se amptelike taal? .....
.....
3. Wat noem jy iemand wat in Brasilië woon? .....
.....
4. Wie is die hoof van die Brasiliaanse gesin? .....
.....
5. Waarin lê die grootste windskopies in Brasilië? .....
.....
6. Hoeveel ongeletterdes is daar in Brasilië? .....
.....
7. Hoe lank duur hulle skoolopleiding? .....
.....
8. Na watter sportsoort is hulle gek? .....
.....
9. Watter belangrike rivier vloei deur Brasilië? .....
.....
10. Wat is die naam van die grootste rivier in die wêreld?
.....

PUNTE BEHAAL: Vrae 1-5

Vrae 6-10

FINALE PUNT

C

LEESMARATON

NAAM:

OUDERDOM: SEUN\DOGTER:

1. In watter land het miere 'n splinternuwe probleem veroorsaak?
---
2. Watter soort miere kan die grootste skade aanrig?
---
3. Hoe lank neem dit hierdie miere om 'n vrugteboord se blare af te stroop?
---
4. Waarin woon hierdie miere?
---
5. Waarvan lewe hierdie miere?
---
6. Hoe groot is die hierdie tuin wat die miere van voedsel voorsien?
---
7. Waarmee word die neste met mekaar verbind?
---
8. Wat noem ons 'n klomp miere bymekaar?
---
9. Wat word deur hierdie miere agtergelaat sodat die ander miere hulle spoor kan volg?
---
10. Watter diertjie word beskou as die slukste in die wêreld?

PUNTE BEHAAL: Vrae 1-5

Vrae 6-10

FINALE PUNT

C

L / 4

APPENDIX D

THE MATERIAL USED IN THE SCANNING TESTS.

CONTENTS.

altyd

Herman Theron was dol op altyd vliegtuie. Hy het naby die lughawe gewoon en byna al sy vrye tyd in die loodse deurgebring.

Dit was natuurlik teen die reëls, maar Herman was 'n gawe seun en al die mense wat daar gewerk het, het baie van hom gehou. Selfs die hoof van die altyd lughawe was sy vriend.

Sy groot begeerte was om eendag self 'n vliegtuig te bestuur en hy het van kleins af alles uitgevra. Hy wou alles van 'n vliegtuig weet en altyd almal het hom graag vertel as hy vir hulle vra.

The reading material used in the Scanning Trial Test.

Een Saterdag was daar 'n vreemde vliegtuig by die lughawe. Dit het eenkant op die vliegveld klaar gestaan om op te styg en Herman het gaan kyk stoep. Hy het daardie soort nog nooit vantevore gesien nie.

Hy stap rondom die vliegtuig om te sien hoe dit gebou is. "O," sê hy vir homself, "ek sal al my sakgeld gee om net te sien hoe dit van binne lyk."

So iets was natuurlik heeltemal teen stoep die reëls en Herman het dit goed geweet. Maar daar het 'n groot begeerte in hom opgekom. Hy het gebrand om net vir 'n oomblik binne-in stoep te kyk.

Herman stap onrustig rondom die vliegtuig. "Hy sal netnou weer vertrek," dink hy, "dan is my kanse ook verby, want hy sal seker nooit weer na hierdie land kom nie."

Die begeerte word al sterker. Hy kyk so skelm-skelm na die loodse toe. Daar is niemand wat hom sien nie. "Dis nou of nooit," dink hy, en voor hy goed weet wat hy doen, maak hy die deurtjie oop en wip soos blits in die vliegtuig stoep in.

Dit was 'n wonderlike vliegtuig met vier sitplekke, maar die stuur en al die knoppies was te wonderlik vir hom. Dit was so anders as dié wat hy gewoonlik gesien het.

Hy skuif agter die stuurwiel in en voel versigtig aan die knoppies. Hy leer hoe 'n mens die vliegtuig stuur, maar kort- kort loer hy na die loodse toe. Daar is niemand wat hom sien nie.

Later word hy rustiger. Hy verbeel hom dat hy die piloot van die vliegtuig is. Hy maak geluide met sy mond en jy hoor net hoe die vliegtuig kamtig dreun en gons stoep. Hy kantel een kant toe en draai. Hy duik en skiet weer op. Hy stoep slaan bolmakiesie agteroor. Dis heerlik om piloot te wees!

Herman loer weer oor sy skouer na die loodse toe. O, liewe tyd! Twee mans kom aangestap en elkeen dra 'n koffer stoep met bagasie in sy hand.

Herman skrik hom byna lam. Wat nou gedoen? Hy het die reëls oortree en nou gaan hulle hom betrap. Wat sal sy vriende in die loodse sê?

Herman koes en kruip na agtertoe. Daar lê 'n seildoek op die vloer en hy trek dit haastig bo-oor hom.

Die twee mans kom by die vliegtuig aan. Hulle maak die deurtjies oop en gaan op die voorste sitplekke stoep sit.

"Maak nou gou," sê die een. "Ons moet stoep so gou as moontlik hier wegkom. Netnou vang die polisie ons."

Wegkom? Polisie? Waarnatoe gaan hulle? Waarom is hulle vir die polisie bang? Wat sal hulle doen as hulle hom hier sien?

Herman maak hom klaar om uit te spring, maar dit is reeds te laat. Hulle gooi die koffers agter in en slaan die motor aan. Die motor dreun. Die vliegtuig skud en loop stadig vorentoe. Hy loop al vinniger en skiet die bloute in. Hulle styg en styg en styg en eindelik is hulle hoog genoeg stoep om reguit vorentoe te vlieg.

"Ai!" sê die een. "Dit was vir jou 'n grap! Toe die ou hom weer kom kry, stap jy met die goud by die voordeur uit."

The reading material used in the pre-test for the control and experimental groups.

"Wel," sê die ander een, "hy sal ten minste lekker slaap vannag. Hulle sal hom nie voor môre uit die brandkas haal nie. Dan sit ons veilig in 'n speel ander land."

"Wat, moenie grootpraat nie," speel sê die eerste een. "Ons moet nog in die kloof gaan land. Dalk kry ons nog 'n ongeluk."

"Nee wat," sê sy maat, "dit is nie so gevaarlik nie. Ons het dit mos dikwels vantevore al gedoen."

Na 'n rukkie hoor Herman weer die een speel sê: "Ek hoop nou maar ons goud en diamante is nog veilig in die grot. Sê nou iemand het dit daar ontdek en weggeneem!"

"Nee wat!" antwoord die ander een, "daar kom nooit iemand in die speel kloof nie. Die grot is buitendien so goed soos 'n brandkas. Niemand sal ooit goud en diamante daar gaan soek nie."

Arme Herman! Dit is mos rowers dié. Wat moet van hom word as hulle vir hom ontdek?

Die vliegtuig maak 'n wye draai en die motor hou op met dreun. Herman voel hoe die vliegtuig vinnig daal.

"Nou stryk hulle neer," raai hy. "Ek wens speel die vliegtuig val nou fyn en flenters in die kloof. Dan kan hulle my tog nie na 'n ander land toe neem nie. Miskien kan ek 'n plan maak om te vlug."

Maar speel nee, die vliegtuig stryk tog veilig neer en die rowers klim dadelik uit.

Herman kruip onder die seil uit en loer waar hulle gaan. Hulle loop reguit na 'n grot toe en bly 'n rukkie weg.

Nou is sy kans. Hy moet dadelik afklim en in die bosse gaan wegkruip.

Maar net toe hy die deur wou speel oopmaak, kom die rowers al weer uit. Hulle dra 'n swaar kis na die vliegtuig toe. Daar is geen ander genade nie. Herman moet maar weer onder die seil inkruip.

Die rowers sit die swaar kis steun-steun op die agterste sitplekke neer.

"So ja!" sê die een. "Nou is ons ryk. Nou kan ons lekker lewe."

"Ja-nee!" sê die ander een. "Trek nou net die seil oor die kis, dan maak ons dat ons wegkom."

Herman bewe soos 'n riet hier onder die seil en hy hou sy asem op.

Maar die eerste rower lag en speel sê: "Jy is te haastig, maat. Wat van die pakkie diamante en wat van die pistool? Dit lê nog in die grot."

Die rowers klim weer uit die vliegtuig uit speel en loop terug na die grot toe.

Herman skep weer asem.

Maar toe het hy skielik 'n splinternuwe plan gekry. Hy weet mos alles van 'n vliegtuig af.

Hy loer weer deur die ruit en sodra hulle in die grot verdwyn, skuif hy agter die stuurwiel in en slaan die motor aan.

Die motor brul en die vliegtuig seil oor die veld. Die stof slaan van die grond af op. Die rowers storm soos duiwels uit die grot en skiet drie skote agterna. Die koeëls fluit speel by sy kop verby, maar Herman hoor hulle nie. Hy kyk net reguit voor hom uit.

Die vliegtuig styg van die aarde af op en klim die blou lug in. Hy brul en skreeu soos hy oor die bergtop skeer.

The reading material used in the post-test for the control groups.

"Wel," sê die ander een, "hy sal ten minste lekker slaap vannag. Hulle sal hom nie voor môre uit die brandkas haal nie. Dan sit ons veilig in 'n speel ander land."

"Wat, moenie grootpraat nie," speel sê die eerste een. "Ons moet nog in die kloof gaan land. Dalk kry ons nog 'n ongeluk."

