Grammatical Mapping and Its Kinds in New Horizon

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1. Introduction

I have been studying grammatical mapping for these four years. I constructed and defined the theory of grammatical mapping mathematically and investigated the kinds of grammatical mappings in my master's thesis. In this paper I will introduce grammatical mapping and present you 32 grammatical mappings in English text. The notion of mapping is borrowed from mathematics. I apply the notion to the description of grammatical structures and call this model 'grammatical mapping'. In this model the grammatical relation between the two words or two sentences is represented by mapping. The description of suffixes can also be possible.

Grammatical mapping is defined using mapping theory in mathematics in Chapter 2 and Chapter 3. In Chapter 4, 32 grammatical mappings are presented, and some remarks on the decision of grammatical mappings are stated in Chapter 5.

2. Mapping

Set is a collection of discrete individuals. If Set $\underline{A}$ consists of the integers 1,2,3,4,5,6, then Set $\underline{A}$ is described as follows;

$$\underline{A}=\{1,2,3,4,5,6\}$$

This set can be rewritten as

$$\underline{A}=\{\underline{x}\mid \underline{x} \text{ is a positive integer less than } 7\}$$

The symbol $\in$ means 'is a member of'. Now we may write

$$5\in\{\underline{x}\mid \underline{x} \text{ is a positive integer less than } 7\}$$

or more simply

$$5\in \underline{A}$$

The notion of 'mapping' is defined by Cartesian product, which is defined as follows; given any two Sets $\underline{A}$ and $\underline{B}$, the set of which members are all the possible ordered pairs with first coordinates from $\underline{A}$ and second coordinates from $\underline{B}$ is called the Cartesian product of A and B, and is denoted $A\times B$. $A\times B$ is the set whose members are ordered pairs $(\underline{x},\underline{y})$ such that the first coordinate '$\underline{x}$' is a member of Set $\underline{A}$ ($\underline{x}\in\underline{A}$) and the second coordinate '$\underline{y}$' is a member of Set $\underline{B}$ ($\underline{y}\in\underline{B}$). Now let $\underline{A}=\{\underline{a},\underline{b},\underline{c}\}$ and $\underline{B}=\{1,2\}$, then $\underline{A}\times\underline{B}=\{(\underline{a},1),(\underline{a},2),(\underline{b},1),(\underline{b},2),(\underline{c},1),(\underline{c},2)\}$. This can be generally written like;

$$\underline{A}\times\underline{B}=\{(\underline{x},\underline{y})\mid \underline{x}\in\underline{A},\ \underline{y}\in\underline{B}\}$$

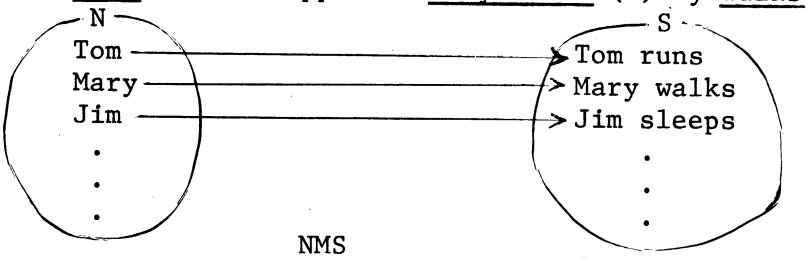
'mapping' which is represented by two arbitrary elements $\underline{x}$ and $\underline{y}$ is a subset of Cartesian product $\underline{A}\times\underline{B}$. Thus mathematically 'mapping' is thought to be any set of ordered pairs.

3. Grammatical Mapping

At first 'N'(nouns or noun phrases) and 'S'(sentences) are given. The notion of mapping, M, is introduced to indicate mapping operations.

In the expression Tom runs, Tom is a noun, so it receives N and Tom runs is a sentence, so it receives S. Thus runs has the grammatical mapping NMS. This is illustrated in Fig 3-1.

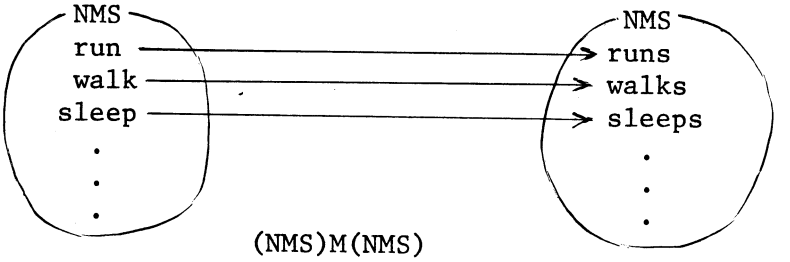
In the expression Mary walks, Mary is a noun and Mary walks is a sentence. Mary (N) is mapped to Mary walks (S) by walks.



NMS

Fig 3-1

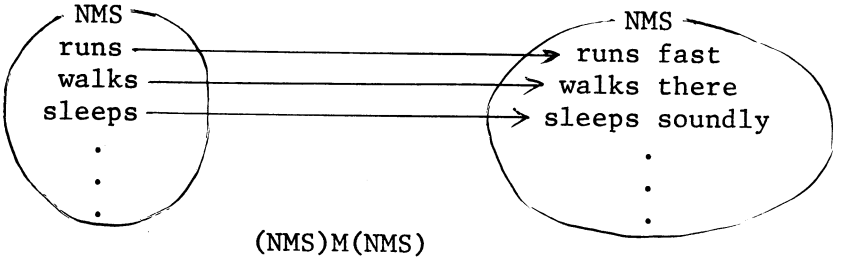
walks maps N to S, so it receives the grammatical mapping NMS. In the same way sleeps receives the grammatical mapping NMS, because it maps N (e.g. I) to S (e.g. I run, I walk, I sleep). Thus mapping from run, walk, sleep to runs, walks, sleeps all receive the grammatical mapping (NMS)M(NMS) as in Fig 3-2.



(NMS)M(NMS)

Fig 3-2

fast, there, soundly are also the grammatical mapping (NMS)M (NMS). They map runs, walks, and sleeps to runs fast, walks there, and sleeps soundly respectively as in Fig 3-3.

