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**ABSTRACT**

This document describes a format for analyzing the information content of sentences and the language patterns that accompany particular information content. The author writes in terms of information structures, each information structure having a corresponding linguistic structure composed of distinctive features. The information structure of a given sentence and its corresponding linguistic structure are frequently conditioned by context, particularly the preceding sentence. The paper illustrates the determination of 12 different information structure types, to which correspond a total of 16 different linguistic structure types. Most of the examples are in German. (VM)

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Ernesto Zierer:

Information structure and linguistic structure

By the term *information structure* we shall here understand a complex of the following *information features*:

- (a) information focus (IF): that piece of information which the speaker considers the most important in his statement, usually the information which he believes will satisfy the hearer's expectation. For example, in sentence (2) below, the information focus is "teacher":

(1) "A man is walking over there."

(2) "It is my teacher."

- (b) definite: the fact that a unit has been identified previously in the context. For example, in sentence (4) below, "He" carries this feature:

(3) "My friend is walking over there."

(4) "He is a very good painter."

- (c) indefinite: the fact that a unit has not been identified previously in the context, though it may have been mentioned. For example, in sentence (1) above, "A man" carries this feature.

To every information structure corresponds a specific *linguistic structure*, composed of specific distinctive features. The information structure of a given sentence, and hence also its corresponding linguistic structure, is frequently conditioned by the context,

(Lenguaje y Ciencias XII-1, 1972, p. 23-31)

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FL 003 469

particularly the preceding sentence. For example, the selection of the forms "it" and "He" in sentences (2) and (4) above is conditioned by the information features "indefinite" and "definite" in sentences (1) and (2).

We shall now apply the model described to the problem of selecting the proper sequence of the direct object and indirect object in German statement sentences, combined with adequate article selection.<sup>1)</sup>

Let us formalize the information structure of a given statement containing a direct/indirect object sequence as a triple

$IS = (x, y, z)$ , where  $x$  ... information focus  
 $y, z$  ... indications as to whether or not the two objects are "definite" (as defined above). Objects carrying the information feature "definite" are marked +, and those which are introduced as "indefinite" are marked -.

Example:

*Ich kaufte meiner Schwester ein Geschenk.*

(I bought my sister a present.)

Let us suppose that in this sentence the word *Geschenk* has an emphatic stress on the second syllable (as indicated above). The direct object (symbolized by 4 below) is then the information focus. The indirect object (symbolized by 3 below) was introduced previously in the context, and hence carries a definite determiner. The direct object carries the feature "indefinite". We express this in the following way:

$IS = (4;+3;-4)$

The distinctive features involved in the linguistic structure corresponding to the information structure type given above are: sequence, stress and determiner type. On the basis of these features

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1) Cf.: L. Monteverde G. & E. Zierer: "Information Psychology and Second Language Learning" in: REVISTA DE PEDAGOGIA CIBERNETICA E INSTRUCCION PROGRAMADA, Vol. IV-1, 1971

we shall define the linguistic structure as

$$LS = ((aXbY) \phi) ,$$

where the small letters stand for the determiner type: i (indefinite), d (definite); the capital letters, for the two objects: 4 (direct), 3 (indirect), such that X is different from Y; and  $\phi$ , for the operator assigning emphatic stress either to X or to Y (by underlining) or to neither of the two. Thus for the example given above we get the linguistic structure

$$LS = (d3i4)$$

The combination of the information features that make up a specific information structure, and the co-ordination of the latter with its corresponding linguistic structure can be illustrated by means of a so-called HOPPE graph.<sup>2)</sup> In this graph (Fig. 1) we distinguish (for our specific purpose here) the information structure level above the dotted line, and the linguistic structure level below it. The points where three lines meet are either marked with two right angles or with two dots. The angles symbolize a logical conjunction when information proceeding from two horizontal lines continues along the line in vertical direction, and a conjunctive dejunction when information coming from one vertical line continues along two horizontal lines at the same time. The two dots symbolize that information proceeding from a vertical line continues only to one of the two horizontal lines at a time, and that information can continue along the vertical line only if it comes from one of the two horizontal lines but not from both at the same time.

