

A THEORY OF PREDICATIVE STRUCTURE.
INSIGHTS FROM JAPANESE AND KOREAN*

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0. INTRODUCTORY REMARKS

The predicative structure, which is both semantically and syntactically based, does not concern any kind of syntagma, nor does it appear until the sentence level. In the course of our subsequent inquiry, this structure will turn out to be a derivative of a determinational one. As an appropriate framework for capturing some relevant aspects of the latter, within which various determinational systems are operative, we shall consider the theory of determination (cf. Bańczerowski 1980).

The presentation of our approach to the predicative structure will assume the form of a deductive theory, utilizing the apparatus of mathematical logic.**

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** Besides the specifically linguistic terms, we shall also employ certain logical terms borrowed mainly from predicate calculus, set theory, the theory of relations and mereology. Their meanings will be explained as follows:

The propositional connectives of *negation*, *conjunction*, *disjunction*, *implication*, and *equivalence* will be denoted, respectively, by the symbols: \sim , \wedge , \vee , \leftrightarrow . The universal quantifier *for every (all) x*, and the existential quantifier *there is (exists) an x such that*, which bind a variable x , are abbreviated, respectively, with the symbols \bigwedge_x and \bigvee_x . The symbol \bigvee_x is reserved for the phrase *there is exactly one x such that*. The symbol $=$ denotes *identity*, and the symbol \neq *diversity*.

Sets will be designated by capital letters. The set whose elements are x, y, z, \dots will be symbolized by $\{x, y, z, \dots\}$. Thus, $X = \{x, y, z, \dots\}$ means that x, y, z , are elements of the set X . The formula $x \in X$ reads: x belongs to X , or x is an element of X . The formula $x \notin X$ reads: x does not

1. PRIMITIVE AND SOME DEFINED TERMS

A fragment of the theory of determination, required for the purposes of description of the predicative structure, presupposes the following six primitive terms:

- (i) *Ut* - the set of all utterances,
- (ii) *Sn* - the set of all sentences,
- (iii) *Wrd* - the set of all words,
- (iv) *Stg* - the set of all syntagmas,
- (v) *fr* - the relation of being a phrase of,
- (vi) *ftd* - the relation of phrasal determination,

An understanding of the intuitive sense of the above terms is available to an ordinary linguist, and does not require any highly advanced linguistic thinking. What we simply want to say by this is that the concepts denoted by these terms should be relatively easy to identify. Nevertheless, aiming at an avoidance of possible undesirable interpretations we shall give a brief ex-

belong to X . In order to express the *inclusion* of a set X in a set Y we shall write $X \subset Y$. If $X \subset Y$, then X is called a subset of Y . The statement that X is not a subset of Y is written as $X \not\subset Y$. The *empty set* is denoted by \emptyset . The set of all subsets of X is called the powerset of X and it is designated by $\mathcal{P}(X)$.

The operations of *sum*, *intersection*, *difference* and *Cartesian product*, defined on two sets X and Y , will be symbolized, respectively, by $X \cup Y$, $X \cap Y$, $X - Y$, $X \times Y$.

The Cartesian product $X \times Y$ of two sets X and Y is the set of all ordered pairs (x, y) with $x \in X$ and $y \in Y$. The subsets of $X \times Y$, where X and Y are any sets, will be called *binary relations* in the product $X \times Y$. The fact that R is a binary relation in $X \times Y$ will be expressed in the form $R \subset X \times Y$. In order to say that x bears the relation R to y we shall write $x R y$ or, alternatively, $(x, y) \in R$.

The *image of an element* x under the relation R , i.e. the set of all successors of x in the ordered pairs $(x, y) \in R$ will be denoted by $R^>x$, and the *inverse image of an element* x under the relation R , i.e. the set of all predecessors of x in the ordered pairs $(x, y) \in R$ will be denoted by $R^<x$. The set $R^>x$ is called the *image of a set* X given by the relation R . It contains those objects y which are successors in the pairs $(x, y) \in R$, where $x \in X$. The set $R^<X$ is referred to as the *inverse image of a set* X given by the relation R . It contains those objects y which are predecessors in the pairs $(y, x) \in R$, where $x \in X$. The *converse of the relation* R will be denoted by \check{R} . If $x R y$, then $y \check{R} x$ holds. A relation which is *reflexive*, *symmetric*, and *transitive* will be called an *equivalence* relation.

A relation $R \subset X \times Y$ is called a *function from* X *to* Y , if for every $x \in X$ there is exactly one $y \in Y$ such that $x R y$. If R is a function from X to Y , then we shall write $R: X \rightarrow Y$. The *unique element* $y \in Y$ which is associated with an element $x \in X$ under the function R will be designated by $R(x)$.

The *relation of being a part of*, denoted by the symbol P , belongs to the primitive terms of mereology. The formula $x P y$ means that an entity x is a part of an entity y . The relation P is reflexive, antisymmetric and transitive. In terms of the relation P we can define the relation of mereological *sum*, symbolized by S . The formula $y S X$ reads: y is the whole composed of all and only of the elements of a set X . Since the relation S is a function we shall use the symbol $S(X)$ to denote the unique whole associated with a set X .

planation of them. Primitive terms must be available beforehand in order that the development of a formal theory is made possible.

Although the term 'utterance' will rarely be resorted to in our approach, it is a convenient object of reference for some other lingual entities, and therefore we prefer to start our discussion with just this term.

An *utterance* being a simplex or complex lingual sign and capable of functioning as an autonomous communicative unit, is a stretch of physical, articulatory and acoustic signals, perceived as an auditory object. We shall assume, although it may appear highly controversial, that an utterance, by virtue of being a sign, obligatorily conveys semantic information, i.e. it designates a certain fragment of reality, conceived of in a broad sense, and possesses meaning. Utterances are viewed here as individual, concrete, non-repeatable entities, produced *hic et nunc*, i.e. by a definite speaker in a definite time and place. Besides this, they will also be treated as mereological wholes.

A *sentence* is but a special kind of utterance. Sentences, as complete communicative units, will be divided here into simplex and complex ones. The set of the former will be denoted by *Sns* and the set of the latter - by *Snc*. These two terms lend themselves to being defined, and their definitions will be formulated subsequently.

A *word* (= *actual lex*) is a certain part of an utterance, namely, a minimal unit already provided with both lexical and grammatical information. Thus, inflexional forms, together not only with desinences but also with prepositions, postpositions, articles, and the like, will be treated as wholes *sui generis*, i.e. words. The following forms are examples of words in English: *in a town*, *on the table*, *toward the moon*, *of the friend*, etc.

A *syntagma* is an utterance or part thereof consisting of at least two words. Of course, not every arbitrary expression made up of more than one word will be termed a syntagma, but only a sensical one. Such expressions as: *a white flower*, *a flower of flowers*, *a flower is blooming*, etc. are syntagmas in English. For our purposes, however, the term 'syntagma' will be restricted to hypotactic syntagmas.