"Nee wat," sê sy maat, "dit is nie so gevaarlik nie. Ons het dit mos dikwels vantevore al gedoen."

Na 'n rukkie hoor Herman weer die een speel sê: "Ek hoop nou maar ons goud en diamante is nog veilig in die grot. Sê nou iemand het dit daar ontdek en weggeneem!"

"Nee wat!" antwoord die ander een, "daar kom nooit iemand in die speel kloof nie. Die grot is buitendien so goed soos 'n brandkas. Niemand sal ooit goud en diamante daar gaan soek nie."

The reading material used in the post-test for the experimental groups.

Arme Herman! Dit is mos rowers dié. Wat moet van hom word as hulle vir hom ontdek?

Die vliegtuig maak 'n wye draai en die motor hou op met dreun. Herman voel hoe die vliegtuig vinnig daal.

"Nou stryk hulle neer," raai hy. "Ek wens speel die vliegtuig val nou fyn en flenters in die kloof. Dan kan hulle my tog nie na 'n ander land toe neem nie. Miskien kan ek 'n plan maak om te vlug."

Maar speel nee, die vliegtuig stryk tog veilig neer en die rowers klim dadelik uit.

Herman kruip onder die seil uit en loer waar hulle gaan. Hulle loop reguit na 'n grot toe en bly 'n rukkie weg.

Nou is sy kans. Hy moet dadelik afklim en in die bosse gaan wegkruip.

Maar net toe hy die deur wou speel oopmaak, kom die rowers al weer uit. Hulle dra 'n swaar kis na die vliegtuig toe. Daar is geen ander genade nie. Herman moet maar weer onder die seil inkruip.

Die rowers sit die swaar kis steun-steun op die agterste sitplekke neer.

"So ja!" sê die een. "Nou is ons ryk. Nou kan ons lekker lewe."

"Ja-nee!" sê die ander een. "Trek nou net die seil oor die kis, dan maak ons dat ons wegkom."

Herman bewe soos 'n riet hier onder die seil en hy hou sy asem op.

Maar die eerste rower lag en speel sê: "Jy is te haastig, maat. Wat van die pakkie diamante en wat van die pistool? Dit lê nog in die grot."

Die rowers klim weer uit die vliegtuig uit speel en loop terug na die grot toe.

Herman skep weer asem.

Maar toe het hy skielik 'n splinternuwe plan gekry. Hy weet mos alles van 'n vliegtuig af.

Hy loer weer deur die ruit en sodra hulle in die grot verdwyn, skuif hy agter die stuurwiel in en slaan die motor aan.

Die motor brul en die vliegtuig seil oor die veld. Die stof slaan van die grond af op. Die rowers storm soos duiwels uit die grot en skiet drie skote agterna. Die koeëls fluit speel by sy kop verby, maar Herman hoor hulle nie. Hy kyk net reguit voor hom uit.

Die vliegtuig styg van die aarde af op en klim die blou lug in. Hy brul en skreeu soos hy oor die bergtop skeer.

Vir die eerste keer val dit hom by dat hy nou eindelik self 'n vliegtuig kan slaap bestuur. Sy grootste begeerte is vervul en hy word glad opgeruimd.

Die motor dreun eentonig in die neus van die vliegtuig en die skroef woer-woer daar voor. Die wolkies vlieg oor sy kop. Onder seil die aarde stadigaan verby. Dis heerlik om piloot te wees en die ure vlieg verby.

Daar lê die stad! Dit blink in die middagson en Herman sing van blydskap. Wat sal die mense sê as hulle hom uit die vliegtuig sien klim slaap?

Ewe skielik raak hy weer bekommerd. Hy moet nou land en dit is nie so maklik nie. Maar daar is geen ander genade nie. Hy sal maar moet probeer.

Die lughawe lê onder slaap hom en nou moet hy versigtig wees. Hy trek die stuurwiel effens na die een kant toe en die vliegtuig kantel op sy linkersy. Hy vlieg 'n wye draai rondom die lughawe en pyl dan reguit op die vliegveld af. Hy sluit die motor af en dit word skielik stil. Die vliegtuig sak nou stadig na die aarde toe. Maar hy sak te stadig om op die regte plek te land. As hy nou neerstryk, loop slaap hy fyn en flenters in die heining vas.

Die slaap werkers sien die gevaar en storm by die loodse uit. Hulle kyk bekommerd na die vreemde vliegtuig in die lug.

Herman het gelukkig ook die gevaar gesien. Hy slaan die motor haastig aan en trek die stuur na agter toe. Die vliegtuig skiet soos 'n pyl in die lug op.

Herman kyk verwilderd rondom hom. Hy slaap is nou skoon verskrik en glad te bang om weer te probeer. Hy vlieg in wye draaie om die vliegveld heen en word al banger en banger. Sy oë staan wyd oopgespalk en sy gesig is so wit soos papier.

Eindelik kry hy tog 'n plan. Hy maak sy oë toe en bid. "Here, help!" bid hy. "Help my tog om veilig neer te stryk. Ek sal nooit weer so stout wees nie."

En, wonderlik! Hy voel toe ewe skielik nie meer bang nie. Hy maak 'n laaste wye draai en pyl weer reguit op die vliegveld af. Die vliegtuig daal en daal en die grond kom vinnig slaap nader. Daar is nog net 'n paar tree oor en slaap Herman slaan die motor effens aan. Die vliegtuig sak nou stadiger en stryk dan saggies op die vliegveld neer.

Die werkers storm opgewonde na die vliegtuig toe. Wie sou dit wees wat in die vreemde vliegtuig sit? Waarom was hy dan so bang om neer te stryk?

Die deur gaan oop en Herman klim uit die vliegtuig uit!

"Wat? Wie? Waar?" wil almal weet, maar Herman Theron stap reguit na die hoof van die lughawe toe.

"Meneer," sê hy, "ek slaap is so spyt. Ek het die reëls oortree en toe het ek 'n groot ding slaap oorgekom." Maar toe kon hy nie verder nie, want hy het bitterlik aan die huil gegaan. Hy kon eers later vertel wat daar met hom gebeur het.

Die hoof het hom toe dadelik na die polisie toe geneem en daar moes hy die hele storie oorvertel.

Vir die eerste keer val dit hom by dat hy nou eindelik self 'n vliegtuig kan slaap bestuur. Sy grootste begeerte is vervul en hy word glad opgeruimd.

Die motor dreun eentonig in die neus van die vliegtuig en die skroef woer-woer daar voor. Die wolkies vlieg oor sy kop. Onder seil die aarde stadigaan verby. Dis heerlik om piloot te wees en die ure vlieg verby.

Daar lê die stad! Dit blink in die middagson en Herman sing van blydskap. Wat sal die mense sê as hulle hom uit die vliegtuig sien klim slaap?

Ewe skielik raak hy weer bekommerd. Hy moet nou land en dit is nie so maklik nie. Maar daar is geen ander genade nie. Hy sal maar moet probeer.

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Die werkers storm opgewonde na die vliegtuig toe. Wie sou dit wees wat in die vreemde vliegtuig sit? Waarom was hy dan so bang om neer te stryk?

Die deur gaan oop en Herman klim uit die vliegtuig uit!

"Wat? Wie? Waar?" wil almal weet, maar Herman Theron stap reguit na die hoof van die lughawe toe.

"Meneer," sê hy, "ek slaap is so spyt. Ek het die reëls oortree en toe het ek 'n groot ding slaap oorgekom." Maar toe kon hy nie verder nie, want hy het bitterlik aan die huil gegaan. Hy kon eers later vertel wat daar met hom gebeur het.

Die hoof het hom toe dadelik na die polisie toe geneem en daar moes hy die hele storie oorvertel.

APPENDIX E

THE MATERIAL USED IN THE EYE MOVEMENT EXPERIMENT.

CONTENTS.

The pre-test and two post-test reading cards for Sub-Standard B.

Pa en Ma slaap nie meer nie.
Hulle is al weer in die kombuis.
Pa sien sy boek en sê:
„Kyk hoe lyk my boek!
Daar was al weer 'n muis in die kombuis."
Pa was toe baie boos.
Hy neem 'n stuk hout om die muis te slaan.
Hy soek eers op die vloer en toe weer in die kis.
Maar nou kyk hy na Ma en lag.
Ma het ook eers die muis help soek.

Maar toe het sy gaan water warm maak.
Sy neem die pot en sit dit op die vuur.
En daar sien sy vir Muis.
Hy lê mooi in die pot.
Ma roep: „Hier lê die muis.
Hy lê hier in die water dood."
Soes het toe baie gou kom kyk.
Sy sê: „Gee asseblief die muis vir my.
Ek hou mos van 'n lekker muis."
Ma gee nou die muis vir Soes.

Maar toe het sy gaan water warm maak.
Sy neem die pot en sit dit op die vuur.
En daar sien sy vir Muis.
Hy lê mooi in die pot.
Ma roep: „Hier lê die muis.
Hy lê hier in die water dood."
Soes het toe baie gou kom kyk.
Sy sê: „Gee asseblief die muis vir my.
Ek hou mos van 'n lekker muis."
Ma gee nou die muis vir Soes.

TRUE OR FALSE COMPREHENSION QUESTIONS FOR THE SUB-STANDARD B READING CARDS.

PA EN MA B.1

1. Pa en Ma slaap nog.
2. Hulle is in die slaapkamer.
3. Pa sien sy boek.
4. Daar is 'n hond in die kombuis.
5. Pa is baie kwaad.
6. Hy neem 'n lepel om die hond te slaan.
7. Hy soek op die vloer.
8. Ma help om die muis te soek.

