ISTVÁN FODOR

The Rate of Linguistic Change

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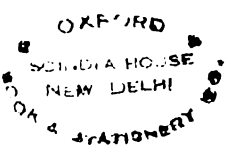
THE RATE OF LINGUISTIC CHANGE



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THE RATE OF LINGUISTIC CHANGE

LIMITS OF THE APPLICATION OF MATHEMATICAL METHODS IN LINGUISTICS

by

ISTVÁN FODOR

BUDAPEST

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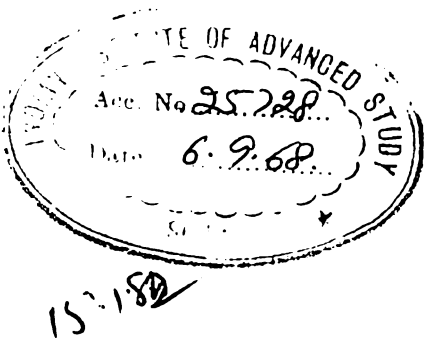

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PREFACE

The decade between 1950-1960 was a period of acute crisis in the development of linguistics. The results of the structuralist schools of thought and those of mathematical linguistics going hand in hand, though not always agreeing with each other, seemed to be in opposition to the results which linguistics has achieved by the traditional methods since the early years of the 19th century. The partisans of the two opposing trends further increased this schism by failing to elucidate the controversial issues and to eliminate these oppositions by viewing them from a wider perspective; instead they proclaimed their own results as the only right ones ignoring or underestimating the works of others. The very inappropriate attitude of the traditionalists can be characterized by the fact that in Hungary (and in some other countries) they tried to stigmatize the new trends as the manifestations of false epistemological schools without being acquainted with these trends. The prejudice of several adherents of the new methods is well summed up in their frequently used epithet "prescientific" applied to the entire heritage of linguistic science.

From the sixties onwards, the efforts to reconcile the two schools have become ever stronger. The fact has become obvious that the new schools furnish many standpoints useful to our discipline, and they yield many results that could not have been achieved by the traditional means and attitudes. The traditional school, on the other hand, is not a dead weight, but a firm basis for further progress. Several adherents of the old and new methods (among the latter also mathematicians and logicians) begin to insist on this newer standpoint. I myself, being a linguist, investigate in the present work the very important and debated question of the rate of lin-

guistic change from the linguistic point of view. Though I sometimes use stronger expressions, they are not directed against the new ideas as a whole, but against their exaggerations.

My present paper is a revised and enlarged version of my article first published in Hungarian in *Nyelvtudományi Közlemények*, 65 (1963), pp. 297-339. The main body of the manuscript has been completed in 1962.

As a linguist, I was obliged to call in the aid of the mathematician-cybernetician, Mr. Ferenc Sándor, for the formulation of the mathematical model. I wish to take this opportunity to express my thanks to him. I express here my acknowledgements to Mr. György Bánkövi, a mathematician, for his valuable suggestions.

October, 1963 ISTVÁN FODOR

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1

THE FACTORS AFFECTING THE CHANGES OF LANGUAGES AND THEIR RATES

In the past decade, mostly American linguists have attempted to invent a procedure for the historical chronology of languages measured by exact means of glottochronology or lexicostatistics. The new procedure – as proved by myself (Fodor, 196l*b*), Bergsland and Vogt (1962) and others – has entirely failed. The main error lies in the fact that the basic word-stock and, in general, all levels of languages do not change at an equal rate over neither a long, nor a short period, but, on the contrary, the rate of change is very unequal, and it varies according to the different languages, too. Therefore, the disproportionate evolution of languages may be postulated.[1] The other essential fallacy of glottochronology is the principle of the identifiability of the word material to be compared.[2]

In the course of checking the glottochronological method, I myself applied the mathematical model set up by Swadesh and Lees, and, in absence of qualification, I did not challenge its validity. Chrétien (1962) acted inversely; he disproved the correctness of the mathematical method without disputing the correctness of the very basic principle, and so he came, though on an other road, to the same conclusion as I did: *all results of glottochronology till now are illusory*. Hence the circle is closed: it is proved that *the method of glottochronology is useless.*

Now the question arises, whether we must definitively give up the

[1] This lawfulness is cognate with the law of the disproportionate evolution of capitalistic society which is linked with the name of Lenin, and which obviously does not concern only the capitalistic, but the human society as a general rule.

[2] In my quoted paper I made a suggestion to the modification of this principle. The adherents of glottochronology too try to make proposals and modifications for the sake of removing the difficulties of the identification. Cf. Guţu-Romalo (1959) and Hattori (1961).

possibility of measuring the historical processes, more closely the changes of languages by quantitative means. A negative answer can rightly awake regret among linguists, as it frustrates our hopes to establish a more exact chronology in the prehistory of the peoples. I have heard many times from researchers who eagerly accepted the new, exact methods of linguistics that the theory of lexicostatistics even in its fallacy is of more service to the entirety of science than the excessively severe criticism, because it seemed to offer a method at least to measure the processes of the linguistic changes more exactly, while the followers of the traditional methods have not ventured even to attempt it. Some opinions have also been advanced, according to which, the starting point may be wrong, the mathematical model may be wrong too, but, sooner or later, more perfect principles and mathematical models will be elaborated; after all, science will find the way out of stagnation through the errors of glottochronology. According to several members of the newest generation of linguists we cannot give a negative answer to the question raised above, it is only a matter of time when we find the best solution. In the discussion in *Current Anthropology* (1962, 2) similar views have been expounded e.g. by Alvar Ellegård, Wilhelm Milke, N. D. Andreyev and Antonio Tovar in contradiction to my negative standpoint and those of many others.

The problem has also philosophical aspects. According to Claus (1961, pp. 209-214) the applicability of the mathematical method cannot be contested on the grounds that it is not suited for measuring qualitative relations and phenomena. As Claus argues the mathematical method cannot be applied if the problems set by the specialized branches of science are not posed clearly, or when the specialist who is not a mathematician does not himself know exactly what he wants to measure,[3] or if the great quantity of the elements and the dense network of their interrelations in the given problem go beyond the possibility of mathematical formulation. Claus considers this latter case an objective difficulty that can be eliminated to some extent in the course of the evolution of (mathematical)

[3] See a similar view of Ashby (1958, pp. 112-113).

science. The author alludes to the precedent of the computers, i.e. many complicated scientific problems involving a multitude of factors that could not be tackled till now are settled by their aid.

I shall examine in the following the thoughts of Claus, of other experts of cybernetics and of the adherents of the mathematical methods in order to find out whether it is possible to measure the rate of linguistic change at all.

Since the linguistic changes do not proceed at an equal rate, I deal above all with the factors which can exert any influence on the rate of the changes, and I shall check whether their effect can be exposed by quantitative, numerical data. After that I shall investigate the different levels of language system in order to decide whether their changes that occured in time can be measured by quantitative means. From the point of view of cybernetics the changes are *transformations*. The factors that give rise to linguistic changes are *operators*, the state of the language system before the changes is the *operand*, and the result of the changes the *transform*. Some factors that cause the changes often modify the role of the other factors, and they have a reaction together with them on the course of the changes altering by this means the whole process of change. According to the interpretation of cybernetics, in the above described interrelation and interdependence of the linguistic changes and factors a case of *feed-back* is present.

So far I have spoken about "factors" and "effects," avoiding the use of the terms "cause" and "purpose". I wish to motivate my procedure by a digression.

Linguistic science, as other disciplines in general, has taken a stand on the causality since the 19th century. Phonemics and the rise of structuralism have involved a new intuition, and the Prague linguistic school entered upon a conscious campaign for the finality principle in its new interpretation. The emergence of cybernetics has given the application of the finality principle in linguistics a push, and it raises the relation of cause and purpose in a new manner in a philosophic respect too. Claus (1961, pp. 290-324) as an adherent of dialectical materialism embraces these views, and says that the relation of cause and purpose is to be interpreted in a new

way. A novel finality principle elucidated by cybernetics comes into prominence instead of the mechanical explanation of the earlier causality. Accordingly, *causality is only a special case (linear causality) of finality*. In a network of relations, in *a system where an effect produced by a cause reacts upon the cause itself*, thus it is a case of *feed-back*, there we face *finality*. Most of the very complicated social phenomena are just of this character.