Words and syntagmas taken together will be called *phrases*. The *set of all phrases* will be denoted by *Frs*, and formally introduced by means of the following definition:

Df 1.1 $Frs = Wrd \cup Stg$

Utterances are but a special kind of phrase. Phrases may often coincide with utterances, but they need not always be appropriate to function as communicative units. They may even be deficient with respect to grammatical information.

The *relation of being a phrase of* (fr) connects two phrases x and y such that the former is a part of the latter. The formula $x fr y$ may be read: x is a phrase of y , or x is a phrasal part of y . We can also say that x is a *hypophrase* of y , and y is a *hyperphrase* of x .

Having at our disposal the relation fr , we are already able to define the *relation of syntagmatization* (stg), as well as the sets Sns and Snc referred to above.

Df 1.2 $stg = \{(X, y) : X \subset Frs \wedge y \in Stg \wedge y = S(X)\}$

On the strength of this definition, a subset of phrases X is combinable into a syntagma y , in symbols: $X stg y$, if and only if the mereological sum of X results in y . Hence, each phrase belonging to X is a part of y . Since the relation stg is the function:

1.1 $stg: \mathcal{P}(Frs) \rightarrow Stg$,

the symbol $stg(X)$ will be employed to denote the unique y being a hyperphrase constructed out of a subset X of phrases. However for the sake of simplicity, in the case of $stg(\{x, y\})$ we shall write $stg(x, y)$. Hence it follows that $stg(x, y) = stg(y, x)$. Of course, not every subset of phrases is combinable into a hyperphrase. Some such combinations may result in nonsensical expressions.

Df 1.3 $Sns = \{s : s \in Sn \wedge \sim \bigvee_x (x \in Sn \wedge x \neq s \wedge x fr s)\}$

Df 1.4 $Snc = \{s : s \in Sn \bigvee_x \bigvee_y (x, y \in Sn \wedge x \neq s \wedge y \neq s \wedge x fr s \wedge y fr s \wedge x fdt y)\}$

According to these definitions, within a simplex sentence no constituent phrase is a sentence. A complex sentence consists of at least two sentences which are in the relation of determination. Thus, our definition of complex sentences refers exclusively to sentences constructed hypotactically.

Last on the list of our primitive terms is the *relation of phrasal determination* (fdt), which binds phrases. The formula $x fdt y$ may be read: a phrase x is determined by a phrase y , or a phrase y determines a phrase x . The very idea of determination in our approach mirrors the operation of restricting (narrowing down) the range of designation of a phrase by another phrase, the former functioning as determinatum and the latter as determinant. The determinant thus provides some information about its determinatum, or, more correctly, it only selects such information from the informational range designated by the determinatum. The hyperphrase resulting from the fusion of the two phrases bearing the relation fdt turns out to be a hyponym of the determinatum itself. This is why determination lies at the basis of formation of more complex lingual signs (hypotactic constructions) out of simplex ones. Consequently, the hypotactic structure rests upon the determinational one.

Example: For the sake of exemplification of phrasal determination, let us avail ourselves of the sentence *A talented student of physics quickly solved this problem* within which the following pairs of phrases, among others, are bound by the relation fdt : (*a student, talented*), (*a student, of physics*), (*solved, quickly*), (*solved, problem*), (*solved, this problem*), (*a student of physics, solved this problem*), (*a talented student of physics, quickly solved this problem*).

The phrases occupying the first position in these pairs function as determinata, and those occupying the second position as their determinants. The relation fdt underlies thus attributive and circumstantial, as well as predicative syntagmas.

In terms of the relation fdt we can define the following three useful notions, i.e.:

- (i) the *relation of word determination* (wdt),
- (ii) the *relation of being determinatum absolutum of* ($dtma$), and
- (iii) the *relation of being a proper hypophrase of* (frp).

The definitions introducing these relations will be formulated as follows:

Df 1.5 $wdt = \{(x, y) : x, y \in Wrd \wedge x fdt y\}$

Df 1.6 $dtma = \{(x, y) : x \in Wrd \wedge y \in Frs - Wrd \wedge x fr y \wedge \sim \bigvee_z (z fr y \wedge z fdt x)\}$

Df 1.7 $frp = \{(x, y) : y \in Frs \wedge x fr y \wedge (x = \check{dtma}(y) \vee \check{dtma}(x) = \check{dtma}(y))\}$

The relation wdt connecting exclusively words, and without concerning syntagmas, is thus but a special case of the relation fdt . The relation $dtma$ holds between a word x and a phrase y such that x is a hypophrase of y , and it does not determine any other phrase within y . Since the relation \check{dtma} is the function:

1.2 $\check{dtma}: Frs \rightarrow Wrd$

the symbol $\check{dtma}(y)$ will be used to denote the unique x being the determinatum absolutum of a phrase y . And, finally, the relation frp binds two phrases x and y , such that the former is a hypophrase of the latter and, additionally, the former is either the determinatum absolutum of the latter, or both have the same determinatum absolutum. The predecessor of the relation frp could be called a *proper hypophrase*, and its successor – a *proper hyperphrase*.

The following simple corollaries may be inferred from the above definitions:

1.3 $wdt \subset Wrd \times Wrd$

1.4 $wdt \subset fdt$

1.5 $dtma \subset Wrd \times Frs$

1.6 $frp \subset fr$ 1.7 $x frp y \rightarrow x = \check{d}tma(y) \vee \check{d}tma(x) = \check{d}tma(y)$ 1.8 $x frp y \rightarrow \sim \bigvee_z (z fr y \wedge z fdt x)$

2. THE SYSTEM OF AXIOMS

The axiom system describing some of the relevant properties of the primitive terms should provide, among others, for the following propositions:

Ax 2.1 $Frs \subset P \langle Ut$ Ax 2.2 $Sn \subset Ut$ Ax 2.3 $fr \subset Frs \times Frs$ Ax 2.4 $x fr y \rightarrow x P y$ Ax 2.5 $x fr x$ Ax 2.6 $x fr y \wedge y fr z \rightarrow x fr z$ Ax 2.7 $x fr y \wedge y fr x \rightarrow x = y$ Ax 2.8 $x \in Wrđ \rightarrow \sim \bigvee_u (u \in Frs \wedge u \neq x \wedge u fr x)$ Ax 2.9 $x \in Stg \rightarrow \bigvee_y \bigvee_z (y, z \in Wrđ \wedge y \neq z \wedge y, z \in fr^< x)$ Ax 2.10 $fdt \subset Frs \times Frs$ Ax 2.11 $\sim x fdt x$ Ax 2.12 $x fdt y \rightarrow \sim y fdt x$ Ax 2.13 $x fdt y \wedge y fdt z \rightarrow \sim x fdt z$ Ax 2.14 $x fdt y \rightarrow \sim \bigvee_z (x fdt z \wedge z fdt y)$ Ax 2.15 $x fdt z \wedge y fdt z \wedge x fr y \rightarrow \check{d}tma(x) = \check{d}tma(y)$ Ax 2.16 $x fdt y \rightarrow fr^< x \cap fr^< y = \emptyset$ Ax 2.17 $x fdt y \rightarrow \bigvee_z (z \in Stg \wedge z = stg(x, y))$ Ax 2.18 $x fdt y \rightarrow \check{x} frp stg(x, y)$ Ax 2.19 $x fdt y \rightarrow \bigwedge_u \bigwedge_v (u frp x \wedge v frp y \rightarrow u fdt v)$ Ax 2.20 $x fdt y \rightarrow \bigwedge_u \bigwedge_v (x frp u \wedge y frp v \rightarrow u fdt v)$ Ax 2.21 $x \in Stg \rightarrow \bigvee_y \bigvee_z (y fdt z \wedge stg(y, z) = x)$

