ADDITIONAL INFORMATION

Name: _____

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Programme applied for: _____

Second choice (if any): _____

Date of application: _____

QUESTION 1: Carefully read the enclosed fragment of text on "Jupiter's stick insects" and provide clear and concise answers to the questions below.

i. Why did the emperor of Jupiter have to resort to memorization in his attempt to learn English?
ii. Which two facts about language make it in principle impossible to memorize all the sentences of a language?
iii. What is the difference between an accidental gap in a language and an ungrammatical sentence?
iv. Why is performance not an accurate reflection of competence in a language?
v. Which property of language is illustrated by the impossibility of *The lioness hurt himself*?
vi. Write down in no more than 30 words what the Jupiter story is about.

QUESTION 2: In no more than 150 words, explain why you want to do this programme.

Please attach your answers to this sheet, and forward to:

The Programme Co-ordinator
Department of General Linguistics
Stellenbosch University
Private Bag X1
7602 MATIELAND
South Africa

JUPITER'S STICK INSECTS

Suppose ... a space ship full of English speakers had landed on Jupiter. They found the planet inhabited by a race of green stick insects who communicated by sitting down and wiggling their stick-like toes. The English speakers learned the Jupiter toe-wiggle language easily. It was a sign language like Washoe's in which signs stood for words, with no obvious structure. So communication was not a serious problem. But the Emperor of Jupiter became highly envious of these foreigners who were able to walk about *and* communicate at the same time. They did not have to stop, sit down, and wiggle their toes. He decided to learn English.

At first, he assumed the task was easy. He ordered his servants to record all the sentences uttered by the English speakers, together with their meanings. Each morning he locked himself into his study and memorized the sentences recorded on the previous day. He carried out this routine unswervingly for about a year, dutifully learning every single sentence spoken by the foreigners. As he was an inhabitant of Jupiter, he had no natural ability for understanding the way a language worked. So he did not detect any patterns in the words, he simply memorized them. Eventually, he decided he knew enough to start testing his knowledge in conversation with the Englishmen.

But the result was a disaster. He didn't seem to have learnt the sentences he needed to use. When he wanted to ask the Englishmen if they liked sea-urchin soup, the nearest sentence he could remember having learnt was 'This is funny-tasting soup. What kind is it?' When it rained, and he wanted to know if rain was likely to harm the foreigners, the most relevant sentence was 'It's raining, can we buy gum boots and umbrellas here?'

He began to have doubts about the task he had set himself of memorizing all English sentences. Would it ever come to an end? He understood that each sentence was composed of units called words, such as JAM, SIX, HELP, BUBBLE which kept recurring. But although lie now recognized most of the words which cropped up, they kept appearing in new combinations, so the number of new sentences did not seem to be decreasing. Worse still, some of the sentences were extremely long. He recalled one in which an English speaker had been discussing a greedy boy: 'Alexander ate ten sausages, four jam tarts, two bananas, a Swiss roll, seven meringues, fourteen oranges, eight pieces of toast, fourteen apples, two ice-creams, three trifles and then he was sick.' The Emperor wondered despairingly what would have happened to the sentence if Alexander hadn't been sick. Would it have gone on for ever? Another sentence worried him, which an English speaker had read out of a magazine. It was a summary of previous episodes in a serial story: 'Virginia, who is employed as a governess at an old castle in Cornwall, falls in love with her employer's son Charles who is himself in love with a local beauty queen called Linda who has eyes only for the fisherman's nephew Philip who is obsessed with his half-sister Phyllis who loves the handsome young farmer Tom who cares only for his pigs.' Presumably the writer ran out of characters to describe, the Emperor, reasoned. Otherwise, the sentence could have gone on even further.

The Emperor had therefore deduced for himself two fundamental facts about language.