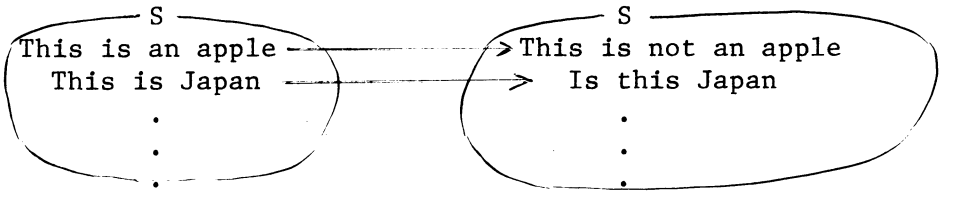


(NMS)M(NMS)

Fig 3-3

From these two illustrations it is clear that -s, fast, there and soundly have the same function syntactically, though different semantically.

Mapping between sentences like This is an apple and This is not an apple, or This is Japan and Is this Japan is the grammatical mapping from a sentence to a sentence. This is shown as in Fig 3-4.

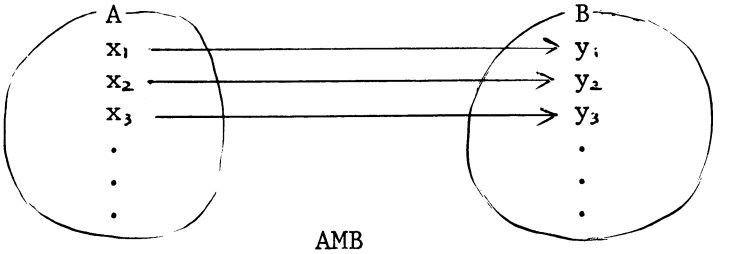


SMS

Fig 3-4

Mappings just presented as yet can be formulated as follows;

$$AMB = \{(x,y) \mid x \in A,\ y \in B\}$$



AMB

Fig 3-5

Using this formula, runs is represented as $NMS(runs) = \{(Tom, Tom\ runs) \mid Tom \in N,\ Tom\ runs \in S\}$. This statement indicates that mapping from Tom(N) to Tom runs(S) is the grammatical mapping NMS. This is the case when x=Tom, y=Tom runs and A=N, B=S. Thus $AMB = \{(x,y) \mid x \in A, y \in B\}$ means 'mapping from an expression x(A) to an expression y(B)' and represents the grammatical mapping AMB. The linguistic unit which maps x to y is the grammatical mapping AMB in the above formula. I will define this grammatical model as 'grammatical mapping'.

4. Grammatical Mappings in NEW HORIZON

32 grammatical mappings are found in all. They are as follows;

1. NMN
2. NMS
3. NM(NMS)
4. (NMN)M(NMS)
5. 2NM(NMS)
6. (NMS)M(NMS)
7. (NMN)M(NMN)
8. NM(NMN)
9. 2NMN
10. 3NMN
11. 4NMN
12. 7NMN
13. 2(NMS)M(NMS)
14. 2(NMN)M(NMN)

15. 2((NMS)M(NMS))M((NMS)M(NMS))
16. 2SMS
17. (NMS)MN
18. (NMS)M(NMN)
19. (NMS)M((NMS)M(NMS))
20. (NMS)M((NMN)M(NMN))
21. SMN
22. SM(NMN)
23. SM((NMS)M(NMS))
24. SM((NMN)M(NMN))
25. NM((NMS)M(NMS))
26. (NMN)M((NMS)M(NMS))
27. (NMN)M((NMN)M(NMN))
28. ((NMS)M(NMS))M((NMS)M(NMS))
29. (NM(NMS))M(NM(NMS))
30. (2NM(NMS))M(2NM(NMS))
31. ((NMN)M(NMS))M((NMN)M(NMS))
32. SMS

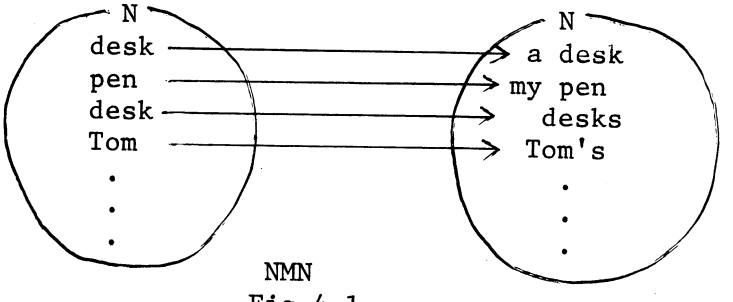
Now let's examine these mappings more detail.

4.1. NMN

pen is a noun and my pen has the function of a noun as a whole. They are both N's. Mapping pen(N) to my pen(N) is written as NMN. The expression my maps pen to my pen.

In a similar way, desk and desks are both nouns, because desks, though inflected, behaves like a noun. Thus the inflection -s gets the grammatical mapping NMN.

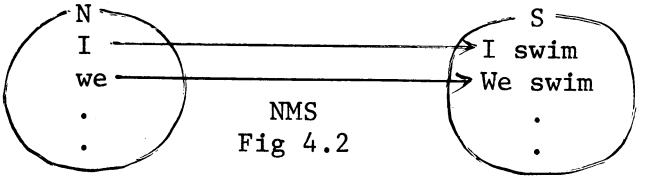
Tom and Tom's are both nouns. So mapping Tom to Tom's is written NMN, and the expression -'s gets the grammatical mapping NMN. They are illustrated as in Fig 4.1



NMN
Fig 4.1

4.2. NMS

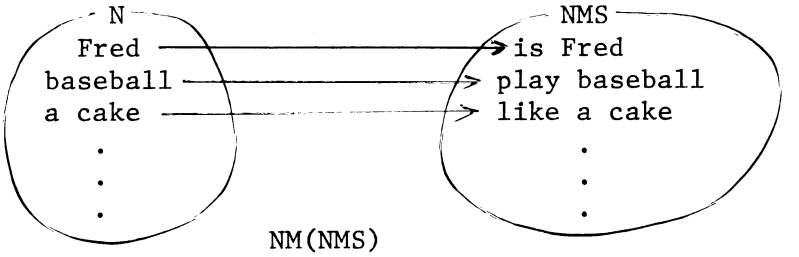
I and we are nouns and I swim and We swim are sentences, so mapping I to I swim and we to We swim are the grammatical mapping NMS. This is shown as follows together with some other examples.