Let us now briefly elucidate the intuitive sense concealed in the symbolic formulations of the above axioms. Such an elucidation will certainly facilitate a proper understanding of these dry formulae.

Axiom 2.1 states that phrases are but parts of utterances, i.e. the former occur exclusively within the latter.

According to axiom 2.2 sentences form a subset of utterances. In other words, the former are but a special kind of the latter.

Axiom 2.3 says that the relation fr connects phrases and according to axiom 2.4, if x is a hypophrase of a phrase y , then x is a part of y .

According to axioms 2.5 - 2.7 the relation fr is reflexive, transitive, and antisymmetric. Thus, by virtue of Ax 2.5 a phrase x is at the same time its own hypophrase.

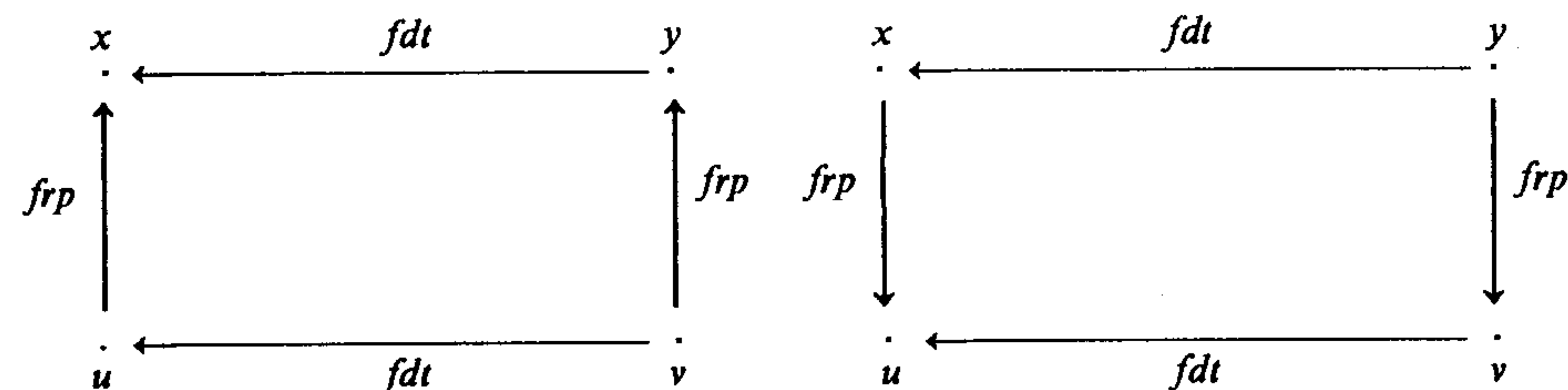
In light of axiom 2.8, words are minimal phrases, i.e. each word is exclusively its own hypophrase.

Axiom 2.9 provides that each syntagma consists of at least two different words which are its hypophrases.

Axiom 2.10 says that the relation fdt binds phrases. And from axioms 2.11 - 2.14 we know that fdt is irreflexive, asymmetric, antitransitive, and antidense. What is more, in light of axiom 2.15 any two phrases x and y , being determined by the same phrase z , and such that x is a hypophrase of y , have identical determinata absoluta.

Axiom 2.16 states that phrases bearing the relation fdt do not have any common phrase. Such phrases, according to axiom 2.17, form exactly one syntagma which, in light of 2.18, the predecessor of the relation fdt is a proper hypophrase of.

The contents of axioms 2.19 and 2.20 are in a certain sense analogous; and almost metaphysical. The former of these axioms says that if a phrase x is determined by a phrase y , then each proper hypophrase of x is determined by each proper hypophrase of y . The latter of these axioms states that if a phrase x is determined by a phrase y , then each proper hyperphrase of x is determined by each proper hyperphrase of y . The contents of these two axioms may be visualized in the following graphs:



Axiom 2.21 provides for any hypotactic syntagma only one binary division into phrases which exhaust completely this syntagma and bear the relation fdt .

By presenting the primitive terms and axioms, the foundation for an axiomatic theory of determination has been laid. Within this theory we intend to define precisely some fundamental semanto-syntactic notions which are indispensable to develop a certain fragment of the conceptual apparatus of theoretical syntax.

3. IMMEDIATE CONSEQUENCES OF AXIOMS

Before we proceed further with more basic problems, let us here formulate some simple corollaries which are immediately obtainable from the above axioms.

- 3.1 $x \text{ frp } x$
 3.2 $x \text{ frp } y \wedge y \text{ frp } z \rightarrow x \text{ frp } z$
 3.3 $\check{d}tma(x) \text{ frp } x$
 3.4 $x \text{ frp } z \wedge y \text{ frp } z \rightarrow \check{d}tma(x) = \check{d}tma(y)$
 3.5 $x \text{ fdt } y \wedge y \text{ frp } z \rightarrow x \text{ fdt } z$ (Ax 2.20)
 3.6 $x \text{ fdt } \check{d}tma(y) \rightarrow x \text{ fdt } y$ (Ax 2.20)
 3.7 $x \text{ fdt } y \wedge x \in \text{Wrd} \wedge y \in \text{Stg} \rightarrow x \text{ wdt } \check{d}tma(y)$ (Ax 2.19)
 3.8 $x \text{ wdt } y \wedge y \text{ wdt } z \rightarrow x \text{ fdt } \text{stg}(y,z)$ (Ax 2.20)
 3.9 $x \text{ fdt } y \wedge x \in \text{Stg} \rightarrow \check{d}tma(x) \text{ fdt } y$ (Ax 2.19)
 3.10 $x \text{ fdt } y \wedge \text{stg}(x,y) \text{ fdt } z \rightarrow x \text{ fdt } z$ (Ax 2.19)
 3.11 $x \text{ fdt } y \rightarrow \bigwedge_z (z \text{ frp } x \rightarrow z \text{ fdt } y)$ (Ax 2.19)
 3.12 $x \text{ fdt } y \wedge x,y \in \text{Stg} \rightarrow \check{d}tma(x) \text{ wdt } \check{d}tma(y)$ (Ax 2.19)
 3.13 $x \text{ fdt } y \wedge y = \check{d}tma(\text{stg}(Y)) \rightarrow x \text{ fdt } \text{stg}(Y)$
 3.14 $x \text{ fdt } y \rightarrow \sim \bigvee_{u,v} (u,v \neq x,y \wedge u,v \in \text{fr}^< \text{stg}(x,y) \wedge \text{stg}(u,y) = \text{stg}(x,y) \wedge u \text{ fdt } v)$ (Ax 2.17, Ax.21)
 3.15 $x \text{ fdt } y \wedge y \text{ frp } z \rightarrow x \text{ fdt } z$ (Ax 2.20)

The above theorems should also be instrumental in understanding the axioms themselves.