We cannot enter into the discussion of the philosophical aspect of this question within the narrow scope of this paper, as the goal of my investigation is only the consideration of the factors that are effective in the changes of languages and the sketching of their interrelations in a slightly clearer way as compared with our knowledge till now. As will be seen later, in the domain of the linguistic changes, the case of linear causality is really scarce, on the contrary, that of the feed-back is a more usual phenomenon. Furthermore, I shall speak about "factors", "effects" rather than about "causes", which term will be used at most as a synonym for the notion.

In general, there are two kinds of factors that are operative on the elements of language: the *external* and the *internal factors*. Among the external factors I am listing here those that are denoted by the theoreticians of linguistics as the causes of the linguistic changes (chiefly sound changes). In the enumeration I disregard both historical and logical order:

1. least effort and ease (Curtius, Whitney, Zipf);
2. economy and expression (Martinet);
3. retention of structure and symmetry (Trubetzkoy and the Prague school);
4. aesthetics (Croce, Vossler);
5. geographical circumstances (Osthoff, Neolinguistics);
6. culture (Wundt);
7. popular character, race, world-view (Grimm, Humboldt, Whorf);
8. differences in the speech of the generations succeeding each other (Paul);
9. historical events (Jespersen);

10. substratum (Schuchardt, Ascoli);
11. social changes (Meillet, Marr).

This enumeration is not complete at all, only the most important theories are indicated. I cannot dwell here on these hypotheses, but undoubtedly, each contains a kernel of truth (the aesthetic theory may be said the least reliable of all), at the same time, the changes of languages can be explained by none of them alone. These hypotheses could be proved only if it could be deduced from any of them for what reason a linguistic change came into being, and why a given language form is established, furthermore, what kind of concrete changes are to be expected in the future in a given language, thus, which linguistic form will change into which other form in what time. Such requirements cannot be raised, of course, in connection with the above theories. Martinet (1955) illustrates the sketches of some phonemic changes on the basis of his principle of economy, but even if the new linguistic state is more "economical" than the old one, still many kinds of new and likewise economical linguistic states could result. The cluster *-kt-*, for instance, underwent a change in several Indo-European languages perhaps with a view to a more economical energy utilization in the articulation. The theory does not explain in itself, however, why this cluster – though being an element of the given cluster system – became a geminate phoneme in some languages (e.g. Italian *otto*), why *k* is lost in another (French *huit*), why *k* became a fricative phoneme in a third one (German *acht*), why the two sounds developed into an affricate in a fourth one (Spanish *ocho*), why the "uneconomical" cluster *-kt-* remained in the fifth language (Greek ὀκτώ), and, finally, why it turned into an occlusive cluster of another type in the sixth language (Roumanian *opt*).[4] And why did the final voiced consonants become voiceless after the loss of the reduced vowels in the majority of the Slavic languages while remaining voiced only in Serbo-Croate and in Ukrainian which could not influence each other for lack of closer contacts? Still more uncertain is the possibility of the pre-

[4] Martinet (1955, pp. 138-144) himself deals with this question.

diction of the linguistic changes compared to the explanation of the accomplished processes.[5] If a process of change has already started, one may undertake – mainly by the aid of statistical methods – a more circumspect prediction, but even then it is uncertain whether the process does not stop or does not take another direction. The Hungarian suffix morpheme *-ban/ -ben* 'in' is pronounced nearly always without *-n* in the colloquial language. This process may completely end in the future, so may the suffix *-ba/ -be* 'into' fully merge with *-ban/ -ben*, and the Hungarian orthography may sanction the pronunciation, but this change cannot be predicted with any certainty, for the form without *-n* did not originate in our days, it has been in existence for several centuries, and has not been advancing since those times.[6]

Let us disregard now the examination to what extent the mentioned hypotheses are suitable for the explication of the linguistic changes, but let us choose those of them that can produce a certain effect on the rate of the changes. We find very little among the previous linguistic theories in this connexion: the pioneers of the hypotheses dealt with the changes themselves, the problem of the rate was only just touched upon. The remarks of Vendryes (1950, pp. 402-420) are to be emphasized among the works in this regard before glottochronology.

To be sure, there is no cause which would not exert an influence on the development of the language while controlling the rate of change; nevertheless, not every cause that influences the quality of the linguistic change plays a major part in the rate of the changes. It is difficult to imagine that the factor of the tendency towards economy or the tendency towards ease – supposing it causes linguistic transformation of some kind at all – would determine its rate too. Whereas the following *external factors* appear to have a great deal to do with the rate of change:

[5] Cf. the more optimistic comments of Toporov (1959) and some general arguments in *Psycholinguistics* (1954, pp. 150-158).

[6] Lehmann (1962, p. 163) also draws a careful conclusion concerning the future evolution of the English phoneme *k*.

1. the historical effect;
2. the cultural effect;
3. the social effect;
4. the geographical effect;
5. the effect of the neighbouring and foreign peoples;
6. the national character.

In the next sections I shall deal with the nature of the external factors in detail.

As to the role and nature of the *internal factors*, we grope in the dark, though it is evident that these determine the special character of a language, and they form the most important rules which appear in the shape of the phonetic laws, paradigmatic, syntactic and other rules, viz. of their diachronical changes. Now we have reached the so called *inherent laws* of language. This important phenomenon was the subject of thorough studies and sharp debates in the Soviet Union (cf. Zvegintsev, 1952*a*) and in other countries, so in Hungary (cf. Deme, 1957) in the course of the discussion on Marrism in the past decade, no progress has been made, the nature of the inherent laws has remained unelucidated. Nevertheless, it may be assumed that the inherent laws of language, beside the quality of the changes, also contribute to the formation, regulation of the rate of change. After all, it depends on the inherent laws that a given language is more or less conservative than some other.

Before coming to the analysis of the factors of the rate of change, we must examine briefly whether these factors influence which levels of the language, i.e. which levels are to be measured – if possible – by quantitative means. We shall not dwell long on this topic, since it is a truism that each part, element of the language is permanently changing. I shall give prominence to the phonemic, morphemic, syntactic and lexical structure, as it is to be expected; as can be seen later, the greater units may be divided into further groups down to the basic elements of the languages (phonemes, morphemes), but in the case of the dissection of the linguistic levels into these nearly innumerable units our effort would fail from the very first.

It is very important to set apart the *linguistic levels*, because they

do not change at an equal rate in proportion to each other, sometimes the phonemic system changes more rapidly, sometimes the syntax, sometimes the morphological structure. Unquestionably, among the linguistic levels it is the *word-stock* that *reacts the most sensitively to all external effects*, this is the most rapidly changing level of the language as compared to the others. The word-stock differs from the phonemic and grammatical structure in the fact that the quality of the external effects is to be demonstrated here the most freely, and that the inherent laws of language are the less effective here. This is why a language can transform its lexical stock to such a great extent (chiefly under foreign influence) contrasted with its phonetic stock and grammatical structure. One distinguishes usually the *basic vocabulary* from the *entire word-stock*. Though it would be fruitless to enumerate the single words in the basic word-stock or to point out that they do not belong there, still the discrimination of these two layers of the vocabulary is no empty abstraction. It is a fact that *the basic vocabulary is the most constant layer of a language* and is least exposed to changes as compared to the entirety of the word-stock. In this connexion the theoreticians of lexicostatistics are right, but Swadesh (1952) is wrong in assuming that the slow change of the basic word-stock has an equal rate.

The different behaviour of the linguistic levels is due evidently to their substance. Sound system, morphology, syntax, vocabulary each form a particular structure, and the character of their components determines the stability and the transformations of the system. From the point of view of stability, it is very important to ask how many numbers of elements the system consists of. The size of the sound system varies according to the different languages, usually it is composed, however, of a few dozen phonemes, their number nowhere going beyond a hundred. The morphemic system is based on the relation of far more elements. In the languages which have a more scanty formal system, the number of the inflexional morphemes is fewer, in the synthetic languages, their number is more, they range ordinarily from several hundreds to several thousands. The components of syntactic system consist partly of markers (e.g. conjunctions), partly of sign-like connexions, interrelations (e.g. or-

der). The number of these constituents and of their connections and rules of syntax amounts – to several thousands or even several tens of thousands. The elements of vocabulary are many millions. The number of words itself may be estimated about hundred thousands or millions.[7] But the idioms, locutions, proverbs, etc. which also appear as elements of the language system, are not included in these figures. Besides, we have still to consider the infinite number of the unmarked relations (e.g. the distribution of the synonyms within one category, like: *house – hut – palace*). In examining the constancy and mutability, thus the stability and instability of the systems, *the sound system seems to be the most stable, the morphemic system is much less stable, syntax seems to be still less constant*, as it is more easily transformed by foreign influences, but *vocabulary* – as mentioned above – *keeps permanently changing* so that even *the contemporary observes the process of transformation* (though the basic vocabulary itself is very stable).