NMS
Fig 4.2

4.3. NM(NMS)

As shown in Fig4.3, the expression be(is) Fred, play baseball, like a cake map he, I, you (N) to He is Fred, I play baseball, You like a cake (S), so that they get grammatical mapping NMS. is, play, like map Fred, baseball, a cake (N) to is Fred, play baseball, like a cake (NMS), so they get the grammatical mapping NM(NMS) as follows

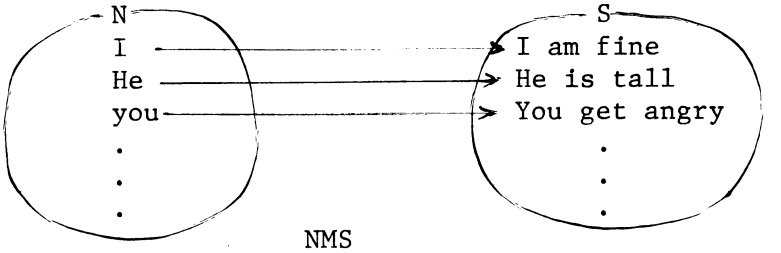


NM(NMS)

Fig 4.3

4.4. (NMN)M(NMS)

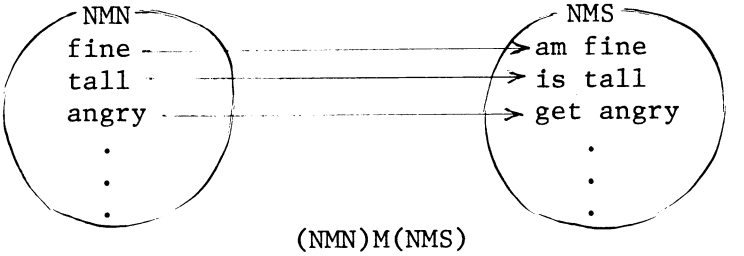
The expressions am fine, is tall, get angry etc. map I, he, you (N) to I am fine, He is tall, You get angry (S) as follows;



NMS

Fig 4.4-1

fine, tall, angry are the grammatical mapping NMN as shown in 4.1. They are mapped to am fine, is tall, and get angry by am, is and get am, is and get map the elements which are the grammatical mapping NMN to elements which are the grammatical mapping NMS. Thus they are the grammatical mapping (NMN)M(NMS) as Fig 4.4-2.

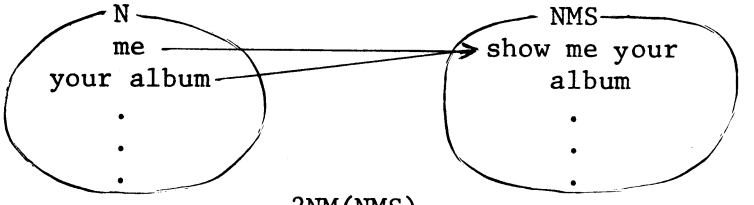


(NMN)M(NMS)

Fig 4.4-2

4.5. 2NM(NMS)

This means 'mapping two N's to one NMS', such as 'mapping me(N) and your album (N) to show me your album (NMS)'. call and give also map two N's to one noun phrase. They are illustrated in the following way.



2NM(NMS)
Fig 4.5

4.6. (NMS)M(NMS)

there maps walk (NMS) to walk there (NMS), so it is written as '(NMS)M(NMS)'. down is the grammatical mapping (NMS)M(NMS), because it maps sit (NMS) to sit down (NMS). -ing, -s, and can (swim) are also the grammatical mapping (NMS)M(NMS). -ing, -s, can map run, talk, swim (NMS) to running, talks, can swim (NMS).

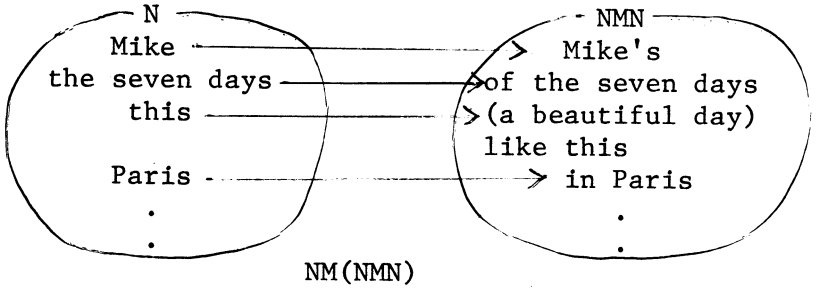
It should be noticed that mapping see to saw is also represented as (NMS)M(NMS). In this case we have no expressions, such as -ed in listened, so strange as it may be, it is natural to remember that grammatical mapping represents the relation between linguistic units. Thus the relation between see and saw is represented as (NMS)M(NMS).

4.7. (NMN)M(NMN)

very beautiful, quite well, and neary two behave like an adjective as a whole respectively. beautiful, well, two are the grammatical mapping NMN in 4.1, and they are all mapped to very beautiful, quite well, neary two (NMN) by very, quite, neary. Thus very, quite, neary are the grammatical mapping (NMN)M(NMN). The inflections, such as -er, -est, are also this grammatical mapping. They map old (NMN) to older or oldest (NMN).

4.8. NM(NMN)

This grammatical mapping is possessed by -'s, of, and like etc. They map Mike, the seven days, and this (N) to Mike's, of the seven days and (a beautiful day) like this (NMN). Mike's, of the seven days and like this receive NMN, because car, dog, name, day (N) are all mapped to Mike's, Jane's, of the seven days, day like this (N) respectively. in also maps Paris (N) to in Paris. in Paris maps many people (a noun phrase) to many people in Paris (a noun phrase), so it obtains the grammatical mapping NMN. in maps Paris (N) to in Paris (NMN). Thus in is given the grammatical mapping NM(NMN).

