International Journal of Humanities, Volume 3, Number 4, 2011

'ESTABLISHING THE NEXUS OF SYNTACTIC COMMUNICATION BETWEEN ENGLISH AND MATHEMATICS: AN INTRODUCTION'

[1]A. A. Iliyas and [2]A. D. Adeshola
[1]Dept. of General Studies, Kwara State College of Education (Technical), Lafiagi, Nigeria
[2]Dept. of Mathematics, Kwara State University, Malete, Nigeria

ABSTRACT

This preliminary study has attempted a description of a core aspect of both Language and Mathematics called syntax. It endeavours to succinctly explain what syntax entails and in chronological order, a review of major thoughts on syntax evolution is highlighted. Parsing, a vital contribution of the transformational grammar school of thought is employed to analyze a set of six corpuses. Subsequently, automata mathematical syntactic theory is explained. As a way of finding possible areas of convergence in the curious presence of Syntax in English (language) and Mathematics particularly in this era of multi-disciplinary approach to study, the sentences analyzed with tree structure (language syntax) are replicated using free semigroup (Mathematical syntax). Implications of this endeavour are enunciated and probable other areas of research explorations between the two subjects are identified to mould reactions and subsequent studies in this direction.

INTRODUCTION

The underlying concept of this work is to attempt a clear description of basic syntactic features in Englis language and Mathematics. This shall be done in such descriptive forms which will enable non-speciali hindsight into what in both fields syntax entail. In order to achieve this feat, the use of Automa mathematical theory is intended to be displayed in pointing out similarities in the analysis of syntact components as can be found in English and Mathematics.

However, complete similitude may be hard to come by, but this preliminary analytical attempt of syntax found in English and Mathematics is designed to spore further the academic quest into possible areas convergence between the two seeming parallel subjects.

The implication of the foregoing is that it is a bold step towards tackling the difficulty encountered in t study and application of the two subjects. When linguistic components are mathematically explained, it is doubt, a bridge of the gulf between scientifically oriented issues and their corresponding linguistic moc through which they are expressed. Conversely too, the study provides a vista for figure-phobic individu with a view to developing inquisitive interest in the knowledge of Mathematics.

SYNTAX

The etymology of syntax can be traced to a Greek word that refers to "placing together" Olujide (1999)[1 In most cases, syntax describes the language expert justifications for the way various words are combinec realize sentence. It can be pointed out that the primary unit of this linguistic analysis (syntax) is the wc However, its concern for words has to do with how words are **strung** together to achieve meaning sentence. So the pre-occupation in syntactic analysis is the focus on the relationship among words and h these relationships lead to meaningful sentences.

Basically, there are two major kinds of structural relationships, these are:

- Syntagmatic relations.
- Paradigmatic relations.

Syntagmatic relations: deriving from the sentence focus of syntax, this relations seek to explain h sentences are composed using different constituent structures. A form of horizontal relationship in w words are orderly joined together to convey meaning Olujide (1999)[11]. Structures (words of diffe classes) that are woven together in this form to realize larger meaningful unit (sentences) are described t in syntagmatic relationship Lyons (1966)[9].

Syntagmatic relations can also be found at sentence level. The constituents of this unit is usual

NP-Binta + VP- kicked + NP-the ball.
The combinations here have demonstrated syntagmatic relations.
It should be pointed out that a syntagmatic relation is not limited to contiguity. There are instances, as Olujide (1999)[11] puts it, when 'linguistic units that are separated by other units can be more closely bonded together than contiguous ones' (P.47). For example, the sentence 'the activist has all along been advocating fair play in the polity' –' has' is separated by 'all along' from 'been advocating' in this sentence, even though they belong to the same linguistic notation (class): unlike 'activist'. Yet, the meaning is not affected despite the intercession.
Paradigmatic relations: this refers to a form of relationship, which Lyons (1970)[9], as cited by Olanrewaju (2000)[10], captures as 'set of elements which can be substituted one for another in a context' (P.16).
A situation where words of a sentence can be substituted by another words since they have the same linguistic features (class and meaning) lead to the realization of paradigmatic relations, for example:

