

**A LOGICAL ANALYSIS OF SELECTED TEXTS IN NYANJA**

**By**



**Sande Ngalande**

THESIS  
M.A.  
NGH  
2007  
C.1

**A dissertation submitted in partial fulfilment of the requirements for the degree of  
Master of Arts in Linguistic Science**

**The University of Zambia**

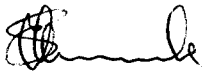
**LUSAKA**

**June 2007**

271251

## DECLARATION

I, Sande Ngalande, do hereby declare that this dissertation is my own work, and that it has not been submitted for a degree at this university or any other, and that it does not include any published work or material from another dissertation.

Signed.....

Date .....

© Sande Ngalande 2007. All rights reserved.

## CERTIFICATE OF APPROVAL

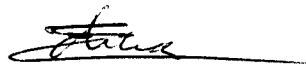
This dissertation of SANDE NGALANDE is approved as fulfilling in part the requirements for the award of the degree of Master of Arts in Linguistic Science of the University of Zambia.

Signed: 

Date: 5/7/07

Signed: 

Date: 5/7/07

Signed: 

Date: 6/7/07

## ABSTRACT

This study, *A Logical Analysis of Selected Texts in Nyanja*, applies logic to Nyanja as an African language. This is because most studies have concentrated on Western languages and only a few Asian languages. There is hardly any evidence of such studies on African languages, let alone Zambian languages.

The investigation was corpus-based and it dealt with five text types or genres; *conversation, novel, oral narrative, play, and proverb*. Data were collected from printed texts, notes and recordings that were done during the investigation. A desk study was employed in two phases. Phase one involved the extraction of data for analysis from the collected texts according to text types while phase two involved the analysis of all the collected data.

Both formal and informal logic were applied to the study during data analysis. A total of 545 syllogisms were crafted and categorised according to syllogism-type. Thereafter, logic patterns were observed within various text types and later in the entire data. The findings were then discussed according to specific genres and according to all genres as a collective corpus. From the discussion, conclusions and recommendations were made.

One of the major conclusions of the study was that, in actual practice, human beings use a much abbreviated system of logic. There was no syllogism that was found presented or used in its entirety from the premises to the conclusion. In fact, it was revealed that 80% of free communication or conversation was in form of conclusions which are actually an end product in the syllogism process. One of the marked conclusions was that life in general is one big syllogism. The most common syllogism type was Modus Ponendo Ponens (MPP). The next popular syllogism was the Hypothetical followed by Modus Tollendo Tollens (MTT). It was revealed that MTT is associated with critical or advanced thinking, MPP is associated with ordinary human thinking and the Hypothetical syllogism is associated with human experience. Based on the use of syllogisms a theory called *Character Assembling* was developed. The theory is designed

for use in literary criticism. It is a product of the relationship between logic and literary criticism.

The study makes recommendations on the following areas: Logic and other Academic Disciplines, the Character Assembling Theory, Logic and Various Variables, Logic and Grammar, Modal Logic, and the entire Investigation.

The entire work has been organised into six chapters. Chapter One introduces the investigation. Chapter Two gives an overview of logic as an academic discipline. The next chapter presents all the data that was collected. Chapter Four contains the findings of the study after the analysis of the data presented in Chapter Three. Chapter Five is the discussion of the findings and Chapter Six is used to draw conclusions and recommendations.

## **DEDICATION**

To my parents: Mr. Steven Ngalande and Mrs. Faith Ngalande.

## ACKNOWLEDGEMENTS

Many people, to whom I am forever thankful, contributed to the successful completion of this investigation. Of these, I would like to make special mention of Professor Vincent Musamba Chanda (PhD), my academic supervisor, who guided me throughout the work. He also gave me unlimited access to his personal library resources including textbooks used in this work.

Many thanks to Dr. John Simwinga for his moral, spiritual and technical support as well as for kindly allowing me to use his computers and office throughout my work.

I am indebted to my cousin Dr. Judith Lungu and family for their wonderful and unwavering support throughout my work. Thanks also to all my family members who encouraged me and prayed for me.

Most of all, I am eternally grateful to God who granted me both good health and the intellectual capacity required to complete the work.

## TABLE OF CONTENTS

Declaration .....	ii
Certificate of Approval .....	iv
Abstract .....	v
Dedication .....	vii
Acknowledgements .....	viii
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.0 General Introduction .....	1
1.1 Background .....	1
1.2 Nyanja .....	2
1.2.1 Nyanja in Guthrie’s Classification of Bantu Languages .....	4
1.2.2 Greenberg’s Classification of African Languages .....	4
1.3 Statement of the Problem .....	4
1.4 Rationale .....	4
1.5 Significance of the Study .....	5
1.6 Objectives .....	5
1.7 Methodology .....	5
1.7.1 Data Collection .....	6
1.7.1.1 Sources .....	6
1.7.1.2 Techniques of Data Collection .....	7
1.7.1.3 Data Arrangement .....	7
1.7.2 Data Analysis .....	8
1.7.2.1 Theoretical Framework .....	8
1.7.2.2 Procedure of Analysis .....	8
1.8 The Scope and Limitations of the Study .....	9
1.8.1 Scope .....	9
1.8.2 Limitations .....	9
1.9 Ethical matters .....	10
1.10 Literature Review .....	10
1.10.1 Genesis of Logic as a Discipline .....	11
1.10.2 Logical Analysis .....	11
1.10.3 Sentential Logic .....	17
1.10.4 Aristotelian and Formal Logic .....	18
1.10.4.1 Aristotelian Logic .....	18
1.10.4.2 Formal Logic .....	19
1.10.4.2.1 Simple Apprehension .....	19
1.10.4.2.2 Judgment .....	19
1.10.4.2.3 Reasoning .....	20
1.10.5 Logical Syntax .....	21
1.10.6 Deduction .....	21
1.10.7 Predicate Logic .....	22
1.10.8 On the Metalanguage of Logic .....	25
1.10.9 Logic and Language .....	26
1.10.10 Set Theory .....	27
1.10.11 Language-games .....	27

1.10.12	Philosophical Logic	28
1.10.13	Philosophy and Linguistics	31
1.11	Conclusion	32

**CHAPTER TWO: LOGIC AS AN ACADEMIC DISCIPLINE .....33**

2.0	Introduction	33
2.1	On the Definition of Logic	33
2.2	Argument	34
2.2.1	Statement	34
2.2.2	Premise	35
2.2.3	Conclusion	35
2.2.4	Validity and Soundness	35
2.2.5	Strength and Cogency	37
2.2.6	Syllogism	39
2.2.7	Fallacy	40
2.2.8	Enthymeme	40
2.3	Propositional Logic	40
2.3.1	Some Argument Forms	41
2.3.1.1	Modus Ponendo Ponens (MPP)	41
2.3.1.2	Modus Tollendo Tollens (MTT)	41
2.3.1.3	Denying the Antecedent	42
2.3.1.4	Affirming the Consequent	42
2.3.1.5	Hypothetical Syllogism	43
2.3.1.6	Disjunctive Syllogism	44
2.3.2	Logical Connectives	44
2.3.2.1	Implication	45
2.3.2.2	Conjunction	45
2.3.2.3	Disjunction	46
2.3.2.4	Negation	47
2.3.2.5	Disjunction and Negation	48
2.3.2.6	Equivalency	48
2.3.2.7	Exportation	50
2.3.2.8	Importation	51
2.3.3	Formulae	51
2.4	Predicate Logic	52
2.4.1	Predicates	52
2.4.2	Quantifiers	53
2.4.2.1	Existential Quantifiers	54
2.4.2.2	Universal Quantifiers	54
2.4.3	Arguments in Predicate Logic	54
2.5	Logic and Language	55
2.5.1	Natural Language	55
2.5.2	Natural Logic	56
2.5.3	Formal Language	56
2.6	Scope of Logic	57
2.6.1	Deductive logic	57
2.6.2	Inductive Logic	57

2.6.3	Formal Logic	58
2.6.4	Informal Logic	58
2.7	Logical Analysis	58
2.8	Other Types of Logic	59
2.8.1	Aristotelian Logic	59
2.8.2	Modern Logic	59
2.8.3	Modal Logic	59
2.8.4	Dialectical Logic	60
2.8.5	Mathematical Logic	61
2.8.6	Philosophical Logic	61
2.8.7	Logic and Computation	61
2.9	Some Common Modal Verbs in Nyanja	61
2.10	Some Important Names in Logic	62
2.10.1	Aristotle	62
2.10.2	Rudolf Carnap	63
2.10.3	Boethius	63
2.10.4	Bertrand Russell	64
2.10.5	Ludwig Wittgenstein	64
2.10.6	Petrus Ramus	65
2.10.7	Gottlob Frege	65
2.10.8	Benedetto Croce	66
2.10.9	Gottfried Wilhelm Leibniz	66
2.11	Definitions of Some Relevant Terms	67
2.11.1	Argument	67
2.11.2	Conclusion	67
2.11.3	Deduction	67
2.11.4	Enthymeme	67
2.11.5	Inference	68
2.11.6	Premise	68
2.11.7	Proposition	68
2.11.8	Rhetoric	68
2.11.9	Sophism	68
2.11.10	Syllogism	68
2.11.11	wff	68
2.12	Conclusion	69
<b>CHAPTER THREE: DATA</b>		<b>70</b>
3.0	Introduction	70
3.1	Conversation	70
3.2	Novel	74
3.3	Oral Narrative	92
3.4	Play	133
3.5	Proverb	155
3.6	Conclusion of Chapter	157
<b>CHAPTER FOUR: FINDINGS</b>		<b>158</b>
4.0	Introduction	158

4.1	Conversation .....	158
4.1.1	Syllogism for Conversation .....	158
4.1.2	Statistics for Conversation .....	166
4.2	Novel .....	168
4.2.1	Syllogism for Novel .....	168
4.2.2	Statistics for Novel .....	172
4.3	Oral Narrative .....	174
4.3.1	Syllogism for Narrative .....	174
4.3.2	Statistics for Narrative .....	186
4.4	Play .....	188
4.4.1	Syllogism for Play .....	188
4.4.2	Statistics for Play .....	193
4.5	Proverb .....	195
4.5.1	Syllogism for Proverb .....	195
4.5.2	Statistics for Proverb .....	208
4.6	Summary .....	210
4.7	Conclusion .....	213

**CHAPTER FIVE: DISCUSSION OF FINDINGS .....** **214**

5.0	Introduction .....	214
5.1	Discussion .....	214
5.1.1	Conversation .....	215
5.1.1.1	Major Category .....	215
5.1.1.2	Premise .....	215
5.1.1.3	Minor Category .....	216
5.1.1.4	Case Study .....	217
5.1.1.5	Conclusion .....	219
5.1.2	Novel .....	219
5.1.2.1	Major Category .....	219
5.1.2.2	Premise .....	220
5.1.2.3	Minor Category .....	221
5.1.2.4	Case Study .....	221
5.1.2.5	Conclusion .....	223
5.1.3	Oral Narrative .....	223
5.1.3.1	Major Category .....	223
5.1.3.2	Premise .....	224
5.1.3.3	Minor Category .....	224
5.1.3.4	Case Study .....	225
5.1.3.5	Conclusion .....	226
5.1.4	Play .....	226
5.1.4.1	Major Category .....	226
5.1.4.2	Premise .....	227
5.1.4.3	Minor Category .....	227
5.1.4.4	Case Study .....	229
5.1.4.5	Conclusion .....	230
5.1.4.5.1	Character Assembling .....	230
5.1.4.5.2	Character Maintenance .....	231

5.1.4.5.3	Character Development	231
5.1.4.5.4	Character Assassination	233
5.1.4.5.5	Summary of the Theory	234
5.1.5	Proverb	234
5.1.5.1	Major Category	235
5.1.5.2	Premise	235
5.1.5.3	Minor Category	235
5.1.5.4	Case Study	236
5.1.5.5	Conclusion	240
5.1.6	Summary Discussion	240
5.1.6.1	Major Category	240
5.1.6.2	Premise	241
5.1.6.3	Minor Category	242
5.1.6.4	Case Study	242
5.2	Summary	244

**CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS .....245**

6.0	Introduction	245
6.1	Conclusion	245
6.1.1	The Relationship between Logic and Human Experience and Tradition	246
6.1.2	The Relationship between Premise and Syllogism	247
6.1.3	The Nature of Human Logic	247
6.1.4	The Relationship between Logic and genre	247
6.1.5	Logic and Literary Criticism	249
6.1.6	Summary of Conclusions	249
6.2	Recommendations	250
6.2.1	On the entire Investigation	250
6.2.2	On Modal Logic	250
6.2.3	On Logic and Grammar	250
6.2.3.1	Logic and Syntax	251
6.2.3.2	Logic and Semantics	251
6.2.3.3	Logic and Morphology	251
6.2.4	On Logic and Various Variables	252
6.2.4.1	Logic and Gender	252
6.2.4.2	Logic and Age	252
6.2.4.3	Logic and Geography	252
6.2.4.4	Logic and Social, Economic and Political Status	252
6.2.5	On the Character Assembling Theory	252
6.2.6	On Logic and other Academic Disciplines	252
6.2.6.1	Law	252
6.2.6.2	Religion	252
6.2.6.3	Psycho-Social Counseling	253
6.2.6.4	Political Science	253
6.2.6.5	Education	253
6.3	Finale	253

**BIBLIOGRAPHY .....254**

**List of Maps**

Chapter One  
Main Language Divisions in Zambia .....3

**List of Figures**

Chapters One and Two  
Figure 1: Validity and Soundness .....37  
Figure 2: Strength and Cogency .....39  
Figure 3: Modal Logic .....60

Chapter Five  
Figure 1: Character Assembling .....234  
Figure 2: A Type of Louse .....238

**List of Charts**

Chapter Four  
Chart 1: Major Category - Conversation .....167  
Chart 2: Premise - Conversation .....167  
Chart 3: Minor Category - Conversation .....168  
Chart 4: Major Category - Novel .....173  
Chart 5: Premise - Novel .....174  
Chart 6: Minor Category - Novel .....174  
Chart 7: Major Category - Narrative .....187  
Chart 8: Premise - Narrative .....187  
Chart 9: Minor Category - Narrative .....188  
Chart 10: Major Premise - Play .....194  
Chart 11: Premise - Play .....194  
Chart 12: Minor Category - Play .....195  
Chart 13: Major Category - Proverb .....209  
Chart 14: Premise - Proverb .....209  
Chart 15: Minor Category - Proverb .....210  
Chart 16: Major Category - Summary .....212  
Chart 17: Premise - Summary .....212  
Chart 18: Minor Category - Summary .....213

Chapter Five  
Chart 1: Minor Category - Character .....228

**List of Tables**

Chapter Four  
Table 1: Syllogism for Conversation .....158  
Table 2: Conversation Statistics .....166  
Table 3: Syllogism for Novel .....168  
Table 4: Novel Statistics .....172  
Table 5: Syllogism for Narrative .....174

Table 6: Narrative Statistics .....	186
Table 7: Syllogism for Play .....	188
Table 8: Play Statistics .....	193
Table 9: Syllogism for Proverb - Primary .....	195
Table 10: Syllogism for Proverb – Secondary .....	202
Table 11: Proverb Statistics .....	208
Table 12: Summary - All Genres .....	210
Table 13: Summary - All Genres: in Percentage .....	211

## Chapter Five

Table 1: Statistics According to Character .....	227
--	-----

## CHAPTER ONE

### INTRODUCTION

#### 1.0 General Introduction

This chapter introduces the investigation entitled *A Logical Analysis of Selected Texts in Nyanja*. It begins by giving the background to the investigation. Since the investigation is on Nyanja, a section has been devoted to giving information about Nyanja. Thereafter, the problem of the investigation is stated, which is followed by the rationale of the research. The significance and the objectives of the study are also presented in this chapter. These are followed by the methodology of the investigation which is dealt with in two major parts: one part discusses the methodology involved in data collection and the other deals with the methodology and theoretical framework used in the data analysis phase. Next, the scope and limitation of the study are discussed, followed by a discussion of ethical issues encountered during the investigation. The last part of the chapter presents a review of relevant literature and is followed immediately by a section that concludes the chapter.

In this study except for direct quotations from written texts, the orthography used is what is referred to as Standard Nyanja by the *1977 Zambian Languages Orthography Approved by the Ministry of Education*. Tone has not been transcribed and marked except in direct quotations and is not part of the analysis although it can also have its own implications on logic.

#### 1.1 Background

Logic has remained one of the most intriguing and significant areas of scholarly investigations for almost all centuries. It has in fact been acknowledged since the time of Aristotle, one of the great philosophers, that logic has a part to play in general education. Thus before embarking on the study of any science, social or natural, Aristotle, according to *The Encyclopaedia Britannica* (1981 Vol. 11), thought that one should receive some training in logic. Today, centuries later, logic is taught at many a university and it is for many educational programmes a compulsory subject. *The Encyclopaedia Britannica* (1981 Vol.11) acknowledges that logic is gradually taking over the role that

the study of classical languages used to play in general instruction. It goes further to emphasise that for better understanding of the working of one's native language, the study of logic is as helpful as the study of Latin grammar upon which most linguistic thinking is traditionally based. Most of the studies in logic have, however, been in the area of philosophy where the subject has been widely explored. Although Plato and Aristotle did some studies that almost directly related logic to linguistics, it is only recently, towards the beginning of the 20<sup>th</sup> century, that the influence of logic on linguistics has been investigated. Much more needs to be done in logic as it more relevantly relates to linguistics. In fact, semantics, an area not as well studied as other levels of linguistic analysis, is directly related to logic. The knowledge about the influence of logic on semantic interpretation would help linguists to study the semantics of any language more satisfactorily.

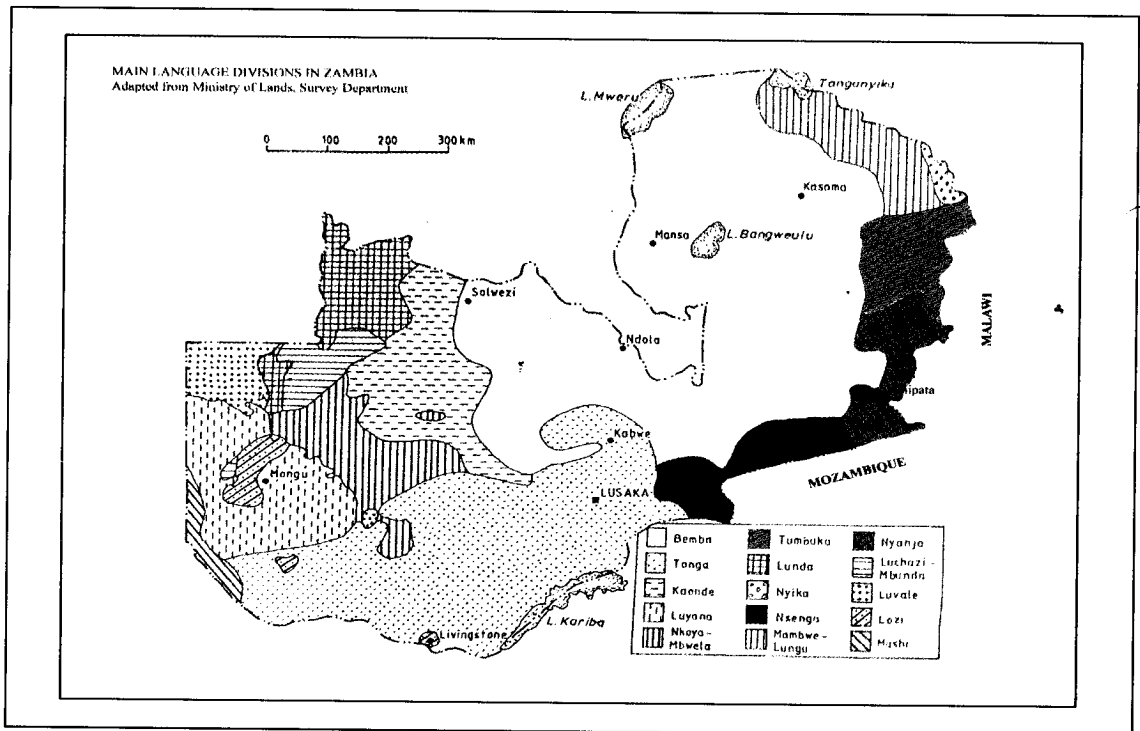
Even though there have been many studies in logic for many centuries, most of these studies have been done in Western countries with a few in Asia, specifically in China and India. Apart from some studies in African rhetoric there has hardly been any attempt to apply studies in logic to African languages. This research is therefore an attempt at contributing to semantics through the study of logic as well as applying logic to African languages particularly the Nyanja of Zambia. The scope of the investigation is discussed in Chapter two.

Considering that logic as a field of study is relatively new in this part of Africa, Chapter Two discusses the subject in some detail in order to introduce the discipline in an elementary manner. The chapter also provides an operational definition of the term 'logical analysis' as used in the present study.

## **1.2 Nyanja**

Nyanja is one of the languages spoken in the Eastern Province of Zambia. In essence, there is not such a language as Nyanja or a speech community referred to as Nyanja. What is known as Nyanja, referred to and spelt as 'Cinyanja' or 'Chinyanja', is Chewa (Cichêwa), a native language of the Chewa people of Katete District whose Paramount

Chief is Gawa Undi. In this dissertation ‘Nyanja’ will still be used as a synonym of ‘Chewa’. However ‘Nyanja’ will not include what is referred to as ‘Nyanja’ in Lusaka. A section of speakers in Lusaka speak some form of a lingua franca that has a reasonable vocabulary from Chewa and which is called ‘Cinyanja’. Nyanja is also spoken in other districts in Eastern Province. These include the districts neighbouring Katete namely Mambwe, and Chipata. Others are Petauke, Lundazi, and Chadidza. Nyanja is also spoken in Zambia’s neighbouring countries, particularly Malawi and Mozambique. The following map shows where Nyanja is spoken in the Eastern Province.



When Zambia attained independence in 1964, it was faced with the challenge of adopting a National Official Language. Given the complexity of its multilingual situation, the country adopted English as the National Official Language and language of instruction in education. In addition, seven indigenous languages were designated as Regional Official Languages by province. These included Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja, and Tonga. Nyanja was chosen for the Eastern and Lusaka regions. As a result, Nyanja has assumed the status of Regional Official Language. It is taught as a subject in some schools; used as language of instruction in lower grades, as lingua franca

in church, traditional and political gatherings and is employed as the language of mass communication in both the national and private media.

### **1.2.1 Nyanja in Guthrie's Classification of Bantu Languages**

According to Guthrie's classification of Bantu languages, Nyanja falls under Zone N which is made of four groups, namely 10, 20, 30 and 40. Nyanja belongs with Group 30 as a dialect cluster called N31. There are three dialects, namely Nyanja, Cewa, and Manganja identified as N31a, N31b, and N31c respectively. The Nyanja used in this study is a combination of Nyanja (N31a) and Chewa (N3b) also spelt as 'Cewa'.

### **1.2.2 Greenberg's Classification of African Languages**

Greenberg has classified Nyanja as falling under the Niger-Kordofanian Family of African languages. Within the family Nyanja falls under the Niger-Congo branch and Benue-Congo group. Within the Benue-Congo group it falls under the Bentoid Sub group called Bantu. Nyanja is therefore a Bantu language.

## **1.3 Statement of the Problem**

Current investigations in logic are mostly done on Western languages. These studies have been conducted over centuries. There is, however, hardly any evidence of studies in logic carried out on African languages let alone Zambian languages. In this manner, theories in logic have been a product of various investigations of Western languages particularly English. Thus, an evident information gap exists regarding logic and African languages. As a consequence, this study undertakes to apply theories of logic to African languages focussing on some selected texts in Nyanja of Zambia. It is an attempt at observing how formal systems of logic work in Nyanja.

## **1.4 Rationale**

Logic is a very essential area in linguistics and every linguist ought to have some insight into the subject. Linguists consciously or, usually, unconsciously do use logic in their studies. The popular Chomsky's "Syntactic Structures" is said to be based on logic. In fact, with logic, it is easier to deal with semantics, an area that is not distinctly specified

in grammars. This study has not only initiated logical studies on Zambian languages, but also made an attempt at both specifying logic peculiar to Zambian languages and at marking a path towards discovering 'Zambian Logic' and eventually 'African Logic.'

### **1.5 Significance of the Study**

The study is significant in being an inaugural investigation into the application of formal logic to Zambian languages. It has provided the basis for further research in logic and Zambian languages. It provokes enough questions to motivate scholars into embarking on such studies. The study, as will be shown, identifies logic as an essential tool in literary criticism and discourse analysis.

### **1.6 Objectives**

The general objectives of the study are as follows:

- a. To analyse the kind of systems of logic found in selected texts in Nyanja.
- b. To find out the extent to which certain systems of logic can be regarded as peculiar to Nyanja as opposed to English.
- c. To find out how much logic can be of help to the linguistics of Zambian languages.

The Specific objectives of the study are as follows:

- a. To categorize the kind of syllogisms and systems of logic in the selected Nyanja texts.
- b. To ascertain the contribution of Zambian culture to logic in Nyanja.
- c. To find out whether certain systems of logic are text specific.
- d. To describe in some level of detail the logical component of the grammar of Nyanja.
- e. To observe how deduction and syllogism work in Nyanja.