There are a finite number of elements which can be combined in a mathematically enormous number of ways. And it is in *principle* impossible to memorize every sentence because there is no linguistic bound on the length of a sentence. Innumerable 'sub'-sentences can be joined on to the original one, a process known as *conjoining:*

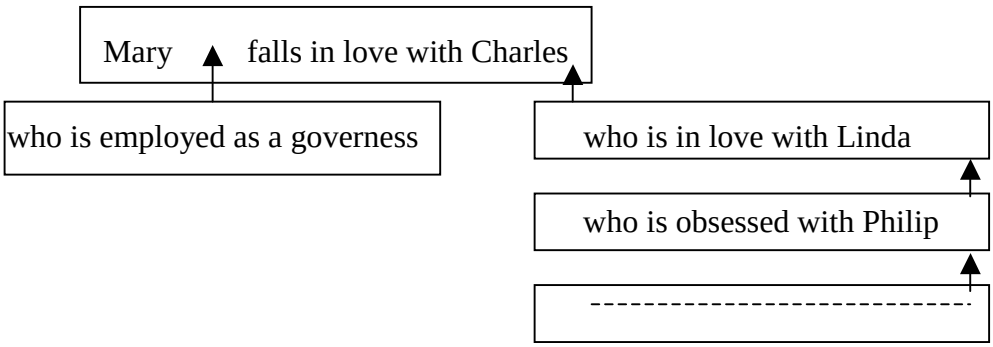
ALEXANDER ATE 10 SAUSAGES +

(ALEXANDER ATE) 4 JAM TARTS +

(ALEXANDER ATE) 2 BANANAS +

(ALEXANDER ATE) A Swiss ROLL +…

Alternatively, sub-sentences can be inserted or *embedded* inside the original one:



This property of language is known as RECURSIVENESS from the Latin to 'run through again' — you can repeatedly apply the same rule to one sentence, a process which could (in theory) go on for ever. Of course, in practice you would fall asleep, or get bored or get a sore throat. But these are not *linguistic* reasons for stopping. This means that no definite set of utterances can ever be assembled for any language.

The Emperor of Jupiter eventually concluded that memorization of all English sentences was impossible. He realized it was the *patterns* behind the utterances which mattered.

How should he discover what these were? One way would be to make a list of all the

English words he had collected, and to note whereabouts in the sentence each one occurred. He started to do this. But he hit on problems almost immediately. He had a feeling that some of his sentences had mistakes in them, but he was not sure which ones. Was ‘I hic have hic o dear hic hiccups’ a well-formed English sentence or not? And what about ‘I mean that what I wanted I think to say was this’?

His other problem was that he found gaps in the patterns, and he didn’t know which ones were accidental, and which not. For example, he found four sentences containing the word ELEPHANT:

THE ELEPHANT CARRIED TEN PEOPLE

THE ELEPHANT SWALLOWED TEN BUNS

THE ELEPHANT WEIGHED TEN TONS

TEN PEOPLE WERE CARRIED BY THE ELEPHANT

But he did not find:

TEN BUNS WERE SWALLOWED BY THE ELEPHANT

TEN TONS WERE WEIGHED BY THE ELEPHANT

Why not? Were these gaps accidental? Or were the sentences ungrammatical? The Emperor did not know, and grew very depressed. He had discovered another important fact about language: collections of utterances must be treated with caution. They are full of false starts and slips of the tongue. And they constitute only a small subset of all possible utterances. In linguistic terms, a speaker’s *performance* is likely to be a random sample bespattered with errors, and does not necessarily provide a very good guide to his *competence,* the internalized set of rules which underlie them.

The Emperor of Jupiter realized that he needed the help of the foreigners themselves. He arrested the spaceship captain, a man called Noam, and told him that he would free him as soon as he had written down the rules of English. Noam plainly knew them, since he could talk.

Noam was astounded. He pleaded with the Emperor, pointing out that speaking a language was an ability like walking which involved knowing *how* to do something. Such knowledge was not necessarily conscious. He tried to explain that philosophers on earth made a distinction between two kinds of knowing: knowing that and knowing *how.* Noam knew *that* Jupiter was a planet, and factual knowledge of this type was conscious knowledge. On the other hand, he knew *how* to talk and *how* to walk, though he had no idea how to convey this

knowledge to others, since he carried out the actions required without being aware of how he actually managed to do them.