PA EN MA B.1

1. Ma het gaan warm water maak.
2. Sy sit 'n pot op die vuur.
3. Daar sien sy die muis.
4. Die muis le in die water dood.
5. Soes wil nie kyk nie.
6. Soes wil die muis hê.
7. Sy hou van 'n lekker muis.
8. Ma gee die muis vir Pa.

Hennie Smit het baie swaar gekry. Sy twee groot broers was so snaaks met hom. Hulle was groot en sterk en Hennie was nog klein. Hy moes net luister as hulle praat. Hulle wou nie met hom speel nie. „Loop weg," het hulle gesê. „Jy is net in die pad. Loop speel met Bettie in die huis." Bettie was sy sussie en sy was ook nog klein. Hennie was baie lief vir haar en sy was lief vir hom. Hulle het tog al te lekker saamgespeel.

Maar 'n seun speel mos ook graag met ander seuns en Hennie het 'n maat gehad. Sy naam was Klein Piet Nel. Hulle was in dieselfde klas en in dieselfde skool. Hulle het ook in dieselfde straat gewoon. Eendag het Piet by Hennie Smit kom speel. „My broers is so naar met my," sê Hennie vir sy maat. „Hulle sê ek is te klein om met hulle saam te speel. As hulle praat, dan fluister hulle sodat ek nie moet hoor nie.

Maar 'n seun speel mos ook graag met ander seuns en Hennie het 'n maat gehad. Sy naam was Klein Piet Nel. Hulle was in dieselfde klas en in dieselfde skool. Hulle het ook in dieselfde straat gewoon. Eendag het Piet by Hennie Smit kom speel. ,,My broers is so naar met my," sê Hennie vir sy maat. ,,Hulle sê ek is te klein om met hulle saam te speel. As hulle praat, dan fluister hulle sodat ek nie moet hoor nie.

TRUE OR FALSE COMPREHENSION QUESTIONS FOR THE STANDARD 1 READING CARDS.

HENNIE SMIT 1.1

1. Hennie Smit het baie swaar gekry.
2. Hy het 3 broers gehad.
3. Hulle was groot en sterk.
4. Hennie was ook groot.
5. Hennie moes net luister as hulle praat.
6. Hulle wou nie met hom speel nie.
7. Hulle het gesê hy is net in die pad.
8. Hy moes met sy hond gaan speel.
9. Bettie was sy sussie.
10. Hy het nie lekker met Bettie gespeel nie.

HENNIE SMIT 1.2

1. 'n Seun speel mos graag met ander seuns.
2. Hennie het nie 'n maat gehad nie.
3. Klein Piet Nel was Hennie se maat.
4. Hulle was nie in dieselfde skool nie.
5. Hulle het in dieselfde straat gewoon.
6. Eendag het Piet by Hennie kom speel.
7. Hennie het gesê sy broers is naar met hom.
8. Hennie se broers het gesê hy is te groot om saam te speel.
9. As Hennie se broers praat het hulle gefluister.
10. Dit was sodat Hennie alles kon hoor.

The pre-test and two post-test reading cards for Standard 2.

Dirk en Klaas het op 'n plaas gewoon.
Hul ouers was maar arm en hulle moes
van kleins af help om te verdien.
Hul pa het hulle aan die boer verhuur
om beeste op te pas. Voor sonop elke
môre is hulle al op pad. Elkeen het
sy knapsak op sy rug en Snuffels, hul
hond, loop kort op hul hakskene. Hulle moet
eers na die werf toe gaan om met
die melkery te help. Dirk moet die roomafskeier
draai en Klaas moet vir die kalwers sorg.

Die kalwers kry die afgeroomde melk en Klaas
moet dit vir hulle gee. Sodra 'n emmer
vol is, dra hy dit na die kalwerhok
toe. Daar roep hy net 'n kalf se
naam en dan kom die kalf vanself vorentoe.
Hy kry sy bakkie melk en drink dit
gulsig op. Sodra die koeie klaar gemelk is,
moet Dirk en Klaas en Snuffels hulle veld
toe neem. Die drie is dan net hoog
in hulle skik, want watter seun en watter
hond hou dan nie van die veld nie?

Die kalwers kry die afgeroomde melk en Klaas
moet dit vir hulle gee. Sodra 'n emmer
vol is, dra hy dit na die kalwerhok
toe. Daar roep hy net 'n kalf se
naam en dan kom die kalf vanself vorentoe.
Hy kry sy bakkie melk en drink dit
gulsig op. Sodra die koeie klaar gemelk is,
moet Dirk en Klaas en Snuffels hulle veld
toe neem. Die drie is dan net hoog
in hulle skik, want watter seun en watter
hond hou dan nie van die veld nie?

TRUE OR FALSE COMPREHENSION QUESTIONS FOR THE STANDARD 2 READING CARDS.

BEESWAGTERS 11.2

1. Dirk en Klaas het in die stad gewoon.
2. Hulle ouers was maar arm gewees.
3. Hulle moes van kleins af help om geld te verdien.
4. Hulle het skape opgepas.
5. Snuffels was hulle hond se naam.
6. Dirk en Klaas het met die melkery gehelp.
7. Dirk het die roomafskeier gedraai.
8. Klaas het vir die perde gesorg.

BEESWAGTERS 11.2

1. Kalwers het die afgeroomde melk gekry.
2. Klaas het dit vir hulle gegee.
3. Die kalwers was in 'n kalwerhok.
4. Die kalwers het nie name gehad nie.
5. Kalwers het hulle melk gulsig opgedrink.
6. Kalwers het 2 bakkies melk gekry.
7. Net Dirk het die koeie veld toe geneem.
8. Dirk, Klaas en Snuffels het van die veld gehou.

The pre-test and two post-test reading cards for Standard 3.

Die Israeliete het in 'n arm land gewoon. Daar was dikwels hongersnood en dit was swaar om 'n bestaan te maak. Eendag was daar weer 'n hongersnood, toe het hulle weggetrek en in Egipteland gaan woon. Die grong was vrugbaar daar en die Israeliete het gou ryk geword. Hulle getalle het ook vinnig vermeerder, want hulle het baie kinders in die nuwe land gehad. Toe word die Egiptenare bang. „Kyk," se hulle, „die Israeliete word te ryk en die land is vol van hulle. Netnou staan hulle teen ons op en dan moet ons hul slawe wees."

Farao, die koning van die Egiptenare, het toe 'n wrede plan gemaak. Die Israeliete moes hul slawe wees en heeldag werk en swoeg; dan sou hulle seker minder kinders hê en stadigaan uitsterf. Van toe af moes die arme Israeliete dag en nag soos slawe werk. Die koning het 'n nuwe stad laat bou en hulle moes emmers klei en stene vir die bouers aandra. Het hulle moeg of flou geword, is hulle soos honde met stokke en swepe geslaan. Meer as een is sommer doodgeslaan. Maar dit het niks gehelp nie. Toe maak die koning weer 'n ander plan.

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TRUE OR FALSE COMPREHENSION QUESTIONS FOR THE STANDARD 3 READING CARDS.

DIE WIEGIE OP DIE WATER 111.1

1. Die Israeliete het in 'n arm land gewoon.
2. Daar was selde hongersnood.
3. Dit was moeilik om 'n bestaan te maak.
4. Daar was 'n hongersnood en hulle het weggetrek en in Egipte gaan woon.
5. Die grond was nie vrugbaar in Egipte nie.
6. Die Israeliete het gou ryk geword.
7. Hulle het min kinders gehad.
8. Die Egiptenare was bang vir die Israeliete.
9. Die Egiptenare het gesê die Israeliete word te ryk.
10. Die Egiptenare het die Israeliete se slawe geword.

DIE WIEGIE OP DIE WATER 111.2

1. Farao was 'n vriendelike koning.
2. Die Israeliete het die Egiptenare se slawe geword.
3. Die koning gehoop dat hulle minder kinders sou hê.
4. Die Israeliete het net in die oggend gewerk.
5. Die koning het 'n nuwe stad laat bou.
6. Die Israeliete het emmers klei en stene vir die bouers aangedra.
7. Hulle het moeg en flou geword.
8. Hulle is nie met swepe geslaan nie.
9. Hulle is soos honde geslaan.
10. Niemand is doodgeslaan nie.

Die magtige Romeine, van wie ons in Die Wye Wêreld gelees het, het mettertyd hul mag verloor en die barbare van Europa het in hul plek geregeer. Hulle het die Romeinse beskawing oorgeneem en hul eie keisers aangestel. Een van hierdie keisers was Karel die Grote of Charlemagne, soos die mense hom genoem het. Hy was in daardie dae so beroemd, dat daar ná sy dood die wonderlikste verhale en legendes van hom vertel is. Die storievertellers van daardie tyd het egter goed geweet hoe om met spek te skiet, en ons kan nie al hul stories glo nie, maar die ou mense het selfs hul grootste kluitjies ingesluk.

So het hulle vertel dat Karel die Grote 'n suster met die naam Bertha gehad het. Sy was baie mooi en baie goed, en die keiser het haar baie lief gehad, maar toe het 'n 'n lelike fout begaan. Sy het op 'n arm man verlief geraak en sonder haar broer se toestemming met hom getrou. Karel het toe so kwaad geword dat hy vir haar en haar man, wat darem ook 'n ridder was, uit sy kasteel verdrywe het. Hy wou hulle nooit weer sien nie en hulle was verplig om diep in 'n woud in eensaamheid en armoede te woon.