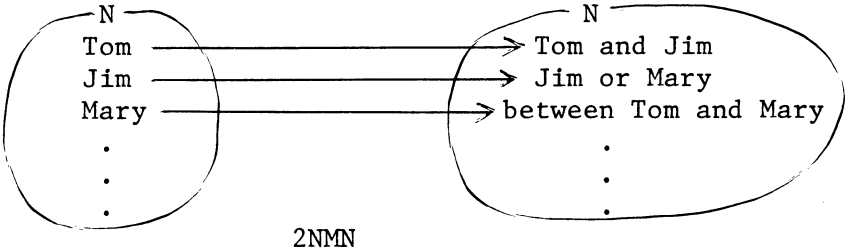


NM(NMN)
Fig 4.8

(Parenthetical material is not part of the example, but context for clarity)

4.9. 2NMN

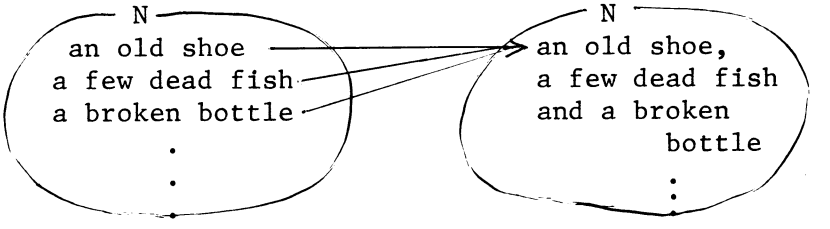
The linguistic units which map two nouns to a noun phrase are this grammatical mapping. They are and, or, between...and..., and either...or.... These map Tom, Jim and Mary to Tom and Jim, Jim or Mary, between Tom and Mary and either Jim or Mary which are N as a whole respectively. Thus and, or, between...and..., and either...or ... receive the grammatical mapping 2NMN.



2NMN
Fig 4.9

4.10. 3NMN

and obtains this grammatical mapping. It maps an old shoe, a few dead fish, a broken bottle which have all the same privileges of occurence as a noun to an old shoe, a few dead fish, and a broken bottle which is a noun phrase as a whole. This is shown as in Fig 4.10. Here the expression and combines to the three clusters of elements an old shoe, a few dead fish, a broken bottle.



3NMN
Fig 4.10

4.11. 4NMN

In the expression they are spring, summer, fall and winter, and maps the four nouns to one expression spring, summer, fall and winter which is a noun phrase as a whole.

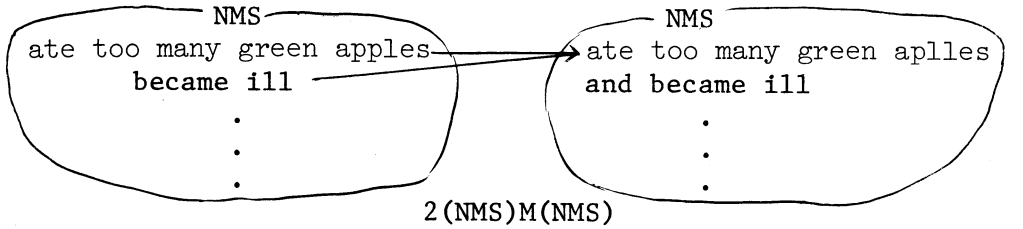
4.12. 7NMN

and in the expression They are Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday is this grammatical mapping. It maps seven nouns to one noun phrase Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday.

4.13. 2(NMS)M(NMS)

and and or which occur between the two linguistic units which are NMS are this grammatical mapping. The phrases ate too many green

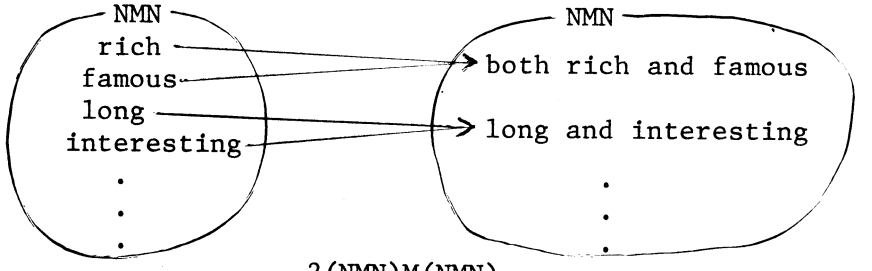
apples and became ill receive the grammatical mapping NMS. and combines to both these expressions to form the larger expression ate too many green apples and became ill. In this case and maps two NMS's to one NMS, so it is given the grammatical mapping 2(NMS)M(NMS).



2(NMS)M(NMS)
Fig 4.13

4.14. 2(NMN)M(NMN)

rich and famous are both NMN's in 4.1. In the expression both rich and famous which is the grammatical mapping NMN as a whole, both...and... maps two NMN's to one NMN.

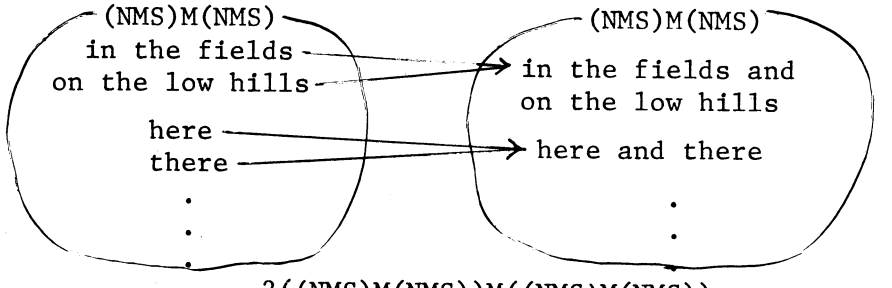


2(NMN)M(NMN)
Fig 4.14

The expression both...and... combines two words rich and famous(NMN) to form the larger expression both rich and famous (NMN), so it is given the grammatical mapping 2(NMN)M(NMN).

4.15. 2((NMS)M(NMS))M((NMS)M(NMS))

in the fields and on the hills are both the grammatical mapping (NMS)M(NMS). The linguistic units which occur between the two phrases receive this grammatical mapping. In the expression in the fields and on the hills, and maps two (NMS)M(NMS)'s to one (NMS)M(NMS).