The HOPPE graph shown as Fig. 1 corresponds to the following sentences:

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<sup>2)</sup> Cf.: E. Zierer: La representación de sistemas de procesamiento informacional mediante gráficos HOPPE, Trujillo: Universidad Nacional de Trujillo, 1972

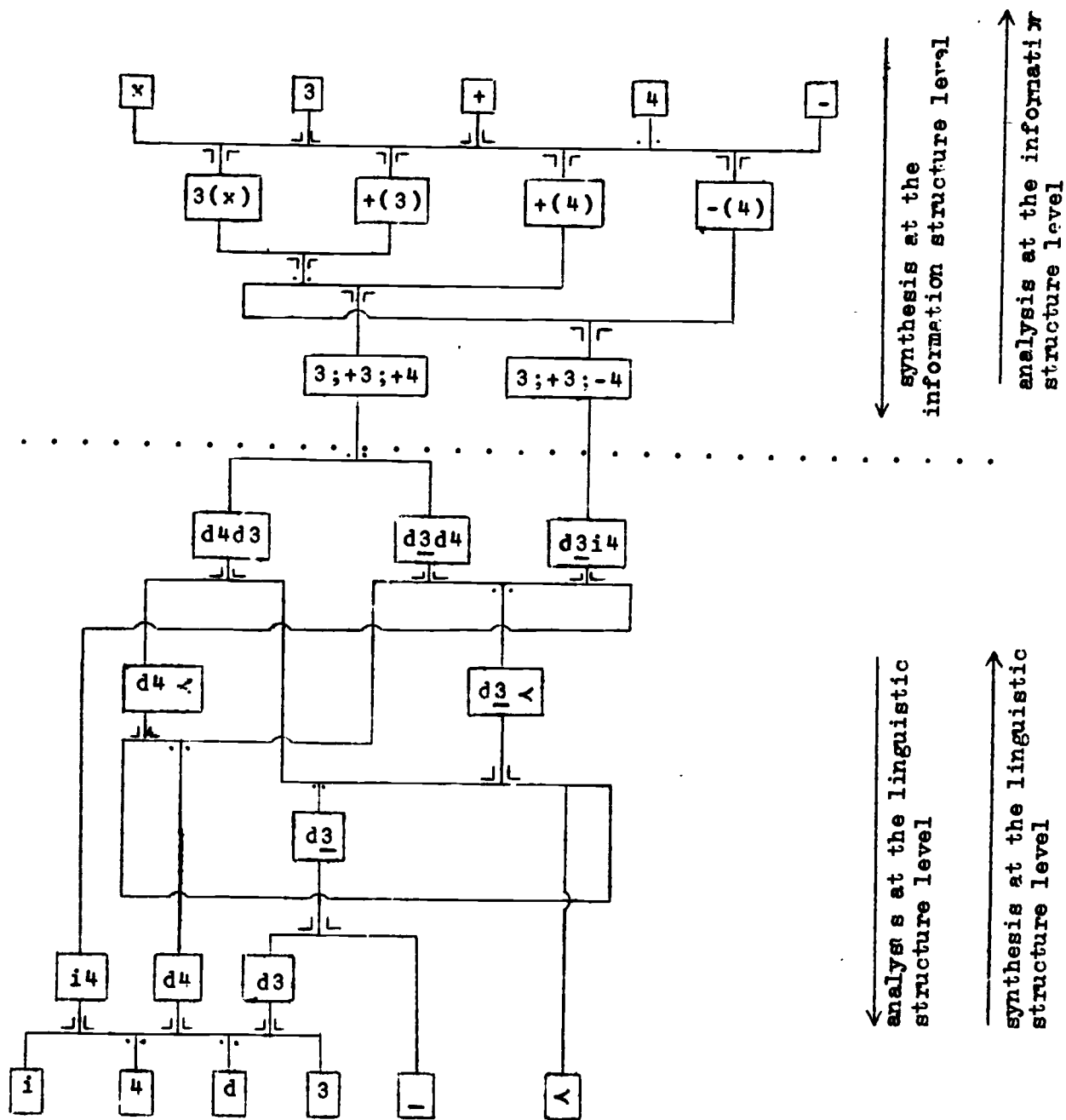


Fig. 1: HOPP graph showing the co-ordination of the information structure of sentences (1), (2), (3) - Cf. text - with their corresponding linguistic structures.