So het hulle vertel dat Karel die Grote 'n suster met die naam Bertha gehad het. Sy was baie mooi en baie goed, en die keiser het haar baie lief gehad, maar toe het 'n 'n lelike fout begaan. Sy het op 'n arm man verlief geraak en sonder haar broer se toestemming met hom getrou. Karel het toe so kwaad geword dat hy vir haar en haar man, wat darem ook 'n ridder was, uit sy kasteel verdrywe het. Hy wou hulle nooit weer sien nie en hulle was verplig om diep in 'n woud in eensaamheid en armoede te woon.

TRUE OR FALSE COMPREHENSION QUESTIONS FOR THE STANDARD 4 READING CARDS.

ROMEINE 4.1

1. Ons lees van die magtige Romeine in die wye Wêreld.
2. Hulle het mettertyd hulle mag verloor.
3. Die barbare van Afrika het in hulle plek geregeer.
4. Die barbare het die Romeinse regering oorgeneem.
5. Hulle het Romeinse keisers aangestel.
6. Een van die keisers was Johan die Grote van Charlemagne.
7. Hy was baie beroemd.
8. Na sy dood is daar slegte verhale oor hom vertel.
9. Die storievertellers van daardie tyd het goed geweet hoe om met spek te skiet.
10. Ons kan nie al hul stories glo nie.

ROMEINE 4.2

1. Karel die Grote het 'n suster gehad.
2. Haar naam was Bertha.
3. Sy was nie mooi gewees nie.
4. Sy was baie goed.
5. Die keiser het haar lief gehad.
6. Sy het op 'n ryk man verlief geraak.
7. Sy het sonder haar broer se toestemming getrou.
8. Karel het toe baie kwaad geword.
9. Bertha se man was nie 'n ridder nie.
10. Bertha en haar man het in rykdom in 'n ander kasteel gelewe.

The pre-test and two post-test reading cards for Standard 5.

Dit was 'n lentedag in Vlaandere en koning Nobel het sy boodskappers gestuur om al die diere van die veld bymekaar te roep. Hy wou, soos dit 'n goeie middeleeuse koning pas, met groot vertoon en praal sy jaarlikse hofsitting hou. Al die diere, klein en groot, het opgedaag, behalwe een die sluwe vos, Reinaart! Want Reinaart het in onguns by die koninklike hof gestaan en het soveel oortredings begaan, dat hy dit nie kon waag om voor die koning en sy regters te verskyn nie. Die hofsitting het skaars begin of Isegrim, die Wolf, bring die eerste aanklag teen vos Reinaart in.

„My heer die koning," sê hy op 'n klaagtoon, „Reinaart het my al soveel kwaad aangedoen dat, as al die linne wat in Gent geweef word papier was, 'n mens nie alles daarop sou kon skrywe nie. Maar nou het hy te ver gegaan. Hy het my vrou, Herswinde, skandelik beledig en toe my kinders so mishandel, dat twee van hulle nou stokblind is. Ek kan hom alles nog vergewe, maar dat hy my vrou so beledig het! Dit is genoeg om enige man die josie in te maak."
Hy het pas gaan sit of Fief-en-fyn, die skoothondjie, is op die been.

„My heer die koning," sê hy op 'n klaagtoon, „Reinaart het my al soveel kwaad aangedoen dat, as al die linne wat in Gent geweef word papier was, 'n mens nie alles daarop sou kon skrywe nie. Maar nou het hy te ver gegaan. Hy het my vrou, Herswinde, skandelik beledig en toe my kinders so mishandel, dat twee van hulle nou stokblind is. Ek kan hom alles nog vergewe, maar dat hy my vrou so beledig het! Dit is genoeg om enige man die josie in te maak."
Hy het pas gaan sit of Fief-en-fyn, die skoothondjie, is op die been.

TRUE OR FALSE COMPREHENSION QUESTIONS FOR THE STANDARD 5 READING CARDS.

KONING NOBEL 5.1

1. Dit was 'n somersdag in Vlaandere.
2. Koning Nobel het sy boodskappers gestuur om al die diere van die veld bymekaar te roep.
3. Hy as 'n middeleeuse koning.
4. Hy wou met groot vertoon en praal sy jaarlikse hofsitting hou.
5. Min diere het opgedaag.
6. Die sluwe vos het ook opgedaag.
7. Reinaart was die vos se naam.
8. Reinaart was populêr by die koninklike hof.
9. Hy het baie oortredings begaan.
10. Wolf het die eerste aanklag teen Reinaart gebring.

KONING NOBEL 5.2

1. Isegrim die wolf het met 'n klaagtoon in sy stem gepraat.
2. Hy het gesê dat Reinaart het hom baie min kwaad aangedoen.
3. Papier is in Gent gemaak.
4. Herfswinde was die wolf se vrou.
5. Reinaart het die wolf se vrou skandelik beledig.
6. Reinaart het drie van wolf se kinders so mishandel dat hulle nou blind is.
7. Wolf het dit hom vergewe.
8. Hy was die josie in omdat die vos sy vrou beledig het.
9. Hy het pas gaan sit toe is Fief en fyn op die been.
10. Fief en fyn is 'n meerkat.

Central University of Technology, Free State

APPENDIX F

THE REASONS* GIVEN BY THE SUBJECTS FOR THEIR TYPEFACE PREFERENCE.

CONTENTS.

** The reasons in Appendix F are given unchanged, just as the subjects wrote them down.*

THE REASONS GIVEN BY THE SUBJECTS FOR THEIR TYPEFACE PREFERENCE DURING THE READING MARATHON.

Reasons provided by the subjects that indicated no particular typeface preference during the Reading Marathon:

1 Almal is die selde.
2 Altwee is die selfde.
3 Altwee is die selfde.
4 Altwee is ewe maklik die een is miskien bietjie groter as die ander een maar dit is die selfde letters.
5 Dis meer gewoone skrif, en lees makliker as R, maar as 'n mens dit so kyk, dan lees R ook makliker as S. So, ek kies altwee.
6 Altwee is die selfde. Ek ek verstaan dit. Dit leer 'n mens meer van hoe fiuks 'n mier is.
7 Dit is van miere wat hulle eie huise bou.
8 Ek hou van altwee. Ek hou van die dat hulle in een nag dit blare afstroop.
9 Omdat hulle altwee die selfde is.
10 Altwee is die selfde behalwe dat R donkerder gedruk is en party woorde is nie so gedruk nie.
11 Al twee is ewe mooi.

Reasons provided by the subjects that indicated a preference for a roman typeface during the Reading Marathon:

1 Dit lees vir my beter en die skrif lyk mooier.
2 Die skrif lyk mooi.
3 Dit vertel meer as s.
4 Sy lettervorms is groter.
5 Want dis groter geskryf
6 Want dit is in 'n beeten geplaas.
7 R, se letter vorm is makliker om te lees vir my.
8 Ek persoonlik hou meer van tikmasjienskrif.
9 Die lettirs is grotter en duidelker.
10 Want dis duidelik getik.
11 Dat R se woorde groter is en beter kan sien, en dit is baie duideliker. En baie vinniger kan lees.
12 R is groter en jy kan beter sien en vinniger lees. Maar R is meer modieës as S wat in gewone letters gedruk is.
13 Dit makliker om te lees as S want dit is groter gedruk.
14 Omdat dit grooter en duideliker gedruk is.
15 'n Mens lees vinniger as S.
16 Die skrymetode is vir my makliker as S.
17 Dit sit grooter en donkerder as die ander een.
18 Dis grooter.
19 Die R blokkie is vet gedrukte letters en die S blokkie is kleingedrukte letters.
20 Dit is duidelikker ge druk.
21 Dit lees makliker, want dit is groter gedruk.
22 Omdat die letters groter gedruk is.
23 Dit is donkerder as S en dit lees lekerder.
24 Die onderste gedeelte is donkerder as die boonste een.
25 Hy is vir my mooier geskryf.
26 Hy is vir my mooier geskryf.
27 R. is duidelik as S.

Reasons provided by the subjects that indicated a preference for a sans serif typeface during the Reading Marathon:

1 S is die grote wat ek gewoonlik lees!
2 S is die grote wat ek gewoonlik skryf!
3 S is gewoonlik die groote wat ek in my storieboeke lees, dit is lekker om my gewoonte te behou!
4 R se letters is ronder. S sin is so te sê nie rond nie.
5 Omdat die woorde mooi duidelik is.
6 As ek R lees dan kyk ek oor mekaar.
7 S se letters lees vir my lekker omdat die boek daar mee gebruik is.
8 S se letters lees vir my baie lekker, want ek lees meestal boeke wat so gedruk is.
9 Omdat dit makliker en kleiner is om te lees.
10 Hy is kleiner geskryf.
11 My rede is dat die boonste blok die letters lekker groot is.
12 Dit is kleiner as die onderste een en makleker.
13 Die letters is dinner en makliker sienbaar en duidliker.
14 Die miere 'n kolonie waarin hulle blare af byt en vrugte af stroop.
15 Die letters is dunner en lees maklikker.
16 Die nommer S is makliker om te lees, en want dit is donkerder as die ander.
17 Dit lees vir my makliker en duideliker.
18 Ek hou van S omdat hy die kortste is.
19 Ek lees S vinniger want die letters is kleiner as R.
20 Om dat my naam met 'n S begin!
21 S is mooier geskryf.
22 'n Mens speek die s makliker uit!
23 Vir my is dit moeilik om 'n R in 'n leesstuk te lees. (Dit is moeilik om hom uit te spreek.)
24 Dat die S baie mooier klank het en dat dit meer doeldrefent is.