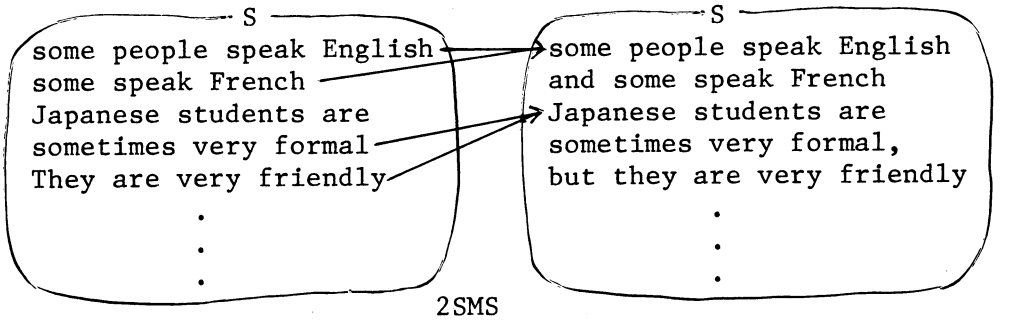


2((NMS)M(NMS))M((NMS)M(NMS))
Fig 4.15

4.16. 2SMS

The linguistic units between two sentences are this grammatical

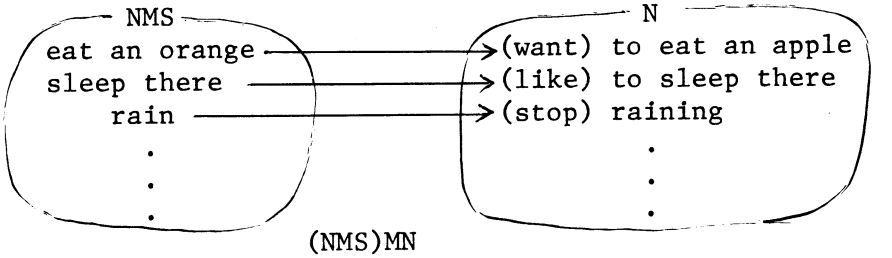
mapping. For example, two sentences some people speak English and some speak French are mapped to one sentence some people speak English and some speak French by and. but also maps two sentences Japanese students are sometimes very formal and They are very friendly to one sentence Japanese students are sometimes very formal, but they are very friendly. Thus and and but etc. receive the grammatical mapping 2SMS as follows;



2SMS
Fig 4.16

4.17. (NMS)MN

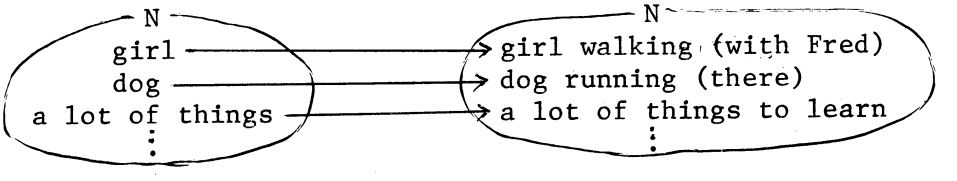
sleep there, eat an orange and rains map they (N) and it (N) to they sleep there (S), they eat an orange (S) and it rains (S), so they are all indicated as NMS. The expression to eat an apple, to sleep there, raining function like a noun in the phrases want to eat an apple, like to sleep there and stop raining. The linguistic units to and -ing map NMS (eat, sleep or rain, etc.) to N (...to eat..., to sleep, or ...raining). So they are all given the grammatical mapping (NMS)MN.



(NMS)MN
Fig 4.17

4.18. (NMS)M(NMN)

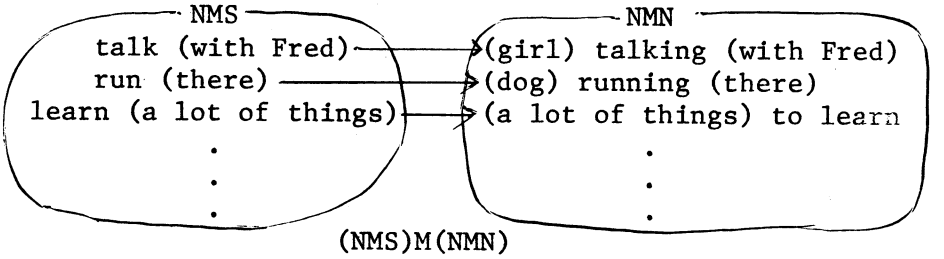
The expression talking maps girl (N) to girl talking (with Fred which behaves like a noun as a whole, so this is given the grammatical mapping NMN. running there is also given the grammatical mapping NMN. In a similar way, to learn maps a lot of things (N) to a lot of things to learn (N), so it is indicated as NMN.



NMN

Fig 4.18-1

Thus the expression -ing and to are the grammatical mapping (NMS)M (NMN) as in Fig 4.18-2.

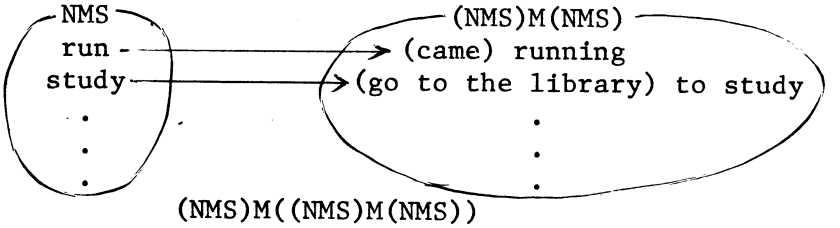


(NMS)M(NMN)

Fig 4.18-2

4.19. (NMS)M((NMS)M(NMS))

The expressions running and to study are indicated as (NMS)M(NMS), because they map came and go to the library which are both indicated as NMS as a whole to came running and go to the library to study which are also indicated as NMS. -ing and to map run and study which are indicated as NMS to running and to study which are indicated as (NMS)M(NMS), so they are the grammatical mapping (NMS)M((NMS)M(NMS)).

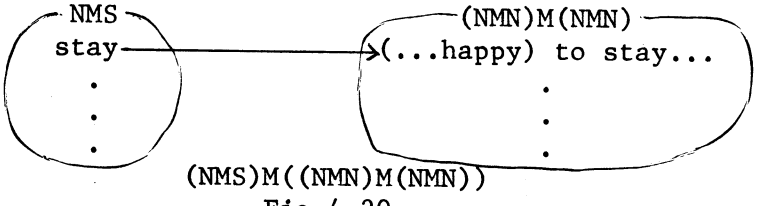


(NMS)M((NMS)M(NMS))

Fig 4.19

4.20. (NMS)M((NMN)M(NMN))

In the expression ...happy to stay here, to stay here maps happy (NMN) to happy to stay here (NMN), so it is indicated as (NMN)M(NMN). stay is indicated as NMS. to maps stay here (NMS) to to stay here ((NMN)M(NMN)). Thus it is the grammatical mapping (NMS)M((NMN)M(NMN)).