Referring to the experiences of linguistic history (without proofs) Lehmann (1962, p. 2) is of the opinion, however, that sound system alters more readily than does grammar. Doubtlessly, it is a fact that the above characterized rule does not obtain consistently. The sound system of Russian has undergone a relatively greater change than has Russian morphology, as compared with the Common Slav state, and if we compare the Russian phonemic system only with the noun declension, the extent of change was absolutely greater in the sound system. We have to point out that the phonemic system itself does not behave uniformly during the change, now the vowel system, now the consonantal system undergoes greater transformation. The vocalism of archaic Sanskrit is, for instance, more advanced in comparison with that of Latin, whereas the consonantism of the latter is altered to a greater extent. But apart from the exceptions, the order of the mutability of the linguistic layers suggested above is by and large true.

As to the linguistic system, the following law can be ascertained: *the more components form a system, the less stable it is, the less com-*

[7] Cf. Kelemen (1954), Vértes (1955) and Vendryes (1950, pp. 219-224).

ponents constitute the system, the more stable it is. That is, *the number of the elements of the system is in inverse ratio to the measure of its stability.* This regularity seems to apply to other systems (cf. to the stability of the atomic kernel?) as well.

2

THE FACTORS WHICH CONTROL THE RATE OF LINGUISTIC CHANGES

2. 1. THE HISTORICAL EFFECT

The great events of history transform peoples and countries. It is evident that they can cause lasting changes in the languages of these peoples too. Among the linguists it was Jespersen (1929, pp. 259-261) who dealt with the role of the historical events in the linguistic changes in detail, and he discovered the proper causes of linguistic changes in them. According to his opinion, the great conquests, wars, destructions play the most important part, namely, in the time of the enormous historical upheavals the parents can mind less their children, therefore the younger generation grows up without, or only under slight, supervision of the older one, in consequence, the speech of the fathers has a smaller effect on the language of the offspring, and it cannot keep the linguistic differentiating processes completely in check.

In the history of the English people the 7th-11th centuries brought the greatest transformation from the beginning of the Viking invasion till the Norman Conquest. On the contrary, the greatest transformation in English did not occur in those centuries, but later, in the 11th-15th centuries. As a matter of course, linguistic changes can follow the historical events more slowly, but the great time lag cannot be explained by this. The permanent and embittered defense against the Danish and Norwegian raids of ever growing dimensions, the belligerent and non-belligerent relations (commercial relations during the reign of Canute the Great, the settling and assimilation in a great dimension of the Vikings) that took place in the 7th-10th centuries, transformed Anglo-Saxon to a lesser extent, while the Norman Conquest took place in a very short time, it bore down the

resistance of the Anglo-Saxon people definitely so that the reconstruction of the country was carried out with much less effort under the Norman rule, and yet the English language has passed through a radical change since this time. The Viking epoch caused larger changes only in the word-stock (including form-words) which are insignificant, however, as compared to the great changes after the Norman Conquest, by which the Anglo-Saxon vocabulary (including basic word-stock, though the computations of the glottochronologists did not reveal this) has entirely changed and has transformed into a mixed Romance-Germanic vocabulary. But the phonemic system, that is to say, mainly the vocalism (e.g. monophthongization of the diphthongs), and much rather, the whole grammatical system also passed through a large-scale alteration, by which the synthetic character of the language changed into an analytic type with fixed word order. In the course of four centuries, the aspect of the English language of our days has evolved after, as it were, the rapid changes. English linguistic history characterized by a slower development (enrichment of the word-stock by the rise of new notions) presents a larger period of change only once again during the 15th-19th centuries, but chiefly during the 18th-19th centuries that conduced to the definitive forms of the vocalism of today (the rise of new diphthongs out of Middle English monophthongs).

One tries to compare in vain the greater milestones of English history with the most important periods of the history of linguistic changes, no direct or indirect correlations are to be found between them. The chaotic centuries of the Viking epoch passed without considerable traces. After the Norman Conquest the language changed radically, but it needed four centuries. In the course of the 17th-19th centuries England became a great maritime, later a world, power but the English language altered only its vocalism to a greater extent during this period.[1]

[1] Jespersen (1925, p. 261) thinks that greater linguistic changes occurred, however, in the latter period too, in so far as the vulgar speech style has greatly diverged from the cultured English style in consequence of the miserable circumstances of life of the industrial working class and of the lack of schooling of the proletarian children. Jespersen is wrong, however, because the English language

No significant historical events can be shown in the other centuries? Surely they can. The 16th century was the bloody epoch of reformation and counter-reformation. The collision between the nobility and the middle-class, the English revolution took place in the 17th century. But after all, important historical events can be demonstrated in all centuries, the significant events of the alterations of English are linked, on the contrary, only with certain centuries.

One would search in vain for indirect connexions between the greater changes in the history of other peoples and of other languages. The history of the modern European languages is characterized in general by the facts that the largest transformations proceeded in the course of the 9th-15th centuries, that is, by and large parallel to the great transformation of English. The standard works in historical linguistics fix the boundaries between the old and middle states of these languages usually in these centuries. The first phase of development, that is the old phase of the European languages can be clearly distinguished from the middle stage, more clearly, than the middle phase from the time of the formation of the modern state. That is to say, the changes transformed Old French, Old High German, Old Russian, even Old Hungarian, etc. in respect of sound system, grammar and vocabulary[2] in a quite higher degree, than they did later when the middle phase turned into the modern language state, and when the boundary line can be drawn only by the linguist, often on the basis of external criteria (e.g. of a unified literary language) that are not connected with the internal development of the language. Of course, tight boundaries fixed to a date can be artificially marked out between the old and middle stages too.

As to the Neo-Latin languages, the situation is different. In the course of the 8th-10th centuries, Latin ceases to be a living language, but it successively turns into the particular Neo-Latin languages. In point of view of the Romance languages, these centuries also

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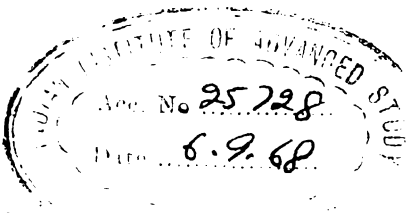
itself has not changed, only the difference has grown greater between the several stylistic variants of the language.

[2] In the transformation of vocabulary I do not reckon here the growth of the vocabulary that is linked with the development of society and culture.



resulted in immense changes, if we do not separate the Vulgar Latin forms used in the given Province from Neo-Latin that developed out of it, but consider both as being the same language. The three centuries mentioned above abounded in bloody, chaotic transformations and events: the formation of the Carolingian Empire, the reign of Charlemagne, the destruction of the Longobards, etc. Of course, the former centuries had also been full of such events: the invasion of the Franks in Gaul, the invasion of the Longobards in Lombardy, etc. It may be presumed, after all, that all linguistic changes of a greater size may be connected with a historical upheaval of great importance, but one cannot always find significant linguistic alterations after all great historical transformations. From the time of the 14th and 15th centuries, the epoch of the major linguistic changes is closed. Henceforth, changes only of less size occur in the linguistic system.[3]

We may draw the lesson from this that the *great historical transformations* may throw light on the course of the greater linguistic changes and *may accelerate the process.* As our experiences are lacking, however, concerning the question *when this effect of the historical upheavals occurs*, and *when it fails to come about, we cannot draw any conclusion* from historical linguistics.[4] It is possible that the right explanation lies in the action of other tendencies which cross the historical effect. All this is a very little lesson for the quantitative method. We know only that *the great historical events can be taken in account as operators in certain cases.* This cannot be written, however, in exact form, and *we may scarcely expect that the mathematical method can be applied in historical science*, and *that the great historical events can ever be expressed by mathematical quantities in the future.*

[3] The change of *-aj> -ej* (*vajce> vejce*), the so called "přehláska" can be mentioned as an instance of such later changes that happened in the history of the Czech language, while the earlier forms of přehláska (*-a> -e* after palatal vowels) is enacted still in the 12th century.

[4] The collation of the historical data of the non-European languages may enrich our knowledge concerning the problem, but we cannot expect an essentially different result from the investigation.