### **1.7 Methodology**

The research involved both qualitative and quantitative methods in both data collection and data analysis. The qualitative methods were essential in exploring logic in the text

and the quantitative methods, or a combination of the two, were essential in interpreting trends and making comparisons within and between genres.

A corpus-based approach was used. Several data in the form of texts both written and spoken were collected. An attempt was made to have as exhaustive a list as possible according to different genres. The type of text and/or genre, therefore, served as the criterion for selection of texts. Thus, sampling was in this case not necessary. Text-types included the novel, play, proverb, conversation, newspaper article, and miscellaneous literature in prose.

### **1.7.1 Data Collection**

Initially the research was designed to collect some of its data from Katete District where the Chewa speaking people, who are sometimes referred to as Nyanja speakers, live. Considering that (a) the project was funded very late by the sponsor, The University of Zambia and (b) that the data collected from general literature and Nyanja speakers was enough to analyse, the Katete mission was cancelled.

Given that the researcher was also a Nyanja speaker, some of the data was a product of introspection. Quite a good amount of information was collected on a notepad as the researcher observed some interesting syllogisms being used by people in general.

#### **1.7.1.1 Sources<sup>1</sup>**

Sources of materials included libraries, the public and private media, textbooks, individuals, and the general public. Specific materials collected included the following:

1. *Zomfula*, a novel.
2. *Pali Imfa Pali Mabvuto*, a play.
3. *Poceza M'madzulo*, a collection of oral narratives.
4. *Nzeru Zakale*, a collection of proverbs.
5. *Wisdom of the People*, a collection of proverbs.

---

<sup>1</sup> Full information about the texts appears in the Bibliography.

Any unspecified<sup>2</sup> material with texts of Nyanja that were found useful was collected. Initially the study was meant to collect some materials from Katete district. However the plan was abandoned when enough materials were collected from Lusaka.

### **1.7.1.2 Techniques of Data Collection**

Two techniques of data collection were used, namely (a) note taking and (b) recording. The researcher moved with a notebook where miscellaneous texts were recorded such as people's conversations and an item in any type of media.

A tape recorder was used to collect spoken texts from people. The target was any fluent Nyanja speaker. Two situations obtained. The first was a mere interview on any topic where the informant was aware that he or she was being recorded on tape. The second was on public buses where conversations of people were recorded without them knowing that they were being recorded. This was not only with the objective of obtaining natural results from an unsuspecting informant but also avoiding the negotiations of getting informants to attend an interview.

### **1.7.1.3 Data Arrangement**

All the texts that were collected were labelled as primary raw data, although most of them had been used by authors for different purposes. The recorded data were transcribed. The data were translated into English and organised according to genres. All statements that seemed to be eligible for logical analysis were typed according to genres. Thereafter, all the data were treated in an initial analysis that rendered it ready for logical analysis. Thus, the primary data were processed and labelled secondary or ready for logical analysis. As it will be noted later, it is not possible to logically analyse natural language when it is in an ordinary format or a format used in everyday conversation or any ordinary text. Since this phase was designed to extract logical data, data ready for logical analysis, it was regarded as an advanced stage in data collection. It was therefore a transitional stage from data collection to data analysis.

---

<sup>2</sup> These are materials collected at random during the period of data collection.

## **1.7.2 Data Analysis**

As earlier pointed out both qualitative and quantitative methods were used in both data collection and data analysis. Introspection was also used at data analysis. Thus, some of the conclusions were based on introspection in combination with other methods. Other methods included observation and statistics. A close observation of logic in various texts was carried out. After all syllogisms were crafted they were categorized. All statistics were calculated based on the categorisation. The statistics were very helpful in observing various trends in the logic of various texts as well as all the collected or crafted syllogisms.

### **1.7.2.1 Theoretical Framework**

Considering that logic is in the modern sense taken to mean deductive logic with its ramifications<sup>3</sup>, the major theory was deduction and the syllogism. However, logic can also be viewed as a sum total of different theories. For this reason, minor theories such as the set theory were used in identifying other systems of logic available in the selected Nyanja texts. In view of the fact that more than one system of logic is always employed in language and that logic consists of theories of language, it was necessary to use more than one theory for the purpose of thorough analysis. Overall, both formal and informal logic were applied to some degree.

Although it was proposed in the research proposal that the logical component in government binding would be applied, the theory was not applied because it was found that the study would be too wide to complete within the specified period of time. Its application would have, nevertheless, yielded interesting results and it must be added on to the list of recommendations to carry out such a study.

### **1.7.2.2 Procedure of Analysis**

Secondary data were analysed in order to extract statements equivalent to propositions for logical analysis. The data were analysed within the genres or the text categories. Accordingly, syllogisms were crafted and categorised. Later on, the crafted syllogisms

---

<sup>3</sup> The Encyclopaedia Britannica Vol. 11 1981 p 56.

were also analysed in order to draw conclusions on logic in Nyanja. Thus formal logic, and specifically deduction and syllogism were applied. The process of drawing conclusions was worked out in relation to the objectives of the study. In other words, the data were studied at any particular time with a view to achieving one of the objectives. In section 2.8 it is noted that some of the objectives were over ambitious and could, therefore, not be achieved within this study. However, there were some pointers to achieving those objectives in later studies.

As a corpus-based study, the desk study was found to be the most appropriate approach to achieving the objectives of the study. Conclusions of the study were first, general to all types of texts and second, specific to categories or text-types.

## **1.8 The Scope and Limitations of the Study**

### **1.8.1 Scope**

The findings of this research are best treated as specific to the data that was analysed. In this manner whenever generalisations are made to all Nyanja speakers, they should be understood within the context of the data that was analysed. In a number of cases the study referred to conclusions that are generalisations about human beings. Here too human beings are best understood as Nyanja speakers. The use of the term 'human beings' presupposes that even though further research needs to be conducted, the findings and conclusions of the research can be potentially generalized to all human beings. Those conclusions that were only limited to particular types of the texts were treated in the discussions within the texts concerned.

The research was among other things successful in initiating logical analysis of texts in Zambian languages. It is hoped that this study will be extended in both size and coverage of languages and issues.

### **1.8.2 Limitations**

The biggest limitations were funds and time. The sponsor could not give beyond the figure that budgeted for. This means that the budget was made primarily on the basis of

the figure that the sponsor had proposed. More funds would have been helpful in collecting a wide range of data and using more sophisticated methods of data collection such as the internet and recording equipment.

In terms of time, the sponsor could only allow a programme that had to be concluded within a specified period of time of two years. As a result, as much as the researcher wanted the research to be as representative as possible, he could only deal with a limited amount of data. What was really time consuming was data analysis that begun at the stage of data collection. Logic cannot be seen directly through ordinary language. The data collected in form of ordinary language had to be reduced to logical data in form of syllogisms which are presented in Chapter Four. In crafting syllogisms from ordinary language, the researcher had to be as fair as possible in order to craft syllogisms that were the closest to the syllogisms conveyed by ordinary language. This means that human error is possible in crafting syllogisms just as human communication or reasoning is full of error. In order to be fair and as precise as possible in crafting syllogisms a lot of time was spent at data analysis.

### **1.9 Ethical matters**

The biggest ethical challenge was in recording conversations by whatever means. In trying to avoid unsuspecting informants to recognize the recorder so that they could behave as naturally as possible, the recorder was hidden. In order to avoid implications all names of informants<sup>4</sup> are withheld because no permission was sought to record their conversations. Informants provided information without knowing that they were being recorded.

### **1.10 Literature Review**

Information in terms of textbooks was very limited. There were nonetheless a number of books in philosophy that had chapters on logic. Only a few texts were found that were entirely dedicated to logic or logic and language. There are also a few internet sources that have been cited, as shown in the Bibliography.

---

<sup>4</sup> Some informants were known to the researcher.

The literature has been reviewed thematically. Thus the information has been organized according to topics. Rather than collect all that is said about the topic, it was opted that an author or two be covered for a particular topic.

### **1.10.1 Genesis of Logic as a Discipline**

The *Encyclopaedia Britannica* (1981, Vol. 11) provides an extensive historical background to logic. It begins by pointing out that traditionally, logicians have distinguished between deductive logic, whose principles are used in drawing new propositions out of premises in which they lie latent, and inductive logic, which ventures conclusions from particular facts that appear to serve as evidence for them. The current account of logic is, however, taken to mean deductive logic with all its ramifications. Aristotle and Plato are presented as great thinkers of logic. Out of the work of Aristotle and earlier Greek mathematicians, rhetoricians and philosophers, it was understood that in its wider sense, logic comprised three theories of language. The sophists, a school that Plato had founded about 4<sup>th</sup> Century BC, later made further progress in theories of language.

Both in the West and the East, the origin of logic is associated with an interest in the grammar of language and in the methodology of argument and discussion, be it in the context of law, religion or philosophy. It has also been acknowledged since the time of Aristotle that logic has a role to play in general education and especially in all sciences. Later, René Descartes and Bertrand Russell in the 17<sup>th</sup> century confirmed the contribution of logic particularly to mathematical methods of analysis. In the East, however, there is what has been specified as Indian and Chinese logic.

### **1.10.2 Logical Analysis**

Hodges (1977: 86) regards logical analysis as one of the chief skills of logic. He explains logical analysis as follows;

We first select a small number of ways of combining short sentences into longer sentences. Then we show that very many sentences, if they are not already built up in these ways, mean the same as certain other sentences which are also built up. Logical analysis consists in finding these other sentences; it stands somewhere between translating and paraphrasing.

He admits that others view logical analysis as part of an enterprise to replace English by a new and more rational language.

Hodges analyses sentences into Sentence-functors and Truth-functors. He analyses sentences as having constituencies marked in square brackets such as:

[Cobalt is present] but [only a green colour appears].

He further identifies the constituencies as part of the matrix:

$\Phi$  but  $\psi$

He calls the Greek letters  $\Phi$  and  $\psi$  as sentence variables or symbols standing for sentences. The variables stand for the holes in which constituents should be placed. He also uses the letter 'x' as a sentence variable. He notes, however, that there are several senses in which these symbols can be used. The matrix is also called the sentence-functor.

Hodges notes that a sentence is true when both or all constituent sentences are true. Thus the sentence above can be expressed in the truth table below:

$\Phi$	$\psi$	$\Phi$ but $\psi$
T	T	T
T	F	F
F	T	F

F	F	F
---	---	---

where T = True and F = False. In this manner if in ‘ $\Phi$  but  $\psi$ ’ ‘ $\Phi$ ’ is replaced by a false sentence and ‘ $\psi$ ’ by a true one, then the whole sentence is false as in the third row in the truth table. He also points out that not every matrix (sentence-functor) has a truth table as it may sometimes not be the case that the truth table of the constituent sentences are enough by themselves to determine the truth-value of the whole.

Hodges identifies the following as truth-functors that are most commonly used in logic.

(1) The *negation* truth-functor ‘It is not true that  $\Phi$ .’

The truth-functor is rewritten in symbols as ‘ $\neg\Phi$ ’.

$\Phi$	$\neg\Phi$
T	F
F	T

‘ $\neg\Phi$ ’ is called the *negation* of the sentence  $\Phi$  while ‘ $\neg$ ’ is pronounced as ‘not’.

(ii) The *conjunction* truth-functor ‘ $\Phi$  and  $\psi$ ’.

The truth-functor is written as ‘ $[\Phi \wedge \psi]$ ’. This yields a false sentence unless truths are put for both ‘ $\Phi$ ’ and ‘ $\psi$ ’, in which case it yields the truth.

$\Phi$	$\Psi$	$[\Phi \wedge \psi]$
T	T	T
T	F	F
F	T	F
F	F	F

$[\Phi \wedge \psi]$  is called the *conjunction* of the sentences  $\Phi$  and  $\psi$  while  $\Phi$  and  $\psi$  are *conjuncts*. This is pronounced  $\Phi$  and  $\psi$ .

(iii) The *disjunction* truth-functor ‘either  $\Phi$  or  $\psi$ , or both’.

This is written as ‘ $[\Phi \vee \psi]$ ’.

$\Phi$	$\Psi$	$[\Phi \vee \psi]$
T	T	T
T	F	T
F	T	T
F	F	F

In all cases ‘ $[\Phi \vee \psi]$ ’ yields the truth except where ‘ $\Phi$ ’ and ‘ $\psi$ ’ are both replaced by false sentences. ‘ $[\Phi \vee \psi]$ ’ is called the *disjunction* and  $\Phi$  and  $\psi$  are *disjuncts*. It is, therefore pronounced ‘ $\Phi$  or  $\psi$ ’.