		brilliant students
I		
We		
They	like/admire	them
You		you

Syntactic discourse has passed through different phases. Experts who have dwelt on this aspect of language study are of different ages (era), hence the description traditional and modern grammarians.
Pioneer efforts in describing grammar can be credited to the Traditional grammarians that Osisanwo (1999)[12] traces to Greece and later the period of classical antiquity in Europe. The primary provision of the Traditional Grammar (T.G) was the prescriptive rules that language is rules governed. Other main assumptions of the T.G. are:

a. Language exhibits universal attributes that is, the basis of discussing grammar can be applied to all languages.
b. T.G. relies on notional definition of all aspects of a language. For instance, Osisanwo (1999)[12] citing Lowth (1763)[8] defines noun as 'the name of anything conceived to subsit, or which we have notion'; the name of persons and things.' (P.3) respectively.
c. Identification of tenses and parts of speech. The T.G. identified eight parts of speech and different tenses in English that subsequently have remained basis for syntactic reference. These include, noun, pronoun, verb, and so on.
d. T.G. emphasized the primacy of written language form over speech.

However, structural grammar credited to Ferdinand de Saussure and his student, Bloomfield criticized and postulated improvement upon the assumptions of Traditional grammar. For instance, structural grammar refutes the universality of language but supports language of specifics Olanrewaju (2000)[10]. Structural grammar describes language as essentially speech. In lieu of the prescriptive mode of the T.G., Structural grammar advocates descriptive approach to language, hence it's been called descriptive grammar.
Noam Chomsky proposed a rather radical approach to language discourse in his Syntactic Structures (1957) [2]. He posits that linguists' analysis should be anchored on the principles that empower a native speaker to compose and understand limitless numbers of sentences Olanrewaju (2000)[10].
The postulations of Chomsky are generally tagged transformational Generative rules (TG). This theory explains that a native speaker of a language possess an implicit in depth intuitive knowledge of the rules of the language and this knowledge is demonstrated in the native speaker's ability to generate infinite sentences and to be able to judge sentences as grammatical, ungrammatical, ambiguous or synonymous and so on. He adds that this knowledge too should enable him to undertake unit by unit description of sentences of a language. This will also involve accounting for what makes a sentence ungrammatical when one is discovered Olanrewaju (2000)[10]. Chomsky also sets out the distinction between competence and performance, both of which play crucial roles in the intuitive knowledge of a language and the explicit.
Transformational Generative rule also makes a distinction between 'Deep and surface structures. The deep structure depicts the meaning of the sentence while the surface structure refers to the sound, or what (Tomori 1977)[14] puts as 'the form in which the sentence appears, phonologically or orthographically' (P.31).
Consider for example the following sentences:

The two sentences have one and the same deep structure (meaning) but in clearly different surface (forms. sound. etc).

Olujide (1999)[11] posits that as part of the indebtedness of Transformation Generative grammarians to Traditional Grammar. technical terms like sentence. subject. predicate. clause. phase. objective complements. and parts of speech among others provide fundamental guide for comprehensive discussion of the sentence. This theory (T.G) consists of three core parts namely:

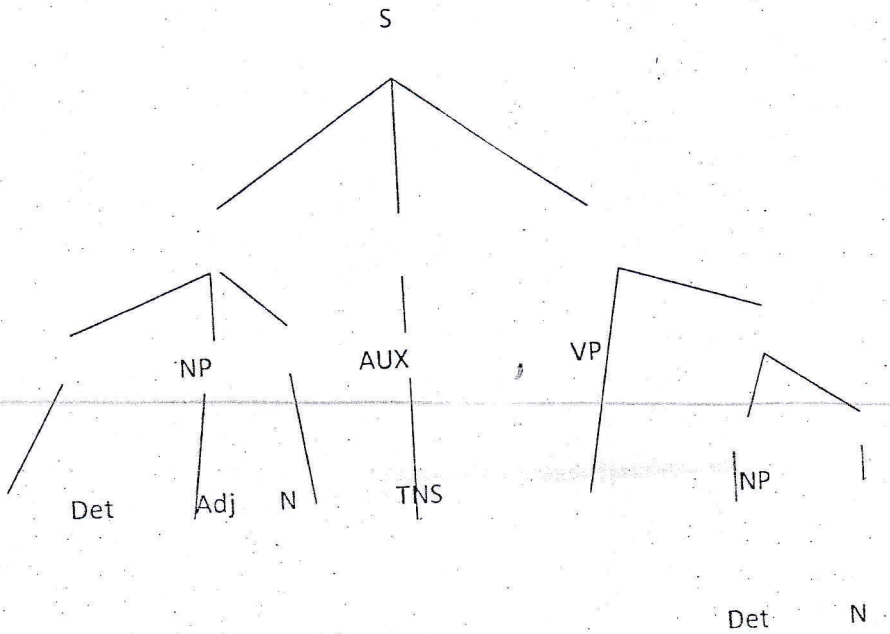
a. Phrase structure rules;
b. Transformational rules: and
c. Morpho-phonemic rules

