XX. LINGUISTICS[*]

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RESEARCH OBJECTIVES

The ultimate objective of our research is to gain a better understanding of man's mental capacities by studying the ways in which these capacities manifest themselves in language. Language is a particularly promising avenue because, on the one hand, it is an intellectual achievement that is accessible to all normal humans and, on the other hand, we have more detailed knowledge about language than about any other human activity involving man's mental capacities.

In studying language it has long been traditional to deal with certain topics such as pronunciation, inflection of words, word formation, the expression of syntactic relations, word order, and so forth. Moreover, the manner in which these topics are treated has also been quite standard for a very long time. This format has on the whole proved to be quite effective for the characterization of all languages, although quite a few shortcomings have been noticed and discussed at length. It would seem plausible that the main reason for the success of the traditional format is that it was adequate to the task, and to this extent the traditional framework embodies true insights about the nature of language. Much of the effort of our group continues to be devoted to the further extension of the theoretical framework of linguistics and to the validation of particular aspects of the framework. As our work progresses it becomes ever clearer that a single framework must indeed underlie all human languages for when really understood the differences among even the most widely separate languages are relatively minor.

The preceding discussion leads quite naturally to the question, "What evidence from

outside of linguistics might one adduce in favor of the hypothesis that all languages are constructed in accordance with a single plan, a single framework?" It seems to us that the most striking evidence in favor of the hypothesis is, on the one hand, the rapidity with which children master their mother tongue, and on the other hand, the fact that even a young child's command of his mother tongue encompasses not only phrases and utterances he has heard but also an unlimited number of phrases and utterances he has not previously encountered. To account for these two sets of facts, we must assume that in learning a language a child makes correct inferences about the structural principles that govern his language on the basis of very limited exposure to the actual sentences and utterances. In other words, we must assume that with regard to matters of language a child is uniquely capable of jumping to the correct conclusions in the overwhelming majority of instances, and it is the task of the student of language to explain how this might be possible.

A possible explanation might run as follows. Assume that the human organism is constructed so that man is capable of discovering only selected facts about language and, moreover, that he is constrained to represent his discoveries in a very specific fashion from which certain fairly far-reaching inferences about the organization of other parts of the language would follow automatically. If this assumption is accepted, the next task is to advance specific proposals concerning the devices that might be actually at play. The obvious candidate is the theoretical framework of linguistics, for while it is logically conceivable that the structure of language might be quite distinct from that of the organism that is known to possess the ability to speak, it is much more plausible that this is not the case, that the structures that appear to underlie all languages reflect quite directly features of the human mind. To the extent that this hypothesis is correct — and there is considerable empirical evidence in its favor — the study of language is rightly regarded as an effort at mapping the mysteries of the human mind.

M. Halle

A. ON THE FORMALIZATION OF INFINITE SETS OF PHONOLOGICAL RULES

In this report we describe a formalism for rules of the type: "Do something to every n^{th} vowel," where n can be any integer. Rules of this type are fairly common (essentially with n = 2): vowel syncope in Indo-European (Borgstrøm[1]), vowel dropping in Old Irish (Thurneysen[2]), stress-assignment in Southern Paiute (Sapir[3]), reducing of unstressed vowels in modern Kalmyk, a dialect of Mongolian, schwa-dropping in French, and so forth. Chomsky and Halle[4] proposed using the schema (X)* to represent such rules. This supplementary device is not actually needed; a judicious use of conventions already available (specifically, variables over sequences of segments and parentheses) enables accounting for the same range of phenomena. The essential idea behind the present proposal comes from Halle who mentioned once that he had the intuition that such processes are the result of a combination of conjunctive and disjunctive ordering;[5] thus, disjunctive ordering would be responsible for skipping certain vowels. Given this basic idea, it is a rather straightforward task to work out the corresponding formalism. In this report, C stands for [−syll], V for [+syll], $\overline{V}$ for $\begin{bmatrix} +syll \\ +long \end{bmatrix}$.
    Consider first the schema

(1)   A $\longrightarrow$ B / $\underline{\quad\quad}$ (T)U

where A, B, T, U are phonological matrices. The application of (1) to a given form is governed by the following conventions

(2) (a) (1) abbreviates the set of two rules

(1a) $A \longrightarrow B \ / \ \underline{\quad\quad} TU$

(1b) $A \longrightarrow B \ / \ \underline{\quad\quad} U.$

(b) If either of the two rules (1a), (1b) is applied, the other cannot be applied (unless we deal with two nonintersecting domains of application or with two different cycles).

(c) Given a form to which neither (1a) nor (1b) has yet applied, if the structural condition for (1a) is met, then it must apply; in other words, (1a) is ordered before (1b).