(iv) The *arrow* truth-functor ‘ $[\Phi \rightarrow \psi]$ ’

Hodges says this is also known as *material implication*. This can be best expressed by a truth table.

$\Phi$	$\Psi$	$[\Phi \rightarrow \psi]$
T	T	T
T	F	F
F	T	T
F	F	T

The table shows that false can only be realized out of ‘ $[\Phi \rightarrow \psi]$ ’ when there is a true sentence for ‘ $\Phi$ ’ and a false sentence for ‘ $\psi$ ’. The ‘ $\rightarrow$ ’ is best read, he suggests, as ‘arrow’. In ordinary language ‘ $[\Phi \rightarrow \psi]$ ’ is expressed as, for example, ‘**If** the paper turns

red, **then** the solution is acid’ or ‘[the paper will turn red  $\rightarrow$  the solution is acid]’ or ‘the paper will **only** turn red **if** the solution is acid’.

(v) The *biconditional* truth-functor ‘ $\Phi$  if and only if  $\psi$ ’.

The truth-functor is written as ‘ $[\Phi \leftrightarrow \psi]$ ’.

$\Phi$	$\Psi$	$[\Phi \leftrightarrow \psi]$
T	T	T
T	F	F
F	T	F
F	F	T

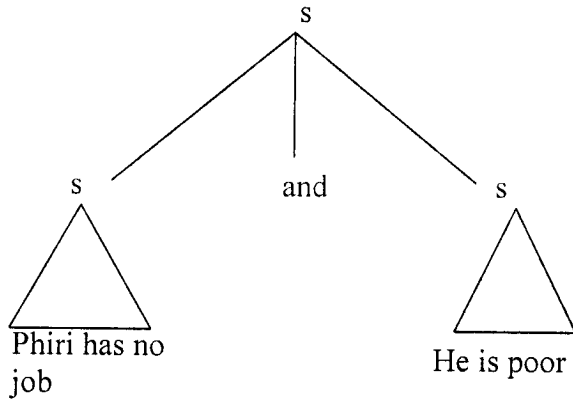
‘ $\leftrightarrow$ ’ is pronounced as ‘if and only if’ and sometimes ‘**precisely if**’ or ‘**just if**’. For example, ‘the number is even **if and only if** it is divisible by two’ or ‘the number is even **precisely if** it’s divisible by two’ or ‘[the number is even  $\leftrightarrow$  it’s divisible by two]’.

Hodges rightly points out that these truth-functors are not without problems. However, he analyses complex sentences using a combination of truth-functors in form of tree diagrams. For instance:

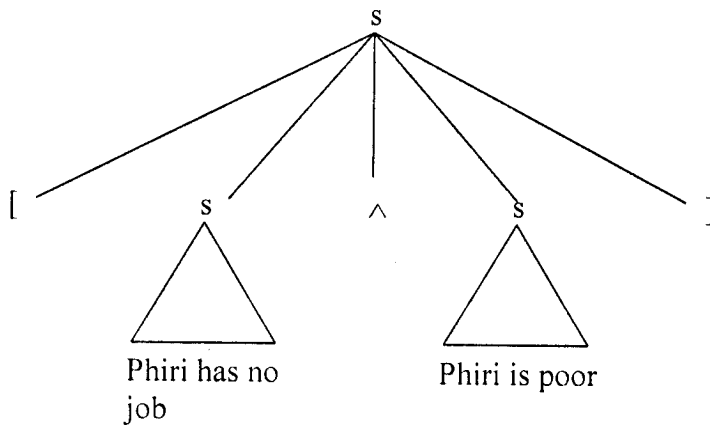
Phiri has no job, and he is poor.

It is possible to rewrite the sentence in form of the tree diagram. The diagrams have merely been adapted from Hodges (1977).

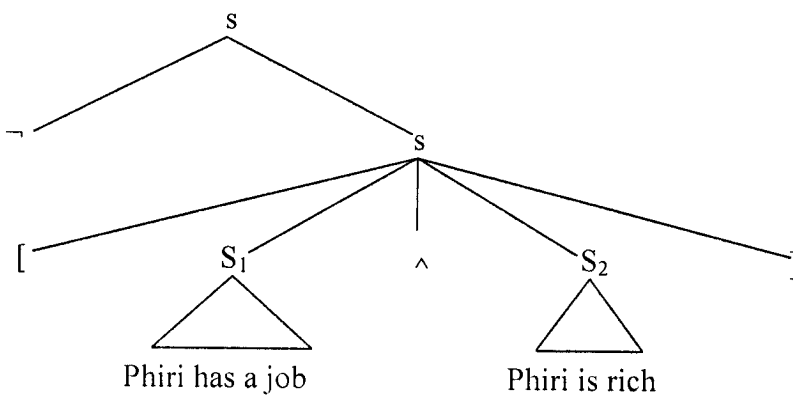
EITHER: When the scope of ‘and’ is the whole sentence =  $[\Phi \wedge \psi]$ .



OR:



OR: If the sentence was 'Phiri has no job and he is not rich'



In this case *negation* ‘ $\neg$ ’ applies to the whole conjunction  $[s_1 \wedge s_2]$  and individual conjuncts ‘ $s_1$ ’ and ‘ $s_2$ ’. The subscripted roman numerals are not used by Hodges but are symbolized by  $\Phi$  and  $\psi$  in his book.

### 1.10.3 Sentential Logic

Bergmann (1998) introduces logic and discusses both sentential (propositional) and predicate logic. She discusses derivations in sentential logic which she refers to as the derivational system.

On derivation she offers to develop, in her discussion, techniques that parallel the sort of informal reasoning that we do as human beings in everyday discourse. She therefore develops steps that are taken in evaluating an argument as its conclusion is derived or deduced from its premises. She uses the following example (p 44):

Whales breathe by lungs and whales are warm-blooded.

If whales breathe by lungs, then whales are not fish.

---

Whales are warm-blooded and whales are not fish.

The line divides the conclusion from its premises. She outlines the following as the steps in the reasoning process of the above argument.

- |   |              |
|---|--------------|
| (1) Whales breathe by lungs and whales are warm-blooded.  | Assumption   |
| (2) If whales breathe by lungs, then whales are not fish. | Assumption   |
| (3) Whales breathe by lungs.                              | From 1       |
| (4) Whales are not fish.                                  | From 2 and 3 |
| (5) Whales are warm blooded.                              | From 1       |
| (6) Whales are warm-blooded and whales are not fish.      | From 4 and 5 |

She then symbolizes the inferences as follows:

- |           |            |
|-----------|------------|
| (1) L & W | Assumption |
|-----------|------------|

- |                        |              |
|------------------------|--------------|
| (2) $L \supset \sim F$ | Assumption   |
| (3) L                  | From 1       |
| (4) $\sim F$           | From 2 and 3 |
| (5) W                  | From 1       |
| (6) $W \ \& \ \sim F$  | From 4 and 5 |

Bergmann observes that semantics is concerned with interpretation of language while syntax is concerned with the formal properties of a language. She therefore concludes that the reasoning above can be viewed as the application of syntactic rules used to derive sentences from other sentences. Unlike truth-values of sentences, she calls these rules derivation rules. She discusses many derivation rules. For instance, she suggests that using a derivation rule it is possible to derive from a sentence of the form P and Q another sentence. It is also used to derive from P another  $\sim P$ . The following are the derivation rules she discusses: reiteration, introduction and elimination rules for '&', introduction and elimination rules for ' $\supset$ ', introduction and elimination rules for ' $\sim$ ', introduction and elimination rules for ' $\vee$ ', and introduction and elimination rules for ' $\equiv$ '.

#### 1.10.4 Aristotelian and Formal Logic

Wallace (1977) in outlining elements of philosophy has looked at logic. He looks at logic in general under Aristotelian logic and proceeds to look at formal logic in detail.

##### 1.10.4.1 Aristotelian Logic

Wallace defines logic as the art of sound discourse. In so far as man is required to engage in discourse his or her intellect is called reason and he or she is defined from this as rational. The method to rational procedure is thus called logic. He also notes that logic may also be viewed as a science. He describes discourse as a mental manipulation of objects which is sound only so long as it is achieved according to the demands of the relations that accrue to objects as known that order them one to another. The relations from which the rules of discourse are taken are called second intentions. Thus the second

intention is the subject matter of logic. In this manner logic is the science of second intention.

Wallace here outlines three orders of rational operation which include: (1) simple apprehension, which is grasping an object without affirming or denying anything about it; (2) judgment, which is denying or affirming something of something else; and (3) reasoning, which is proceeding to new knowledge from previous knowledge. The three respectively, yield the logic of the term or concept, the logic of the proposition, and the logic of argument.

Finally, he gives two divisions of logic, formal and material. The former studies discourse to see whether it is valid or not. The latter discusses discourse assumed to be valid to see what requirements it must fulfill to achieve a determinate degree of scientific force.

#### **1.10.4.2 Formal Logic**

##### **1.10.4.2.1 Simple Apprehension**

Wallace identifies simple apprehension as the first act of the intellect that grasps what a thing is without affirming or denying anything of it. He observes that in apprehending the essence of something the intellect forms within itself the formal concept or mental word whose external sign is the spoken or written term. The concept is both the intellectual knowledge which is understood and the means by which the known is understood. Wallace notes that since the concept is the internal representation of a thing's essence, the term or word is then the external sign of the concept. He observes further that the notion of sign is helpful in clarifying the meanings of both term and concept. He says, "A sign is anything that represents to a knowing power something other than itself" (p. 15).

##### **1.10.4.2.2 Judgment**

Wallace identifies judgment as the second operation of the intellect by which something is affirmed or denied of something else. He observes that by judging and forming a

proposition the intellect restores natures to subjects and accidents to substances thereby re-establishing the condition in which things exist. He calls two elements that are joined in judgment as the *subject* and *predicate*. The first represents the thing to be understood and the second represents what is understood about the thing. Since judgment signifies existence, he says, it always involves *truth* and *falsity*. As the concept is related to the simple apprehension so is *proposition* to judgment.

#### **1.10.4.2.3 Reasoning**

Wallace says reasoning is the third operation of the intellect by which it passes from what it knows already to what it does not yet know. He defines reasoning as the process by which the mind passes from at least two premises or antecedent to the conclusion. He characterizes the logical link established by reasoning between the antecedent and the consequent as the manifestation of inference. The inference is therefore known as the argument which is either good or valid, or it is only apparently good, in which case it is a fallacy.

Wallace defines a syllogism as an artificial deductive process. He says it is artificial not because the inference it signifies is artificial but because the forced disposition of the antecedent and the conclusion according to logical laws is an artifact of the mind. He identifies a number of types of syllogisms which include the following:

- (a) The categorical syllogism which is an argument in which two terms are compared with a third term in the antecedent and the conclusion states whether or not the two terms agree with each other.
- (b) The polysyllogism which is a series of categorical syllogisms arranged in such a way that the conclusion of the previous syllogism becomes the premise of the next.
- (c) The hypothetical syllogism which has a compound proposition as a major premise.

### **1.10.5 Logical Syntax**

Carnap (1964) defines the logical syntax of a language as the formal theory of the linguistic forms of that language – the systematic statement of the formal rules which govern it together with the development of the consequences which follow from these rules. He notes that the prevalent opinion is that syntax and logic, in spite of some point of contact between them, are fundamentally theories of a very different type. The syntax of a language is supposed to lay down rules according to which linguistic structures such as sentences are built up from elements such as words. The chief task of logic, on the other hand, is supposed to be to formulate rules according to which judgments may be inferred from other judgments or conclusions drawn from premises. Carnap observes, however, that the development of logic shows that it can only be studied with any degree of accuracy when it is applied, not to judgments but rather to linguistic expressions of which sentences are the most important, because one can lay down sharply defined rules for them. Further, he observes that every logician from Aristotle has dealt with the sentence in laying down rules. Therefore, logic is concerned with the relations of meaning between sentences.

On formal language of logic Carnap (1964) states that definitions and rules of the syntax of a language are concerned with forms of that language. Thus language can be written as a calculus using symbols. The finite series of these symbols is called an expression of calculus. The rules of calculus determine the conditions under which an expression can be said to belong to a certain category of expressions. It is this system of a language described by only the formal structure that is called calculus. In the widest sense, logical syntax is the same thing as the construction and manipulation of a calculus. When it is maintained that logical syntax treats language as a calculus it does not mean that language is nothing more than a calculus.

### **1.10.6 Deduction**

Raymond (1952) provides fundamental principles of formal deductive reasoning, a major theory in modern logic. Chapter Three of this book clearly outlines deduction and syllogism. It states that formal logic is interested in the form or structure of reasoning. In

other words it is concerned with the correctness of reasoning irrespective of whether or not the elements of reasoning agree with reality. Consequently, a syllogism of the sort

Every M is P  
Every S is M  
Therefore, every S is P

is, according to formal logic, a good syllogism no matter what equivalents are for M, P, and S. However, logic is in general concerned with the soundness of arguments.