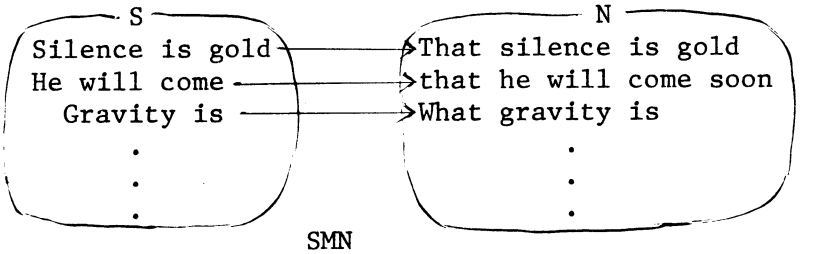
(NMS)M((NMN)M(NMN))

Fig 4.20

4.21. SMN

This means 'mapping a sentence to a noun'. In the expressions we must also say that silence is not always gold and Do you know what gravity is, That silence is gold and what gravity is function

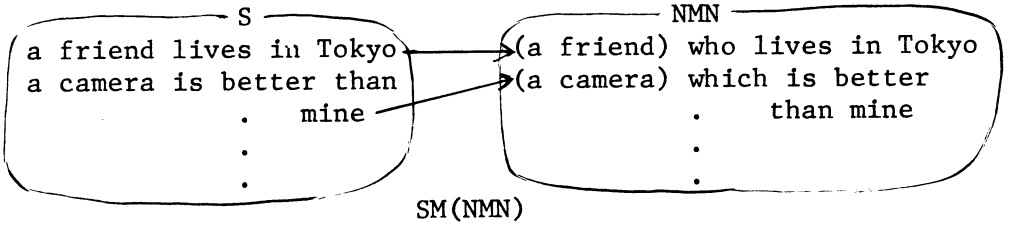
like a noun as a whole, so they are indicated as N. Since that and what map silence is gold and gravity is (what) (S) to that silence is gold and what gravity is (N), they are indicated as SMN. This is shown as in Fig 4.21.



SMN
Fig 4.21

4.22. SM(NMN)

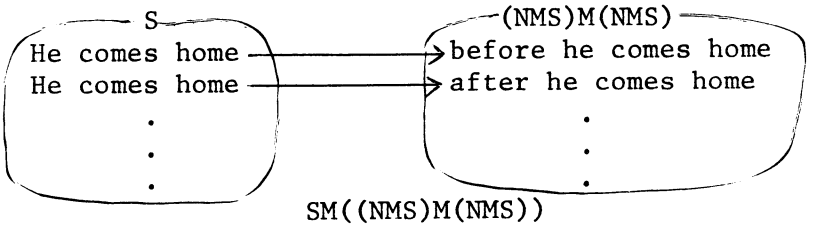
a friend who lives in Tokyo is N as a whole. who lives in Tokyo gets the grammatical mapping NMN, because it maps a friend (N) to a friend who lives in Tokyo (N). Thus who maps a friend lives in Tokyo (S) to who lives in Tokyo (NMN), and I give the grammatical mapping SM(NMN) to who. This is the same in the case of which in a camera which is better than mine.



SM(NMN)
Fig 4.22

4.23. SM((NMS)M(NMS))

before and after get this grammatical mapping. These two expressions map rains (NMS) to rains before he comes home or rains after he comes home (NMS), so they are given the grammatical mapping (NMS) M(NMS). before and after map he comes home (S) to before he comes home or after he comes home ((NMS)M(NMS)).
Thus they get grammatical mapping SM((NMS)M(NMS)).

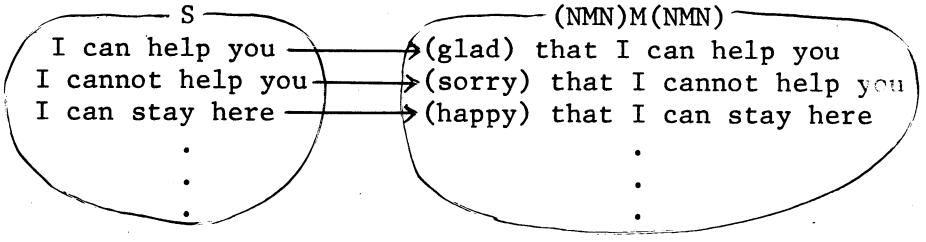


SM((NMS)M(NMS))
Fig 4.23

4.24. SM((NMN)M(NMN))

glad and sorry get the grammatical mapping NMN in 4.1. glad that I can help you and sorry that I cannot help you get also NMN

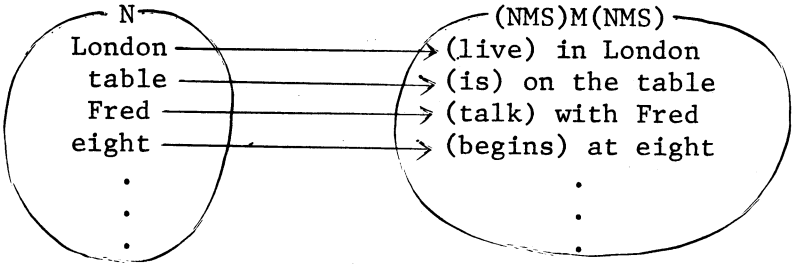
as a whole. Thus that I can help you and that I cannot help you map glad and sorry (NMN) to glad that I can help you and sorry that I cannot help you (NMN), so they are given the grammatical mapping (NMN)M(NMN). In these expressions, that maps sentences to the expressions whose grammatical mapping is (NMN)M(NMN), so it receives the grammatical mapping SM((NMN)M(NMN)).



SM((NMN)M(NMN))
Fig 4.24

4.25. NM((NMS)M(NMS))

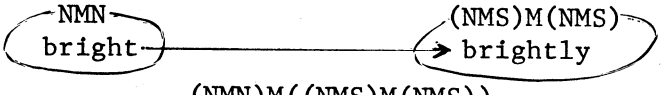
The expressions in London, on the table are the grammatical mapping (NMS)M(NMS) as a whole. In these expressions, the linguistic units in, on map London, the table (N) to in London, on the table ((NMS)M(NMS)), so they receive the grammatical mapping NM((NMS)M(NMS)).