Consider such a rule as

(3) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} (\ C_0 V \ ) \ X \ \#$

where X is a variable ranging over sequences of syllables. Rule (3) stands for the infinite set of schemas S:[6]

(4) $S = \{ V \longrightarrow \ldots \ / \ \underline{\quad\quad} (\ C_0 V \ ) \ C_0 V^n \ \# \ | \ n = 0, 1, 2, \ldots \}.$

Given the form

(5) $\# \ C_0 V C_0 V C_0 V C_0 V C_0 V C_0 V C_0 V \ \#$ (7 syllables),

there are 7 values of X which are relevant:

(6) (i) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} (\ C_0 V \ ) \ C_0 V^6 \#$

(ii) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} (\ C_0 V \ ) \ C_0 V^5 \#$

$\vdots$

(vi) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} (\ C_0 V \ ) \ C_0 V \ \#$

(vii) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} (\ C_0 V \ ) \ \#$

The seven schemas in (6) are "applied" simultaneously. Consider (7), where the schemas in (6) have been expanded into their component parts:

(7) (i) (a) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} C_0 V^7 \#$

(b) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} C_0 V^6 \#$

(ii) (a) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} C_0 V^6 \#$

(b) $V \longrightarrow \ldots \ / \ \underline{\quad\quad} C_0 V^5 \#$

(iii) (a) $V \longrightarrow \ldots / \underline{} C_o V^5 \#$

(b) $V \longrightarrow \ldots / \underline{} C_o V^4 \#$

(iv) (a) $V \longrightarrow \ldots / \underline{} C_o V^4 \#$

(b) $V \longrightarrow \ldots / \underline{} C_o V^3 \#$

(v) (a) $V \longrightarrow \ldots / \underline{} C_o V^3 \#$

(b) $V \longrightarrow \ldots / \underline{} C_o V^2 \#$

(vi) (a) $V \longrightarrow \ldots / \underline{} C_o V^2 \#$

(b) $V \longrightarrow \ldots / \underline{} C_o V \#$

(vii) (a) $V \longrightarrow \ldots / \underline{} C_o V \#$

(b) $V \longrightarrow \ldots / \underline{} \#$

Let us suppose that schema (i) "applies" to (5). As (ia) cannot apply, (ib) applies. But (ib) = (iia); hence, by convention (2b), (iib) cannot apply because (iiia) = (iib), (iiia) does not apply; then, (iiib) applies. Along the same lines, as (iva) = (iiib), by convention (2b), (ivb) cannot apply, i.e., (va) cannot apply; i.e., (vb) applies, etc. To sum up, the set

(8) $V \longrightarrow \ldots / \underline{} C_o V^6 \#$

$V \longrightarrow \ldots / \underline{} C_o V^4 \#$

$V \longrightarrow \ldots / \underline{} C_o V^2 \#$

$V \longrightarrow \ldots / \underline{} \#$

will apply to (5), yielding

(9) $\# C_o \ldots C_o V C_o \ldots C_o V C_o \ldots C_o V C_o \ldots \#.$

Similarly, if we suppose that (i) does not "apply," we shall get

(10) $\# CVC \ldots CVC \ldots CVC \ldots CV \#.$

In other terms, the string "$\underline{} (C_o V) X \#$" in (3) formalizes the notion of "every other vowel." This formalism can be generalized. Thus a rule applying to every third vowel has the form[7]

(11) $V \longrightarrow \ldots \; / \; \underline{\qquad}(\; C_o V \; (\; C_o V \;) \;) \; X \; \# .$

We see that we are left with an indeterminacy; that is, there are two complementary sets of rules which can apply to a form such as (5) to yield either (9) or (10). We do not have a convention such as (2c) which would enable us to choose between the two sets. An example of how this problem can be solved is to assume that every other vowel of a word receives primary stress, beginning with the first one. We write the rule

(12) $V \longrightarrow [1 \; \text{stress}] \; / \; \#YC_o \underline{\qquad}(\; C_o V \;)X\#$

and posit the following convention.

(13) In a schema making use of variables ranging over sequences of syllables, the rules of the expansion of the schema corresponding to the value "$\emptyset$" of the variables must be applied when a form meets the structural condition of those rules.

This is a very natural convention: It simply means that the variables are used to their full "potential"; in (12), for instance, if the rule corresponding to $Y = \emptyset$ were not applied to the word, we could replace the schema by

(14) $V \longrightarrow [1 \; \text{stress}] \; / \; \#C_o VYC_o \; \text{----}(\; C_o V \;)X\#.$

Along those lines, the rule for Stress Assignment in Southern Paiute[8] is

(15) $V \longrightarrow [1 \; \text{stress}] \; / \; \#\langle C_o VY \rangle C_o \text{----} \langle (C_o V) \; X \rangle C_o V \; \#.$

In Tübatülabal, a rule lengthens every other vowel following a long vowel; the rule does not apply to vowels adjacent to long vowels.[9,10] We will represent this phenomenon by

(16) (i) $V \longrightarrow \bar{V} \; / \; \bar{V} C_o VYC_o \underline{\qquad}(C_o V)X(C_o \bar{V} Z)\#$

(ii) $\bar{V} \longrightarrow V \; / \; \underline{\qquad} C_o \bar{V}$

We simply need to state the following (very natural) convention:

(17) Let $V \longrightarrow \ldots \; / \; \ldots AX \ldots \underline{\qquad} \ldots YB \ldots$ be a subset of a set of schemas S (where X and Y are variables over sequences of syllables, and A and B are phonologically specified syllables). Then S applies to any domain such that $X \neq TAU$, $Y \neq WBZ$.

ADDENDUM

In a recent report, "On Algorithms for Applying Phonological Rules,"[11] S. R. Anderson proposed the following algorithm.