### 1.10.7 Predicate Logic

Lepore (2000) provides a procedure for the use of symbols in predicate logic. Before defining major terms that he works with including 'predicate' itself, he gives examples of arguments on which he bases his discussion. All arguments are numbered numerically. Here is the first category of arguments he presents:

- (1) All dogs are mortal.
- (2) Fido is a dog.
- (3) So, Fido is mortal
  
- (4) All philosophers are eccentric.
- (5) Some philosophers are American.
- (6) So, some Americans are eccentric.

He explains the limits of logical interpretation of these arguments. He observes that given that every premise and conclusion in the arguments is a simple statement and that none is a conditional, a conjunction, a negation, or a disjunction; the validity of the arguments cannot rest on any logical relationship among their premises and conclusion. He clarifies the point by suggesting the use of symbols in the following manner:

Letting 'A' represent 'All dogs are mortal'

Letting 'D' represent 'Fido is a dog'

Letting 'M' represent 'Fido is mortal'

He observes that the correct symbolisation of the arguments is

(7)  $A, D \therefore M$

He observes further that any adequate truth table for (7) will have a row, in which its premises are true and its conclusion false. However, not every deductively valid argument is valid by virtue of its form.

Even though no sharp line can be drawn between those arguments that are valid due to the meanings of 'non-logical' expressions and those valid due to the meanings of 'logical' expressions alone, it is noteworthy that arguments (8) – (10) and (11) – (13) [below] are both valid and each seems to share whatever form (1) – (3) has (Lapore 2000: 132).

(8) All boys are tall.

(9) John is a boy.

(10) So, John is tall.

(11) All people with jobs are working.

(12) The woman next door is a person with a job.

(13) So, the woman next door is working.

Using arguments (8) to (13) he concludes that:

The arguments suggest that, even though there is an intuitive sense in which the subject matter of (1) – (3) is dogs and their mortality, the words 'dog' and 'mortal' are immaterial with respect to the deductive validity of (1) – (3). It is due to other words (and the 'structure' of the argument) that the

argument is valid. ...This is why we can say of argument (8) – (10), though it is about boys and their height, and of argument (11) – (13), though it is about people who work, that they are deductively valid for whatever reason argument (1) – (3) is (Lapore 2000: 132).

Lepore makes a difference between **singular terms** and **general terms**. He calls singular terms like ‘Aristotle’ those that include proper names, definite descriptions, demonstratives, and pronouns. He gives examples of general terms such as ‘man’ and ‘Italian’. He suggests the use of the lower-case letters ‘a’, ‘b’, ‘c’, ‘d’, ..., ‘w’ to symbolize singular terms and reserving ‘x’, ‘y’, and ‘z’ for other duties. He also suggests to subscript any singular term to form new singular terms, such as, ‘a<sub>1</sub>’. He does this so that the number of distinct singular terms that can appear in an argument has no arbitrary finite upper bound.

In contrast to singular terms, which can refer to, describe, name, or designate particular objects, he suggests **property predicates** as expressions that ascribe or attribute properties (features, characteristics, or attributes) to the object that the singular term refers to. He identifies in the statements below those in parts in boldface as singular terms and those that are not as property predicates or simply predicates.

(14) **Ludwig** is a dog.

(15) **Ludwig** is small.

(16) **Rover** is a dog.

(17) **The Rembrandt** is lost.

(18) **That** is tall.

He suggests to symbolize property predicates by capital letters superscripted with the numeral (1) as follows: ‘A<sup>1</sup>’, B<sup>1</sup>, ‘C<sup>1</sup>’, ‘D<sup>1</sup>’, ..., ‘Z<sup>1</sup>’.

On the basis of all the symbols for both singular terms and property predicates he has suggested the following symbolisation.

- (19)  $D^1 l$                        $D^1$ : is a dog; l: Ludwig  
(20)  $S^1 l$                          $S^1$ : is small  
(21)  $D^1 r$                         r: Rover  
(22)  $L^1 t$                          $L^1$ : is lost; t: the Rembrandt  
(23)  $T^1 m$                          $T^1$ : is tall; m: that

Finally he suggests symbolisation for the **Quantifiers**. Lepore observes that the grammar of general expressions like ‘every fish’, ‘no tall boy’, ‘every house on the block’, or ‘some men’ agrees with that of singular terms. For instance ‘Ludwig’ can be replaced with ‘No tall boy’ in ‘Ludwig left’. However these general expressions are different in character from singular terms. They are called quantifiers.

He uses the symbol  $\exists$  for existential quantifiers and  $\forall$  for universal quantifiers. For example:

(24)  $\exists D^1$  e.g. ‘something is a dog’ where  $\exists =$  ‘something’ and as noted earlier  $D^1 =$  ‘is a dog’.

(25)  $\forall D^1$  e.g. ‘everything is a dog’, where  $\forall =$  ‘everything’ and as above  $D^1 =$  ‘is a dog’.

### 1.10.8 On the Metalanguage of Logic

McCawley (1981) also discusses propositional logic among many other topics in logic. On language and metalanguage used to discuss logic, he observes that symbols used in formal logic constitute the vocabulary of the system of formal logic. He observes that “the symbols represent various elements of meaning that are parts of the propositions that figure as premises and conclusions of inferences in that system of logic” (1981: 38).

He introduces symbols that he says are not part of logic but are part of a metalanguage which is used to talk about the system of logic. The first symbol<sup>5</sup> he introduces is  $\vdash$ ,

---

<sup>5</sup> This is not the exact symbol he uses. It is only similar in shape.

read as ‘turnstile’ which is used in two ways. When it is placed before a formula it means the formula can be proven in the logical system. Thus ‘ $\vdash (A, \sim A)$ ’ is a proposition in the system of propositional logic and ‘ $\vdash \vdash (A, \sim A)$ ’ is a proposition about that system. Secondly, it is used to indicate that a conclusion can be inferred from the premises. For example,  $A_1, A_2, \dots, A_n \vdash B$ .

He uses the symbol<sup>6</sup>  $\#$  to represent the relation of deductive equivalence. This is where it is necessary to indicate that the formulas written on either side of a deductive equivalence are inferable from each other. Thus the following equivalences are possible:

- (a)  $\sim (\vee AB) \# \wedge (\sim A, \sim B)$
- (b)  $\sim (\wedge AB) \# \vee (\sim A, \sim B)$
- (c)  $\wedge (\supset AC, \supset BC) \# \supset (\vee AB, C)$

He says he has avoided the use of the usual symbol of equivalence ( $\equiv$ ) because it does not match any device of natural language.

### 1.10.9 Logic and Language

Layman (2002: 89) begins the chapter on logic and language by stating his opinion on the subject as follows:

In order to construct, analyse, and evaluate arguments well, one must pay close attention to language. Many errors of logic stem from a careless or imprecise use of language, and many misunderstandings about logic stem from misunderstandings about that nature of language.

Layman announces the purpose of his chapter to be a series of clarifications about the relationships between logic and language. Specifically, he is finding out whether the logical relationships change as linguistic meaning changes. He cites an example from the Bible in the book of Timothy Chapter Four, verse twelve. He observes that according to

---

<sup>6</sup> See footnote above.

the King James Version of the Bible the word ‘conversation’ in 1611 did not mean “talking together” as it does now but it meant “conduct”. The verse reads “*Let no man despise thy youth, but be thou an example of the believers, in word, in conversation, in charity, in spirit, in faith, in purity.*” He suggests, therefore, that in order to avoid errors in logic, the difference should be made between the emotive force and the cognitive force of statements. He observes that logic mainly has to do with cognitive meaning and therefore logicians should watch for interferences by the emotive force. He quotes David Kelly in his *Art of Reasoning*: “If you have a logical argument to back up a conclusion, there is nothing wrong with stating it in such a way that your audience will endorse it with their feelings as well as with their intellects” (Layman 2002: 93).

#### **1.10.10 Set Theory**

Allwood et al (1997) identify set theory as having connections to logic. They characterize what they call the most important concepts in this theory. They define a set as a number or a collection of things or entities of any kind. A set consists of elements that are also known as members. Allwood et al point out that set theory does not put restriction on sets. Thus, it is possible to have a set whose members have no connection whatsoever. Set theory is helpful in the logical component of semantics.

#### **1.10.11 Language-games**

Kenny (1973) discusses Wittgenstein’s work on ‘language-games’. He notes that the theory of meaning is closely connected with the concept of language-game. Wittgenstein<sup>7</sup> distinguishes between sign and symbol. The sign being what is sensibly perceptible in the symbol, and two different symbols may have their sign in common whether written or spoken sounds. In this case the signs will signify in different ways. In order to recognize the symbol in the sign, one has to look at the significant use. If a sign has no use it is meaningless; on the other hand if everything behaves as if a sign had meaning, then it does have the meaning. Part of its use is apparently in its logical syntax. Thus a word has meaning only as part of a sentence.

---

<sup>7</sup> Wittgenstein, Ludwig was born on 26<sup>th</sup> April 1889 in Vienna and died on 29<sup>th</sup> April 1951 at Cambridge in Cambridgeshire, England.

Wittgenstein regarded it as oversimplification to regard the connection between language and reality as consisting only of two elements, the name-relation and the pictorial nature of the proposition. This led to the exploration of the notion of language-games. He came to believe that name functions as name only in the context of a system of linguistic and non-linguistic activities. He believed the function of rules in many games has similarities with the function of rules in language. The comparison of language to game was not meant to suggest that language is a pastime; on the contrary, it was meant to bring out the connection between the speaking of language and non-linguistic activities. The speaking of language is considered as part of a communal activity, a way of living in society which Wittgenstein calls a 'form of life'. Through sharing in the playing of language-games, language is connected to life.

The fullest list of language-games given by Wittgenstein is in one of his works, the *Philosophical Investigations* published in 1953. The list includes obeying and giving orders, describing the appearance of objects, giving measurements, constructing an object from a description, reporting an event, speculating about an event, forming and testing a hypothesis, presenting the results of experiments in tables and diagrams, making up stories, acting plays, singing catches, guessing riddles, telling jokes, translating from one language into another, asking, thanking, cursing, greeting and praying.

### **1.10.12 Philosophical Logic**

Wolfram (1989: 1-2) notes that it is very difficult to delimit and define philosophical logic. He begins by stating that it is the other branch of logic besides and related to formal logic. Its subject matter is therefore related to that of logic, namely arguments, meaning and truth, but its objects are different. He says:

Rather than setting out to codify valid arguments and to supply axioms and notations allowing assessment of increasingly complex arguments, it examines the bricks and mortar from which such systems are built. Although

it aims, among other things, to illuminate or sometimes question the formalisation of arguments into systems with axioms which have been affected, it is not restricted to a study of arguments which formal logic has codified.

At pains to try and define philosophical logic, Wallace gives an example of an activity in philosophical logic. He says:

Are there only two truth values? The propositional calculus in formal logic operates with two truth values, *true* and *false*, and thereby makes the supposition that any instance of the kind of thing that p, q, r stand for has just one of the two truth values, true and false (this is an axiom (postulate) of the system.) In philosophical logic the question arises as to whether any one sentence with a particular meaning (or whatever p, q, r stand for in an argument) is always either true or false (Wolfram 1989: 3).

In formal logic the letters p, q, r are symbols for propositions. He also observes the difficulty in dealing with the subject and the predicate in philosophical logic.

In the study of philosophical logic it becomes evident that it is very far from clear exactly what qualifies a term as a 'predicate'. Being in a particular position in a sentence seems to be one feature attributed to 'predicates' but not the only one. For instance, in 'Tigers exist', 'exist' is often said *not* to be a predicate. 'True' in 'that statement is true' has also often been said not to be a predicate (pp 4-5).

Haack (1978) understands the business of the philosophy of logic to be the investigation of the philosophical problems raised by logic just as the business of the philosophy of science would be to investigate the philosophical problems raised by science. He observes that the concern of logic is to discriminate valid from invalid arguments; and

formal logical systems such as the sentence and predicate calculi. Likewise, he observes the following to be among the philosophical questions raised by logic:

What does it mean to say that an argument is valid? That one sentence follows from another? That a statement is logically true? Is validity to be explained as relative to some formal system? Or is there an extra-semantic idea that formal systems aim to represent? How do formal logical systems help one to assess informal arguments? How like 'and' is '&', for instance, and what should one think of 'p' and 'q' as standing for? How does one recognize a valid argument or a logical truth? Which formal systems count as logics, and why? (P 1).