But the Emperor was adamant. Noam would not be freed until he had written down an explicit set of rules, parallel to the system internalized in his head.

Noam pondered. Where could he begin? After much thought he made a list of all the English words he could think of, then fed them into a computer with the instructions that it could combine them in any way whatsoever. First it was to print out all the words one by one, then all possible combinations of two words, then three words, then four words, and so on. The computer began churning out the words as programmed, and spewed out (in the four-word cycle) sequences such as:

DOG INTO INTO OF

UP UP UP UP

GOLDFISH MAY EAT CATS

THE ELEPHANT LOVED BUNS

DOWN OVER FROM THE

SKYLARKS KISS SNAILS BADLY.

Sooner or later, Noam reasoned, the computer would produce every English sentence.

Noam announced to the Emperor that the computer was programmed with rules which made it potentially capable of producing all possible sentences of English. The Emperor was suspicious that the task had been completed so quickly. And when he checked with the other foreigners, his fears were confirmed. The others pointed out that although Noam's computer programme could in theory generate *all* English sentences, it certainly did not generate *only* the sentenccs of English. Since the Emperor was looking for a device which paralleled a human's internalized grammar. Noam's programme must be rejected, because humans did not accept sentences such as:

DOG INTO INTO OF.

It was also unlikely that they would accept

GOLDFISH MAY EAT CATS

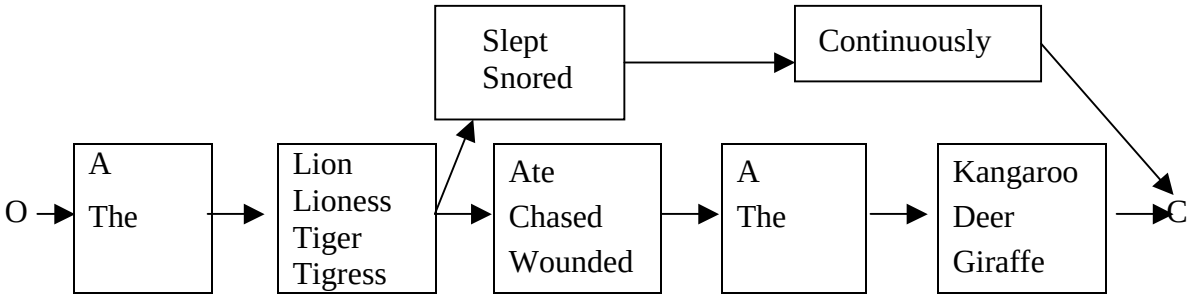
or SKYLARKS KISS SNAILS BADLY.

But there was nothing really wrong with these grammatically: these were accidental facts about the diet of goldfish and the amatory preferences of skylarks which need not be included in the grammar.

So Noam went away again and thought hard. It dawned on him that all sentences were straightforward word 'strings': they were composed of words strung together, one after the other. And the order in which they occurred was partially predictable. For example, THE had to he followed either by an adjective such as GOOD, LITTLE or by a noun such as FLOWER, CHEESE, or occasionally an adverb such as CAREFULLY as in

THE CAREFULLY NURTURED CHILD SCRIBBLED OBSCENE GRAFFITI ON THE WALLS.

Perhaps, he pondered, one's head contained a network of associations such that each word was in sonic way attached to the words which could follow it in a sentence. He started to devise a grammar which started with one word, which triggered off a choice between several others, which in turn moved to another choice, until the sentence was complete:



This simple device could account for quite a number of different sentences:

A LION ATE A KANGAROO

THE TIGRESS CHASED THE GIRAFFE,

and so on. If he continued to elaborate it, perhaps it could eventually include all possible sentences of English.

He presented it to the Emperor, who in turn showed it to the other Englishmen. They pointed out a fatal flaw. Such a device could not possibly account for a speaker's internalized rules for English, because English (and all other languages) has sentences in which non-adjacent words are dependent on one another. For example, you can have a sentence:

THE LIONESS HURT HERSELF.