(1) <u>Revised Simultaneous Application Convention (RSAC)</u>:

Scan the string for segments that satisfy the constraints of the rule. When such a segment is found, identify it, and associate with that identification an identification of the environmental analysis that makes the rule applicable to that segment. If any environment contains a segment marked as undergoing the rule (other than the one with whose applicability this environment is associated), mark that as a violation. Then erase the minimal number of applicability identifications and their associated environment specifications that will eliminate all of the violations. Apply the rule simultaneously to the segments remaining marked as undergoing the rule.

(2) <u>Principle 2</u>: When, in applying RSAC, two or more possibilities exist for eliminating the violations in an analysis of a form with respect to a rule, and each is minimal, in that it eliminates the smallest possible number of applications of the rule within the form, and the rule is an iterative one, choose that elimination set which allows the rule to reapply over one that does not allow reapplication.

Anderson offers as an example a rule of tone loss in Acoma:

$$(3) \quad V \longrightarrow [\text{-high tone}] \quad / \quad [\text{+obst}] \begin{bmatrix} \overline{} \\ \text{-long} \end{bmatrix} [\text{+obst}] \, C_o \begin{bmatrix} V \\ \text{+high tone} \end{bmatrix}$$

He assumes that this rule is iterative. Consider in this light the underlying form /sípékáawání/ ($\overset{?}{\text{v}}$ stands for $\begin{bmatrix} V \\ \text{+high tone} \end{bmatrix}$; the other tone features are left unmarked). On a first pass the rule yields /sipékáawání/, in accordance with RSAC and Principle 2. On the second pass, the rule lowers the tone on /e/. The output is sipekáawání 'when I chopped wood'. Consider now the underlying form /súcítístáaní/ where three consecutive syllables satisfy the conditions for tone loss. The surface form is <u>sucítistáaní</u> 'when I was thinking' as predicted by RSAC; Principle 2 does not come into play and there is only one pass.

Anderson's algorithm predicts that we would obtain "pisícititáawí" from the hypothetical underlying form /písícítítáawí/ where four consecutive syllables satisfy the conditions for tone loss. Whether such behavior can be observed in the language is an empirical issue. We want to point out that the evidence for iterative rules is very slim (not to mention that such rules constitute an incredibly powerful device[12]). Moreover, in the case of /súcítístáaní/, RSAC and the principle underlying Principle 2 (rules apply to maximize their utilization in the grammar unless they are explicitly prevented from doing so) are actually in conflict: If rule (3) were to apply to /súcítístáaní/ in accordance with the maximization principle, it should reapply twice to yield *sucitistáaní. Under these circumstances, Principle 2 appears to be totally ad hoc.

We note that in the case of <u>sucítistáaní</u> RSAC produces an alternation of the type that we have been considering in this report. It is easy to see, however, that such a

principle cannot take the place of the formalism that we have been proposing. Consider, for example, a language in which words are assigned stress on every even-numbered vowel. If we state the rule as:

(4) $V \longrightarrow [1 \text{ stress}]$ / $C_0 V C_0 \underline{\quad\quad}$

the string

(5) $\#C_0 V C_0 V C_0 V C_0 V C_0 V C_0 V C_0 V\#$ (7 syllables)

will be analyzed by RSAC either as

(6) $\#C_0 V C_0 V$ $C_0 V C_0 V$ $C_0 V C_0 V$ $C_0 V\#$

or

(7) $\#C_0 V$ $C_0 V C_0 V$ $C_0 V C_0 V$ $C_0 V C_0 V\#$

If we write the rule as

(8) $V \longrightarrow [1 \text{ stress}]$ / $(\#) C_0 V C_0 \underline{\quad\quad}$

to insure that the second vowel in the word is stressed, we still have two alternatives:

(9) $\#C_0 V C_0 V$ $C_0 V C_0 V$ $C_0 V C_0 V$ $C_0 V\#$

(10) $\#C_0 V C_0 V$ $C_0 V$ $C_0 V C_0 V$ $C_0 V C_0 V\#$

In this case (as in the case of any word with an odd number of syllables) Principle 2 is of no help, and Anderson's algorithm incorrectly yields two outputs.

<div align="right">J. R. Vergnaud</div>

<div align="center">Footnotes and References</div>

1. C. H. Borgstrøm, "Thoughts about Indo-European Vowel Gradation," Norsk Tidsskrift for Sprogvidenskap 15, 137-187 (1949).

2. R. Thurneysen, A Grammar of Old Irish (San Francisco Book Imports, San Francisco, 1961).

3. E. Sapir, "Southern Paiute, A Shoshonean Language," Proc. Am. Acad. Arts Sci., Vol. 65, No. 1-3, 1930.

4. N. Chomsky and M. Halle, The Sound Pattern of English (Harper and Row Publishers, Inc., New York, 1968).

5. M. Halle, Private communication, 1971.

6. We assume that substrings enclosed in parentheses are expanded later than variables lying outside the parentheses. As far as (3) is concerned the other alternative (variables first, parentheses second) would be meaningless. A recent proposal by Halle (Ling. Inquiry 2, 540 (1971)), suggests that this ordering convention is more general; variables should be expanded first, wherever they show up. Halle points out that a rule which treats a given segment A on a par with the boundary of the word can be formalized as

$$B \longrightarrow C \quad / \quad \# \, (XA) \text{———} Y \, \#$$

$$\text{or} \quad B \longrightarrow C \quad / \quad \# \, Y \text{———} (AX) \, \#$$

where X and Y are variables. If the parentheses were to be expanded first, convention (2b) would forbid the rule to apply at the same time within the word and at the extremity, which is empirically wrong, as J. W. Harris has pointed out to Halle.