4. HYPOTACTIC COHESION

Phrases not only determine other phrases or are determined by them, but also result in syntagmas, which may exhibit a different degree of compactness or fusion. This fusion could be conceived of as the force of hypotactic cohesion which binds some phrases more strongly than others. This force, in turn, will find reflection in the *relations of a smaller degree of hypotactic cohesion*.

However, the hypotactic cohesion is at least a biaspectual phenomenon, i.e. it can be inspected from at least two different angles, which will be illustrated by the following situation. Let us suppose that determination relation between the phrases x,y and z , being constituents of the same hyperphrase, are as follows:

$x \text{ fdt } y$ and $\text{stg}(x,y) \text{ fdt } z$, whence we infer that also $x \text{ fdt } z$ holds (cf. Ax 2.19).

The question about the degree of hypotactic cohesion could refer to either of the following:

- (i) (x,y) and $(\text{stg}(x,y), z)$, or to
 (ii) (x,y) and (x,z) .

Consequently, we shall distinguish two relations of a smaller degree of hypotactic cohesion $<_{hc}$ and $<_{hc}^*$, whose definitions will be formulated below. Since the latter of these relations is not directly connected with our present considerations, it will be treated only incidentally here.

$$\text{Df 4.1 } <_{hc} = \{[(x,y), (u,v)] : x \text{ fdt } y \wedge u \text{ fdt } v \wedge \wedge [(u \text{ frp } x \wedge v \text{ fr } x) \vee (u \text{ frp } y \wedge v \text{ fr } y)]\}$$

According to this definition, phrases x and y are hypotactically less cohesive than phrases u and v , in symbols: $(x,y) <_{hc} (u,v)$, if and only if x bears the relation *fdt* to y , u bears the relation *fdt* to v , and moreover u is a proper hypophrase of x and v is a hypophrase of x , or u is a proper hypophrase of y and v is a hypophrase of y .

Example: The pair of phrases (*a talented student, of physics*) is hypotactically less cohesive than the pair of phrases (*a student, talented*), because the syntagma consisting of these two latter phrases may be determined by the phrase *of physics*. Similarly, the pair of phrases (*a talented student of physics, quickly solved this problem*) is less cohesive than the pair of phrases (*a talented student, of physics*).

The following theorems can be deduced:

- 4.1 $<_{hc} \subset \text{fdt} \times \text{fdt}$
 4.2 $(x,y) <_{hc} (u,v) \rightarrow x \text{ fdt } y \wedge u \text{ fdt } v$
 4.3 $\sim (x,y) <_{hc} (x,y)$
 4.4 $(x,y) <_{hc} (u,v) \rightarrow \sim (u,v) <_{hc} (x,y)$
 4.5 $(x,y) <_{hc} (u,v) \rightarrow (u \text{ frp } x \wedge v \text{ fr } x) \vee (u \text{ frp } y \wedge v \text{ fr } y)$
 4.6 $(x,y) <_{hc} (u,v) \rightarrow u \text{ fdt } v \wedge (u \text{ fdt } y \vee x \text{ fdt } u)$ (cf. Ax 2.19, Ax 2.20)
 4.7 $(x,y) <_{hc} (u,v) \rightarrow u \text{ fdt } y \vee x \text{ fdt } u$
 4.8 $(x,y) <_{hc} (u,v) \rightarrow \text{stg}(u,v) \text{ frp } x \vee \text{stg}(u,v) \text{ frp } y$
 4.9 $(x,y) <_{hc} (u,v) \rightarrow \text{stg}(u,v) \text{ fdt } y \vee x \text{ fdt } \text{stg}(u,v)$
 4.10 $x \text{ fdt } y \rightarrow \bigwedge_{u,v} [u \text{ frp } x \wedge v \text{ fr } x \wedge u \text{ fdt } v \rightarrow (x,y) <_{hc} (u,v)]$
 4.11 $x \text{ fdt } y \rightarrow \bigwedge_{u,v} [u \text{ frp } y \wedge v \text{ fr } y \wedge u \text{ fdt } v \rightarrow (x,y) <_{hc} (u,v)]$
 4.12 $(x,y) <_{hc} (u,v) \rightarrow [u \text{ fdt } y \wedge \text{stg}(u,v) \text{ fdt } y] \vee [x \text{ fdt } u \wedge x \text{ fdt } \text{stg}(u,v)]$
 4.13 $x \text{ fdt } y \wedge \text{stg}(x,y) \text{ fdt } z \rightarrow (\text{stg}(x,y), z) <_{hc} (x,y)$
 4.14 $x \text{ fdt } y \wedge z \text{ fdt } \text{stg}(x,y) \rightarrow (z, \text{stg}(x,y)) <_{hc} (x,y)$
 4.15 $x \text{ fdt } y \wedge \text{stg}(x,z) \text{ fdt } y \rightarrow (\text{stg}(x,z), y) <_{hc} (x,z)$
 4.16 $x \text{ fdt } y \wedge x \text{ fdt } \text{stg}(y,z) \rightarrow (x, \text{stg}(y,z)) <_{hc} (y,z)$

The above theorems establish a net of interdependences among the relations *fdt*, *frp*, *fr*, *stg* and $<_{hc}$. However, the most essential feature of the relation $<_{hc}$ seems to be expressed by theorem 4.8, which states that the syntagma made up of the pair (u,v) of phrases being the successor of $<_{hc}$ forms a proper hypophrase either of x or y , such that the pair (x,y) forms the predecessor of $<_{hc}$.

Df 4.2 $<_{hc}^* = \{[(x,y),(u,v)]: x \text{ fdt } y \wedge u \text{ fdt } v \wedge [(stg(u,v) \text{ fdt } y \wedge u=x) \vee (x \text{ fdt } stg(u,v) \wedge u=y)]\}$

In light of this definition, phrases x and y are hypotactically less cohesive than phrases u and v , in symbols: $(x,y) <_{hc}^* (u,v)$, if and only if the syntagma consisting of u and v is determined by y while u equals x or this syntagma determines x while u equals y .