If each word triggered off the next only, then you would not be able to link the word following HURT with LIONESS, you would be just as likely to have

*THE LIONESS HURT HIMSELF.

Similarly, a sentence starting with EITHER, as in

EITHER BILL STOPS SINGING OR YOU FIND ME EAR PLUGS

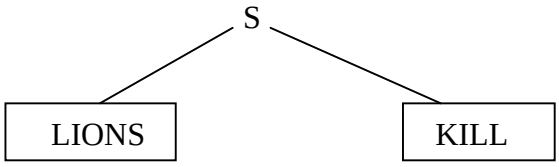
would not fit into this system, since there would be no means of triggering the **OR.** Furthermore, in this left-to-right model, all the words had equal status, and were linked to one another like beads on a necklace. But in language, speakers treat 'chunks' of words as belonging together:

THE LITTLE RED HEN / WALKED SLOWLY / ALONG THE PATH / SCRATCHING FOR WORMS.

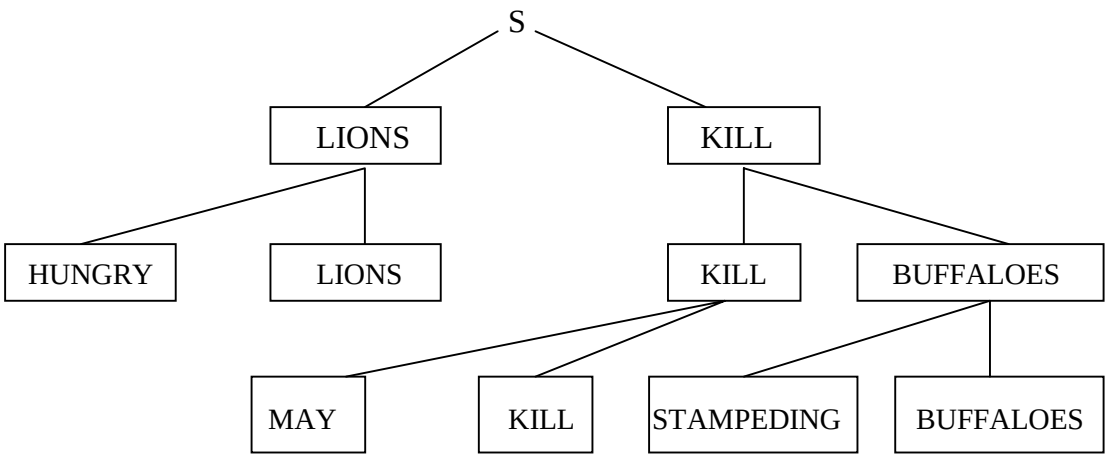
Any grammar which claimed to mirror a speaker's internalized rules must recognize this fact.

Noam, therefore, realized that an adequate grammar must fulfil at the very least two requirements. First, it must account for *all* and *only* the sentences of English. In linguistic terminology, it must be *observationally adequate.* Secondly, it must do so in a way which coincides with the intuitions of a native speaker. Such a grammar is spoken of as being *descriptively adequate.*

Noam decided, as a third attempt, to concentrate on a system which would capture the fact that sentences are split up into chunks of words which go together. He decided that a multi-layered, 'downward branching' system was the answer. At the top of the page he wrote the letter S to represent 'sentence'. Then he drew two branches forking from it, representing the shortest possible English sentence (not counting commands).



Then each branch was expanded into a longer phrase which could optionally replace it:



This tree diagram clearly captured the *hierarchical* structure of language, the fact that whole phrases can be the structural equivalent of one word. It diagrammed the fact that HUNGRY LIONS functions as a single unit in a way that KILL STAMPEDING does not.

The Emperor of Jupiter was delighted. For the first time he began to have an inkling of the way language worked. 'I want some soup ... some seaweed soup ... some hot seaweed soup ... some steaming hot seaweed soup,' he murmured to himself, realizing the importance of Noam's new system.

The other Englishmen praised the system, but grudgingly. They admitted that the tree diagram worked very well for sentences such as

HUNGRY LIONS MAY KILL STAMPEDING BUFFALOES.