7. We are describing "propagations" from left to right. To describe "propagations" from right to left, (3) and (11) will have to be replaced by (a) and (b), respectively:

(a) $\quad V \longrightarrow \ldots \quad / \quad \# \, X \, (\ C_0 V \ ) \text{———}$

(b) $\quad V \longrightarrow \ldots \quad / \quad \# \, X \, (\ (\ C_0 V \ ) \ C_0 V \ ) \text{———}$

8. N. Chomsky and M. Halle, op. cit., p. 347.

9. T. M. Lightner, "On Swadesh and Voegelin's 'A problem in phonological alternation'" (unpublished paper, 1971).

10. J. D. McCawley, "Length and Voicing in Tübatülabal," Papers from the Fifth Regional Meeting of the Chicago Linguistic Society, 1969, pp. 407-415.

11. S. R. Anderson, Quarterly Progress Report No. 103, Research Laboratory of Electronics, M.I.T., October 15, 1971, pp. 159-164.

12. J. R. Vergnaud, "Some Phonological Problems in French, Tübatülabal and Turkish" (unpublished paper, M.I.T., 1971).

B. A TRANSFORMATIONAL RULE IN RUSSIAN PHONOLOGY

Modern Russian exhibits an alternation of phonetic [ov] with [u] in the present tense of some first conjugation a-stem verbs:

(1) klevat,   'to peck':   kljuju (1 sg.),   kljuet   (3 sg.),   kljujut   (3 pl.)

     torgovat, 'to trade': torguju (1 sg.),   torguet (3 sg.),   torgujut (3 pl.)

     celovat,   'to kiss':   celuju (1 sg.),   celuet   (3 sg.),   celujut   (3 pl.)

I know of two attempts to account for this alternation within the framework of generative phonology. Lightner[1] suggests that both alternants are derived from the underlying diphthongs /ŏŭ/ and /ĕŭ/, where /ŭ/ is to be identified with the so-called back yer. For example, ignoring irrelevant details, the phonological representation for celovat, is, under this analysis, /cel+ŏŭ+ā+t,/. There is a rule which converts /ŭ/ into /w/ when followed by a vowel, and a later rule which converts /w/ into /v/, giving us the correct form. In the present tense, we find such phonological representations as

/cel+ŏŭ+ā+ĕ+t/ for the third person singular, where lax /ĕ/ is the theme vowel, and /t/ the marker for the third person. The first rule of interest to apply to this form converts a tense vowel into /j/ when followed by a lax vowel. (Lightner labels this rule V̄:j.) Application of this rule gives us the representation /cel+ŏŭ+j+ĕ+t/. Notice that the ŭ → w rule cannot apply at this stage. There is a further rule that converts dipthongs into monophthongs, by deleting the first member and tensing the second. Thus, in this particular case, we have /ŏŭ/ going to tense /ū/ and we derive /cel+ū+j+ĕ+t/ as desired.

It is not feasible in this report to give a thorough, critical evaluation of Lightner's analysis, but my own study[2] suggests that his proposals depend upon a rather dubious syntactic analysis of the Russian verb, and that the rules involved in the alternation do not have the independent motivation which Lightner alleges.

An extremely interesting suggestion was made recently by Morris Halle[3] as an alternative to Lightner's proposed solution of the problem. Halle proposes to account for the alternation partly through an extension of the well-known rule which tenses yers before /j/ followed by a morpheme beginning with a consonant. (As an alternative, Lightner[1] proposed a laxing rule (ū:ŭ) which operates in the environment _____ j + V.) Take, for example, verbs like kryt, 'to cover', pit, 'to drink', and šit, 'to sew'. The present tense forms (e.g., 1 sg. kroju, p'ju, š'ju) indicate that the proper underlying representations for the stems of these verbs are /krŭj-/, /pĭj-/, and /šĭj-/, respectively. When these stems are followed by a consonant, as in the infinitive, the stem vowels are tensed. Halle sets up /ŭj/ and /ĭj/ as the diphthongs underlying the ov~u alternation, deriving /w/ from /j/ by an interesting rule that is discussed by Flier.[4]

Consider the form torguet from underlying /tŏrg+ŭj+ā+ĕ+t/ according to Halle's analysis. Lightner's rule (V̄:j) gives /tŏrg+ŭj+j+ĕ+t/. Now, the question arises, How does tensing apply to this form? Observing that /ŭ/ is tensed to unrounded /ȳ/ when /j/ is followed by a [+consonantal] segment and that /j/ is [−consonantal], Halle formulates the following tensing rule:

$$(2) \quad V \rightarrow \begin{bmatrix} +\text{tense} \\ \alpha\text{round} \end{bmatrix} \Big/ \ \#\# \ X \ \underline{\quad} \ j + \begin{bmatrix} -\text{syll} \\ -\alpha\text{cons} \end{bmatrix} \ Y\#\#$$

By this rule, we derive /tŏrg+ūj+j+ĕ+t/, as required. For those cases when the input to rule (2) is the front yer /ĭ/ (e.g., klevat,/kljuet), we need an additional rule to apply after rule (2):

$$(3) \quad \begin{bmatrix} +\text{syll} \\ +\text{round} \end{bmatrix} \rightarrow [+\text{back}]$$

We illustrate the use of rule (3) in the following derivation.