Example: In conformity with definition 4.2, the pair of phrases (*a student, of physics*) is hypotactically less cohesive than the pair of phrases (*a student, talented*). Similarly, the pair of phrases (*a student, solved*) is less cohesive than (*solved, this problem*).

The following corollaries can be inferred:

$$4.17 \quad <_{hc}^* \subset fdt \times fdt$$

$$4.18 \quad (x,y) <_{hc}^* (u,v) \rightarrow x \text{ fdt } y \wedge u \text{ fdt } v$$

$$4.19 \quad (x,y) <_{hc}^* (u,v) \rightarrow u=x \vee u=y$$

$$4.20 \quad (x,y) <_{hc}^* (u,v) \rightarrow [(stg(u,v),y) <_{hc} (u,v)] \vee [(x,stg(u,v)) <_{hc} (u,v)]$$

$$4.21 \quad x \text{ fdt } y \wedge stg(x,y) \text{ fdt } z \rightarrow (x,z) <_{hc}^* (x,y)$$

$$4.22 \quad x \text{ fdt } y \wedge z \text{ fdt } stg(x,y) \rightarrow (z,y) <_{hc}^* (x,y)$$

The relation $<_{hc}^*$ thus mirrors a different aspect of hypotactic cohesion than the relation $<_{hc}$ does.

5. IMMEDIATE PHRASAL CONSTITUENCY

One aspect of the force of hypotactic cohesion has been mirrored in the relation $<_{hc}$. Another aspect of this force, closely related to the former, will be captured by the *relation of immediate phrasal constituency* symbolized by *ifc* and defined as follows:

Df. 5.1 $ifc = \{[(x,y),z]: x \text{ fdt } y \wedge stg(x,y) = z\}$

In light of this definition, two phrases x and y are immediate phrasal constituents of a phrase z , in symbols: $(x,y) ifc z$, if and only if x and y bear the relation of determination, and z consists exclusively of x and y .

Example: Two phrases *a talented student* and *of physics* are immediate phrasal constituents of the phrase *a talented student of physics*.

While deciding upon the degree of hypotactic cohesion, we compare two pairs of phrases which are capable of forming a hyperphrase. While asking about the immediate phrasal constituents, we have at our disposal a phrase and are looking for two of its hypophrases. Thus the relations $<_{hc}$ and *ifc* present two related ways of inspecting the determinational structure of syntagmas, although they have been defined independently of each other.

Since according to Ax 2.17 two phrases being in the relation *fdt* create exactly one syntagma, and since according to Ax 2.21 each syntagma allows for exactly one binary division into constituent phrases which are in the relation *fdt* and exhaust this syntagma completely, both the relation *ifc* as well as its converse \check{ifc} are, respectively the functions:

$$5.1 \quad ifc: fdt \rightarrow Stg$$

$$5.2 \quad \check{ifc}: Stg \rightarrow fdt.$$

Consequently, the symbols $\check{ifc}(x,y)$ and *ifc*(z) may be used; the former denoting the syntagma z consisting of the phrases x and y and the latter denoting the immediate constituents of z .

The following corollaries may be inferred:

$$5.3 \quad (x,y) ifc z \rightarrow x \text{ fdt } y$$

$$5.4 \quad (x,y) ifc z \rightarrow stg(x,y) = z$$

$$5.5 \quad (x,y) ifc z \rightarrow x \text{ frp } z \wedge y \text{ fr } z$$

$$5.6 \quad x \text{ fdt } y \leftrightarrow (x,y) ifc stg(x,y)$$

$$5.7 \quad (x,y) ifc z \rightarrow \bigwedge_{u,v} [u \text{ frp } x \wedge v \text{ fr } x \wedge u \text{ fdt } v \rightarrow (x,y) <_{hc} (u,v)]$$

$$5.8 \quad (x,y) ifc z \rightarrow \bigwedge_{u,v} [u \text{ frp } y \wedge v \text{ fr } y \wedge u \text{ fdt } v \rightarrow (x,y) <_{hc} (u,v)]$$

$$5.9 \quad (x,y) ifc z \rightarrow \sim \bigvee_{u,v} [u \neq x \wedge v \neq y \wedge (u,v) ifc z]$$

$$5.10 \quad (x,y) ifc z \rightarrow \sim \bigvee_{u,v} (u \text{ frp } z \wedge v \text{ fr } z \wedge (u,v) <_{hc} (x,y))$$

The first two of the above theorems immediately follow from definition 5.1. Theorem 5.5 says that immediate constituents of a phrase are its hypophrases, and theorem 5.6 - that phrases connected by the relation *fdt* are immediate constituents of the syntagma which results from the fusion of these phrases. The last three theorems state important interdependences between the relations *ifc* and $<_{hc}$. Theorem 5.9 is a generalization of 5.7 and 5.8. It says that if two phrases x and y are immediate constituents of a syntagma z , then there are no other immediate constituents of z .

PREDICATION: SUBJECT PHRASE - PREDICATE PHRASE

Discussing predicative structure, we shall operate with two relations of predication; one being more specific and the other more comprehensive. The former will be denoted by the symbol pd^* , and its definition will be formulated along the following lines:

Df 6.1 $pd^* = \{(x,y): \bigvee_s (s \in Sns \wedge x \text{ frp } s \wedge y \text{ fr } s \wedge stg(x,y) = s \wedge x \text{ fdt } y)\}$

In light of this definition, the two phrases x and y bear the relation of predication, in symbols: $x \text{ pd}^* y$, if and only if x is a proper hypophrase of a simple sentence s , y is a hypophrase of s , both completely exhaust s and x is determined by y . Thus, it is obvious that the relation of predication pd^* is reducible to the relation of determination.

The following corollaries may be easily deduced:

- 6.1 $pd^* \subset \text{frp} \langle Sns \times \text{fr} \langle Sns$
 6.2 $x \text{ pd}^* y \rightarrow x \text{ frp } stg(x,y) \wedge y \text{ fr } stg(x,y)$
 6.3 $x \text{ pd}^* y \rightarrow stg(x,y) \in Sns$
 6.4 $x \text{ pd}^* y \rightarrow x \text{ fdt } y$
 6.5 $pd^* \subset \text{fdt}$
 6.6 $x \text{ pd}^* y \leftrightarrow \bigvee_s (s \in Sns \wedge (x,y) \text{ ifc } s)$
 6.7 $x \text{ pd}^* y \leftrightarrow \sim \bigvee_{u,v} [u \neq x \wedge v \neq y \wedge (u,v) \text{ ifc } stg(x,y)]$
 6.8 $x \text{ pd}^* y \rightarrow \sim \bigvee_{u,v} [u \text{ frp } stg(x,y) \wedge v \text{ fr } stg(x,y) \wedge (u,v) <_{hc} (x,y)]$

The last three theorems state some of the interdependences between the relations pd^* and ifc on one hand, and between pd^* and $<_{hc}$ on the other. Two phrases x and y , being bound by the relation pd^* , are at the same time the only immediate phrasal constituents of the sentence resulting from the combination of these phrases. They also display the smallest degree of hypotactic cohesion within this sentence.