But they had one major objection. Did Noam realize just how many trees might be required for the whole language? And did he realize that sentences which speakers felt to be closely related would have quite different trees? For example:

HUNGRY LIONS MAY KILL STAMPEDING BUFFALOES

would have a tree quite different from

STAMPEDING BUFFALOES MAY BE KILLED BY HUNGRY LIONS.

And a sentence such as

TO CHOP DOWN LAMP-POSTS IS A DREADFUL CRIME

would have a different tree from

IT IS A DREADFUL CRIME TO CHOP DOWN LAMP-POSTS.

Worse still, had Noam noticed that sentences which were felt to be quite different by the speakers of the language had exactly the *same* trees?

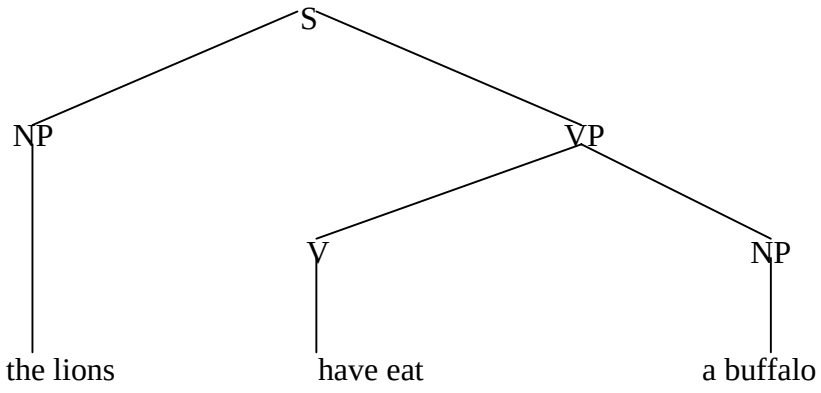
THE BOY WAS LOATH TO WASH

had exactly the same tree as

TIlE BOY WAS DIFFICULT TO WASH.

Surely Noam could devise a system in which sentences felt by speakers to be similar could be linked up, and dissimilar ones separated?

After much contemplation, Noam realized he could economize on the number of trees needed, and he could also capture the intuitions of speakers that certain sentences were similar if he regarded similar sentences as belonging to the same basic tree! Actives and passives, for example, could be related to an underlying tree:



Then this ‘deep structure’ tree could be ‘transformed’ by operations known as transformations into different surface structure. It provided the basis for both the lions have eaten a buffalo and a buffalo has been eaten by lions.

Using the same principle, Noam realized that he could explain the similarity of

TO CHOP DOWN LAMP-POSTS IS A DREADFUL CRIME

IT IS A DREADFUL CRIME TO CHOP DOWN LAMP-POSTS.

Conversely, the difference between

THE BOY WAS LOATH TO WASH

THE BOY WAS DIFFICULT TO WASH

could be explained by suggesting that the sentences are connected to different deep structure strings.

The Emperor of Jupiter was delighted with Noam's latest attempt, and the other Englishmen agreed that Noam seemed to have hit on a very good solution. He appeared to have devised a clear, economical system which was able to account for *all* and *only* the sentences of English, and which also captured the intuitions of the speakers about the way their language worked. A further Important bonus was that the system could possibly be used for French, Chinese, Turkish, Arawak, or any other language in the strange human world.

However, the Emperor was still somewhat puzzled. Had Noam explained to him how to actually *produce* English sentences? Or had he merely drawn him a map of the way in which related sentences were stored in an Englishman's head? Noam was rather vague when asked about this. He said that although the map idea seemed nearer the truth, the map nevertheless had important implications for the way in which sentences were produced and recognized. The Emperor was extremely puzzled by this statement. However, he decided that Noam had done some splendid work, and so should be set free, and rewarded handsomely. Meanwhile, the Emperor made a mental note that when he had some more spare time, he would have to contemplate more thoroughly the question of how Noam's proposals related to the way humans produced and recognized sentences.

TEXT by J. Aitchison