(4) /klĭj+ā+ĕ+t/   underlying form of kljuet

    klĭj+j+ĕ+t   V̄:j

    kl,ĭj+j+ĕ+t   palatalization before front Vs and /j/

    kl,ūj+j+ĕ+t   rule (2) (tensing)

    kl,ūj+j+ĕ+t   rule (3)

    [kl,ujɔt]   other rules

In the infinitive forms, the yers are subject to a lowering rule and /j/ becomes /w/ by Flier's glide-conversion rule.

(5) /tŏrg+ŭj+ā+t,/   /klĭj+ā+t,/

    tŏrg+ŏj+ā+t,   klĕj+ā+t,   yer lowering

    tŏrg+ŏw+ā+t,   klĕw+ā+t,   j → w

Other rules (e.g., palatalization and w → v) give the correct phonetic representations.

    Unfortunately, this highly interesting proposal will not work because of aspectual pairs such as klevat, /kljunut, and plevat, /pljunut, 'to spit'. For the perfective forms, rule (2) gives incorrect results, predicting */klīj+nu+t,/ and */plīj+nu+t,/ from underlying /klĭj+nu+t,/ and /plĭj+nu+t,/, since /n/, of course, is [+consonantal]. I shall not discuss ad hoc measures to patch up rule (2) but will outline an alternative in the spirit of Halle's solution. It seems to me that what is most attractive about his proposal is the idea that the ov~u alternation is part of the phenomenon of yer-tensing. I suggest that underlying the alternation are the diphthongs /ŭw/ and /ĭw/. Furthermore, I propose that rule (2) be replaced by the following transformational rule:

(6)
$$
\begin{bmatrix} +\text{syll} \\ -\text{cons} \\ +\text{high} \\ -\text{tense} \end{bmatrix}
\begin{bmatrix} -\text{syll} \\ -\text{cons} \\ +\text{high} \\ \alpha\text{round} \\ \beta\text{back} \end{bmatrix}
\Longrightarrow
\begin{bmatrix} 1 \\ +\text{tense} \\ \alpha\text{round} \\ \beta\text{back} \end{bmatrix}
\ / \ \underline{\quad} \ [-\text{syll}]
$$
      1   2

Essentially, what rule (6) says is that before a nonsyllabic segment a yer plus glide cluster becomes a tense monophthong whose specifications for the features [back] and [round] depend upon those of the underlying glide. Thus, /ŭw/ and /ĭw/ go to /ū/, and /ŭj/ and /ĭj/ go to /ī/. To derive the correct phonetic forms, we require that rule (6) apply after palatalization. We also require the application of a familiar rule which changes /ī/ to /ȳ/ following a hard consonant, as in the following derivations.

(7) /krŭj+t,/ /pĭj+t,/ /klĭw+nu+t,/ /tŏrg+ŭw+ā+ĕ+t/

tŏrg+ŭw+j+ĕ+t V̄:j

p,ĭj+t, kl,ĭw+nu+t, palatalization

krī+t, p,ī+t, kl,ū+nu+t, tŏrg+ū+j+ĕ+t rule (6)

krȳ+t, i → y

All attempts to handle the ov~u alternation have been plagued by the problem of deriving the deverbal noun torgovlja 'trading'.[1,2] If the ov suffix in this noun is the same as that of the verb, then we should expect rule (6) to apply, giving *torguja from the natural underlying representation /tŏrg+ŭw+j+ā/. There are at least two possible solutions: We can bracket the underlying representation of torgovlja as ((tŏrg+ŭw)+j+ā), making yer lowering a cyclic rule, so that on the second cycle we get (tŏrg+ŏw+j+ā), to which rule (6) cannot apply. Alternatively, we may claim that the suffix in the deverbal noun is not the same as that of the verb, but rather a suffix with the same phonetic shape but a less abstract underlying form /+ŏw+/ which is found in many adjectives (e.g., torgovyj, stolovaja, metrovyj, tigrovyj, etc.) and nouns (e.g., torgovka, oblicovka, metrovka, traktovka, etc.).

The second alternative seems to be much more reasonable. In the first place there is no independent motivation for the proposed bracketing of torgovlja. Second, with one exception, we never find traces of the ov~u alternation outside the verb paradigms. There is one noun form (and, to my knowledge, only one) for which we seem to have reason to posit the /+ŭw+/ suffix. This is poceluj 'kiss'. We give this word the underlying representation /pŏ=cel+ŭw+j+ŭ/, with /+j+/ as the same noun-forming suffix of other masculine nouns (e.g., rubl, from /rub+j+ŭ/, and vozd, from /vŏd+j+ŭ/), and /+ŭ/ as the marker for the nominative masculine singular. Rule (6) applies in the expected fashion. Thus, aside from this one noun, we conclude that instances of the suffix ov outside the verb paradigms are derived from underlying /+ŏw+/ rather than /+ŭw+/.