- (1) *Ich schenkte der Mütter das Buch.*
- (2) *Ich schenkte das Buch der Mütter.*
- (3) *Ich schenkte der Mütter ein Buch.*

The information structures and linguistic structures corresponding to these sentences are:

- |     |               |                     |
|-----|---------------|---------------------|
| (1) | IS: (3;+3;+4) | LS: (d <u>3</u> d4) |
| (2) | IS: (3;+3;+4) | LS: (d4d <u>3</u> ) |
| (3) | IS: (3;+3;-4) | LS: (d3i <u>4</u> ) |

Comparing the three sentences with each other we find that (1) and (2) have the same information structure but different linguistic structures.

In the HOPPE graph we notice two processes at each level:

at the information structure level: synthesis, as the process proceeds from top to bottom; and analysis, as we proceed from bottom to top;

at the linguistic structure level: analysis, as the process proceeds from top to bottom; and synthesis, as the process proceeds from bottom to top. We can then say that a process of synthesis at the information structure level corresponds to a process of analysis at the linguistic structure level, and a process of analysis at the information structure level corresponds to a process of synthesis at the linguistic structure level.<sup>3)</sup>

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3) Cf. also: A. Hoppe: "Der sprachliche Formulierungsprozess als Grundlage automatischer Hin- und Her-Übersetzung, in: K. Steinbuch & S. W. Wagner (Ed.): Neuere Ergebnisse der Kybernetik. München/Wien: R. Oldenbourg Verlag, 1964, pages 95-108

It may also occur that the whole event is the information focus, as in the following sentence:

(4) *Ich schrieb der Mutter einen Brief*

(without any emphatic stress). This sentence would be the answer to the following question:

(5) *Was machtest du?*

In the IS-formula corresponding to sentence (4) A stands for "whole event". In the LS-formula, neither 3 nor 4 are underlined as <sup>they</sup> do not carry any emphatic stress:

IS: (A;+3;-4)

LS: (d3i4)

The problem dealt with here involves 12 different information structure types, to which correspond a total of 16 different linguistic structure types:

(1) IS: (3;+3;+4):

(1) LS: (d3d4) *Ich schenkte der Mutter das Buch.*

(2) LS: (d4d3) *Ich schenkte das Buch der Mutter.*

(2) IS: (3;+3;-4):

(3) LS: (d3i4) *Ich schenkte der Mutter ein Buch.*

(3) IS: (3;-3;+4):

(4) LS: (d4i3) *Ich schenkte den Apfel einem Kind.*

(5) LS: (i3d4) *Ich schenkte einem Kind den Apfel.*

(4) IS: (3;-3;-4):

(6) LS: (i3i4) *Ich schenkte einem Kind einen Apfel.*

- (5) IS: (4;+3;+4):  
(7) LS: (d3d4) *Ich schenkte der Mutter das Bäch.*  
(8) LS: (d4d3) *Ich schenkte das Bäch der Mutter.*
- (6) IS: (4;+3;-4):  
(9) LS: (d3i4) *Ich schenkte der Mutter ein Bäch.*
- (7) IS: (4;-3;+4):  
(10) LS: (i3d4) *Ich schenkte einem Kind das Bäch.*  
(11) LS: (d4i3) *Ich schenkte das Bäch einem Kind.*
- (8) IS: (4;-3;-4):  
(12) LS: (i3i4) *Ich schenkte einem Kind einen Apfel.*
- (9) IS: (A;+3;-4):  
(13) LS: (d3d4) *Ich schickte der Mutter das Paket.*
- (10) IS: (A;+3;-4):  
(14) LS: (d3i4) *Ich schrieb der Mutter einen Brief.*
- (11) IS: (A;-3;+4):  
(15) LS: (i3d4): *Ich zeigte einem Freund das Museum.*
- (12) IS: (A;-3;-4):  
(16) LS: (i3i4): *Ich schrieb einem Freund einen Brief.*

Admittedly, not all of the patterns given above occur with the same frequency or are equally acceptable.

Fig. 2 represents the 12 information structure types in binary coding.