The predecessor of the relation pd^* will be called the subject phrase and its successor – the predicate phrase. The *relation of being the subject phrase of* (sf), and the *relation of being the predicate phrase of* (pf) will be formally introduced in the following way:

Df 6.2 $\text{sf} = \{(x,s): \bigvee_y (x \text{ pd}^* y \wedge s = stg(x,y))\}$

Df 6.3 $\text{pf} = \{(x,s): \bigvee_y (y \text{ pd}^* x \wedge s = stg(y,x))\}$

Since the converses of the relations sf and pf are the functions:

6.9 $\check{\text{sf}}: Sns \rightarrow \text{frp} \langle Sns$

6.10 $\check{\text{pf}}: Sns \rightarrow \text{fr} \langle Sns$

we are entitled to use the symbols $\check{\text{sf}}(s)$ and $\check{\text{pf}}(s)$ to denote the subject phrase of simple sentence s , and the predicate phrase of s , respectively. These two phrases are immediate constituents of s , and they exhibit the smallest degree of hypotactic cohesion which, in turn, finds expression in the following theorems:

6.11 $s \in Sns \rightarrow (\check{\text{sf}}(s), \check{\text{pf}}(s)) \text{ ifc } s$

6.12 $s \in Sns \rightarrow \check{\text{sf}}(s) \text{ pd}^* \check{\text{pf}}(s)$

6.13 $s \in Sns \rightarrow \sim \bigvee_{x,y} [x \text{ fr } s \wedge y \text{ fr } s \wedge (x,y) <_{hc} (\check{\text{sf}}(s), \check{\text{pf}}(s))]$

The subject phrase does not determine any other phrase within a simplex sentence, i.e. it always functions as a proper hypophrase, necessarily incorporating determinatum absolutum. These statements can be formally expressed by means of the following theorems:

6.14 $x \text{ sf } s \rightarrow x \text{ frp } s$

6.15 $x \text{ sf } s \rightarrow \check{\text{dtma}}(s) \text{ frp } x$

The definitions formulated below introduce in a formal manner:

(i) the *set of all subject phrases* (Sf), and

(ii) the *set of all predicate phrases* (Pf).

Df 6.7 $\text{Sf} = \text{sf} \langle Sns$

Df 6.8 $\text{Pf} = \text{pf} \langle Sns$

The subject phrase should be kept distinct from the subject, and the predicate phrase – from the predicate. The *relation of being the subject of* (sb), and the *relation of being the predicate of* (pr) will be defined, respectively, as follows:

Df 6.9 $\text{sb} = \{(x,s): x = \check{\text{dtma}}(\check{\text{sf}}(s))\}$

Df 6.10 $\text{pr} = \{(x,s): x = \check{\text{dtma}}(\check{\text{pf}}(s))\}$

In light of these definitions, the subject of a sentence is identical with the determinatum absolutum of the subject phrase of this sentence, and the predicate of a sentence is identical with the determinatum absolutum of the predicate phrase of this sentence.

The *set of all subjects* (Sb) and the *set of all predicates* (Pr) can be now defined, respectively, as follows:

Df 6.11 $\text{Sb} = \text{sb} \langle Sns$

Df 6.12 $\text{Pr} = \text{pr} \langle Sns$

Predication is equivalent with bringing about the hypotactic polarization of a sentence into a subject phrase and a predicate phrase, which exhaust this sentence completely. The obvious structural caesura interjecting itself between these two phrases, which is independent of linear word order, specifies the predicative dichotomy of a sentence. This dichotomy is clearly semantically and syntactically based, which ultimately derives from the semantic and syntactic foundation of the determination itself. We shall also assume that each sentence, however improbable and objectionable it might seem, not only designates a certain fragment of reality and conveys meaning, but also shows how it is constructed with respect to the signification at issue.

Fragments of reality are split following the dualistic principle: entity – its properties. The former is designated by a subject phrase and the latter by

a predicate phrase. Consequently, the ascription of the intended properties to an entity is achieved by means of determining the subject phrase by the predicate phrase, whereby, at the same time, the range of designation of the subject phrase is appropriately restricted. Informally, we may say that a subject phrase designates an entity, which is spoken of within a sentence, and a predicate phrase designates that which is said about the entity spoken of.

The very essence of predication thus originates from its being but one particular case of determination. By describing a certain property attributed to the entity designated by a subject phrase, the predicate phrase says something about the former. Obviously, the predicative structure associated with a sentence in the framework of the theory of determination will often differ from the logical (i.e. predicate) structure associated with this sentence in terms of the predicate theory. However, we shall not go into this problem here.

7. PREDICATION: THEME – RHEME

The relation of predication is by no means limited only to phrases within simplex sentences. A simplex sentence, as a whole, may function in turn as determinatum or determinant. Two cases may be distinguished:

- (i) a sentence is determined by another sentence,
- (ii) a phrase which is not a sentence is determined by a sentence.

To illustrate the former case we shall avail ourselves of the following compound sentence.

(7a) *The young man drove a car, while the storm was raging.*

The main clause *The young man drove a car* is determined by the subordinate clause *while the storm was raging*, i.e. the latter provides some information about the former. The main clause thus acquires determinational status similar to that of a subject phrase. In order to describe the state of things designated by this sentence, we can construct sentences in which the determinational relationships are shaped in different ways and which may be exemplified, among others, by the following:

- (7b) *The storm was raging, while the young man drove a car.*
- (7c) *A car was driven by the young man, while the storm was raging.*
- (7d) *The young man drove a car during a raging storm.*
- (7e) *The young man's drive in a car was during a raging storm.*

Thus, to a certain permissible extent, the determinational relationships may be changed relatively freely within a certain lexical framework.

Let us now turn attention to expressions in which a phrase, while not being a sentence, is determined by a sentence. To begin with, let us consider the

possibilities of changing determinational and predicative relationship within the following simplex sentence:

(7f) *The supervisor inspected work in the factory.*

As it should be remembered, the entity spoken about in a simplex sentence is that designated by a subject phrase. In the case of (7f), it is the entity designated by *the supervisor*. But one would be justified in asking the question: Is there always an obligation to speak about this entity while constructing the expressions with the purpose of describing the state of things as designata (7f)? In other words, must *the supervisor* always function as subject phrase? Of course not! We can speak about the designata of other phrases as well. This may be reflected in the possibility of forming lexically and translationally equivalent expressions (paraphrases) such as the following:

- (7g) *Work in the factory was inspected by the supervisor.*
- (7h) *The inspection of work by the supervisor was done in the factory.*
- (7j) *It was in the factory that the supervisor inspected work.*

As the above sentences show, each word (or its homolexic variant) of the initial sentence (7f) could be the determinatum absolutum of an appropriate proper phrase functioning as a subject phrase, except for *in the factory*. However, the latter possibility seems to be available in Polish, where the translational equivalent of (7j) is as follows:

(7k) *W fabryce, to nadzorca skontrolował pracę.* (Or *W fabryce – nadzorca skontrolował pracę.*)

In this sentence the phrase *w fabryce* “in the factory” assumes the status of subject phrase, and the sentence *to nadzorca skontrolował pracę* “The supervisor inspected work” - the status of predicate phrase. Thus, in (7k) the whole sentence determines a phrase which itself is not a sentence.