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References

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C. LEXICAL AND INFERRED MEANINGS FOR SOME
TIME ADVERBS

One major result of recent semantic investigations is that the interpretation of a sentence cannot be completely specified in either deep or surface structure simply by combining the lexical readings of its constituents. The combinatorial reading for a sentence is often subject to processes, some formal and some dependent on knowledge of the world, which extend, restrict, or totally change the meaning. In this report we shall attempt to specify some of these processes as they apply to sentences containing certain time adverbials, such as until, before, during and throughout.

Under most circumstances the sentences (1a) and (2a) are interpreted as synonymous, but the differential acceptability of (1b) and (2b) shows that the basic meanings of the (a) sentences cannot be identical.

(1) a. Before the arrival of the rebel army, the government forces controlled the town.

    b. During one period before the arrival of the rebel army, the government forces controlled the town.

(2) a. Until the arrival of the rebel army, the government forces controlled the town.

    b. *During one period until the arrival of the rebel army the government forces controlled the town.[1]

The contrast between (1b) and (2b) suggests that until has the lexical reading (3), while before has the lexical reading (4), and sentence (2b) is ungrammatical because the meaning of until contradicts the meaning of during one period.

(3) until = at all times prior to NP

(4) before = at some time(s) prior to NP
    (where NP is the object of the adverb phrase).

If these readings are roughly correct, then we have a simple explanation for the fact that until is only grammatical in sentences with non point-action interpretations. Sentence (5a) would be unacceptable because the meaning of until contradicts the meaning of die, a point-action verb which in this context cannot be interpreted as repetitive. This contradiction stands out if we construct the reading for the sentence, as in (5b).

(5) a. *John died until dawn.

    b. John died at all times prior to dawn.

As (6b) shows, the corresponding sentence with before contains no contradiction in the reading. This explains why before is not restricted to non point-action environments.

(6) a. John died before dawn.

    b. John died at some time prior to dawn.

We have shown that <u>before</u> and <u>until</u> must be given distinct lexical readings, but the problem of explaining the apparent synonymy of (1a) and (2a) remains. Both sentences appear to mean that the government forces controlled the town right up to the arrival of the rebel army, but only the sentence with <u>until</u> has this interpretation by virtue of the lexical readings of its parts. The <u>before</u> sentence is interpreted as synonymous with the <u>until</u> sentence by virtue of an inference or implicature. The way in which such an inference can be distinguished from the basic meaning of a sentence is that it can be canceled in the appropriate context. Thus (7) is anomalous because the second sentence contradicts the lexical reading of the first; but (8) is acceptable because here the second sentence merely cancels an inference normally made from the first.

(7) *Until he died John was sick with pneumonia, but he was cured of it, and died of something else.

(8) Before he died, John was sick with pneumonia, but he was cured of it, and died of something else.

The rule of implicature which accounts for the apparent synonymy of some <u>before</u> and <u>until</u> sentences might be stated as follows:

(9) If a sentence containing an adverb with an existential quantifier in its lexical representation asserts that a durative action or state occurs in a specific time period, then the action or state is presumed to have occurred throughout the period, context permitting. In other words, context permitting, existential quantifiers in time adverbs are reinterpreted as universal quantifiers.[2]

In addition to <u>before</u>, rule (9) applies to the adverb <u>during</u>. This accounts for the synonymy of sentences like (10) and (11).

(10) The government forces occupied the town during the battle.

(11) The government forces occupied the town throughout the battle.

The differential acceptability of (12) and (13) demonstrates that <u>throughout</u>, like <u>until</u>, contains a universal quantifier in its lexical representation while <u>during</u>, like <u>before</u>, contains an existential quantifier.

(12) *John died throughout the night.

(13) John died during the night.

There is another rule of inference, similar to (9), which operates on sentences with <u>before</u> (and <u>during</u>), but this inference also operates on <u>until</u> (and <u>throughout</u>). Sentences (1a) and (2a), for example, seem to mean not only that the government forces controlled the town right up to the arrival of the rebel army, but also (14).

(14) When the rebel army arrived, the government forces lost control of the town.

In both (1a) and (2a), however, this meaning is not basic but only implicated. The implicature of (14) can be explicitly canceled, as in (15).

(15) $\left\{\begin{array}{c}\text{Before}\\\text{Until}\end{array}\right\}$ the arrival of the rebel army, the government forces controlled the town. Then when they arrived the rebels decided not to attack so the government was able to hold on.

Similarly, (10) and (11) suggest (16) but that suggestion can be canceled, as in (17):

(16) The government forces stopped occupying the town at the end of the battle.

(17) The government forces occupied the town $\left\{\begin{array}{c}\text{during}\\\text{throughout}\end{array}\right\}$ the battle and kept on occupying it for two weeks afterward.

The rule of implicature which gives (14) and (16) might be stated as (18):

(18) If a durative action or state occurs in a specified time period, then, context permitting, the action or state is presumed to end at the end of the period.

One immediate result of Principle (18) is that it allows us to explain the semantic interpretation of sentences like (19) which contain the <u>not</u> <u>until</u> construction.