A particular coinage of the traditional grammar that is employed in this paper is parsing that Olujide (1999)[11] describes thus:

> *Classifying every word in a sentence for the purpose of making clear the relationship of the word to the sentence, as well as, to the other words in the sentence , parsing...follows this procedure. Identifying the structural components of the sentence. stating the part of speech of each word. describing the inflectional forms of all inflected words and explaining the relationship of each word to other words (p.52).*

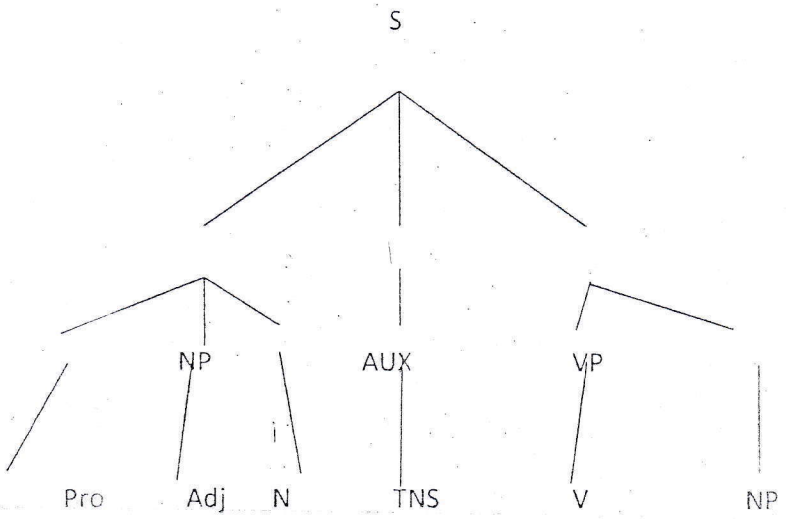
Parsing is especially employed to describe the corpuses analyzed in this paper because tree diagram is a indispensable approach of syntactic analysis of the transformationalists.