An expression consisting of a phrase, which is not a sentence and functions as a subject phrase, and of a sentence functioning as predicate phrase will be called a *phraseosentence*. Before we formally define this notion, let us first introduce an auxiliary term, namely, the *set of all phrasons*, symbolized by *Frn*.

Df 7.1 $Frn = \{x: x \in (Frs - Sn) \wedge \sim \bigvee_y (y \text{ fr } x \wedge y \in Sn)\}$

According to this definition, phrasons are those phrases which are neither sentences nor incorporate sentences. The following corollaries may be inferred:

- 7.1 $Frn \subset Frs$
- 7.2 $Frn \cap Sn = \emptyset$
- 7.3 $f \in Frn \rightarrow \bigwedge_y (y \text{ fr } f \rightarrow \sim y \in Sn)$

The set of all phraseosentences (*Fsn*) will be defined in the following way

$$\text{Df. 7.2 } Fsn = \{u: u \in Ut \wedge \bigvee_x \bigvee_s (x \in Frn \wedge s \in Sns \wedge x \text{ fdt } s \wedge stg(x,s) = u)\}$$

In light of this definition, a phraseosentence consists of a phrason being determined by a sentence. However, this definition seems to be inadequate to the extent that it does not include utterances consisting of a sentence being determined by a phrason among phraseosentences.

Phraseosentences as defined above abound especially in such languages as Japanese and Korean, and they may be demonstrated by means of the following examples:

Japanese:

- (7l) *Kare-wa Eigo-ga wakarimasu.* 'He understands English.'
 (7m) *Zoo-wa hana-ga nagai.* 'The elephant has a long trunk.'
 (7n) *Niwa-de-wa sakura-ga saita.* 'A cherry-tree bloomed in the garden'

Korean:

- (7o) *Kū-nūn mōri-ga ap'ūda.* 'He has a headache.'
 (7p) *K'okkiri-nūn k'o-ga kilda.* 'The elephant has a long trunk.'
 (7r) *Pom-e-nūn kkoch'-i p'inda.* 'In the spring flowers are blooming'.

The peculiarity of the above phraseosentences can be better sensed, although only approximately, when we are exposed to their literal translations which are as follows:

- (7l) *As for him, English is understood.*
 (7m) *As for the elephant, the trunk is long.*
 (7n) *As for in the garden, a cherry-tree bloomed.*
 (7o) *As for him, the head aches.*
 (7r) *As for in the spring, flowers are blooming.*

Let us now adduce Japanese examples of nominalized phraseosentences occurring within complex sentences:

- (7s) *Kare-to-wa hanasanakatta koto-ga zannen desu.* 'The fact that I did not speak to him is regrettable.'
 (7t) *Kanojo-wa daigaku-de Nihongo-o oshieta koto-ga arimasu.* 'She has taught Japanese at the university.'

Are phraseosentences themselves sentences as well? Without giving a decisive answer here, however, we are convinced that their structure seems to be sufficiently distinct to justify singling them out as a separate category of utterances. What we would like to suggest next is to subsume sentences and phraseosentences under the more comprehensive hyperonymic term of *nuntiations*, which is intended to refer to a syntactic category of utterances rather

than to a pragmatic one. Since the terms subject phrase and predicate phrase have been confined exclusively to simplex sentences, we would further suggest the use, with respect to nuntiations, of the terms *theme* and *rheme* in an analogous sense. Also, the relation of predication should be conceived of in a more comprehensive way.

The definitions formulated below introduce the following four notions:

- (i) the set of all nuntiations (*Nu*),
- (ii) the relation of predication (*pd*),
- (iii) the relation of being a theme of (*th*),
- (iv) the relation of being a rheme of (*rh*).

$$\text{Df 7.3 } Nu = Sn \cup Fsn$$

$$\text{Df 7.4 } pd = \{(x,y): \bigvee_n (n \in Nu \wedge x \text{ frp } n \wedge y \text{ fr } n \wedge stg(x,y) = n \wedge x \text{ fdt } y)\}$$

$$\text{Df 7.5 } th = \{(x,n): n \in Nu \wedge \bigvee_y (x \text{ pd } y \wedge stg(x,y) = n)\}$$

$$\text{Df 7.6 } rh = \{(x,n): n \in Nu \wedge \bigvee_y (y \text{ pd } x \wedge stg(y,x) = n)\}$$

The understanding of the sense of each of the above definitions should not present any difficulty. The following corollaries can be easily inferred:

$$7.4 \quad pd \subset Frs \times Frs$$

$$7.5 \quad \check{th}: Nu \rightarrow Frs$$

$$7.6 \quad \check{rh}: Nu \rightarrow Frs$$

$$7.7 \quad pd^* \subset pd$$

$$7.8 \quad sf \subset th$$

$$7.9 \quad pf \subset rh$$

$$7.10 \quad pd \subset fdt$$

$$7.11 \quad n \in Nu \rightarrow (\check{th}(n), \check{rh}(n)) \text{ ifc } n$$

$$7.12 \quad n \in Nu \rightarrow \sim \bigvee_{x,y} [x \text{ fr } n \wedge y \text{ fr } n \wedge (x,y) <_{hc} (\check{th}(n), \check{rh}(n))]$$

$$7.13 \quad x,y \in Frs \wedge x \text{ pd } y \rightarrow stg(x,y) \in Nu$$

$$7.14 \quad x \text{ th } n \rightarrow x \text{ frp } n$$

$$7.15 \quad x \text{ th } n \rightarrow \check{dtma}(n) \text{ frp } \check{th}(n)$$

The relation of predication *pd** thus appears as one particular case of the relation *pd* binding theme and rheme, which in turn are more comprehensive than subject phrase and the predicate phrase, respectively.