(19) Not until noon did John wake up.

Sentence (19) appears on first reading to be synonymous with (20), but the differential acceptability of (21) and (22) shows that although (19) suggests (20) it does not entail (20) and so cannot be synonymous with it.

(20) John woke up at noon.

(21) *John woke up at noon. In fact, he only woke up at 3 P.M.

(22) Not until noon did John wake up. In fact he only woke up at 3 P.M.

What (19) does entail (and perhaps presupposes) is (23), a fact shown by the self-contradictoriness and consequent unacceptability of (24).

(23) John woke up.

(24) *Not until noon did John wake up. In fact, he didn't wake up at all.

In addition to what it implicates and entails, (19), of course, asserts (25).

(25) John didn't wake up at any time before noon.

In fact, except for the entailment of (23), (19) is synonymous with (26). Sentence (27) shows that (26) does not entail (23), since that entailment would make (27) self-contradictory, which it is not.

(26) Until noon John didn't wake up.

(27)   Until noon John didn't wake up. In fact, he didn't wake up at all.[3]

Principle (18) gives a direct explanation for why both (19) and (26) seem to mean (20). According to (18), the state of John's not waking up is presumed to end at noon, as in (20). The presumption seems somewhat stronger in (19) than in (26), but this is so because part of the presumption given by (18) is already an entailment of (19) (namely, that John did wake up) so that the speaker of (19) is committed by logic to a stronger statement than is the speaker of (26).

One question which is immediately raised by the postulation of principles like (9) and (18) is their status in the theory of grammar. At this point there seem to be two ways of treating the rules, either as instances of the operation of Grice's conversational maxims[4] or as independent semantic principles that cannot be derived simply from the assumption that the speaker of a sentence is trying to communicate efficiently.

In Grice's view, the participants in a conversation ordinarily assume that they are engaged in a cooperative enterprise with an accepted purpose and direction. Therefore they behave and expect their partner(s) to behave according to the following cooperative principle:

(28)   Make your contribution to the conversation such as to advance its accepted purpose or direction.

From this principle Grice derives four categories of conversational maxims, those of quantity, quality, relation and manner. The maxims can be summarized as follows:

(29)   Quantity

    a. Don't give too little information.

    b. Don't give too much information.

(30)   Quality-Try to speak the truth.

    a. Don't lie.

    b. Don't make statements for which you have insufficient evidence.

(31)   Relation-Be relevant.

(32)   Manner-Be easy to understand.

    a. Avoid obscurity and ambiguity.

    b. Be brief and orderly.

It would be a simple matter to make principle (18) follow from maxim (29a). Sentences like (1a), (2a), (10), and (11) say that an action occurred in the period covered by the time adverbial but not what happened otherwise. Under the assumptions that the speaker ordinarily will know if and when the action stopped and also that this information will

usually be relevant to the conversation, it follows that the sentences violate (29a). If we interpret the sentences according to (18), the violation is eliminated. A consequence of the use of the maxims, however, is that they require that interpretations according to (18) not exist in certain contexts. If a speaker uses sentences like (1a), (2a), (10), and (11) when he does not know when the action ended but only that it overlapped the period specified in the adverb phrases, then the addition of an interpretation according to (18) violates (30b) by committing the speaker to saying more than he has evidence for.

It follows that sentences with time adverb phrases ought to be interpreted according to (18) if the speaker can be presumed to know the temporal bounds of the action he is describing but not in the absence of such a presumption. Thus, the sentences of (33) all suggest that the action was coterminous with the time period marked by the adverb phrase.

(33) a. John slept $\left\{ \begin{array}{l} \text{during} \\ \text{throughout} \end{array} \right\}$ the movie.

     b. The baby cried while the record player was on.

     c. Tom was a rebel from the time he was thirteen.

     d. John sang well $\left\{ \begin{array}{l} \text{before} \\ \text{until} \end{array} \right\}$ his recent illness.

The sentences of (34), on the other hand, should not carry interpretations according to (18) because the contents of these sentences suggest that the speaker has no knowledge of the limits of the action or state described.

(34) a. $\left\{ \begin{array}{l} \text{Throughout} \\ \text{During} \end{array} \right\}$ the time I was watching the game, John played well.

     b. The child cried constantly while I was observing it.

     c. John was a good musician from the time I started listening to him.

     d. John played quietly $\left\{ \begin{array}{l} \text{before} \\ \text{until} \end{array} \right\}$ I left the house.

As Grice's maxims would predict, sentences (34a) and (34b) do not carry the suggestion that the action in the sentences ended at the end of the time period given by the adverb phrases. With sentences (34c) and (34d), however, the case is different. These sentences, contrary to what would follow from Grice's maxims, do suggest that the action is coterminous with the end of the time period marked by the adverb phrase. This behavior of (34c) and (34d) is evidence that a rule which is more than an instance of Griceian conversational implicature is needed to account for inferences associated with at least some time adverbs. In its application to adverbs like before, until, and from, (18) seems to be independent of the conversational context and to be a substantive

semantic process in its own right. A first approximation to accounting for the differences among the sentences of (34) would be to say that the postulation of rule (18) as an independent semantic process is necessary for time adverbs with the following semantic feature in common: Their object noun phrases constitute a boundary point of the time period that they describe. For time adverbs whose objects are time periods as wholes rather than boundary points, a Griceian treatment seems adequate. Unfortunately, the underlying reason for this difference remains obscure.