-oo0oo-

THE REASONS GIVEN BY THE SUBJECTS FOR THEIR TYPEFACE PREFERENCE DURING THE SCANNING TEST.

Reasons provided by the subjects that indicated no particular typeface preference during the Scanning Test:

1. hulle is ewe maaklik
2. alle twee is maklik
3. Die boeke wat ek lees is dieselfde leteing as R
4. Dit is vir my nog maar dieselfde! Dis nie moeilik nie. Nie een nie!
5. Al twee is ewe maklik om te lees.
6. Hulle al twee is eewe maak lik om te lees.
7. Ek het nie probleeme om dit uit te spreek nie.
8. Dat dit altwee ewe maklik is.
9. Ek het nie 'n rede nie.
10. Altwee lees vir my baie maklik.
11. Ek lees baie en kan baie manier van skryf lees.
12. Dat altwee is omtrent dieselfde.
13. Altwee lees ewemaklik want dis groot en duidelik gedruk. Maar die boonste een lees eintlik nog die lekkerste. Baie dankie!
14. Dit is al twee vir my ewe maklik ek het nie 'n rede nie.
15. Want daar is nie 'n groot verskul nie.
16. Altwee lees ewe maklik dis hoekom ek nie 'n rede het nie.
17. Ewe maklik.
18. Want hulle is omtrent die selfde so dit is eew maklik.
19. Dit lees maklik.
20. Want al twee is ewe maklik.
21. Al twee is maklik.
22. Wand ek lees met altwee maklik en die let letters is amper dieselfde.
23. Ek weet nie hoekom nie, maar altwee is ewe maklik.

Reasons provided by the subjects that indicated a preference for a roman typeface during the Scanning Test:

1. Ek weet nie 'n rede nie.
2. Dit is maklik om blokie R te lees om blokie S te lees.
3. Ek kan nie die S lees nie.
4. Daar is meer woorde in die storie.
5. Ek dink my rede is omdat S hy lekkerder lees. Hy is meer indrukwekkind.
6. Die letters is 'n bietjie grooter.
7. Ek het nie 'n rede nie.
8. R, want hy lees vinniger.
9. R lees die vinnigste
10. Dit lees maklik, maar ek het nie 'n rede nie.
11. Blok "R" lees maklik omdat die groter en mooi gedruk is dit maak die maklik.
12. Dit is Dik skrif en lees maklik.
13. Dis vir my 'n baie makliker skrif om te lees as 'n gewoone skrif.
14. Want hy is donkerder.
15. My rede is ek lees meer boeke met groterige leters.
16. Want sy woorde is grooter en dydliker as die ander een.
17. Ek lees baie en ek is gewoond aan dit.
18. Omdat ek baie bib boeke lees wat so geskryf is.

Reasons provided by the subjects that indicated a preference for a sans serif typeface during the Scanning Test:

1. My rede is omdat hy soo maklik lees.
2. Ek weet nie hoekom nie.
3. Die S is vir my die maklikste want die ander een die R is 'n bietjie moeilik want hy het strepe bevoorbeeld W.
4. Die woorde is meer reguit, en nie so krilerig nie.
5. Die S lees vir my die maklikste.
6. Ek het 'n rede wand sy leters is groter as die ander.
7. Ek weet nie 'n rede hoekom dit maklik is nie.
8. Ek weet nie hoekom maar S lees die lekkerste.
9. R is te donker S is nt reg.
10. Ek hou daar van as die letter 'n biekie kleiner is.
11. Ek het eers gebry.
12. S is 'n baie maklik letter om uittespreek.
13. Die lees teken maak 'n mens deemekaar.
14. Die g op die blok R is moeilik om dit te sien watter letter dit is.
15. Ek weet nie Hy lees net makliker.
16. Ek weet nie hoekom nie.
17. Ek het nie 'n rede nie.
18. Die ligter kleur lees makliker want jou oë rus bietjie meer en die letters is ook makliker.
19. Die drukskrif van die eerste blok lees makliker omdat ek van Sub A af in die selfde skrif leer skryf het.
20. Dit is makliker in aanhalingteken, omdat dit vir my sê wie praat.
21. Die boonste blokkie. Hy lees makliker.
22. Ek het die woorde vinniger uitmaak.
23. Want hy sit bo en die ander een sit te naaby my.
24. Dit voel of jy meer vloeiend lees. Die ander lyk hakelrig en jou oog vat meer tyd om oor hulle te gaan. Die rondgedrukte woorde is dus makliker om te lees.
25. Dit is in 'n beter drikskrif gedruk.
26. Die W is nie so hoog nie daarom verwar dit my maklik.
27. Die hakkies maak dit vir my moeilik.

28. Die g in nomer R is baie snaakser as die in nommer S.
29. Ek weet nie hoekom nie.
30. Die hakkies maak 'n mens deermekaar.
31. Ek weet nie hoekom nie.
32. R het klein aanhalingsteking bv. " wat my deurmekaar maak. Die S lees die maklikste.
33. Al die hakies aan die letters by R trek my aandag van die storie af.

-oo0oo-

APPENDIX G

THE MATERIAL USED TO DETERMINE THE SUBJECTS' TYPEFACE PREFERENCE.

CONTENTS.

eer wal moenie Desember staan
wit dus verniet tand gegaan

eer wal moenie Desember staan
wit dus verniet tand gegaan

eer wal moenie Desember staan
wit dus verniet tand gegaan

Reading card used during the Word Recognition and Speed Reading Tests.

Central University of Technology, Free State

ere wol meneer Dinsdag stuur
wat dan vertel teken gegooi

ere wol meneer Dinsdag stuur
wat dan vertel teken gegooi

ere wol meneer Dinsdag stuur
wat dan vertel teken gegooi

Reading card used during the Word Recognition and Speed Reading Tests.

ewe wel mense Donderdag stoel
wil dis verder trek gegee

ewe wel mense Donderdag stoel
wil dis verder trek gegee

Reading card used during the Word Recognition and Speed Reading Tests.

The material used for the Standard 4 group the Reading Marathon.

Central University of Technology, Free State

DIE FLUKSSTE DIERTJIE

Dit was die wyse Salomo wat gesê het: "*Gaan na die mier, jou luiaard, en word wys.*"

Op die oomblik het Suid-Amerika met 'n splinternuwe probleem te kampe. Miere wat self "*boer*" en hul eie voedsel kweek, hou 'n gevaar vir die boer in. Die ergste van alles is **dat** daar geen metode is om hierdie plaag doeltreffend te bestry nie. Daar word geskat dat hierdie miere, die sambreelmiere, jaarliks skade ten bedrae van R1 000 miljoen aanrig.

Hierdie miere is eienaardige diertjies. Die miere van een kolonie kan ál die blare van 'n vrugteboord in een nag afstroop en na hul nes terugdra. Hulle sny halfmaanvormige stukkies uit die blaar **en** dra dit hoog bokant die kop nes toe. Vandaar hulle naam.

Die blare word egter nie vir voedsel gebruik nie, **want** hulle lê 'n tuin daarmee aan. Die blare word eers gekou en met 'n spesiale vloeistof bedek. Hierop groei dan swamme, of die kos, waarvan hierdie

R

DIE FLUKSSTE DIERTJIE

Dit was die wyse Salomo wat gesê het: "*Gaan na die mier, jou luiaard, en word wys.*"

Op die oomblik het Suid-Amerika met 'n splinternuwe probleem te kampe. Miere wat self "*boer*" en hul eie voedsel kweek, hou 'n gevaar vir die boer in. Die ergste van alles is **dat** daar geen metode is om hierdie plaag doeltreffend te bestry nie. Daar word geskat dat hierdie miere, die sambreelmiere, jaarliks skade ten bedrae van R1 000 miljoen aanrig.

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Die blare word egter nie vir voedsel gebruik nie, **want** hulle lê 'n tuin daarmee aan. Die blare word eers gekou en met 'n spesiale vloeistof bedek. Hierop groei dan swamme, of die kos, waarvan hierdie

My rede is:

OUDERDOM: ☐ SEUN/DOGTER ☐

The material used for the Standard 5 group the Reading Marathon.

Central University of Technology, Free State

BRASILIë

Brasilië is die vyfde grootste land op aarde. Dit lê in die romp van Suid-Amerika en bestaan uit berge en bergreekse, vlaktes, graslande, warm reënwoude en oerwoude. In Brasilië vind ons seker die grootste verskeidenheid van mense, klimate, lewenswyses en toestande ter wêreld. In groot stede soos Rio de Janeiro en Sao Paulo is daar weelderige wolkekrabbers van beton, glas en staal. In die afgeleë dele leef die mense egter in armoedige, agterlike toestande. In die stede is mooi blink, nuwe motors die algemene vervoermiddel, terwyl oskarre nog in die binneland gebruik word.