(a) The mobile team won the match



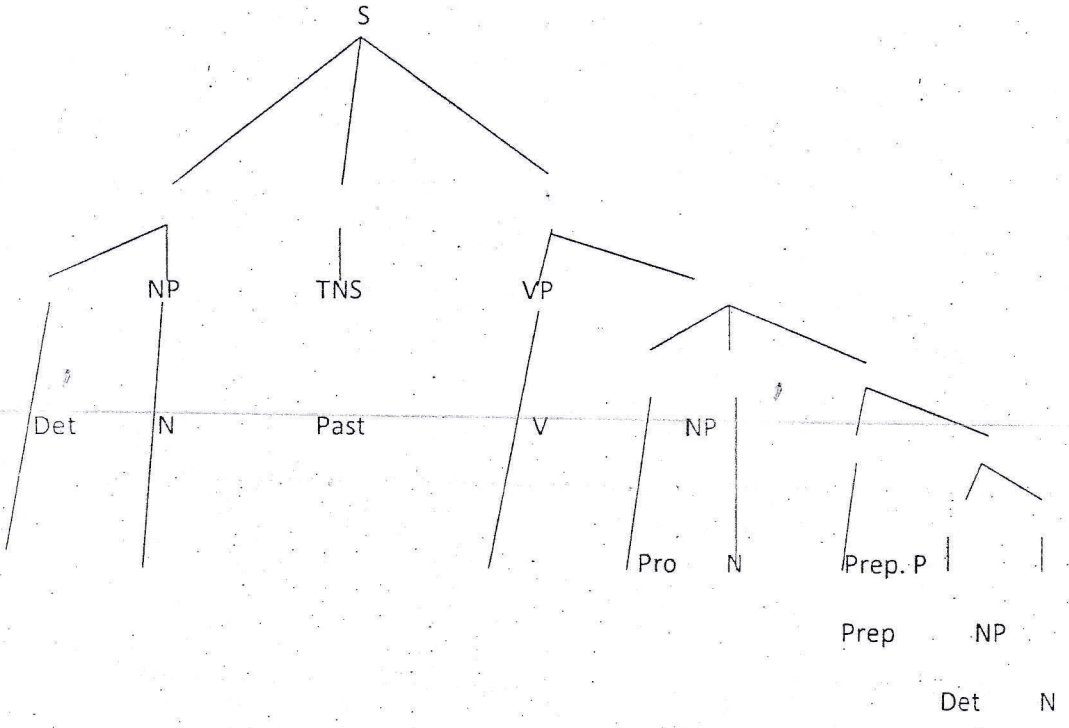
The mobile team past win the match

b. Some rude students were dismissed summarily.



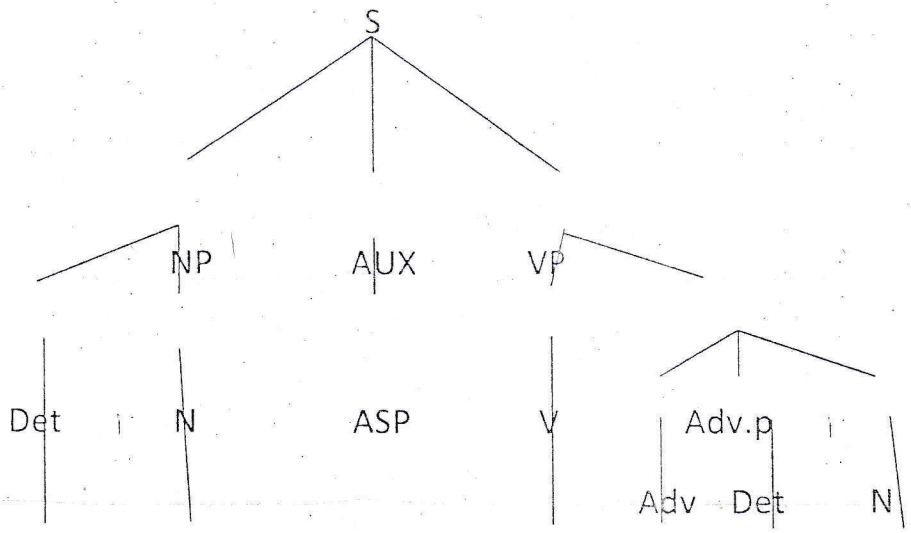
Some rude students past dismiss summarily

(c) The committee found him guilty of the offence.