2. 2. THE CULTURAL EFFECT

There are many cultural factors, and their effects are also different. From our observations it is well-known, on the whole, that the installation and diffusion of many *cultural phenomena, institutions, inventions*, as the *rise of writing, the invention of printing, the embracing of, or the conversion to, a religion*, modern *transport* and *telecommunication* (radio, wire, telephone, television, etc.), *general compulsory education, general compulsory military service* (if this latter is really a progress from the point of view of culture) all produce a significant effect on the development of language by changing, increasing the cultural level of the people. The effect appears also in other components of the language, though indirectly, beside the rapid growth of the vocabulary.

In general, the literary and standard language originates or becomes more unified through the rise and diffusion of writing and printing.[5] The features of the written language (the abstract word-stock, the more complicated syntactic constructions, spelling pronunciation influenced by the written form, abbreviations in writing and in speech, stylistic form variants, etc.) come into being, accordingly. After the relatively shorter transformation period, on the contrary, the established literary language begins to exercise an influence on the development of language in a quite opposite direction: it retards the rate of changes by its conservative character holding authority in respect. The literary language has an effect on the development of the spoken language even if there are large differences between them, that is evidenced by the history of Latin in medieval Europe, and that of Old Church Slavonic resp. Church Slavonic among the East and South Slavic languages. Everywhere in the history of the culturally advanced nations we can find *a more rapid linguistic development following in the wake of the establishment of the literary language, but afterwards, the process of changes slows down.*

[5] The emergence of the use of writing plays such a great role in transforming a language especially, when it becomes established as a result of a reform or of an individual creation (e.g. the rise of Old Church Slavonic by the Cyrillic script).

The reforms of religion, or *the conversion to a new religion* are accompanied by *an effect similar* to the former, in general, if they do not initiate a new obligatory liturgical language. In the history of the German, Czech, Arabic literary languages, the activities of Luther, Hus and Mohammed have therefore great significance. *If*, on the contrary, *the new religion involves the diffusion of a new, foreign liturgical language* at the same time, then *two different effects may arise*. In this case, *the new religion may hinder*, even *impede*, *the formation of the national literary language* (as it happened in several non-Romance countries of Europe because of the absolute domination of Latin in the Middle Ages), *it may develop*, on the other hand, *the use of writing*, and *so it may create the possibility to the formation of a national literary language* in the succeeding centuries. This twofold effect of Latin can be observed in the course of Hungarian. But the Pali writing has spread in this way together with the Pali language through Buddhism from the southern region of India to the Buddhist peoples where the national writing types and thereby the national literary languages (Singhalese, Korean, Burmese, Siamese, etc.) too were formed out of Pali writing.The adoption of the Arabic liturgical language did not hinder the development of the other national languages to such a high degree, still through the Arabic writing many African peoples obtained the use of writing (Hausa, Swahili, Kanuri, Mandingo, Fula, etc.), it is true, however, that Arabic ousted some kinds of writing having already literal traditions in Asia (e.g. Persian Pehlevi).

By the way, it is to be remarked that the conversion to a new religion may have another effect of greater importance on the development of language, though it does not bear closely upon the rate of the linguistic changes, namely, it may form a new language type which will be divergent from the former one, and two different language types can result in the case of competition of the new religion with the older. By this way the Serb literary language type has originated under the influence of the Eastern Orthodox Church by the side of the Croatian literary language type that has developed in the spirit of Roman Catholicism. By this way the homogeneous Lusatian (Sorbian) language has separated in the time

of the Reformation into two literary languages: in the Upper Lusatian (Catholic) and in the Lower Lusatian (Protestant) languages. Reformation and counter-reformation too have left ripples in the history of the Hungarian language. The orthography of Protestant type developed beginning with the second half of the 16th century and it differed from the orthography of the Roman Catholic type which arose after the counter-reformation.[6] This divergence manifested in the wording of the Bible translations, and it traces still appear sometimes today in the form of equivalent variants reflecting non religious stylistic differences (e.g. *vízözön* reflects the Catholic, *özönvíz* the Protestant wording, both meaning 'flood, deluge'). Protestantism promoted the spreading of the national languages against Latin, the weapon of Catholicism, to a great extent, especially in the Middle, Eastern and Northern regions of Europe, so it impeded the possibility of the larger linguistic changes.

The other factors of culture, like the institution of the general compulsory education and of the general compulsory military service, the development of transport and telecommunication, and generally, the raising of the cultural level (e.g. the far-reaching transformation in the Soviet Union and in the people's democratic states that is called "cultural revolution"), *all move in the same direction: they spread the standard and literary language* at the price of the dialects *impeding by it the process of the linguistic changes of greater extent.* A similar tendency of unification prevented the formation of American English as a distinct language that was in the making in the time of War of Independence.[7]

As is to be seen, the manifold cultural factors restrain also the rate of the linguistic changes while contributing to the general rise of the cultural level. The conversion to a new religion does not always yield the same result, therefore each case should be judged on its

[6] See Kniczsa (1952, pp. 10-16).

[7] Concerning this problem see Jespersen's observations (1925, p. 260). He ascribes the cessation of the differentiation partly to the continually increasing number of the English immigrants. However, this point of view cannot be held any longer considering that the larger proportion of the immigrants in USA since the second half of the past century did not speak English as their native tongue.

merits. From the point of view of quantitative analysis, the evaluation of the cultural factors is a very difficult task. It is not possible to give a difinite answer in advance how they slow down the development of language; the case is different also in this connexion. At the same time, it is to be taken into account that *while the effects of the cultural factors on the phonemic and grammatical systems are of regressive* (not in qualitative sense) *character, their effects on the word-stock are of progressive character* (both in qualitative and quantitative sense). The vocabulary stock increases and undergoes other qualitative transformation. This transformation, however, is not of big size, it is far from the great transformation of the English word-stock under the influence of the Norman Conquest.

The quantitative calculation of the cultural factors is a hopeless undertaking from the very first, though they appear more often in countable units as compared to the historical events. It can be proved by statistical data not only that the general compulsory schooling and compulsory military service spread over how many inhabitants, how many telephones, wireless sets, telesets there are in the country, how many motorcars, railway trains, aeroplane do how many passenger-kilometers every year, how many books are published in how many copies, but there are also some data concerning to the cultural states of older epochs, thus, we know how many manuscripts are to be found in the libraries and archives, the incunabula appeared when, where and in how many copies, etc. Nevertheless, it is not yet possible to collect the data indispensable for the mathematical model. *In point of view of the real cultural situation of a society, such numerical data* are not indifferent, but they *reveal very little of the essential character of the problem.*[8]

2. 3. THE SOCIAL EFFECT

Many linguists have already dealt with the role of the social factors in linguistic changes. The majority of scholars never calls into question that society, the system of the social institutions and

[8] Cf. the similar view of Molnár (1962, p. 295).

language are in mutual connection, thus the rise of language must have first of all social preconditions, human speech is also a social phenomenon in a certain respect. However, they have not succeeded to reveal direct interrelations up to now between social development and linguistic change. The theory of Marrism that tried to deduce the stages of linguistic change, the so called "stadial" changes out of the metamorphoses of the social forms ended in failure.[9] The linguist adherents of the sociological school of Durkheim tried to examine more intensively the social side of language. After Saussure this aspect became ever more general beyond the circle of the French linguists. Meillet, also an adherent of the Durkheim-school, laid down the law of semantic change according to which the meaning of a word becomes wider if its use passes from a minor social group to a larger one, and its meaning contracts if it becomes a special word of a minor group (*ad-ripare* > *arriver* — *trahere* > *traire*).

Even if we cannot embrace the primitively simplified sketch of development of Marrism, if the French school – beside their excellent partial results – could not establish an all-embracing theory, it is incontestable that the problem still exists. From the point of our investigation it seems to be self-evident to rely on the lessons of the vocabulary. Doubtlessly, the social transformations involve the change of the word-stock. New words and terms arise in large numbers following the notions of the new social institutions and relations, on the one hand, the names of the obsolescent social notions fall more and more out of use, on the other. The Hungarian Explanatory Dictionary closely reflects the change of the word-stock of Hungarian from the end of the Second World War till our days. The names of the new notions which arose through the social transformation can be found in the dictionary with the stylistic reference *új* 'new' (e.g. *pártbizalmi* 'party group steward', *munkaverseny* 'work-competition') the names of the vanished social order are

[9] It is interesting that some views similar to Marrism sometimes rise among the linguists and the scholars of the neighbouring disciplines. See, e.g. the hypothesis of the social anthropologist Lévi-Strauss (1951).

marked with the label *szoc e* (abbreviated from *szocializmus előtt*) 'before socialism' (e.g. *nagybirtok* 'latifundium', *szolgabíró* 'district administrator before 1945'). Unquestionably, life reacts very quickly to social events, and the new notions are, as it were, on the spot, given a name, but if a notion is not wanted, because a new, often more advanced, form succeeds the given institution, also its name falls soon into oblivion. Such words are to be found in the dictionary mentioned (e.g. *népnevelő* 'party propagandist', *falujárás* 'village propaganda', *sztachanovista* 'stakhanovite') with the explanation in the definition of these entry words that they were used in the beginning period of the socialist transformation.