Onder die inwoners van die land kry ons Rooi Indiane, Portugese, Negers, Japanners (Japannese), Duitsers en Italianers. Die amptelike taal is Portugees. Veral in die stede is dit opvallend dat die groepering van verskeie volke behoue bly. Hiervan is die Japannese die beste voorbeeld. Ten spyte hiervan beskou alle inwoners van Brasilië hulleself as Brasilianers, en elkeen aanvaar die ander as sulks.

Die gesinne is groot. Die gemiddelde gesin bestaan uit sewe of agt lede. Die man is hoof van die gesin,

R

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Die gesinne is groot. Die gemiddelde gesin bestaan uit sewe of agt lede. Die man is hoof van die gesin,

My rede is:

OUDERDOM: ☐ SEUN/DOGTER ☐

The material used in the Scanning Test.

"Wel," sê die ander een, "hy sal ten minste lekker slaap vannag. Hulle sal hom nie voor môre uit die brandkas haal nie. Dan sit ons veilig in 'n speel ander land."

"Wat, moenie grootpraat nie," speel sê die eerste een. "Ons moet nog in die kloof gaan land. Dalk kry ons nog 'n ongeluk."

"Nee wat," sê sy maat, "dit is nie so gevaarlik nie. Ons het dit mos dikwels vantevore al gedoen."

Na 'n rukkie hoor Herman weer die een speel sê: "Ek hoop nou maar ons goud en diamante is nog veilig in die grot. Sê nou iemand het dit daar ontdek en weggeneem!"

"Nee wat!" antwoord die ander een, "daar kom nooit iemand in die speel kloof nie. Die grot is buitendien so goed soos 'n brandkas. Niemand sal ooit goud en diamante daar gaan soek nie."

Arme Herman! Dit is mos rowers dié. Wat moet van hom word as hulle vir hom ontdek?

R

"Wel," sê die ander een, "hy sal ten minste lekker slaap vannag. Hulle sal hom nie voor môre uit die brandkas haal nie. Dan sit ons veilig in 'n speel ander land."

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My rede is:

APPENDIX H

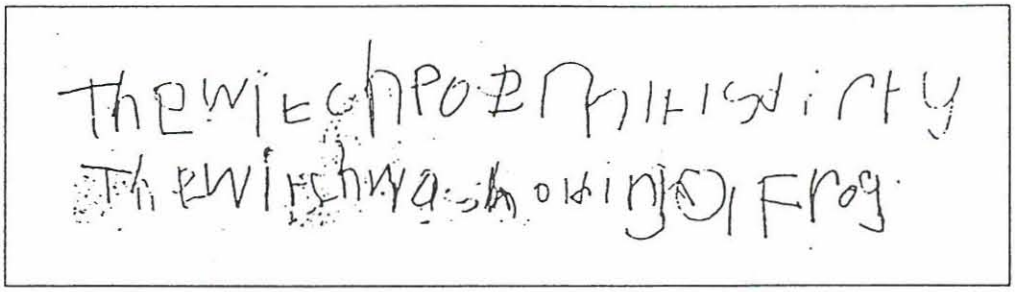
INFORMATION ON THE SASSOON TYPEFACE.

CONTENTS.

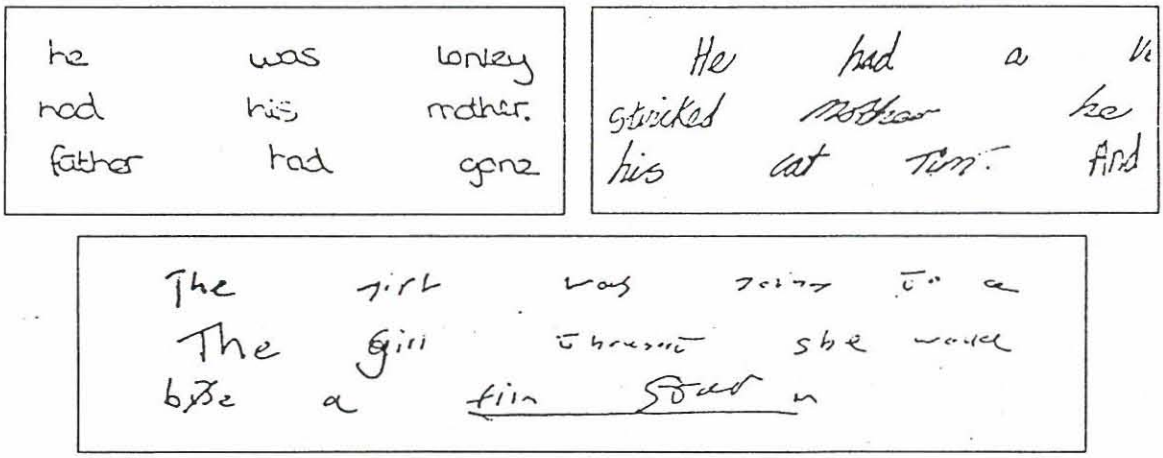
This is the st[illegible]ypeface with a specific purpose; to help children in Primary education.

What can we learn about typography from handwriting? We started to ask this and many other key questions.

Children with learning difficulties often have trouble spacing their handwriting. Their words are either run together or they are spaced much too wide apart.



An eight year old with severe learning difficulties runs all his words together.



Secondary school children's writing showing wide word spacing.

When they are asked why they space their words so far apart they usually reply "Because it is easier to read". This raises the question "Would wider spacing in early reading books help these children to learn more easily?" As a start it seemed a good idea to ask the children what <u>they</u> find easiest to read.

This pilot project is the first of several being undertaken in different parts of the country. Each project asks slightly different questions. Initially we are trying to find out:

1. How much children notice about the variations in typefaces and the spacing used.
2. What they like.
3. Which factors improve their reading performance (accounting for age).

It needs skilled remedial teachers with a detailed knowledge of their pupils to assess these factors. It takes a long time too!

Without going into all haps the most surprising thing was how much they DID notice the differences. They had marked individual preferences with the four typefaces offered and the four kinds of word spacing used.

Of the 16 different combinations the children were offered the general favourite seemed to be the unjustified, double word space given to the slanted sans serif typeface.

The features we have used in our typeface are:

1. The slight slant
2. The clarity of sans serif

Certain features that should improve legibility were included:

1. We increased the ascenders
2. We increased the weight slightly
3. We made careful specifications for both letterspace and wordspace
4. We have some pointers for the use of linespace

He was right out of the water and away from the waves and he lay still. He rolled on to his back, and lay very still. He lay there for a long time. He blew and puffed, and lay there on the sand. And as he lay there, the wind blew more softly and the clouds began to blow away. There was a little blue sky. The sun began to shine a little.

The example shows the 18pt type with letterspace a little 'open', word space is double and there is an additional 12 pts of leading. We recommend this combination to promote easy legibilty, adjusted at different point sizes.

There are many factors that affect legibility. The fashion today in typography is for large x height and short ascenders and descenders. The word spacing is tight.

These points are unlikely to trouble literate adults. It is quite a different matter for those who are struggling to learn to read or anyone with limited vision.

Children with learning difficulties may show through their handwriting that they have trouble in telling where one word ends and another begins. The wider word spacing that we suggest along with the carefully worked out letterspacing should go further still to promote easy legibility.

The next feature of th child orientated characteristic. We have included what type design rminal strokes. Teachers might be more used to thinking of them as exit strokes. These terminals have a dual purpose in our typeface:

1. They help to group the letters together into words even when well spaced; they perform much the same function as the serif does for adults along the baseline.
2. For children our 'exits' have another function; they make the bridge between reading and writing.

This second point needs enlarging. It has been thought necessary to teach children letters resembling the sans serif letters in their first reading books. For far too long therefore our children have been taught what is usually called print-script. These are static letters and a change of movement has been needed before joining could take place. Now things are changing. More and more teachers are beginning to recognise the importance of those exit strokes on the first letters that children learn.

Teachers find that children learn to read in several ways. They often learn faster when they are taught to recognise short words rather that separate letters. The Sassoon Primary typeface with its exit strokes at the base will help to clump the letters of a word together without actually joining them. With these features we hope to have improved the reading quality of the text, with a new typeface that uses letterforms that will be close to those that children are being taught to write.

In this way not only is the link forged between reading and writing, but the emphasis on exit strokes should lead to spontaneous baseline joins and a smooth progression towards an efficient and mature handwriting.

Since the typeface has been produced we have also suggested that it can be put to further use, because of its clarity, to typeset books for the partially sighted. We expect that many more uses can be found for these innovative letters that combine child-orientated "friendliness" with functional legibility.

APPENDIX I

THE U.C.T. SPEED READING AND WORD RECOGNITION TESTS.

CONTENTS.