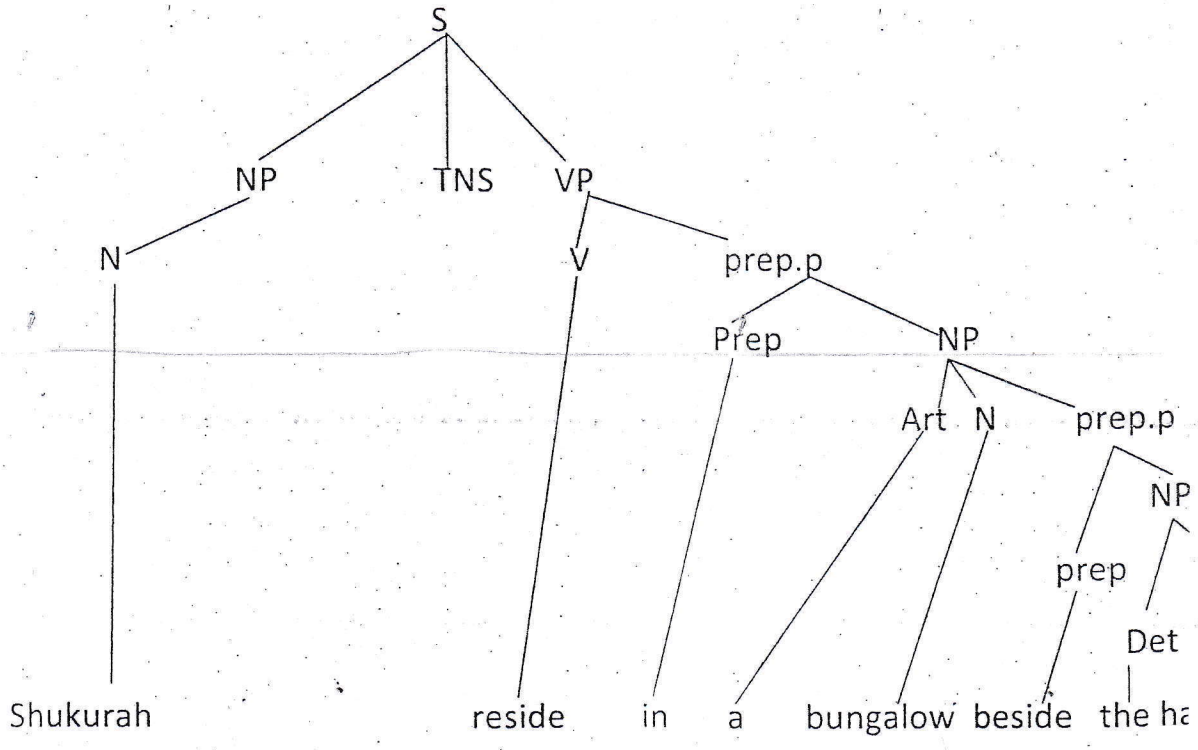
The committee find him guilty of the offence.

d. The teacher will come before the dinner

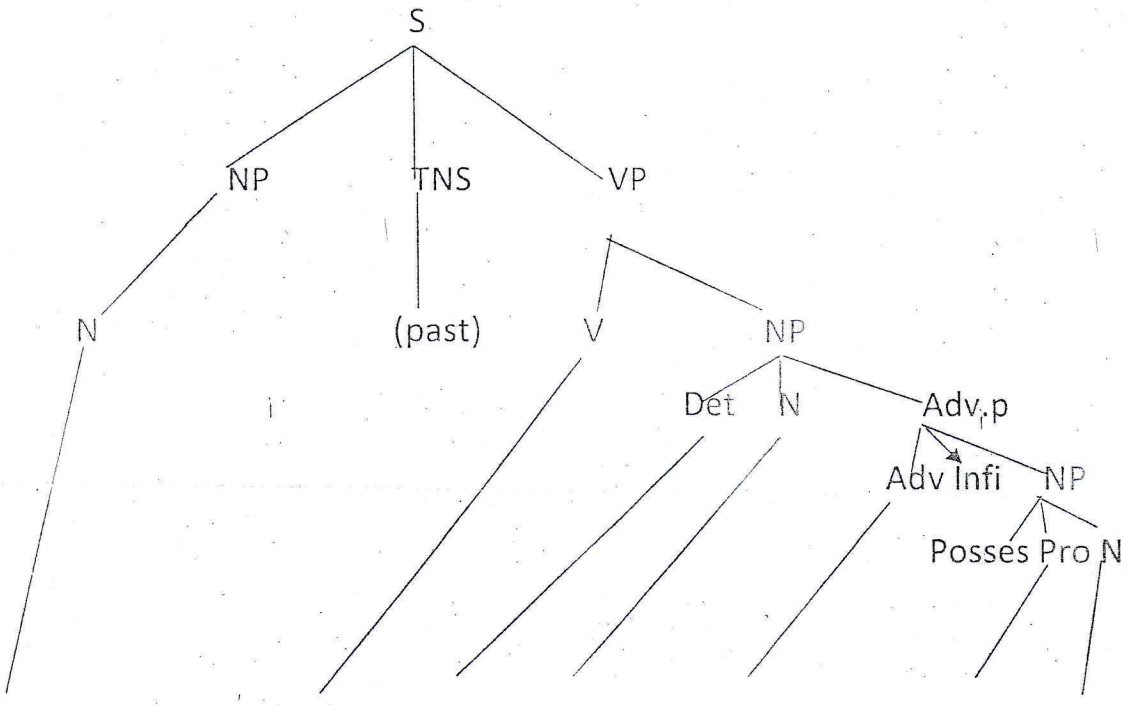


The teachercome before the dinner

e. Shukurah resides in the bungalow beside the hall.



f. Hamid engaged the solicitor to everyone's delight.