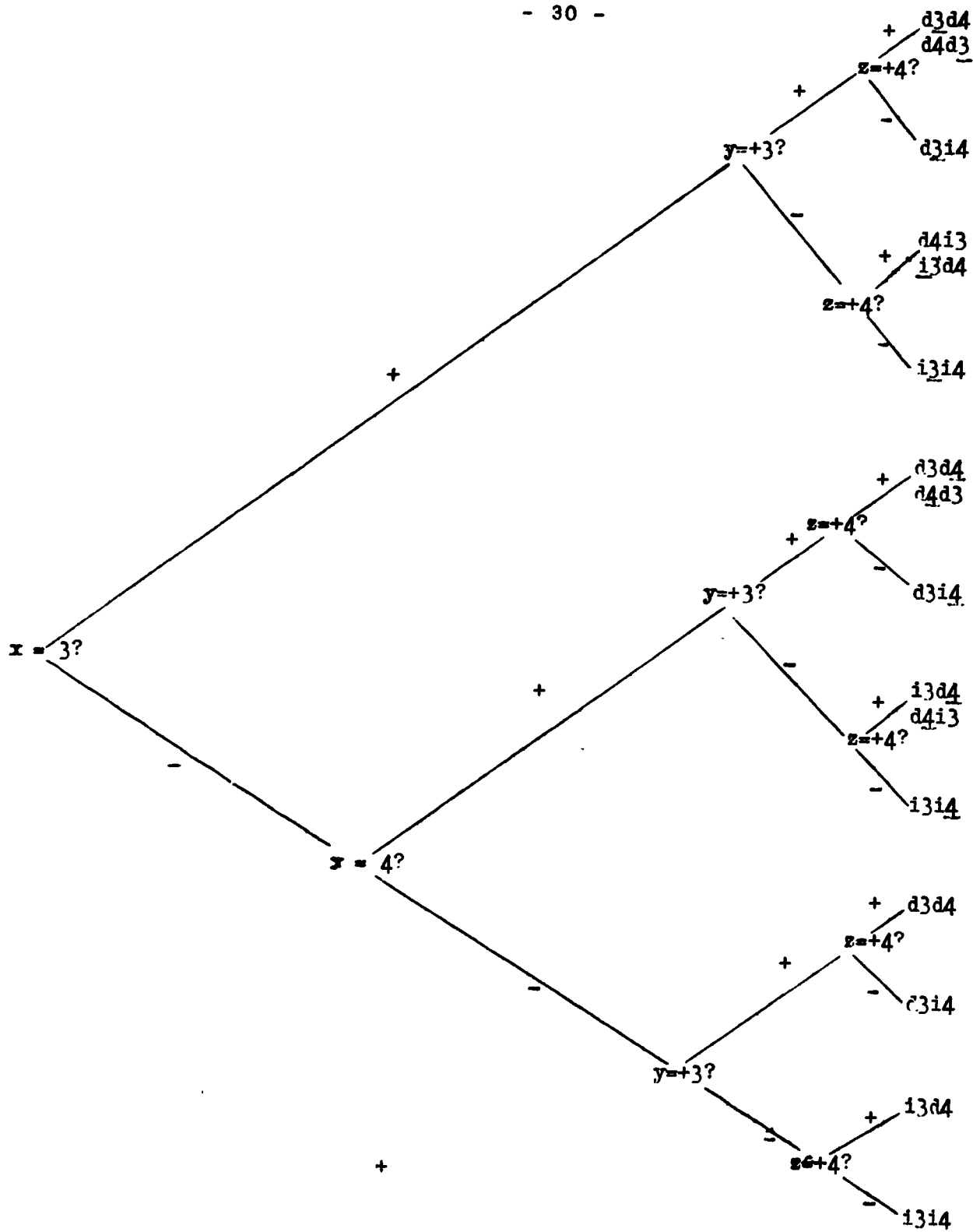


Fig. 2: Binary coding of the 16 linguistic structure types corresponding to the direct/indirect object sequences in German statement sentences. The linguistic structure types are correlated with their corresponding information structure types.

The didactic problem of special interest to the foreign language teacher here is to find out the most convenient grouping of the patterns for the learning process. <sup>4)</sup>

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4) Cf. L. Monteverde G. & E. Zierer: op. cit. pages 46-48