Central University of Technology, Free State

The *U.C.T Speed Reading Test.*

die	en	nie	het	'n	pas	ken	oop	lig	vas
van	is	in	ek	dit	kos	lag	bo	vat	eet
te	hy	sy	wat	om	wit	uur	min	nag	wal
vir	was	dat	op	ons	vol	dra	oud	vyf	oog
my	sal	met	as	u	wet	lug	ne	rus	vel
so	aan	toe	kan	jy	mee	ewe	los	ter	ryk
nou	sê	dan	na	kom	vet	lus	eer	ses	arm
hom	ook	by	nog	of	hoe	lei	rug	bed	kar
al	jou	uit	net	se	tel	son	dam	pos	vry
wil	een	oor	tot	ou	rol	jul	wis	nat	fyn
hoe	tog	sou	sit	kyk	ruk	nes	hek	bou	dik
ja	gee	kry	dis	bly	lid	hof	wa	pad	eis
oom	kon	vra	af	hou	vee	wol	ore	ly	dog
tyd	dag	hul	man	nee	nek	sin	tye	myl	sag
weg	lê	lyk	mos	gou	Mei	dak	ete	lui	mis
hê	dus	wie	ma	ag	lyn	pyp	tak	erg	bad
wou	wel	dae	reg	mag	bak	bek	dek	elk	gek
pa	val	oë	eie	wag	had	jas	kat	lae	dig
pad	end	glo	per	wys	bes	gat	hen	kis	lam
ten	ver	ry	kop	sak	bid	dik	hol	kla	las

Central University of Technology, Free State

The *U.C.T. Word Recognition Test.*

op	in	se	ek	hy
ons	vir	toe	net	die
ou	af	bly	nog	vra
uit	te	wei	skrik	brief
nooit	mense	kuier	gestel	nuwe
baie	eier	veral	gesels	mevrou

liddoring	aanraking	klimaat	hemele	eenvoudige
skildery	lewende	menigte	beoog	beduie
sekere	sowel	begroting	persentasie	poging
hopelik	nederige	tariewe	wetsontwerp	geledere
wemelende	pastorie	omredelik	oorsese	prokureur
oorweging	leningsrekening	gekonsentreer	begerige	omgewing
kwoteer	wesentjies	aarselende	naturel	miserabel
mymerend	simpatie	sedert	argivaris	vereiste

munisipaliteit	nomineer	parodiek	departementele	verveling
redeneer	deklarasie	formule	meerderes	verordeninge
vergesel	mediese	gaoties	ideëel	karikatuur
suspisieus	harmonium	netelige	amendement	eksegese
ongeëwenaard	wysgerige	beëdigd	winsgewende	naïwiteit
geaffilieerde	unaniem	trigonometrie	unaniem	trigonomotrie
monargie	isometries	isolasionisme	koëffisiënt	genealogie
geologies	paleontologie	chauvenisme	pseudoniem	psigoanalise

Central University of Technology, Free State

APPENDIX J

PERMISSION TO DO RESEARCH IN PRIMARY SCHOOLS.

CONTENTS.

Central University of Technology, Free State
DEPARTEMENT VAN ONDERWYS EN KULTUUR
DEPARTMENT OF EDUCATION AND CULTURE

ADMINISTRASIE: VOLKSRAAD
ADMINISTRATION: HOUSE OF ASSEMBLY

ORANJE-VRYSTAATSE ONDERWYSDEPARTEMENT
ORANGE FREE STATE EDUCATION DEPARTMENT

Navrae: C.P. Cilliers
Enquiries:
Verw.: O.1/11/3/3
Ref.: 4074065
Tel.: (051) 47-2211

C R Swartgebou
C R Swart Building
Posbus 521
P.O. Box 521
Bloemfontein
9300

4 Februarie 1991

Mnr. R.W. de Lange
Gasconysingel 76
Helicon-hoogte
BLOEMFONTEIN
9301

Geagte mnr. De Lange

NAVORSINGSPROJEK RAKENDE LEESBAARHEID VAN VERSKILLENDE LETTERTIPES WAARIN ONDER MEER SKOOLHANDBOEKE GEDRUK IS

1. U skrywe van 29 November 1990 het hierop betrekking.

2. Toestemming word hiermee aan u verleen om drie kort leestoetse deur tussen 130 en 170 leerlinge in sub B, st. 2 en st. 4 van 6 Bloemfonteinse laerskole te laat afneem. Die volgende voorwaardes is van krag:

2.1 U moet self alle reëlings met die skole, onderwysers en leerlinge tref.

2.2 Geen skoolhoof, onderwyser of leerling is verplig om aan die navorsing deel te neem nie.

2.3 Geen inligting of kommentaar oor die navorsing mag sonder toestemming van die Uitvoerende Direkteur aan die media bekend gemaak word nie.

2.4 Alle inligting moet streng vertroulik gehanteer word. Skole en respondente se name mag nie in die verhandeling wat op die navorsing volg, genoem word nie en deelnemers aan die navorsingsprojek moenie geïdentifiseer kan word nie.

2.5 Geen inbreuk mag op skoolbedrywighede gemaak word nie.

2.6 Ná voltooiing van die navorsing moet 'n afskrif van die bevindinge aan die OVS Onderwysdepartement geskenk word. Indien 'n opsomming nie reeds daarby ingesluit is nie, moet 'n afsonderlike opsomming (nie langer nie as 2-3 bladsye) van die vernaamste bevindinge en aanbevelings saam met die voltooide bevindinge gestuur word.

2.7 'n Afskrif van hierdie brief moet aan skoolhoofde van skole waar navorsing gedoen word, getoon word.

2.8 Voordat met die navorsing begin word, moet u skriftelik teenoor die Departement bevestig dat al die voorwaardes aanvaar word.

3. U word welslae met u navorsing toegewens.

J.C. Pretorius

UITVOERENDE DIREKTEUR : ONDERWYS

asr/cpcilbr

Central University of Technology, Free State
DEPARTMENT VAN ONDERWYS EN KULTUUR
DEPARTMENT OF EDUCATION AND CULTURE
ADMINISTRASIE: VOLKSRAAD
ADMINISTRATION: HOUSE OF ASSEMBLY
ORANJE-VRYSTAATSE ONDERWYSDEPARTEMENT
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C R Swartgebou
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9300

27 Junie 1991

Mnr. R.W. de Lange
Gasconysingel 76
Heliconhoogte
BLOEMFONTEIN
9301

Geagte mnr. De Lange

NAVORSINGSVERSOEK: LEESBAARHEID VAN VERSKILLENDE LETTERTIPES

1. U skrywe van 21 Junie 1991 het hierop betrekking.

2. Goedkeuring word hiermee aan u verleen om nog vier primêre skole in Bloemfontein se skoolhoofde te nader om drie soekleestoetse deur 30 tot 40 st. 2- en/of st. 4-leerlinge by elke skool te laat aflê.

3. Die volgende voorwaardes is van krag:

3.1 U moet self alle reëlings met die skole en leerlinge tref.

3.2 Geen skoolhoof of leerling is verplig om aan die navorsing deel te neem nie.

3.3 Geen inligting of kommentaar oor die navorsing mag sonder toestemming van die Uitvoerende Direkteur aan die media bekend gemaak word nie.

3.4 Alle inligting moet streng vertroulik gehanteer word. Skole en respondente se name mag nie in die verhandeling wat op die navorsing volg, genoem word nie en deelnemers aan die navorsingsprojek moenie geïdentifiseer kan word nie.

3.5 Geen inbreuk mag op skoolbedrywighede gemaak word nie.

3.6 Ná voltooiing van die navorsing moet 'n afskrif van die bevindinge aan die OVS Onderwysdepartement geskenk word. Indien 'n opsomming nie reeds daarby ingesluit is nie,

moet 'n afsonderlike opsomming (nie langer nie as 2 - 3 bladsye) van die vernaamste bevindinge en aanbevelings saam met die voltooide bevindinge gestuur word.

3.7 'n Afskrif van hierdie brief moet aan skoolhoofde van skole waar navorsing gedoen word, getoon word.

3.8 Voordat met die navorsing begin word, moet die navorser skriftelik teenoor die Departement bevestig dat al die voorwaardes aanvaar word.

4. U word welslae met u navorsing toegewens.

J.S. Strümpher

UITVOERENDE DIREKTEUR : ONDERWYS

asr/brcpcnav/12

Central University of Technology, Free State

ENT VAN ONDERWYS EN KULTUUR
DEPARTMENT OF EDUCATION AND CULTURE

ADMINISTRASIE: VOLKSRAAD
ADMINISTRATION: HOUSE OF ASSEMBLY

ORANJE-VRYSTAATSE ONDERWYSDEPARTEMENT
ORANGE FREE STATE EDUCATION DEPARTMENT

Navrae: C P Cilliers
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Bloemfontein 9300

22 April 1992

Mnr R W de Lange
Gasconysingel 76
Heliconhoogte
9301 BLOEMFONTEIN

Geagte mnr De Lange

DIE LEESBAARHEID VAN SANS SERIF-LETTERTIPES

U skrywe gedateer 21 April 1992 het hierop betrekking.

Ontvangs word hiermee met dank erken van die opsomming en kor verslag rakende die bevindinge van u navorsingstudie oo bogenoemde onderwerp.

Ons ontvang graag ná voltooiing ook u verhandeling, sodat dit aa die onderwyskorps in wyer verband beskikbaar gestel kan word.

Dit is ook aangenaam om u hiermee die nodige goedkeuring te laa verkry om u bevindinge met die oog op publikasie aan di Technikon se personeelblad, asook aan toepaslike vaktydskrifte voor te lê, met die voorwaarde dat individuele skole ni geïdentifiseer mag word nie.