Keys: NP= noun Hamid engage the solicitor sufficiently every one delight

Keys: NP= noun phrase, VP= verb phrase, PREP P= prepositional phrase, ADV P= adverbial phrase, DET= determinant, ART= article, N= noun, V= verb, PRO= pronoun, ADJ= adjective, AUX= auxiliary verb, TNS= tense, ASP= aspect of tense, POSSES= possessive and INFI= infinite.

Free Semi groups

Free Semigroups are first Mathematical objects every human being has to deal with. Even before attending school a child learns a "language". The child acquires "words" (i.e. generators of certain free semigroup) and "sentences" (i.e. sequences of generators) formed by Concatenation of "words". The early learning process relies very heavily on the fact that words and sentences carry meanings, the purpose of communication being the notation of objects, the expression of sensations and, later on, of thoughts and their recognition from or by other members of the social group. This aspect of language is called its semantic aspect. In systematic studies of languages, the semantic aspect of a language is usually distinguished from its syntax, that is, the set of rules leading to the formation or recognition of grammatically correct sentences (F. de Saussure, 1931).

Let A be a set of symbols, called an alphabet. Its elements are letters. Any finite sequence of letters is a word (or a string) over A. The set of all words over A, with at least one letter, is denoted by A^+. The set A^+ is a semi group, the word semi group over A, when the product is defined as the concatenation of words, that is, the product of the words $w_1 = a_1a_2 \ldots a_n, w_2 = b_1b_2 \ldots b_m$ $(a_i, b_i \in A)$ is the word $w_1 . w_2 = w_1w_2 \equiv a_1a_2 \ldots a_nb_1b_2 \ldots b_m$. Also when we join the empty word 1 (which has no letters) into A^+, we have the word monoid $A^*, A^* = A^+ \cup \{1\}$. Clearly, $1 . w = w = w . 1$ for all words $w \in A^*$. Howie (1995)[4]

Let $A = \{a, b\}$ be a binary alphabet. Then $a, b, aa, ab, ba, bb, aaa, aab, \ldots$ are words in A^+. Now, $ab . bab = abbab$. As usual, w^k means the catenation of w with itself k times, for example,

Lemma

Given two words x and y over an alphabet A, the catenation of x with y, denoted by xy, is the wor obtained by appending the word y to x.

Theorem 1.3.2: For any alphabet A, A^+ is a free semi group, and it is freely generated by A.

Proof: From the definitions of alphabet, letters, words and free semigroups, then A can be generated A^+ since all words are strings of letters from A. Assume S to be a semigroup, then $\alpha_0 : A-$ mapping. Given $\alpha : A^+ \to S$ defined by

$$\alpha(a_1 a_2 \ldots a_n) = \alpha_0(a_1)\alpha_0(a_2)\ldots\alpha_0(a_n) \qquad (n \geq 1, a_i \in A).$$

Hence, $\alpha \mid A = \alpha_0$, and α is homomorphism.

Theorem 1.3.3: For each semigroup S there exists an alphabet A and an epimorphism $\psi : A^+ \to S$. (1996)[13]

Proof: Let X be any generating set of S and also let A be an alphabet with $|A| = |X|$, and let $\psi_0 : A \to X$ be a bijection, ψ_0 has a homomorphism extension $\psi : A^+ \to S$ (by definition of freeness Hence, the extension is surjective, since $[\psi(X)]s = \psi([X]s) = \psi(S)$, for X generates S.

Theorem 1.3.4: If S is freely generated by X and $\alpha_0 : S \to P$ is a homomorphism, then α_0 has a u homomorphic extension $\alpha : S \to P$.