At first blush, all this is very fortunate, because the solution would seem to be to proportion the new words that have remained after the social transformation to the entire word-stock considering the chronological extent. For the lexicologist it is evident that this task is unsolvable, thus the volume of the vocabulary cannot be measured either, as I have said earlier. But after the presumed accomplishment of this Sisyphean labour we could not get any usable results either. It seems to be sure that *all languages react with an equal promptness to the rise of new notions*, and *they soon find the adequate denominations* whether they originate continuously, or by the way of revolution-like transformation. The situation is quite different if a people lives in social, cultural backwardness, and has no literary language, or if it has, it is used by a very narrow social circle.

If a transformation of revolutional character happen to this people in such state then the vocabulary of the language is not able to keep up with the rapid rise of the new notions on account of the structural factors of the language, and only an artificial intervention, that is a wide language reforming movement can help. The Hungarian language reform played such a role in the epoch of the national revival (from the end of the 18th to the middle of the 19th century). Similar language reforms made it possible for several minorities in the Soviet Union to create their own literary language after the October Revolution. In our days the necessity has arisen for language reforms of considerable extent in the countries that have recently become independent in Africa in order

to enable the given language with scanty or no literary tradition to function as an official language (e.g. Akan in Ghana).[10]

Leaving the domain of vocabulary, we are on slippery ground. *We cannot explain any case of the changes of the sound or grammatical systems by referring to direct social transformations.* The great changes of language in the 9th-15th centuries mentioned in discussing the historical factor, cannot be brought into connection, for instance, with the end of the allodial period of feudalism. The hypothesis of this kind would lead to the blind-alley of Marrism. The greater social movements operate, however, on the rate of linguistic development.

The settling after the nomadic life usually changes the aspects and situation of the dialects till then, because the tribal dialects are replaced by a new dialectal distribution corresponding to the geographical settlements. The territorial division of the Hungarian dialects evolved after the Hungarian conquest (at the end of the 10th century) in this manner. The larger resettlements and colonizations can again change this situation. The larger blending of the Hungarian dialects has resulted from such large-scale demographical trends in settling by the evacuation and devastation of the population in those parts of Hungary which came under Turkish rule, then by the new resettlements in the depopulated territories after the forcing out of the Turks. *The internal mixture of dialects* that occurs within a shorter interval of time obviously *accelerates the processes of linguistic change*, if the literary language has not yet come into being or its use has not yet become widespread. The *internal mixture of dialects* has a relatively slighter importance *in our epoch*, and it manifests itself rather in the blurring of the dialectal divergencies and in the increase of the effect of the litarary and colloquial languages, thus it *moves in the direction of the slowing down of the linguistic processes.* The settlement of the csángós (Hungarian speaking natives of Moldavia) in Hungary in 1945 is a case in point of this type.

[10] The phenomenon of linguistic taboo is also a very important factor in the permanent changes of the vocabulary in the language of the peoples living in a primitive stage. Cf. Elmendorf (1962).

From the vaster social changes *the vertical demographical trends play a prominent part in linguistic alterations.* This process which is becoming ever more marked in our days began already in the Middle Ages with the growth of the towns: the villages become comparatively depopulated, the population of the towns and cities incessantly grows, and the number of the mammoth cities augments in every corner of the world (already the inhabitants of Tokyo far surpasses 5 millions after New York and London). The population of Budapest has doubled during the past decades, but the population of the Hungarian provincial towns increases too at the expense of the villages. *This large-scale urbanization* exerts its effects also on the rate of linguistic development, inasmuch as it *spreads the norms of the literary and universal colloquial language*, making them obligatory and *slowing down the rate of linguistic changes.*[11] It is possible that this development caused after all the absence of the greater linguistic transformations from the beginning of the 15th century.

Surveying the social factors our knowledge remains obscure enough. We cannot draw quantitative conclusions concerning the size of the social transformations from the changes of the word-stock that react indeed sensitively to the greater social changes. We have only rough inferences about the effects that control the grammar and the phonemic structure. Certain of the larger social transformations (the change of the social forms, revolutions) accelerate the linguistic changes, others (urbanization) slow them down. There are some social phenomena (internal demographical migration, mixture of the dialects) that produce retarding or speeding influence depending on epochs and circumstances. *It may be assumed that other social factors may be effective on the alterations of the languages.* It is to be hoped that we shall have more exact knowledge in this connexion through the development of sociology and the coordination of the sociological and linguistic methods. In the case of the setting up of the mathematical model *the quantitatively undetermined types may only be taken into consideration at present.*

[11] See the similar view in Vendryes (1950, p. 414).

2. 4. THE GEOGRAPHICAL EFFECT

The modifying role of the geographical factors has long since been observed, though its importance has been exaggerated. The causes of linguistic changes, and more generally, of the differences of human speech have been looked for in the differences of the geographical circumstances (the site and the extent of the territory, the climate, etc.). This naive idea can be considered today as antiquated. The neolinguistic school brought into fashion by Italian linguists examined the geographical location of the peoples speaking the given languages from another point of view in order to try to explain the linguistic changes by it instead of the prevalence of the phonetic laws. This hypothesis has turned out a fiasco as to its original programme, but it has yielded useful observations for dialectology. Some theses of the neolinguistic school may be able to elucidate the rate of linguistic changes too. The alterations of the languages spread from territory to territory among the speakers, it is thus not the same whether the entire language area and its single parts (central area and lateral areas) are in what kind of proportion and relation to each other. The territory does not play, of course, a part in so abstract a sense, but it is to be understood together with the number of the inhabitants that live there, otherwise, *the density of population may be that factor which accelerates or slows down the course of linguistic changes.*[12] It is inferred that the more dense the population is, the more likely is the prompt diffusion, the general adoption, the establishment of the linguistic changes, and the more sparse the population is, the more slowly the course of the linguistic change proceeds. This hypothesis is supported by the instance of the Altaic group. The members of this language family are situated on a vast territory, and the number of the speakers of these languages is relatively few, at the same time, these languages have changed comparatively very little for many centuries so that the oldest written records can be easily read today.

Density of population seems to be an exact notion enough, it

[12] The sociological school of Durkheim attached also great importance to the density of population in the research of the causes of the social phenomena.

can be easily determined by statistical data, the trouble, however, is that *we no longer have sufficiently precise statistical data concerning the older states of languages* apart from approximate inferences. By and large it may be supposed that the density of population in China was always denser in ancient times than in the territory of Russia or the Soviet Union. But it would prove very difficult to measure to what extent the Chinese language is archaic or advanced as compared to Russian.

An other hypothesis is based on empirical observations, that is to say, *the more geographically isolated a people is, the less its language reveals changes*, that is the more archaic it is. The first postulate of neolinguistics enunciates a truth identical with this older observation. The instance of Basque and the Caucasic languages seems to corroborate this rule. The proposed lawfulness has a drawback, however, from the point of view of the quantitative computations that the geographical isolation cannot be expressed by mathematical means. The most important data here would be the ratio of the entire length of the frontiers and that of the common boundary lines as compared to the size of the whole territory (in case of islands the average distance of the island from the mainland), the average height above sea level; but it would be fruitless to measure these data: the isolation is not only a geographical notion. There are peoples which surmount the hardly passable natural frontiers in order to come into contact with other peoples (Scandinavian peoples), some peoples, on the contrary, have refrained from the best possibility of contacts (the Japanese till the middle of the 19th century). Otherwise, the sea can be a partition, if a nation wants it, but also the means of the closest relations not only today, but in ancient times too (cf. the origin of the Greek colonies).