Vriendelike groete

UITVOERENDE DIREKTEUR : ONDERWYS

Rig korrespondensie aan die Direkteur: Oranje-Vrystaatse Onderwysdepartement en meld verwysingsnommer
Address correspondence to the Director: Orange Free State Education Department and quote reference number

EDUCATION/ONDERWYS
FAX: (051) 304938

0.1/11/3/3

OVS ONDERWYSDEPARTEMENT

INLIGTINGSTUK RAKENDE VERSOEKE OM NAVORSING IN DIE VRYSTAATSE ONDERWYSDEPARTEMENT TE ONDERNEEM

1. INLEIDEND

Voornemende navorsers en nagraadse studente sal begrip daarvoor hê dat die belange van alle Vrystaatse ouers, leerlinge, onderwysers en departementele amptenare binne sy jurisdiksiegebied deur die OVS Onderwysdepartement beskerm moet word. Dit bring mee dat alle aansoeke om navorsing in die OVSOD te doen, noukeurig oorweeg moet word. Om te voorkom dat sodanige versoeke onvolledig ingedien word en oorweging van die aansoeke dus onnodig vertraag word, word die inligting hieronder tot beskikking van voornemende navorsers gestel.

2. AAN WIE NAVORSINGSVERSOEKE GERIG WORD

2.1 Die aansoeker moet uitdruklik meld of die aansoek by slegs een provinsiale onderwysdepartement of by meer as een ingedien is. Indien die navorsing slegs op die OVS Onderwysdepartement van toepassing is, moet alle versoeke skriftelik gerig word aan :

Die Uitvoerende Direkteur
OVS Onderwysdepartement
Posbus 521
BLOEMFONTEIN
9300

2.2 Waar daar meer as een provinsiale departement, of skole vir buitengewone onderwys, by die voorgenome navorsing betrokke is, word aansoeke gerig aan :

Die Voorsitter
Netwerkkomitee vir Navorsing
Departement van Onderwys en Kultuur
Administrasie: Volksraad
Privaatsak X55
PRETORIA
0001

Nadat beginselgoedkeuring in laasgenoemde geval verkry is, word die volledige aansoek, insluitend die vraelys en/of gestruktureerde onderhoud, tesame met

die toestemming die navorser aan die direkteur van elke betrokke onderwysdepartement gerig.

2.3 Wanneer instansies navorsing wil doen, geld die volgende prosedure:

* RGN-aansoeke word aan die Advieskomitee vir Onderwysnavorsing (AON) gerig.

* Alle ander instansies se aansoeke word aan die Netwerkkomitee vir Navorsing gerig.

3. WAT BY 'N AANSOEK INGESLUIT MOET WORD

Vier afsonderlike stukke moet ingesluit word:

* 'n aanbevelingsbrief van die studieleier;
* 'n volledige uiteensetting van die navorsingsprojek;
* die vraelys of beplanning van die onderhoud;
* 'n konsepbrief aan die skoolhoof.

3.1 In die aanbevelingsbrief bevestig die navorser se studieleier dat die aansoeker 'n ingeskrewe student aan die bepaalde tersiêre inrigting is. Die graad of diploma waarvoor die navorsing onderneem word, moet genoem word, asook enige ander ondersteunende inligting rakende die student en/of die navorsing.

3.2 In 'n volledige uiteensetting van die navorsingsprojek verstrek die aansoeker minstens die volgende gegewens:-

1. Titel (Mnr./Mev./Mej.), voorletters en van;
2. adres;
3. telefoonnommer gedurende kantoorure;
4. naam van universiteit/tersiêre inrigting;
5. graadkursus/diplomakursus;
6. naam van studieleier/promotor;
7. titel van skripsie/verhandeling/proefskrif/verslag;
8. bondige uiteensetting van die onderwerp;
9. doel met navorsing;
10. nut wat navorsing vir die OVS Onderwysdepartement kan hê;
11. volle besonderhede van die persone/groep by wie die navorsing onderneem word, byvoorbeeld geslag, standerd, ouderdomsgroep, taal, woongebied, getal wat by navorsing betrek sal word;
12. 'n presiese aanduiding van die inligting wat verlang word;
13. in watter kwartaal die navorsing onderneem en afgehandel sal word;
14. op watter wyse inligting verkry sal word, byvoorbeeld vraelys, onderhoud, gestandaardiseerde toetse;
15. of die ondersoek ná skoolure uitgevoer sal word;

16. hoeveel tyd d[illegible] duele leerkragte en/of leerlinge as respondente aan die navorsing bestee sal moet word.

3.3 Die volledige vraelys, indien van toepassing, of struktuur van die onderhoud soos goedgekeur deur die studieleier en presies soos dit deur die leerling/leerkrag ingevul moet word, moet ook die aansoek vergesel, asook

3.4 'n konsepbrief aan die skoolhoof waarin die aansoeker die skoolhoof se toestemming vra om in sy skool navorsing te onderneem.

4. VOORNEMENDE NAVORSERS WORD VRIENDELIK OP DIE VOLGENDE GEWYS:

4.1 Normaalweg sal navorsing gedurende die vierde kwartaal nie goedgekeur word nie.

4.2 Kwalifikasies van leerkragte en dosente word normaalweg nie aan navorsers verstrek nie.

4.3 Vrae aan respondente oor kontensieuse aangeleenthede, soos onder andere die ouers, ouerhuise, kerkverband en sedes, word normaalweg nie toegelaat nie.

4.4 Navorsing moet verkieslik ná skoolure gedoen word.

4.5 Vraelyste moet verkieslik in albei landstale wees as persone van albei landstale vir die projek genader word.

4.6 Departementele goedkeuring moet éérs verkry word voordat hoofde van skole en ander inrigtings gevra word of hulle met navorsing behulpsaam sal wees.

4.7 Hoofde van skole en ander inrigtings mag nie sonder die Departement se toestemming magtiging gee dat vertroulike inligting soos leerlinge se kumulatiewe verslagkaarte, IK's of ander persoonlike inligting vir navorsingsdoeleindes gebruik word nie. Alle toetse en prosedures wat die navroser wil toepas, moet in die aansoek genoem word.

4.8 Dit sal soms, veral by sensitiewe navorsing, nodig wees om ouers se skriftelike toestemming te verkry voordat navorsing by hulle kinders onderneem word. Die navorser moet self die toestemming van die betrokke ouers/voogde bekom.

4.9 Vraelyste moet verkieslik anoniem ingevul kan word en moet só opgestel word dat dit nie die Departement, ouers, leerlinge, of personeellede in enige opsig deur selfs net een vraag aanstoot gee of in die verleentheid stel nie. Sulke vraelyste is onaanvaarbaar vir die Departement.

4.10 Slegs vraelyste deur die studieleier goedgekeur is, moet aan die Departement voorgelê word.

4.11 Die Departement verskaf op versoek adresse van bepaalde skole, maar nie adresetikette nie.

4.12 Die taalkundige versorging en tipografiese uiteensetting van vraelyste bly die navorser se verantwoordelikheid en moet aan die Departement se vereistes voldoen.

4.13 Aansoekers moet die Departement 'n redelike tyd gun om die aansoek te oorweeg en aansoeke moet liewer te vroeg ingedien word.

4.14 Aansoeke sal soms met spesifieke bykomende voorwaardes goedgekeur word.

4.15 Navorsers moet so min tyd moontlik by onderwysinrigtings in beslag neem, aangesien die Departement moet toesien dat daar nie onredelike eise aan skool- en werksure gestel word nie.

4.16 Daar moet noukeurig op die implikasies van alle gebruiklike voorwaardes gelet word.

5. GEBRUIKLIKE VOORWAARDES WAT BY GOEDKEURING VAN ALLE NAVORSINGSVERSOEKE GELD:

5.1 Die navorser moet self alle reëlings met die skole, onderwysers en/of leerlinge tref.

5.2 Geen skoolhoof, onderwyser en/of leerling is verplig om aan die navorsing deel te neem nie.

5.3 Geen inligting of kommentaar oor die navorsing mag sonder toestemming van die Uitvoerende Direkteur aan die media bekend gemaak word nie.

5.4 Alle inligting moet streng vertroulik gehanteer word. Skole en respondente se name mag nie in die verslag, proefskrif, verhandeling of skripsie wat op die navorsing volg, genoem word nie en deelnemers aan die navorsingsprojek moenie geïdentifiseer kan word nie.

5.5 Geen inbreuk mag op skoolbedrywighede gemaak word nie.

5.6 Ná voltooiing van die navorsing moet 'n afskrif van die bevindinge aan die OVS Onderwysdepartement geskenk word. Indien 'n opsomming nie reeds hierby ingesluit is nie, moet 'n afsonderlike opsomming (nie langer nie as 2-3 bladsye) van die vernaamste bevindinge en aanbevelings saam met die voltooide bevindinge gestuur word.

5.7 'n Afskrif van [illegible] waarin toestemming tot navorsing verleen word, moet getoon word aan skoolhoofde van skole waar navorsing gedoen word.

5.8 Voordat met die navorsing begin word, moet die navorser skriftelik teenoor die Departement bevestig dat al die voorwaardes aanvaar word.

6. BYKOMENDE SPESIALE VOORWAARDES BY NAVORSINGSVERSOEKE VIR PRE-MAGISTER KWALIFIKASIES:

Navorsing vir pre-magister kwalifikasies is aan die volgende bykomende beperkings onderworpe:

6.1 'n Vraelys mag nie langer as tien minute neem om te voltooi nie.

6.2 Slegs onderwysers mag by ondersoeke betrek word en nie leerlinge nie.

6.3 Die navorser mag nie die volle skoollys gebruik om sy ewekansige trekking van skole te maak nie. Die soorte skole van die OVS sal vir navorsingsdoeleindes in twee groepe verdeel word en die navorsingsbeampte van die OVSOD sal 'n spesifieke groep aan 'n spesifieke navorser toewys.

Opgestel deur die OVS Onderwysburo.