The following two definitions introduce:

- (i) the set of all themes (*Th*), and
- (ii) the set of all rhemes (*Rh*).

$$\text{Df 7.7 } Th = th \langle Nu$$

$$\text{Df 7.8 } Rh = rh \langle Nu$$

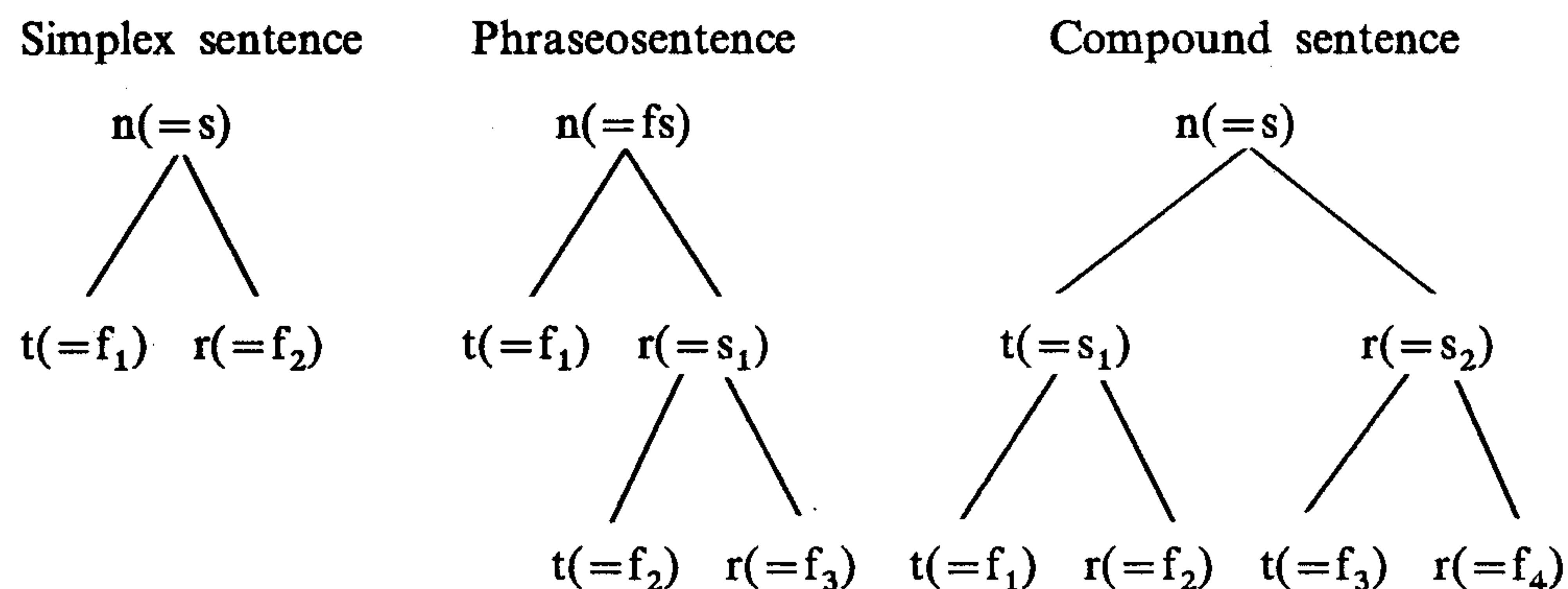
The differences in the predication structure of the three kinds of nuntiation being distinguished above become especially evident if we compare the following three theorems:

$$7.16 \quad s \in Sns \rightarrow \check{t}h(s) \in Frn \wedge \check{r}h(s) \in Frn$$

$$7.17 \quad f \in Fsn \rightarrow \check{t}h(f) \in Frn \wedge \check{r}h(f) \in Sns$$

$$7.20 \quad s \in Snc \rightarrow \check{t}h(s) \in Sns \wedge \check{r}h(s) \in Sns$$

The differences in question may also be visualized in the following graphs, in which n symbolizes a nuntiation, t and r its theme and rheme, respectively, f – a phrason, and s – a sentence.



Of course, the availability of the above types of nuntiations as well as their actual occurrence may vary from language to language.

8. INDICATION OF THEME AND RHEME IN JAPANESE AND KOREAN

After having defined the notions of subject/predicate and theme/rheme there emerges, in a natural way, the question of the lingual indicators (markers) of these entities, or to express it differently, of how we recognize them within nuntiations. This problem is an extensive one and we are not going to deal thoroughly with it now. Instead, we shall only briefly hint at some aspects of it.

In many languages, the function of indicating the subject of a sentence is most commonly accomplished by the nominative case. However, in most languages the nominative is not distinguished morphologically from other cases in an absolute way, i.e. it may formally coincide with other cases of the same noun. Since the concepts of theme/rheme are more comprehensive than the concepts of subject/predicate, the methods of indicating the latter will be included in those of the former.

A relatively consistent method of theme/rheme indication operates in Japanese and Korean, where special particles are used. In Japanese there is *-wa* and *-ga*, and in Korean *-nūn*, *ūn*, *-ga*, *-i*. Rhemes do not exhibit as their markers any segmental morphemes. What deserves particular attention is that nouns not only *in casu recto* but also *in casu obliquo* may appear as themes of nuntiations. For the sake of illustration, let us adduce below additional examples.

- Jap. (8a) *Sensei-wa daigaku-e shiden-de kimasu.*
 'The teacher is coming to the university by a tramcar.'
 (8b) *Daigaku-e-wa sensei-ga shiden-de kimasu.*
 'As for to the university, the teacher is coming by a tramcar.'
 (8c) *Shiden-de-wa sensei-ga daigaku-e kimasu.*
 'As for by the tramcar, the teacher is coming to the university.'
- Kor. (8d) *Na-nūn kū-rūl ōjōkke passo.* 'I saw him yesterday.'
 (8e) *Pada-ga kipta.* 'The sea is deep.'
 (8f) *Pyōg-e-nūn kūrim-i kōllyō isso.*
 'The pictures are hanging on the wall.' (lit. As for on the wall, the pictures are hanging.)

In Japanese the process of transformation of phraseosentences into sentences, at least to a certain extent, seems to be operating. This is achieved by replacing the ignotive subject of the former by the corresponding object. As a result, a construction of the type: *Sensei-wa Eigo-ga wakarimasu* is changed to a construction of the type: *Sensei-wa Eigo-wo wakarimasu*. Such an operation also leads to the simplification of the two-level predicative structure into the one-level one.

The research into the ways of indication of theme and rheme may bring typologically interesting results.

9. CONCLUDING REMARKS

The theory of determination surveyed above seems to offer an adequate framework within which, in terms of the relation of phrasal determination, many fundamental notions can be defined, such as: the relation of a smaller degree of hypotactic cohesion, the relation of immediate phrasal constituency, the relation of predication, the subject phrase/predicate phrase, and the theme/rheme. As it is easily observed, the subject phrase needs not coincide with the theme and the predicate phrase with the rheme. In addition, the subject phrase can cooccur with the theme on one hand, and the predicate phrase with the rheme on the other, within the same nuntiation.

The relation of phrasal determination turns out to be a powerful device capable of establishing natural links among fundamental syntactic concepts. Some other related topics of our theory will be taken up elsewhere.

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