Thirdly, it is noticeable that *a divergence can be observed in development between the speech forms of the motherland and of the newly populated territory*. According to the third postulate of neolinguistics, *the languages of the new areas incline rather to neologism, the language of the motherland, the older area,* on the contrary, *is more conservative*. This observation would be supported by the more advanced stage of Afrikaans as compared to Dutch in the motherland.

The situation is, however, *not so simple. The languages of the new areas,* of the colonies, *are often more conservative as compared to that of the motherland* concerning certain linguistic phenomena as it is manifest from the French spoken in Canada. The language of the Spanish Jews who took refuge from the persecutions of the inquisition in the Balkans preserves, for the most part, a state of several centuries ago.[13]

Thus, *from the three geographical factors* that can be taken into consideration *the first two (density of population and isolation) have a definite influence, though they can hardly or only in our days be measured by quantitative means,* while the third is so complicated that conclusions of universal validity cannot be drawn from it.

2. 5. THE EFFECT OF THE NEIGHBOURING AND OF THE DISTANT FOREIGN PEOPLES

Our discipline has always taken note of the effect of the foreign peoples among the most important factors of the linguistic changes. The language of the indigenous people is considerably exposed to the impact of the languages of the neighbouring peoples, to that of the peoples, who, though more distant, but have a higher cultural level or being more developed in certain respects and to the influence of the peoples who had been living on the same territory, but had become fully assimilated to the people in question. This effect also reveals itself first of all, in the changes of the word-stock, but the language can be enriched by new phonemes adopted mainly from the neighbouring languages through borrowed words. The effect of the substratum, on the other hand, can result in direct sound changes too. Syntax may be changed, modified to some extent by all the three types of this effect. *Morphology is the less sensitive to the foreign effect.* If the foreign influence is, however, extremely strong, then morphology does not remain unaffected by it. Such morphological changes take place in the case of the so called linguistic unions (unions linguistiques), that it is apparent from the instance of the Balkan languages (the extinction of the infinitive,

[13] Vendryes (1950, p. 413) also points out these contradictory facts.

the transformation of the noun declension into analytic character, the post-position of the article, etc.). Also the Asian and African pidgin languages have come into being, after all, through foreign (mutual) influence of an enormous size.

As to the question *how rapidly the foreign impression manifests its effect, that is, to what extent it contributes to the formation of the rate of the linguistic changes, we can draw no detailed conclusions.* The relatively more rapid transformation rate of English was obviously aided by French influence, but perhaps not by the special structure of the French language, but by the extraordinary power and effectiveness of the Norman Conquest, thus by not a linguistic but rather by a historical factor. We have very little possibility to investigate to what extent the Slavic, German, Latin, Italian, French, Turkish, etc. effects have made their impact on the rate of changes of Hungarian. Nevertheless, the loan-words indicate the rate to a certain extent. But *it would be useless to draw a conclusion from the number of the borrowed words.* First of all, we ought not to consider their absolute number, but their frequency, their occurrence in the speech, thus the data of the message, and not that of the code would be competent in this respect.[14] From these numerical data we can deduce, however, at the very most the measure of the effect that impressed the vocabulary, and not the fact whether to what extent the other linguistic processes were accelerated or slowed down though this effect. But the data analyzable from the changes of the vocabulary do not yet refer directly to the rate of change of the word-stock. It would be ascertainable only from the historical facts; owing to the lack of historical data we cannot infer the duration of the influence or the time interval indispensable for the mass adaptation of the loan-words merely from the number and ratio of the borrowed words. Possibly, it can be inferred only that *the less influence affects a language the more conservative it is*, thus we obtain the same result as in the case of the geographical isolation. Nevertheless, *it cannot be stated that the*

[14] There are computations from the loan-words of Hungarian and other languages. See an enumeration of Bárczi (1951, p. 13-14) on the calculations carried out in Hungarian.

more and more manifold the foreign effect is, the more and faster the changes occur in the given language. The foreign impact may be, however, so strong that the language cannot resist it and becomes entirely extinct. Sometimes this process takes place within a short time. In such a case, the inherent forces become very weak, and before extinction, the whole structure is permeated from top to bottom by the components of the foreign language. Polabian (Slavonic language of western type) shows itself in a similar situation at the beginning of the 18th century under German influence according to the written records. Some decades later nobody could speak that language.

The question may still arise how the momentum of these effect is connected with some features of the foreign people. Doubtlessly, the more civilized the given people is, the more it is likely that its language has a greater influence (like Persian on the Turkish language and ancient Greek on Latin). Another time the volume of the influencing people in number (e.g. the German impact on Danish) or its political domination (e.g. the North Germanic influence on English) has a significant part to play.

We could hardly analyze these factors separately, because they operate mostly together. The impact of German was, e.g. therefore so considerable on several languages in Central and East Europe, because it transmitted a higher culture, and had a political role in the German expansion, even the number of the German was also relatively great. At this moment, there is also foreign influence of a kind in which none of the above criteria comes into prominence, consequently, these factors may be summed up in a single one: the effect of the greater authority operates more intensively.

It would be impossible, however, *to demonstrate how the greater foreign influence manifests itself in the speed of the process of the linguistic changes.*

2. 6. THE ROLE OF NATIONAL CHARACTER ("VOLKSSEELE")

This group of questions involves all the hardly definable and not always properly formulated factors that are considered by many

linguists from Herder and Grimm through Humboldt to Whorf as the most important ones from the point of view of the substance of language, of the linguistic diversity of the world and of the motor of development of the languages. Even if we rightfully disbelieve that Lautverschiebung of the Germanic languages is in rapport with the love of freedom of these peoples, if we mistrust the view that European philosophy developed since the Greeks till our days, as it has done, because the mother tongue of the philosophers was an Indo-European language, and the non-Indo-European peoples hold therefore a different opinion about certain categories (space, time), because grammatical categories of other kinds are realized in their language, it is obvious that the national features exert an influence on the system of the language, on its change, in some way, though this action and interaction cannot be directly revealed.

In order to set up a provable theory instead of the many vaguenesses, one must be clear first about the conception of national character, but, sorry to say, we are still in the dark in this respect. The conception of Le Bon (1898) is of subjective nature and it is obsolete in spite of some sharp observations of his. Wundt's idea of Völkerpsychologie remained in torso, or rather he did not reach his aim. Modern sociology has made some attempts on this swampy ground, but the methodical explorations have only just begun.[15]

Further investigation will prove fruitful, provided it is able to distinguish the types of national character proved by psychological test methods instead of abstract, metaphysical categories hitherto used. Even in this case it will be difficult to demonstrate whether the national character has changed during the centuries, and if so, how.

The extrovert national character of the southern type (Italian, Spanish) and the introvert character of the northern type (English, Scandinavian) may be segregated first from the point of view of our problem. One would expect that *the changes proceed more rapidly in the languages of the more communicative peoples of more vivacious life rhythm than in that of the more reserved, taciturn peoples of*

[15] Concerning the state of the present-day research see the summaries of Mead (1953) and Curtis (1960, pp. 265-267), further, the views of Gorer (Kluckhohn-Murray, 1953, pp. 246-259).

slower life rhythm. Developing this train of thought we reach the role of *speech tempo* which is again an unsolved problem about which very little is known analytically. We have only approximative impressions that the average speech tempo is in some languages more rapid (Italian), elsewhere it is slower (Scandinavian languages), but data collected by scientific methods are unsatisfying. We have even scantier knowledge regarding the speech tempo in the former linguistic stages in comparison with that of today, though it would be very important from the point of view of research. Nevertheless, it will scarcely ever come to our knowledge how fast the Romans and the Germanic peoples usually spoke. At best, we shall be able to draw some retrospective conclusions from the data of today and of the future after we have resolved the problem of the measuring of speech tempo.

The establishment of such categories like average speech tempo and the collations of the data referring to them will lead, perhaps, to the possibility of comparison of some national features by quantitative means. But still more peculiarities of this obscure factor remain inaccessible for the quantitative approach though they are important from the point of view of the linguistic development. I have in mind *the subjective emotional factors* existing in the character and soul of each people *which manifest themselves in all historical, cultural, social, political events and processes which are always present, react on, retard or accelerate, corroborate or weaken the external effects.* It is likely that the quality and course of several linguistic changes depend on them. In what follows I shall attempt to throw light on the emotional factors through the case of the history of the English nation and language.