NM((NMS)M(NMS))
Fig 4.25

4.26. (NMN)M((NMS)M(NMS))

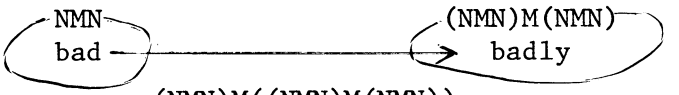
bright is the grammatical mapping NMN. Mapping bright (NMN) to brightly ((NMS)M(NMS)) is this grammatical mapping, so -ly receives the grammatical mapping (NMN)M((NMS)M(NMS)).



(NMN)M((NMS)M(NMS))
Fig 4.26

4.27. (NMN)M((NMN)M(NMN))

badly is given the grammatical mapping (NMN)M(NMN), because it maps injured (NMN) to badly injured (NMN). Thus -ly has the grammatical mapping (NMN)M((NMN)M(NMN)).



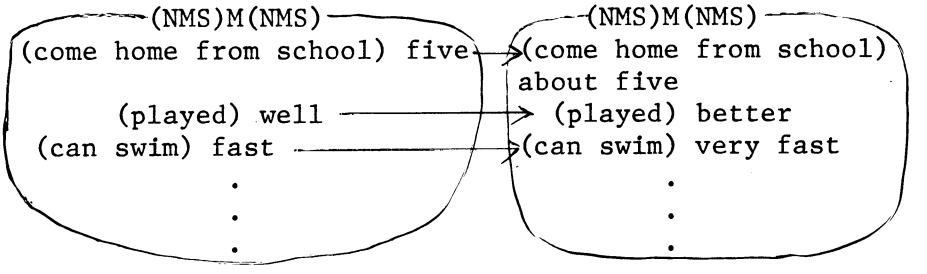
(NMN)M((NMN)M(NMN))

Fig 4.27

4.28. ((NMS)M(NMS))M((NMS)M(NMS))

five in the expression come home from school five is the grammatical mapping (NMS)M(NMS), because it maps come home from school (NMS) to come home from school five (NMS). about maps five ((NMS)M(NMS)) to about five ((NMS)M(NMS)), so it is given ((NMS)M(NMS))M((NMS)M(NMS)).

Mapping well ((NMS)M(NMS)) to better or best ((NMS)M(NMS)) is also this grammatical mapping. These are illustrated as follows;

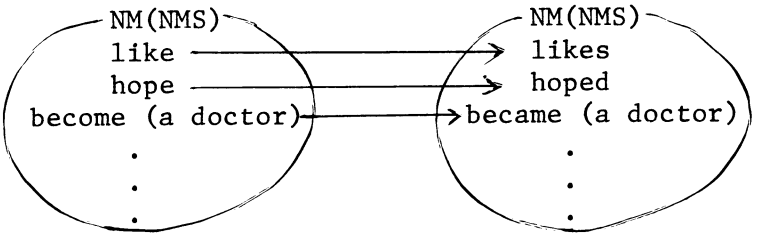


((NMS)M(NMS))M((NMS)M(NMS))

Fig 4.28

4.29. (NM(NMS))M(NM(NMS))

-ing, -s, -ed occurring with the expression given the grammatical mapping NM(NMS) and mapping become (NM(NMS)) to became (NM(NMS)) are this grammatical mapping. For example, play, like, hope are NM(NMS) as shown in 4.3 and -ing, -s, -ed map play, like, hope (NM(NMS)) to playing, likes, hoped (NM(NMS)). Mapping become (NM(NMS)) to became (NM(NMS)) is also this grammatical mapping;



(NM(NMS))M(NM(NMS))

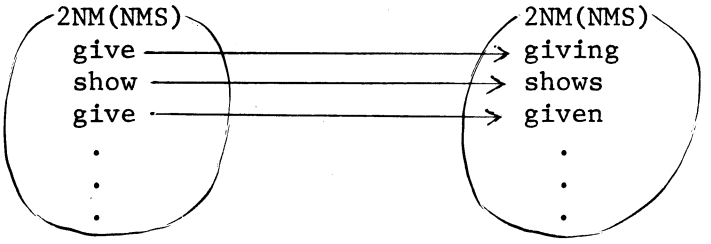
Fig 4.29

The suffixes mapping the expression belonging to 4.3 to itself are put into this grammatical mapping.

4.30. (2NM(NMS))M(2NM(NMS))

-ing, -ed, -s which are added to the expression whose grammatical mapping is 2NM(NMS) are this grammatical mapping. For example, give, show get 2NM(NMS) as shown in 4.5. Mapping give to giving, show to shows and give to given are all put into the grammatical

mapping (2NM(NMS))M(2NM(NMS)).



(2NM(NMS))M(2NM(NMS))

Fig 4.30

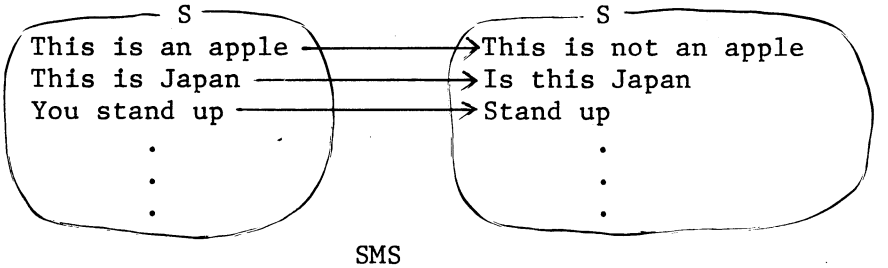
The examples of this mapping is a suffix mapping the expression put into 4.5 to itself.

4.31. ((NMN)M(NMS))M((NMN)M(NMS))

In the expression become ill, become is the grammatical mapping NMS. I describe 'mapping become (ill) to became (ill)' as ((NMN)M(NMS))M((NMN)M(NMS)). Mapping the expression put into 4.4 to itself is put into this grammatical mapping.

4.32. SMS

The following examples which represent 'mapping a sentence to a sentence' belong to this grammatical mapping.



SMS

Fig 4.32

Mapping That is an apple to That is not an apple is SMS, and not receives the grammatical mapping SMS. The relation between This is Japan and Is this Japan is also described as SMS. Changing the position of this and is is mapping This is Japan to Is this Japan. Imperative sentence, exclamation, and emphasis and 'there is...' construction are all described as this grammatical mapping.