Among the problems of the philosophy of logic, Haack (1978: 4) includes the scope of logic. He includes as formal logic, and in several chapters of his book, the following:

- 'traditional' logic      -Aristotelian syllogistic
- 'classical' logic        -2-valued sentence calculus  
                                 Predicate calculus
- 'extended logics'      -modal logics  
                                 tense logics  
                                 deontic logics  
                                 epistemic logics  
                                 preference logics  
                                 imperative logics  
                                 erotic (imperative) logics
- 'deviant' logics        -many-valued logics  
                                 Intuitionistic logics  
                                 quantum logics  
                                 free logics.

He also includes, under the scope of logic, formal systems like standard or classical logic. Extensions of classical logics like necessity and possibility in modal logics are included too.

### **1.10.13 Philosophy and Linguistics**

Katz (1966) treats the philosophy of language as a distinct field from the philosophy of linguistics. He regards it as broad enough to encompass the work of the most of diverse philosophers who have occupied themselves with language. This includes the work of Plato on language, Aristotle's, Descartes', Cordemoy's, Arnauld's, and Leibniz's. Others are Locke, Berkeley, Hume, and Mill. He thinks the philosophy of language also covers the work of modern philosophers like Frege, Husserl, Russell, Wittgenstein, Carnap, Ryle, and Austin.

He says that his approach to the philosophy of language is to begin by drawing the linguistic information from the theory of language as developed in descriptive linguistics. He thinks the theory of language is the first step towards an account of conceptual knowledge in terms of its mode of expression and communication in natural languages. He asserts that the theory of language supplies the philosophers with generalisations about the form and content of languages upon which inferences can be made in revealing truths about the form and content of conceptual knowledge.

The application of logical methods is portrayed in Chomsky's Government and Binding Theory (GB) as presented by Haegeman (1994). GB specifically deals with the logical form in grammar. Its treatment of the d-structure and s-structure is also logical. Steedman (1996) has also used logical theory to analyse the grammar of natural language. He presents surface structures in Combinatory Categorical Grammar (CCG). Thus CCG surface structures reflect the computations by which a sentence may be realised or analysed to define a predicate-argument structure or logical form.

### **1.11 Conclusion**

This chapter has merely introduced the investigation. It has given a background to the logical Analysis of Selected Texts in Nyanja. The problem and rationale of the study have also been stated. The chapter has specified the significance of the study. This is followed by an outline of the methodology that was used in the investigation. Thereafter, the scope and limitation of the study as well as ethical issues in the investigation have been discussed. The chapter ends with the presentation of the literature that was reviewed in the study of logic.

The next chapter is an introduction to logic theory. The chapter provides basic information about logic in order to familiarise the reader with the logic theory that is being applied to the study. Thus, the chapter equips the reader with the necessary information required to understand the entire research.

## CHAPTER TWO

### LOGIC AS AN ACADEMIC DISCIPLINE

#### 2.0 Introduction

Chapter One is an introduction to the investigation. It has specified the problem being investigated and has outlined all the processes that were involved in the investigation. It has specified, among other things, the objectives of the study and has outlined the methodology that was used to achieve the objectives at data collection and data analysis stages.

The present chapter is an introduction to the logic theory being investigated in this study. It is necessitated by the fact that logic is a relatively new discipline in many African studies which requires some background information. The chapter begins by giving the definition of logic as an academic discipline. Next, it looks at the argument or syllogism in some detail. The argument is an essential unit of analysis in logic. As a result, a section is devoted to exploring its various forms. After that propositional logic and predicate logic are discussed. This is followed by a general discussion on logic and language. The chapter then spells out the scope of logic as an academic discipline. Subsequently, the general definition and the operational definition of *logical analysis* as used in this investigation are given. Thereafter, paradigms or fields of logic are outlined. Afterwards, the chapter presents some important names of prominent scholars in the discipline of logic. The chapter ends with definitions of a few terms most of which are repeatedly used in the report.

#### 2.1 On the Definition of Logic

According to *The Encyclopaedia Britannica* (1881 Vol. 11:72-73), “the term logic comes from the Greek word *logos*. The variety of senses that *logos* possesses may suggest the difficulties to be encountered in characterising the nature and scope of logic.” The Encyclopaedia notes the following as some of the translations of *logos*: ‘sentence,’ ‘discourse,’ ‘reason,’ ‘rule,’ ‘ratio,’ ‘the account of meaning of an expression,’ ‘rational principle,’ and ‘definition.’ Logic’s main concern, however, is with the soundness and unsoundness of arguments. It also attempts to make as precise as

possible the conditions under which an argument is acceptable. In this manner, this study is concerned with formal logic whose subject matter is the idea of soundness or validity of an argument of the kind known as deductive. A deductive argument is, roughly, the one in which the claim is made that some conclusion follows with strict necessity from other premise or premises. In a narrow sense deductive logic is concerned with both propositions (also called sentential logic) and noun expressions.

Logic is essential in sharpening one's tools of reasoning as it is concerned with the principles of reasoning. Layman (2002) acknowledges this when he observes that one of the best ways to refine one's natural ability to reason and argue is through the study of logic.

## **2.2 Argument**

Arguments develop when people are engaged in conversations. These could be such conversations as those in debate, lectures, and church sermons, discussions on the media, posters, poems, novels, short stories, the Bible and all sorts of genres. The purpose of arguing, in ordinary language, is to influence people's way of thinking. The speaker therefore lays some ground work upon which he or she builds some conclusions. The same ground work is also meant for the listener to develop his or her own conclusions. An argument in logic is a set of statements that are twofold. There are initial statements that provide the basis upon which a conclusion can be drawn. The initial statements are known as *premises*. Here is an example of an argument:

(1) All lecturers are intellectuals.

She is a lecturer.

So, she is an intellectual.

### **2.2.1 Statement**

A statement is a sentence that is either true or false. It is also called a proposition and the material for logical analysis. A proposition is therefore not simply a sentence in a language. For example, "it is cold" cannot be said to be true or false in itself. This is

because “it is cold” can mean different things in many environments. It is the underlying meaning of the sentence “it is cold” at any one occasion that is termed a proposition which can be assigned truth or falsity. The sentences in (1) are, therefore, all statements or propositions.

### 2.2.2 Premise

A premise is a statement upon which a conclusion is drawn. There are two types of premises namely *major premises* and *minor premises*. Thus the first two statements in (1) above are major and minor statements/premises respectively.

### 2.2.3 Conclusion

This is a statement that has been inferred from others. It is usually preceded by indicators like ‘consequently’, ‘hence’, ‘it follows’, ‘...proves’, ‘this implies’, ‘so’, and ‘to conclude’. In argument (1) the last statement is the conclusion signaled by ‘so’.

### 2.2.4 Validity and Soundness

An argument is valid when all its premises support the conclusion completely (Layman 2002). It is necessarily the case that if the premises are true then the conclusion is true. There is therefore a necessary connection between the premises and the conclusion. For example:

(2) Onse akaswili a zilankhulidwe ayangana pa nkhani za zilankhulidwe.

Sayangana pa nkhani ya zilankhulidwe.

Conco sikaswili wa zilankhulidwe.

All linguists study language.

He does not study language.

So, he is not a linguist.

It is necessarily the case that a linguist must always be the one who studies language. An invalid argument occurs when it is not necessary that if the premises are true then the conclusion is true. For example:

(3) A Chewa a coka kum'mawa  
Akamba Cichewa,  
Conco acoka kum'mawa.

The Chewa people come from Eastern Province.  
He speaks Chewa.  
So, he comes from Eastern Province.

Whilst both premises in (3) can be true, it is not necessarily the case that every person who speaks Chewa comes from Eastern Province.

When an argument is valid with all its premises true, it is said to be a *sound argument*. A sound argument will therefore always have a true conclusion. Argument (4) is sound.

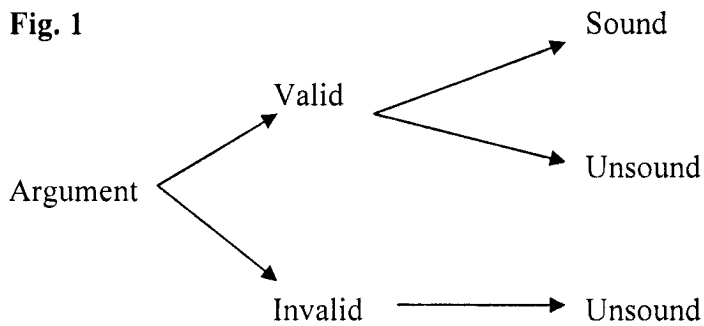
(4) Ndi anthu cabe omwe akhoza kulankhula.  
Nyama sianthu.  
Conco nyama sizingalankhule.

Only human beings can speak.  
Animals are not human beings.  
So, animals cannot speak.

An *unsound argument* can be realized in any one of these three situations: (a) when an argument is valid but has at least one false premise, (b) when an argument is invalid but has all premises true, and (c) when an argument is invalid and has at least one false

premise. Argument (3) is also an example of an unsound argument because all invalid arguments are unsound. Thus, it is not always the case that a linguist is a lecturer.

The argument as characterized so far can be shown as in fig. 1:



### 2.2.5 Strength and Cogency

It is not always the case that an argument is only simply either valid or invalid or sound and unsound. There are situations where an invalid argument has premises that provide partial evidence to support the conclusion. Layman (2002) identifies such an argument as *strong*. The essential feature of a strong argument is that it is probable, but not necessary, that if its premises are true then the conclusion is also true. For example:

(5) Anthu ambiri akonda a Mwanawasa mu Zambia.

Chomba ndi wa mu Zambia.

Conco Chomba akonda a Mwanawasa.

Almost every Zambian likes Mwanawasa.

Chomba is a Zambian.

So, Chomba likes Mwanawasa.

While it can be assumed that the premises to argument (5) are true, it may not be the case that Chomba likes Mwanawasa. However, the strength of the premises provides a probability for Chomba to like Mwanawasa.

A *weak* argument is the one for which it is “not probable that if its premises are true, then its conclusion is true” (Layman 2002: 37). If ‘almost every Zambian’ is replaced by ‘few Zambians, in argument (5), then the argument is weak. This is because even though the premises will be true it will not be probable that Chomba likes Mwanawasa. The probability is highly reduced. However, if ‘almost every Zambian’ is replaced by ‘all Zambians’ then the argument becomes *valid*.

A parallel of a sound argument is called a *cogent argument*. This is the one where an argument is both strong and has only true premises. Argument (5) can be an example of a cogent. An *uncogent argument* is therefore either weak or strong but one with one false premise (Layman 2002). Arguments (6) and (7) can be uncogent. A weak argument is necessarily uncogent.

(6) Ndi anthu ang’ono mu Zambiya omwe akonda a Mwanawasa.

Chomba ndi wa mu Zambiya.

Conco Chomba akonda a Mwanawasa.

Hardly any Zambian likes Mwanawasa.

Chomba is Zambian.

So, Chomba likes Mwanawasa.

(7) Congo cacikulu cipangidwa ndi ndeke zomwe ziululuka.

Kuli congo cacikulu.

Conco ndeke iluululuka.

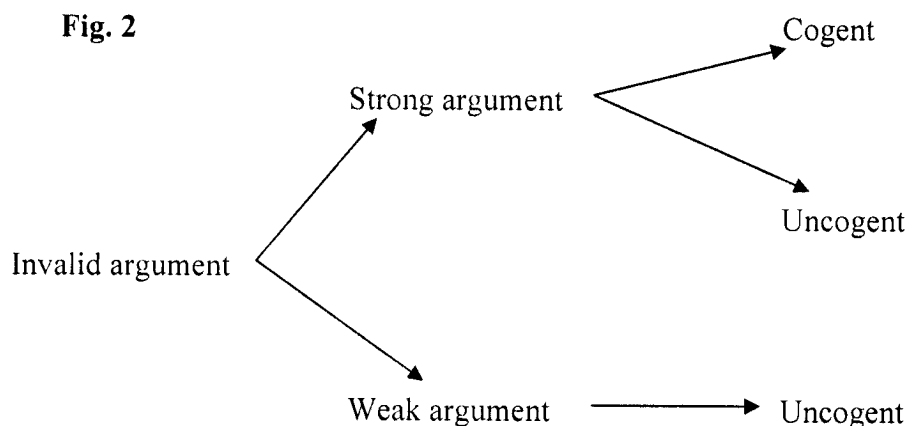
Big noises are made by passing planes.

There is a big noise.

So, a plane is passing.

In diagram form strength and cogency can be represented as in fig. 2.