Proof: By definition, each α_0 has an extension. For the uniqueness suppose both $\alpha : S \to P$ and $\beta : S \to P$ are homomorphic extensions of α_0. Now, for all $x \in S$, $x = x_1 x_2 \ldots x_n$ for some $x_i \in X$, since X generates S. Therefore,

$$\alpha(x) = \alpha(x_1)\alpha(x_2)\ldots\alpha(x_n) = \alpha_0(x_1)\alpha_0(x_2)\ldots\alpha_0(x_n)$$
$$= \beta(x_1)\beta(x_2)\ldots\beta(x_n) = \beta(x),$$

and so $\alpha = \beta$.

Alphabets and Words

A finite underlying set is called an alphabet, a finite sequence of its elements is called a word, and a s finite sequences is called a language, Derick (1987)[3].

Given

$\Phi = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

And

$A = \{Aa, Bb, Cc, Dd, Ee, Ff, Gg, Hh, Ii, Jj, Kk, Ll, \ldots, Zz\}$

The digits 1407295 is a word over an alphabet Φ usually written without any separate comm

goodness is a word over A.

Illustration

Let us consider one of the examples cited above:

(a) The mobile team won the match

Given

$A = \{Aa, Bb, Cc, Dd, Ee, Ff, Gg, Hh, Ii, Jj, Kk, Ll, \ldots, Zz\}$

The words

The

Mobile

Team

Won

CONCLUSION

Foregrounding the evolutionary trend of some established thoughts to explain language brings to fore the precedents that current study seek to build upon. This study in its way also updates discourse about language analysis, particularly in relation with mathematical theory.

The study brings to attention syntax as found in English (language) and Mathematics. Of particular interest is the use of orthographic symbols (Aa, Bb, Cc, etc.) in automata theory to analyze sentence corpuses. The analysis of sentences is presented to replicate sentences parsed (in tree structure) using grammatical class notations (S, NP, VP, ADJ, etc.). Though a preliminary effort, it is posed to open further areas of likely convergence in other planes of language like semantics (meaning), punctuation (especially) and phonetics and phonology.

It is hoped that a further exploration of the syntactical relationships (in language and Mathematics) can evidentially establish the common description of syntax as science of words combination to form meaning.

However, the importance in application of free semi groups and monoids lies in the fact that the elements are words in alphabet. They are strings of symbols, and such strings are encountered in a huge variety of contexts. Any spoken and written statements, any inputs on a computer through the use of keyboard is a string of symbols, Adeshola (2008)[1].

From the foregoing therefore, every Shakespearean play is an element of A+, where A is the set consisting of the 52 upper and lower case letters of the alphabet together with various space and punctuation symbols, Howie (1995)[4].

REFERENCES

Adeshola, A. D., Makanjuola, S. O. and Kehinde, R. (2008). Semigroups in Automata. *International Journal of Engineering and Technical Mathematics,* vol. I pp. 208-213.

Chomsky, N. (1957). *Syntactic structures.* The Hague: Mounton

Derick, W. (1987). *Theory of Computation.* John Wiley and Sons. Inc. Canada.

Howie, J. M. (1995*). Fundamentals of Semigroup Theory.* Clavendon Press, Oxford.

Lowth, R. (1763). *A short introduction to English grammatical.* 2nd edition. London

Lyons, J. (1966). *Firth's theory of meaning'* in Bazel C. E. et al ~(eds). In memory of J. R Firth, London: Longman

Olarewaju, D. O. (2000). *English Syntax: The transformational genrative approach* in Babajide, O. A. (ed) Studies in English Language. Ibadan: Enicrownfit publishers.

Olujide, T. M. (1999). *An Overview of English Syntax* in Adegbija, E. (ed). The English Language and Literature in English, Ilorin: Unilorin Press.

Osisanwo, W. (1994). *An Introductory Analysis of grammar of English Lagos*: Femolus-fetop Publisher

Tero, H. (1996). *Lecture Notes on Semigroups.* Department of Mathematics, University of Turku, Finland.

Tomori, SHO. (1977). *The morphology and syntax of present-day English*: An introduction. Ibadan: Heinemann Educational Books Ltd