If the use of Grice's maxims to account for (18) is problematic, using them to account for (9) is more so. As Grice points out, expressions with the same basic meaning must have the same conversational implicatures, since the conversational maxims refer to general properties of communication and not to peculiarities of particular words or expressions. In this instance all time expressions containing the existential quantifier should be subject to (9). As the sentences of (35) show, however, time expressions with the explicit existential quantifier some are not normally interpreted with some read as all.

(35)   a.   The government forces occupied the town during some of the battle.

      b.   At some times before the arrival of the rebel army, the government forces controlled the town.

If (9) were an instance of conversational implicature, then the sentences with explicit existential quantifiers would be subject to it just as are sentences with the existential quantifiers hidden in the time adverbs. The obvious inapplicability of (9) to (35a) and (35b) demonstrates, therefore, that (9) is not attributable to conversational implicature.

In addition to these objections to using the notion of conversational implicature to account for the specific principles (9) and (18), there is a more general argument against the possibility of using that notion to explain any similar semantic process. The argument is that Grice's maxims are so general and vague that inferences that are not actually made in speech can be derived from sentences by conversational implicature just as readily as inferences that are made. This being the case, Grice's maxims have no explanatory force, whatever their heuristic value. One clear example of such false conversational implicature goes as follows.

A sentence like "John ate the apple" is taken to mean "John ate at least some of the apple," by conversational implicature. If the speaker had meant that the whole apple was eaten, then he would have said, "John ate all of the apple" in order not to violate the maxim of Quantity (29a) by giving too little information. Since he left out the word "all", he must have been obeying the maxim of Quality (30b) and avoided saying more than he knew. Therefore, all that the speaker was saying is that at least part of the apple was eaten.

Of course, the inference normally made from "John ate the apple," is in actual fact the one ruled out above, namely that John ate the whole apple; and this inference can also be derived from the maxims. The reasoning starts by saying that the speaker would have said "John ate at least some of the apple" if that were all he knew (by 30b). Since he left out the qualifying phrase, he must have meant to convey that the whole apple was eaten. Otherwise he would have been giving too little information. Obviously, a theory that accounts for what exists and for what does not exist with equal ease can provide no explanations.[5]

Perhaps a more promising way of integrating Principles (9) and (18) into semantic theory is Geis and Zwicky's notion of "invited inference."[6] They point out that if-then sentences like (36a) tend to be interpreted as if they were biconditionals like (36b).

(36) a. If John comes, I will cheer.

b. If John comes, I will cheer and if John doesn't come, I won't cheer.

In other words, ordinary language conditionals invite the inference of their converses. Principle (18) can be seen as a special case of this sort of invited inference. Sentences containing time adverbs can be stated as conditionals and forming the converses of these conditionals gives the same result as applying (18). Thus the converse of (37a) is (38a) and the result of applying (18) to (37b) is (38b). Clearly, the sum of (37a) + (38a) is synonymous with (37b) + (38b).

(37) a. If t was before noon, then John was asleep at t.
b. John slept until noon.

(38) a. If t wasn't before noon, then John wasn't asleep at t.

b. John stopped sleeping at noon.

Geis and Zwicky believe that there are other principles of invited inference besides "conditionals become biconditionals," two of which they mention in their paper. The fact that (18) is a special case of one principle of invited inference suggests that the principle (9) should also be seen as a principle of invited inference. We look for still more such principles.

<div align="right">A. S. Kroch</div>

Footnotes and References

1. This sentence would be grammatical with commas around the until phrase, but then the sentence would have a different structure. The until phrase would be an appositive phrase and not part of the object of during. With this structure the sentence is no longer unacceptable because it is no longer self-contradictory.

2. This principle applies at least to the following time adverbs: before, during, between, while and after. The semantics of time adverbials is dealt with from an entirely different point of view by M. Geis in "Time Prepositions as Underlying Verbs," Papers of the Chicago Linguistics Society, Vol. 6, pp. 235-249. His treatment, however, does not deal with any of the issues we are concerned with here.

3. Sentence (27) may sound somewhat strained because principle (18) applies very strongly to sentences with <u>until</u>. That (18) is only an implicature and not an entailment, however, is shown by the perfect acceptability of sentence (ii) below:

(i) Until now John hasn't agreed. I am glad that he changed his mind.

(ii) Until now John hasn't agreed. I don't think he will ever change his mind.

4. H. P. Grice, "Logic and Conversation," William James Lectures, Harvard University (unpublished).

5. In their Squib "On Invited Inferences," Geis and Zwicky[6] say that Grice's maxim of relevance[3] cannot generate explanations of their inferences. However, the maxims of Quantity and Quality account for the inferences without difficulty. It is hard to imagine what plausible inference could not be justified by these maxims. See also L. Karttunen, "Counterfactual Conditionals," Ling. Inquiry, Vol. II, No. 4, pp. 566-569, Fall 1971.

6. M. Geis and A. Zwicky, "On Invited Inferences," Ling. Inquiry, Vol. II, No. 4, pp. 561-566, Fall 1971.