Fig. 2



### 2.2.6 Syllogism

The Microsoft Encarta Encyclopedia (2004) defines the syllogism as:

An argument made up of statements in one of four forms: “All A's are B's” (universal affirmative), “No A's are B's” (universal negative), “Some A's are B's” (particular affirmative), or “Some A's are not B's” (particular negative). The letters stand for common nouns, such as “dog,” “four-footed animal,” “living thing,” which are called the terms of the syllogism.

The *Oxford Dictionary of Philosophy* (1977) defines syllogism as “the inference of one proposition from two premises. A well-formed syllogism is made of a major premise, a minor premise, and the conclusion that follows from the premises. Each premise has one term in common with the conclusion, and one term in common with the other premise.”

The following illustrates the structure of a syllogism:

- (8) 1. Ngati munthu ndi wa mu Zambiya, ndiko kuti ndi Mufilika.  
2. Phiri ndi wa mu Zambiya.  
3. Conco Phiri ndi Mufilika.

1. If someone is Zambian, then he is African. Major premise  
2. Phiri is a Zambian. Minor premise

So, 3. Phiri is an African.

Conclusion

### 2.2.7 Fallacy

There are rules, under propositional logic, that are used to determine whether a syllogism or an argument is valid or invalid. When any of these rules is violated a fallacy is formed. A fallacy is therefore an error in reasoning. A formal fallacy involves the explicit use of an invalid form while an informal fallacy is psychological.

### 2.2.8 Enthymeme

According to *The Oxford Dictionary of Philosophy* (1977) an enthymeme is “an argument in which one of the premises is not explicitly stated.” Enthymemes occur as human beings communicate. It is the case that humans, whether by habit or intention, are economic with facts in communication. Usually arguments are presented in argument form. It is the abbreviated arguments that are known as enthymemes. *The Penguin Dictionary of Philosophy* (1997: 170) defines an enthymeme as, “An argument with unstated premise or an unstated conclusion. (It) accords with the seventeenth century definition of an enthymeme as ‘a syllogism complete in the mind and incomplete in expression.’” Either some premise or the conclusion is omitted. Sometimes both the premise and the conclusion are implicit.

## 2.3 Propositional Logic

Propositional logic is also known as statement logic. It is the opposite of predicate logic and a fundamental branch of formal logic. *The Penguin Dictionary of Philosophy* (1997: 555) observes that propositional logic is “concerned with argument-forms whose validity depends on the connectives by which compound propositions are formed from simple ones.” These connectives are understood to correspond to ‘and’, ‘or’, ‘if – then’, ‘therefore’, ‘because’, ‘since’, ‘but’, ‘before’, ‘as’, ‘even though’ and ‘not’. The logical connectives are required to have truth functions because they have fixed and definite meanings which only partly cover their use in ordinary language. The rules that account for the argument forms are referred to as derivational rules in logic.

### 2.3.1 Some Argument Forms

#### 2.3.1.1 Modus Ponendo Ponens(MPP)

The rule deals with conditional propositions or simply conditionals. This is a valid argument formalized as follows, using lower case letters (from p onwards) as variables for propositions:

1. If p, then q, or  $p \rightarrow q$ .
2. p.
- So, 3. q.

By use of assumption it is assumed a proposition  $p \rightarrow q$ . p is the antecedent and q the consequent.

For example:

- (9) 1. Ngati muchini ugwira nchito, ndiko kuti kudzakhala congo.
2. Muchini ugwira nchito.
3. Conco kudzakhala congo.

1. If the machine is on, then there will be noise.
2. The machine is on.
- So, 3. There will be noise.

#### 2.3.1.2 Modus Tollendo Tollens (MTT)

MTT deals with conditionals like MPP. It also deals with valid arguments. The following is the formalization of the argument.

1. If p then q, or  $p \rightarrow q$ .
2. Not q.
- So, 3. Not p.

- (10) 1. Ngati muchini ugwira nchito, ndiko kuti kudzakhala congo.

2. Sikudzakhala congo.
3. Muchini siulugwira nchito.

1. If the machine is on, then there will be noise.
  2. There will be no noise.
- So, 3. The machine is not on.

Modus Ponendo Ponens and Modus Tollendo Tollens, also abbreviated as Modus Ponens and Modus Tollens respectively, are Latin expressions.

### **2.3.1.3 Denying the Antecedent**

Denying the antecedent is an error in reasoning and therefore one of the fallacies. Since it is an error, it constitutes an invalid argument. Because of the element of negation the fallacy resembles MTT. Thus (10) can be an error if it was like the following:

- (11) 1. If the machine is on, then there will be noise.
  2. The machine is not on.
- So, 3. There will be no noise.

The argument is invalid because the conclusion is false. The noise could come from anything else apart from the machine. Unlike in 2.3.1.3 here the formalisation would be as follows:

1. If p, then q.
  2. Not p.
- So, 3. Not q.

### **2.3.1.4 Affirming the Consequent**

This is another popular fallacy. Unlike denying the antecedent, this fallacy resembles MPP. In this manner (9) would be an error in reasoning if it were as follows.

- (12) 1. If the Machine is on, then there will be no noise.  
 2. There will be noise.  
 So, 3. The machine is on.

It is also possible that the noise may not be as a result of the machine but something else. As a result, the conclusion is false. This formalisation is as follows.

1. If p, then q.  
 2. q.  
 So, 3. p

### 2.3.1.5 Hypothetical Syllogism

This argument also deals with valid arguments. It also deals with conditional statements. This argument is called hypothetical on the basis that it deals with conditionals. In fact it was the case in the past that MPP and MTT would be classified as hypothetical because they dealt with conditionals. This is no longer the case now. The conclusion is also a conditional statement.

5. If p, then q, ( $p \rightarrow q$ ).  
 6. If q, then r, ( $q \rightarrow r$ )  
 So, 3. If p, then r, ( $p \rightarrow r$ )

- (13) 1. Ngati kuli umphawi ndiko kuti kulibe ndalama.  
 2. Ngati kulibe ndalama ndiko kuti kulibe msonkho.  
 3. Ngati kuli umphawi ndiko kuti kulibe msonkho.

1. If there is poverty, then there is no money.  
 2. If there is no money, then there is no revenue.  
 So, 3. If there is poverty, then there is no revenue.

### 2.3.1.6 Disjunctive Syllogism

Disjunctive syllogism does not deal with conditionals but “either p or q”. This argument is also valid and its statements are called conjuncts. Either p or q is inclusive in that it can also mean both p and q.

1. Either p or q, ( $p \vee q$ ).

2. Not p.

So, 3. q.

(14) 1. Mwina Tikambe kapena Ganizani anaba nyama.

2. Ganizani sanabe.

3. Conco Tikambe anaba nyama.

1. Either Tikambe or Ganizani stole the meat.

2. Ganizani did not steal.

So, 3. Tikambe stole the meat.

It could also be possible that both stole the meat. However, there can be instances when ‘both’ can do. This would be as follows:

(15) 1. Not both p and q

2. p.

So, 3. Not q.

Although (15) is a valid argument, it is a disjunctive syllogism.

### 2.3.2 Logical Connectives

Logical connectives are also known as logical operators. From the argument forms above a number of logical connectives arise.

### 2.3.2.1 Implication

The operator for implication is  $\rightarrow$  or  $\supset$ . This is the logical 'if...then'. Lapore (2002) observes that implication uses logical conditionals which should be divisible into two components. One component should provide the condition for the truth of the other. Thus MPP and MTT are this kind of logical connectives. The propositions in implication are referred to as antecedent and consequent.

Although 'if...then' is used to represent implication, there are other words in ordinary English that signal implication. These include, among others, *provided*, *provided that*, *should*, and *when*.

The truth table of argument (9) and therefore implication is as follows:

p	q	$p \rightarrow q$
T	T	T
F	T	T
T	F	F
F	F	T

It can therefore be stated from the above statement that a conditional statement is false when its antecedent is true and its consequent is false.

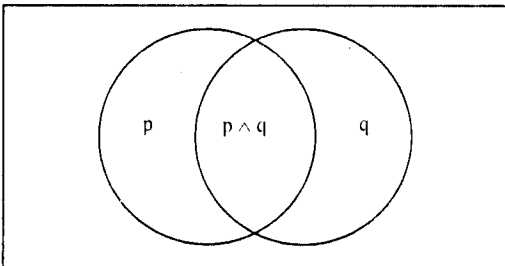
### 2.3.2.2 Conjunction

The conjunction resembles 'and' in everyday language. It is a form of a compound sentence made of two propositions known as conjuncts. The two conjuncts form the conjunction. Unlike in ordinary language, in logic the conjunction is not 'and' but the whole compound made of the two conjuncts. There are several other words that signal conjunction. These include among others, *but*, *while*, *even though*, *though*, *yet*, *however*, and *nevertheless*.

The operator for conjunction is  $\wedge$  or  $\&$ . Thus the conjunction is formalized as  $p \wedge q$ , or  $p \& q$ . For a conjunction to be true both conjunctions must be true. The truth table is as follows:

p	q	$p \wedge q$
T	T	T
F	T	F
T	F	F
F	F	F

Conjunction can be represented in set theory. The truth set of  $p \wedge q$  is the intersection between  $p$  and  $q$  which is the world where both  $p$  and  $q$  are true. The following is the diagramme showing the set. In the diagramm, it is only the area labeled  $p \wedge q$  that is the conjunction.



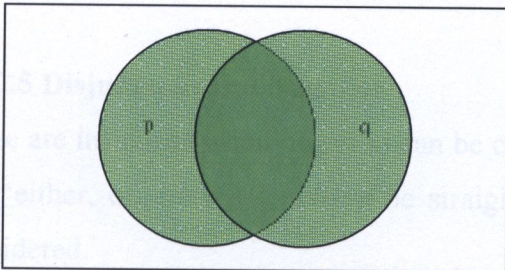
### 2.3.2.3 Disjunction

Disjunction is closely related to 'either, or' or 'or' alone in ordinary English. This is also a form of a compound sentence whose constituents are called disjuncts. In logic the disjunction is not the word 'or' but the whole compound made of the disjuncts.

The operator for disjunction is  $\vee$ . Thus the disjunction is  $p \vee q$ . The truth of the disjunction, therefore, is the truth of either  $p$  or  $q$ . this is shown in the truth table below.

p	q	$p \vee q$
T	T	T
F	T	T
T	F	T
F	F	F

A disjunction can only be false if both disjuncts are false. It is true in any other case. In terms of the Venn diagram, the following is the disjunction. The whole area with the colour green is the disjunction. This area is the world where  $p \vee q$  is true.



#### 2.3.2.4 Negation

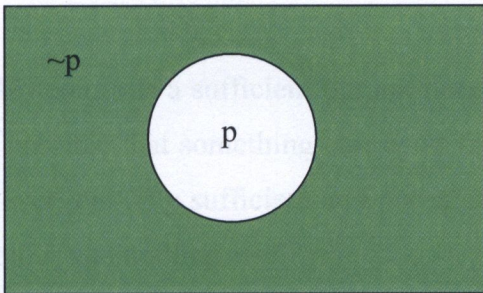
Negation commonly corresponds to 'not' or an expression that means 'it is not the case that' in ordinary language. The operator for negation is  $\sim$ .

In terms of truth value, p is true if and only if q is false. In this case q is the negation of p. In a truth table there will only be two rows one indicating that the negated statement is true and the other the circumstance in which the negated statement is false.

p	$\sim p$
T	F
F	T

Logical negation is applied to the whole statement unlike in ordinary language where negation can also apply to components below the sentence level.

In a Venn diagram the truth set for 'not p' or ' $\sim p$ ' is the world where p is not the case. This world is represented by the colour green.



### 2.3.2.5 Disjunction and Negation

There are instances when negation can be confusing. The use of the words 'neither, nor' and 'either, or' may not always be straightforward. The following statements can be considered.

- (16) Neither UNZA nor CBU were open.
- (17) Either UNZA was open or CBU was open.

Negation in (16) applies to two statements (a) UNZA was open = p and (b) CBU was open = q. The formalisation should be as follows:

$$\sim (p \vee q) = \sim p \sim q$$

This means that in (16) there was negation of disjuncts. (16) is therefore not the same as (17). However, when both conjuncts are negated in (17), the meaning equals that of (16) which is  $\sim p \sim q$ .

### 2.3.2.6 Equivalency

Allwood et al (1977) show that equivalency corresponds to 'if and only if', 'exactly when', 'only when', and 'only if'. Rarely is 'if' used to indicate equivalency. They also observe that equivalency is double implication in terms of truth functions. One

implication is going from antecedent to consequent and another from consequent to antecedent.

(18) Enelesi will buy the dress if the colour is light.