5. Some Remarks on the Decision of Grammatical Mappings

As for the description of the expression Mike's dog, Curry assigned F_2NNN which represents the transformation two nouns to one noun phrase to -'s as follows;

Mike	-'s	dog
N	F_2NNN	N
	N	

He uses the symbol F_2NNN which is represented as 2NMN in the grammatical mapping model. According to Curry's model, and in the expres-

sion Mike and dog is also described as F_2NNN.

Mike	and	dog
N	F_2NNN	N
	N	

Since both -'s and and combine with Mike and dog to become the larger phrase which has the same category N as themselves, they are assigned to F_2NNN. It may be possible to analize the phrase like that from the logical point of view, but I cannot agree to him. I think it is more natural to describe -'s and of as the grammatical mapping NM(NMN) rather 2NMN (F_2NNN) from the linguistic point of view. In this way I subdivided the expressions put into F_2NNN in Curry's model into NM(NMN) and 2NMN.

Mike	-'s	dog
N	NM(NMN)	N
	NMN	
	N	

Mike	and	dog
N	2NMN	N
	N	

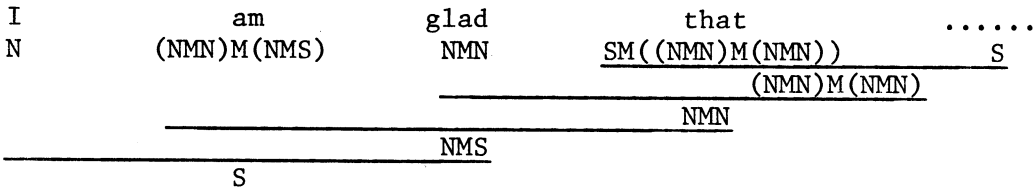
Next I will take the expression to. This expression can receive the two grammatical mapping. In the expression I am happy to stay here, if to stay here combines with happy (NMN), then to is put into (NMS)M((NMN)M(NMN)), because it receives the grammatical mapping (NMN)M(NMN) as a whole as follows;

I	am	happy	to	stay	here
N	(NMN)M(NMS)	NMN	(NMS)M((NMN)M(NMN))	NMS	(NMS)M(NMS)
				NMS	
			(NMN)M(NMN)		
		NMN			
	NMS				
S					

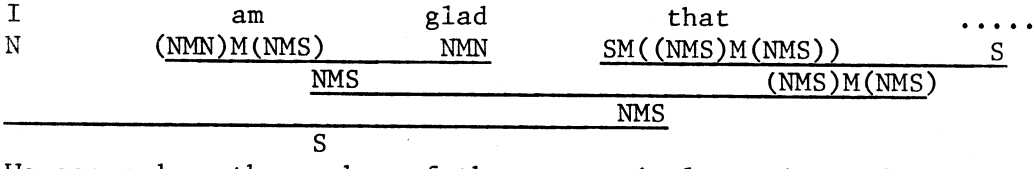
On the other hand, if to stay here combines with am happy (NMS), then to is put into the grammatical mapping (NMS)M((NMS)M(NMS)), because it receives the grammatical mapping (NMS)M(NMS) as a whole as follows;

I	am	happy	to	stay	here
N	(NMN)M(NMS)	NMN	(NMS)M((NMS)M(NMS))	NMS	(NMS)M(NMS)
	NMS			NMS	
			(NMS)M(NMS)		
		NMS			
	S				

There is another problem in describing that in the expression I am glad that I can help you. If that I can help you ((NMN)M(NMN)) combines with only glad (NMN), then since I can help you receives the grammatical mapping S, that is put into the grammatical mapping SM((NMN)M(NMN)).



On the other hand, if combines with am glad (NMS), then that is put into the grammatical mapping SM((NMS)M(NMS)).



We can reduce the number of the grammatical mappings if we take the latter description respectively.

This model is still in a very early stage of development. On closer examination many deeper and difficult problems will appear, but I think this model seems to be a fruitful one as a decision procedure of the syntactic type of the words.

Bibliography

Chomsky,N.(1965) Aspects of the Theory of Syntax. Cambridge: MIT Pr.

Curry,H.B.(1961) "Some logical aspects of grammatical structure" in R.Jakobson(ed.) Structure of Language and Its Mathematical Aspects, Proceedings of the Twelfth Symposium in Applied Mathematics, pp.56-68. Providence, R.I.; American Mathematical Soc.

Hirose,H.(1973) "A Study of Grammatical Mapping", Unpublished

-------- (1975) "Grammatical Mapping in Approaches to Natural Language", Unpublished Master's thesis, Educational College of Osaka

---------(1976) "grammatical mapping ni yoru category no chôsa", Eigokakyôiku no Kenkyû,pp.27-31

Lambek,J.(1958) "The mathematics of sentence structure", American Mathematical Monthly 65, pp.154-170

Lyons,J.(1968) Introduction to Theoretical Linguistics. Cambridge University Press

Nakatani,T.(1970) Ronri, Tokyo, Kyoritsushuppan Co.

Shaumyan,S.K.(1965) "Outline of the applicational generative Model for the description of Language". Foundation of Language

Wall,R.(1972) Introduction to Mathematical Linguistics. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Yano,K.(1970) Shugo, Tokyo, Kyoritsushuppan Co.

1. 写像の理論を言語記述に応用し，これを文法写像と呼ぶ。本論文ではまずこの文法写像を紹介し，NEW HORIZONを分析資料として文法写像の種類の調査を試みた。

2. 写像という概念は「二つの集合A，Bが与えられた時，順序対（x，y）のxを集合Aの要素としyを集合Bの要素とするすべての可能な順序対を要素とする新しい集合」と定義される。

3. 名詞(句)の機能を持つものをN，文の機能を持っているものをSで表わす。Tom runsという表現ではrunsはTom(N)をTom runs(S)に写像すると考えて，写像をMで表わすとNMSと表記できる。

4. NEW HORIZONでは32の文法写像が見い出された。

5. −'sとandの分析では論理学的には二つの名詞を一つの名詞句に変えるものと考えられるが，言語学的な立場から見て前者をNM(NMN)後者を2NMNと分析することにした。これと同様にtoやthatについても二つの分析が可能であると思われる。