English was influenced by two foreign peoples in the Middle Ages: by the invasions and conquests of the Vikings and of Normans. The purpose of the invasion of the Vikings (chiefly Danes and to a smaller extent Norwegians) was plunder at the start and, by and large, through to the end. But at the same time, a process of settling down got under way in Britain helping to drain the over-population of the North Germanic peoples in Scandinavia. This process gave rise to the mixing of one part of the Scandinavian invaders with the

Anglo-Saxon and the native Celtic populations, so that an assimilation process began through intermarriages. The upper layers of Vikings took the least part in it, their aim was, beside plunder and looting, conquests of land. The North Germanic linguistic influence on Anglo-Saxon started first of all from the settled layers, but later it was augmented by the commercial contacts at the time of Canute the Great. It follows from all this that the population of the island looked upon the Viking settlers as of themselves, despite the century old sanguineous invasions, ravages, plunders. The Anglo-Saxons were on rather cordial terms with the settled immigrants, otherwise no intermarriages could have taken place between the two peoples.

On the contrary, the Anglo-Saxons were in a quite different contact with the Normans. The Norman conquerors constituted only a slight fraction of the native inhabitants as to their number, they treated the Anglo-Saxons as a subjugated people; they persecuted the Anglo-Saxon nobility and their households, destroyed a part of them, confiscated their lands, took all leading posts in their hands. There were of course some simple people among the conquerors like craftsmen and even peasants who were presumably friendly towards the native population; trading relations were also established between the two peoples, with the result that interbreeding began slowly from below after long decades. Nevertheless, the official language was still the language of the hated invaders.

While the North Germanic settlers were not considered unanimously as enemies by the native inhabitants, moreover, the settled peasants were treated as of the same kidney by the Anglo-Saxon peasantry, the Normans always remained (till their full assimilation in later times) the hated conquerors for the subjected population apart from the common folk whose number was small. The Vikings were absorbed and became Anglo-Saxons while bringing many loanwords and some grammatical elements along into their new Anglo-Saxon language in the course of the linguistic change; the French element of the population, on the other hand, disappeared after several centuries. Up to that time, all official and public affairs had to be conducted in French, thus the Anglo-Saxons were obliged to

learn the language of their detested masters. It is likely that this difference, the different feelings of the Anglo-Saxon people towards the two alien peoples and conversely, account for the fact that the Viking influence was more negligible than the French one. We have to keep in mind, of course, that French (Anglo-Norman) was then a well developed literary language, while the Dane and Norwegian invaders themselves often used the Anglo-Saxon language.

The conclusions of this parallel seem to contrast with our previous observations, for one ought to expect that the greater the political resistance, that is the hate of the alien conquerors and their language, the more the language of the given people remains intact from the outside influence. But such a regularity does not exist. The Hungarian people, for instance, was obliged to defend themselves in the same manner against the Turkish and German conquerors in the course of the 16th-17th centuries, and it most probably felt that both were ennemies alike, the German influence (lexical borrowing), however, was more significant even in this period than the Turkish one. We must take into account, of course, that the German impact involved at the same time the transmission of a higher culture, much higher than the Turkish one, and perhaps the increasing German influence in the later centuries helped to conserve the words which had been borrowed earlier.

Certainly, the regularity mentioned before may exist in some way or other, it is crossed only by manifold trends of other directions, and so it cannot freely operate. It is possible, for instance, that Anglo-Saxon would have become extinct, and French would be spoken in our days in England, if such a great resistance and hate had not arisen against the Norman invaders.

By the instance of the history of the English people and language I only wished to make it clear that – beside the social, historical, political and other events which produce an effect on the development of a language – we must also consider the feelings of the people towards the foreign contacts.

The differences in national character exercise an influence on the course of the linguistic changes in an enormously complex, compli-

cated and hardly analyzable form. At the present state of our knowledge, concerning this problem, *it is not possible to draw more particular inferences. As regards the quantitative methods, still fewer facts can be traced.* Nonetheless, it may be supposed that quantitative data will also be available for the solution of the problem which will be obtained by thoroughly elaborated scientific means, though several related phenomena will even then remain unanalyzable.

If more exact data than we have today were at our disposal concerning the number of the original Anglo-Saxon inhabitants at the beginning and at the end of the Viking invasions, detailed according to the main sections of the population, concerning the number of the North Germanic invaders, the number of the Viking settlers, and if all such data were also at our disposal concerning the Norman Conquest, one would even in that case be in no position to know what the people may have had in its heart.[16]

[16] Cf. similar observations in Molnár (1962, pp. 295-296) and in Gorer (Kluckhohn-Murray, 1952, pp. 256-257).

THE POSSIBILITY OF MEASURING THE RESULTANT CHANGES BY QUANTITATIVE MEANS

The work of Revzin (1962) contains many useful, or, at the least, suggestive thoughts that attach to the topic and method of the present paper. The material collected by the author with scrupulous care and his discriminating critical insight, cannot ,however, modify my theses. Revzin thoroughly reviews the operations suitable for the quantitative description of some linguistic phenomena. Some other endeavours based on quantitative methods have been appearing in order to reveal typological differences between languages within the same linguistic family. In phonemics the study of Lekomtseva and others (Лекомцева, М. И., Сегал, Д. М., Судник, Т. М., Шур, С. М., "Опыт построения фонологической типологии близкородственных языков", *Slavjanskoje Jazykoznanije*, 1963, pp. 423–476), in morphology that of Volotskaja and others (Волоцкая, З. М., Молошная, Т. Н., Николаева, Т. М., Ревзин, И. И., Цивьян, Т. В., "Об одном подходе к типологии славянских языков", *Slavjanskoje Jazykoznanije*, 1963, pp. 510–522) elaborated such methods with which I could only acquaint myself after having closed my manuscript. Undoubtedly, the data authentically demonstrate the different typological features of the cognate languages in some particularities; nevertheless, these otherwise important figures are not suitable for quantitatively characterizing the changes of the whole of these languages because one cannot find any trace of interdependence or trend among the data in spite of the author's assertions (*Slavjanskoje Jazykoznanije*, pp. 426 and 516). My own quantitative analyses (see further on) have induced me rightly to come to my conclusions. *The mathematical models are serviceable only for the description or measurement of some partial phenomena, they are not suitable for the overall*

quantitative characterization of the totality of the changes occurring in a language mainly in lack of such interdependences or trends.

3. 1. THE PHONEMIC SYSTEM

As our task is to analyze system-like changes, we have to do with phonemes. This fact makes the task more difficult considering that the hypothetical arranging of the phonemic system of the stage of (parent) language without written records is always arbitrary. At the same time, one has to reckon with an other puzzle, namely, that a part of the changes does not influence the system (the phonemic stock and the arrangement of the phonemes), besides, there are changes by which some phonemes change into allophones, in other case, variants become phonemes. It follows that it is not possible to base diachronic research upon the phonemes only.

The phonemic system of Proto-Indo-European is still a moot point, and the disputes are not yet settled whether some hypothetical units were self-contained phonemes or allophones. Some scholars affirm that the difference between palatal and velar consonants (satem-centum languages) was not a phonemic opposition. Disregarding here the unresolved polemic I try to measure the difference of the changes of the sound system of Proto-Indo-European and some daughter languages. I singled out the units of the phonemic or sound system mainly on the basis of Krahe's (1958) tables.

The system of Proto-Indo-European, Old Indic, Greek, Latin, Proto-Germanic, Lithuanian, Common Slav consisted of the numbers of phonemes (sounds) as given in Table I.

It is not a simple task to range each phoneme among these types. I wish to mention only the instance of Common Slav. I ranked the phoneme *ě* among the (short) diphthongs (beside *ju* that cannot be regarded, however, as a diphthong according to many Slavists), though it might have been a monophthong. All the vowels are included in the group of the short vowels, though *a*, *u*, *i*, *y*, was, as a matter of fact, long, *e*, *o*, was short, *ъ*, *ь* was very short (reduced). The difference in quantity of the vowels did not form, however, a phonemic opposition in Common Slav, in fact the quantitative dif-

TABLE I

	Conso-nants	Semi-vowels	So-nants	Short Vowels	Long Vowels	Short Diph-thongs	Long Diph-thongs
Proto-Indo-European	29	2	4	6	5	6	6
Old Indic	21	2	1	3	5	2	–
Greek	16	2	–	5	5	6	–
Latin	16	2	–	5	5	3	–
Proto-Germanic	18	2	–	4	4	4	–
Lithuanian	14	2	–	4	4	5	–
Common Slav	24	1	2	10	–	2	–

ference of the reduced vowels may have been phonemically relevant as compared to the others, the quantity difference of which became blurred in the Common Slav epoch. Concerning the problem of the quantity there are some opposing views (of Trubetzkoy, Jakobson and Mareš, e.g.) that I disregarded in making this table.