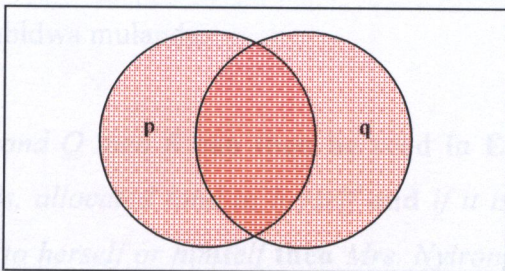
(19) Enelesi will buy the dress if and only if the colour is light.

In (18) colour is a sufficient but not necessary requirement for Enelesi to buy the dress. It is possible that something else apart from colour can make her buy the dress. In (19) however, the only sufficient and necessary requirement is that the dress should be light in colour and nothing else.

Equivalency is the conjunction of two implications. This is formalized as  $(p \rightarrow q) \wedge (p \rightarrow q)$ , which translates into the following truth table. The operator for equivalency is  $\equiv$ . Because of involvement of conjunction 'true' can only be achieved if both statements (implications) on either side of the equivalency are either true or false.

p	q	$p \equiv q$
T	T	T
T	F	F
F	T	F
F	F	T

In terms of the Venn diagram, the following is attainable. The truth set is the area without colour and the intersection is the area that has a darker colour.



### 2.3.2.7 Exportation

Exportation is a type of rule that operates on conditionals. It is a type of inference of the following form according to the *Penguin Dictionary of Philosophy*.

$$\frac{\text{If (P and Q) then R}}{\text{If P, then (if Q then R)}}$$

The inference can be formalized as follows:

$$((p \& q) \supset r) \supset (p \supset (q \supset r))$$

The formalized inference reads as:

If P and Q then R then if P then if Q then R. in other words, *If P and Q then R* derives *If P then if Q then R*.

An example of exportation is as follows:

P = Amai Nyirongo, Nduna ya Malo, adzipatsa malo;

Q = Siciloledwa kuti Nduna ya Malo idzipatse yekha malo; ndi

R = Amai Nyirongo afunika kuimbidwa mulandu.

P = Mrs. Nyirongo, the Minister of Lands, allocated land to herself;

Q = It is illegal for a Minister of Lands to allocate land to herself or himself; and

R = Mrs. Nyirongo should be prosecuted in the court of law.

*If P and Q then R can then be read in Nyanja as ngati Amai Nyirongo, Nduna ya Malo, adzipatsa malo ndi ngati siciloledwa kuti Nduna ya Malo idzipatse yekha malo ndiye kuti Amai Nyirongo afunika kuimbidwa mulandu. If P then if Q then R in Nyanja reads as ngati Amai Nyirongo, Nduna ya Malo, adzipatsa malo ndiye kuti ngati siciloledwa kuti Nduna ya Malo idzipatse yekha malo ndiye kuti Amai Nyirongo afunika kuimbidwa mulandu.*

*If P and Q then R can then be read in English as if Mrs. Nyirongo, the Minister of Lands, allocated land to herself and if it is illegal for a Minister of Lands to allocate land to herself or himself then Mrs. Nyirongo should be prosecuted in the court of law.*

*If P then if Q then R reads in English as if Mrs. Nyirongo, the Minister of Lands, allocated land to herself then if it is illegal for a Minister of Lands to allocate land to herself or himself then Mrs. Nyirongo should be prosecuted in the court of law.*

### 2.3.2.8 Importation

Importation is the converse of exportation. The form of importation is, therefore, as follows:

$$\frac{\text{If P, then (if Q then R)}}{\text{If (P and Q) then R}}$$

Or:  $(p \supset (q \supset r)) \supset ((p \ \& \ q) \supset r)$

Using the example of exportation above, importation will appear as follows:

*If P then if Q then R reads as if Mrs. Nyirongo, the Minister of Lands, allocated land to herself then if it is illegal for a Minister of Lands to allocate land to herself or himself then Mrs. Nyirongo should be prosecuted in the court of law. If P and Q then R can then be read as if Mrs. Nyirongo, the Minister of Lands, allocated land to herself and if it is illegal for a Minister of Lands to allocate land to herself or himself then Mrs. Nyirongo should be prosecuted in the court of law.*

### 2.3.3 Formulae

When an argument is formalized by use of specific rules and symbols, it is written as a formula. Like there are valid and invalid arguments, there are also well-formed formulae and ill-formed formulae. A well-formed formula is abbreviated as wff and wffs as the plural. Logic is obviously concerned with well-formed formulae. In propositional logic individual variables are also considered as wffs. A wff, therefore, satisfies the rules of formation of formal systems. Some wffs include the following:

p

~P

p ^ q

p → q

An ill-formed formula hence looks like ‘ $p\sim$ ’ or ‘ $\wedge p$ ’.

## 2.4 Predicate Logic

It may not be possible to evaluate some arguments using processes in propositional logic. In propositional logic statements were decided whether correct or true using truth tables or tautology. However, some arguments cannot be shown to be true in propositional logic. Propositional logic deals with the proposition, in form of a sentence, as a whole. Predicate logic however allows us to make inferences that occur within a proposition or sentence. It is therefore possible in predicate logic to logically analyse constituents below or within the sentence. In this manner, predicate logic adds to propositional logic or takes over where propositional logic leaves off.

### 2.4.1 Predicates

In predicate logic it is possible to distinguish between a subject and a predicate of a sentence. *The Penguin Dictionary of Philosophy* (1997: 442) describes a predicate as “that which is asserted or denied of the subject in a sentence; that which is asserted or denied of the thing(s) referred to in a sentence.” In this manner, the linguistic definitions of subject phrase and predicate phrase are helpful in understanding the subject and predicate in logic. A subject, in linguistics, is something or someone of which something is said or predicated. Allwood et al (1977) rightly call sentences with predicates as, therefore, predications. For example:

(20) Menyani is an actor.

‘Menyani’ is the subject and ‘is an actor’ is the predicate in (20). Subjects are called individual constants and are symbolized by lower case letters. Thus ‘Menyani’ can be symbolized by the letter ‘a’. The predicates are simply called predicates or predicate constants. Predicates are symbolized by upper case letters. Thus ‘is an actor’ in (20) can be symbolized by ‘M’.

Accordingly, (20) can be formalized as follows:

M (a)

The predicate is written before the subject or individual constant by convention. A standard rule can be written in Greek letters as shown below. This means in the rule anything can be a subject ( $x$ ) and anything can be a predicate ( $\Phi$ ) and not necessarily what is in (20) above.  $\Phi$  and  $x$  are variables.

$\Phi (x)$

In logic, what are referred to as subjects and objects in grammar are called arguments. In this section (2.4.1) arguments will be used in that sense to further categorize predicates. If a predicate takes one argument, it is called a one-place predicate. Thus (20) is a one-place argument symbolized 'M'. If a predicate takes two arguments it is called a two-place predicate. Accordingly, depending on the number of arguments a predicate is named. A two-place predicate is formalized as in (21).

(21) Menyani admires Tikambe.

$\Phi (x_1, x_2)$

The predicate is represented by the Greek symbol  $\Phi$  and the arguments (Menyani and Tikambe) are represented by  $x_1$  and  $x_2$  respectively.

### 2.4.2 Quantifiers

In ordinary English quantifiers are words like *all*, *every*, *each*, *any*, *most*, *many*, *some*, *no*, *nearly all*, and *almost all*. In logic quantifiers are considered to be operators that can transform a regular sentence into the one to which a truth value can be assigned. There are several types of quantifiers but existential and universal quantifiers are common in studies in logic.



### 2.4.2.1 Existential Quantifiers

Consider the sentence in (22):

(22) Some plants are trees.

We can formalize it into *x plants are trees*, or *for some x, x is a tree*, or *there is at least one x such that x is a tree*. This is formalized as in (23).  $\exists$  is a symbol for an existential quantifier and x represents ‘plants’.

(23)  $(\exists x) (\text{tree } x)$ , if tree is represented by T, the formalisation is  $(\exists x) (T x)$

Thus (23) reads as ‘there is at least a plant (= some) such that the plant is a tree’.

### 2.4.2.2 Universal Quantifiers

Consider the sentence in (24):

(24) Every tree is a plant.

We again formalize it into *every tree is a plant* as in (25). The symbol for universal quantifier is  $\forall$ , x = tree, and P = plant.

(25)  $(\forall x) (P x)$

### 2.4.3 Arguments in Predicate Logic

Following from all above under predicate logic, it is possible to logically analyse arguments like the one in (26).

(26) 1. All men are mortal.

2. Mangani is a man.

Therefore, 3. Mangani is mortal.

The validity of the argument does not hold in the entire statements as in propositional logic but in the logical interpretation of the relationship between individual constants and quantifiers. An analysis in propositional logic would have (26) analysed as an invalid argument. The formalisation would be something like (27).

(27) 1. A

2. B.

So, 3. C

There would be no circumstances according to (27) where 'C' would be the conclusion from the premises 'A' and 'B'.

## **2.5 Logic and Language**

In the analysis of arguments, language is essential. It is believed as it has already been alluded to, that many errors of logic and misunderstandings about the systems of logic originate from careless use of language and the lack to appreciate its nature.

### **2.5.1 Natural Language**

A natural language is the kind that is used for everyday communication. It is thus ordinary. Natural languages have an alphabet, a vocabulary and a grammar. Examples of natural language include Nyanja and English.

In logic, the meaning in natural language is essential. There is meaning that is standard dictionary meaning. This is a kind of meaning provided by definitions. Hence there is the *definiendum*, which is the word being defined and the *definiens* which is the word or words defining (the definiendum). This meaning is also known as *cognitive*. Meaning provided by definition depends on the standard meaning of a word as used in a language at a particular period of time. It is, therefore, the case that standard meanings of words change with time. The other type of meaning is *contextual* and relative to the speaker's intention. Accordingly, in logic, both standard meaning and the speaker's specific intention are necessary and captured as a proposition.

Sometimes speakers communicate with an intention to provoke certain emotions in the listener (in speech or writing). This kind of conversation carries with it emotive force of words. This is the kind of emotion that is generated by words like *idiot*, *thug*, *dull*, and *lunatic*. Logic is much more to do with cognitive meaning than the emotive force.

### 2.5.2 Natural Logic

There are elements in natural language that constitute its natural logic. These are a collection of terms and implicit rules in natural language that allow human beings to reason and argue in the particular language. Examples of these logical terms include among others "and", "or", "not", "true", "false", "if", "therefore", "every", "some", "necessary", "possible", "therefore", and "is the same as". The use of such words is not the same in natural language and natural logic (<http://www.philosophy/dictionary/N/naturallogic>). Examples of rules can be seen in 2.3 above.

### 2.5.3 Formal Language

As stated above, it is evident that one ought to be careful with meaning in natural language. Natural language usually has many ambiguities which are unwanted in logic. Logic demands precision. In order to solve or avoid problems of natural language formal systems known as formal languages are developed. These constitute in the symbols and formation rules that count as wffs. These systems in logic are used to formalize natural language. Thus formalisation is the process of translating arguments or statements from natural language into formal notations. By so doing, one can account for valid and invalid arguments in natural language. In other words, a formal language contains natural logic or there is a relationship between the two. It is also possible to view natural logic and formal language is synonymous to some extent.

Like natural language, a formal language or formal system of logic has an alphabet, a vocabulary and a grammar. The alphabet is made of various symbols such as  $\sim$  or  $\equiv$ . The

vocabulary is what these symbols read as, and the grammar is the rules by which these symbols are used to read as wffs.

## **2.6 Scope of Logic**

According to *The Encyclopaedia Britannica* (1981 Vol. 11:72-73), as earlier quoted in 2.1, “the variety of senses that *logos* (logic) possesses may suggest the difficulties to be encountered in characterising the nature and scope of logic.” The Encyclopaedia notes the following as some of the translations of *logos*: ‘sentence,’ ‘discourse,’ ‘reason,’ ‘rule,’ ‘ratio,’ ‘the account of meaning of an expression,’ ‘rational principle,’ ‘and ‘definition.’ Logic’s main concern, however, is with the soundness and unsoundness of arguments

Modern logic is generally understood as the science that deals with the principles of valid reasoning. It is taken that from a set of premises one is able to derive a true conclusion under certain acceptable conditions. Thus logic is treated as primarily concerned with the analysis of arguments deductively. Logic as a science has different forms. These include, among others, deductive and inductive logic and formal and informal logic.

### **2.6.1 Deductive Logic**

Deductive logic is deductive reasoning which is concerned with drawing conclusions from given premises. In other words reasons are given to support a particular claim. Validity in deductive logic is considered if and only if there is no instance when the premises are true and the conclusion is false.

### **2.6.2 Inductive Logic**

Inductive logic is concerned with inductive reasoning. In this reasoning conclusions are drawn before observations. However, the conclusion is based on previous or similar observations to those that one will carry to verify the conclusion. It is the reverse of deductive reasoning. In this case the truth of the premises (observations) does not