Let me list the differences of the mentioned phonetic systems from these data in Table II, according to the proportion of vowels and consonants (in this connexion I placed the semi-vowels among consonants, and the sonants among vowels).

TABLE II

	Total Phonemes	Total Consonants	Total Vowels	Ratio
Proto-Indo-European	58	31	27	1.15
Old Indic	34	23	11	2.09
Greek	34	18	16	1.13
Latin	31	18	13	1.38
Proto-Germanic	32	20	12	1.66
Lithuanian	29	16	13	1.20
Common Slav	39	25	14	1.79

What kind of conclusions can be drawn from this table? Whether Old Indic moved away in the highest degree from the Indo-European parent language as to the ratio of the vowels to the consonants, or the Lithuanian and Greek stand the nearest to it, or Proto-Germanic and Common Slav are on the same level with each other?

If the Proto-Indo-European data are rightly reconstructed, then the ratio points out this conclusion. As for the absolute figures, the position is quite different, all later language systems stand very far from Proto-Indo-European, and they reveal a general trend towards the reduction of the phonemes in number. But do these figures really grasp the main point of the linguistic changes? Surely, in the course of the changes some phonemes entirely perished (e.g. in Common Slav aspirated and velar consonants are already lacking), at the same time, new ones arose (e.g. in Common Slav the nasal vowels: ϱ, ϱ). Unquestionably, such individual changes cannot be characterized by quantitative means. It is implicitely needful (and more possible) to proportion the phonetic types to each other, e.g. the voiced to the voiceless consonants, the occlusives to the fricatives. One might count how changes come about according to the 12 distinctive features in the given languages.[1]

Nevertheless, all these comparisons are not sufficient for the quantitative measuring of the entire system. The existence of the phonemes do not say much in themselves, thus the languages differ from each other in regard of the frequency of the phonemes. An other important factor is the arrangements of the phonemes, that is, which phonemes and clusters occur at the beginning, which at the end and which in the interior of the morphemes. Otherwise, the distinction between the linguistic system (code) and the linguistic work (Sprachwerk according to Humboldt and message according to cybernetics) is to taken also into consideration. Some data collected by Herdan (1956, pp. 84-85) will better illustrate the difference. Accordingly, the ratio of Italian, English, Czech vowels to the consonants in the code and in the message (in the texts) comes out as follows:

	Italian Vowels/Consonants	English Vowels/Consonants	Czech Vowels/Consonants
Code	7 : 26	18 : 26	12 : 24
Message	85 : 100	59 : 100	69 : 100

[1] The theory of distinctive features is established by Jakobson-Fant-Halle (1955), but the prosodic features were only outlined in their paper. Šaumyan (1958) made an attempt at applying a more accurate analysis of the history of the Polish phonemic changes on the basis of the distinctive features. See still my valuation on the two theories (Fodor, 1961*a*).

Italian has scarcely three times as many vowels than consonants, but in speech these vowels are used more frequently so that almost one vowel occurs for every consonant. Czech uses its vowels, which are half as numerous as its consonants, much less frequently in speech so that scarcely more than one vowel occurs for every two consonants. English uses its vowels the least frequently albeit English has the most vowels among the three languages according to the code.[2]

If all circumstances are taken into consideration by the computations, we *have to obtain at least the following quantitative data: absolute number of the phonemes, absolute number of vowels and consonants, the ratio of vowels to consonants, absolute numbers and ratios of the detailed genetic and/or acoustic types of phonemes, all these data detailed according to code and message, the load and the arrangement of the phonemes.*

One part of these computations cannot be performed at all. There are some scattered results regarding the load of the phonemes in some languages, but a hypothetical parent language without written records or one having some records but of short length cannot furnish sufficient data respecting message.[3]

It would be absolutely impossible to catch the very essence of the linguistic changes out of the immense profusion of the quantitative data obtained after the calculations that can be carried out. Obviously, we ought to draw the lessons only from a few selected data. But which are the most important facts that may be singled out? Maybe the absolute numbers or the proportions? The data of the code or of the message? The ratio of the occlusives to the fricatives? The ratio of the labial vowels to the illabial ones? Claus (1961, pp. 214-222) following Ashby (1958, pp. 39-41) points out

[2] Nikonov (1960) considers that the ratio of the vowels to the consonants in the message is the most characteristic feature of the phonemic system of a language suitable for drawing also inferences concerning the rate of changes. I cannot agree with the author, however, that this ratio is more important than others of the phonemic structure.

[3] There are results of investigation from a language stage that has more extensive written traditions. See first of all the paper of Papp (1962) on the Hungarian *i* dialect in the 16th century.

that modern science cannot pay equal attention to the manifold, complicated relations of facts, but such a procedure is not needed at all, because science has to pick out the most important components of the interrelations, and so it can get to the bottom of the investigated material. Claus cites the economic law discovered by Marx as an instance in which the conditions of an increase of the production in a peculiar country are determined and so the whole process is characterized by the most important link.

Despite the above case, one has to be sceptical about the possibility of description of all the complicated rules of the social and economic phenomena by revealing only one or a few interrelations. Linguistic structure consists generally in very manifold, complicated relations, including even the phonemic system which comprises as it does the fewest components. Some examples will elucidate what kind of contradictory data can be obtained by continuing the quantitative comparisons.

Above all, I shall display the comparison on the proportion of the Indo-European vowels and consonants once again, repeating only the data of the last column, that is, the proportions themselves. Beside this column I will show another column containing the proportions of the ratios to the Proto-Indo-European situation that I counted 1.00:

Proto-Indo-European	1.15	1.00
Old Indic	2.09	0.55
Greek	1.13	1.01
Latin	1.38	0.84
Proto-Germanic	1.66	0.69
Lithuanian	1.20	0.96
Common Slav	1.79	0.64

Let us now consider two other comparisons, one concerning the consonants, the other the vowels. First, I shall indicate the ratio of the oral occlusives to all the consonants giving then the proportions again compared to Proto-Indo-European (Table III).

Secondly, I display the proportion of the long vowels (together with long diphthongs) to all the vowels, and similarly to the former

TABLE III

	Number of Consonants	Number of Oral Consonants	Ratio	Ratio (to Proto-Indo-European)
Proto-Indo-European	31	20	1.55	1.00
Old Indic	23	15	1.53	1.01
Greek	18	9	2.00	0.78
Latin	18	6	3.00	0.52
Proto-Germanic	20	8	2.50	0.62
Lithuanian	16	6	2.66	0.58
Common Slav	25	8	3.13	0.50

table, I give the ratio of the ratios. The Common Slav data are omitted owing to the fact – as I have mentioned – that the difference in quantity may have ceased to exist in this language. I wonder if this is the right procedure. (See Table IV.)

TABLE IV

	Number of Vowels	Number Long Vowels	Ratio	Ratio (to Proto-(Indo-European)
Proto-Indo-European	27	11	2.45	1.00
Old Indic	11	5	2.20	1.11
Greek	16	5	3.20	0.76
Latin	13	5	2.60	0.94
Proto-Germanic	12	4	3.00	0.81
Lithuanian	13	4	3.25	0.75

Let us place the three ratios in proportion to Proto-Indo-European side by side (Table V).

TABLE V

	Vowels to Consonants	Oral Occlusives to Consonants	Long Vowels to all Vowels
Old Indic	0.55	1.01	1.11
Greek	1.01	0.78	0.76
Latin	0.84	0.52	0.94
Proto-Germanic	0.69	0.62	0.81
Lithuanian	0.96	0.58	0.75
Common Slav	0.64	0.50	– —

The proportional figures obtained by the comparisons of three different kinds show a very diffuse picture. Each two data of the Greek and Proto-Germanic languages are, by and large, identical, two data of Old Indic are also very near to each other, the other data are fully dissimilar to each other. Particularly, Lithuanian reveals the dispersion. It must be borne in mind that the ratios are doubly graded, the discrepancies become relatively blurred. After all, *in the closed system composed of relatively few elements, like the phonetic system, it is not possible to pick out of the quantitative data a coherency that points to one direction. Neither does it reveal a single relation that may be picked out in order to characterize only the vowel system or the consonantal system by it.* The result comes up to the expectations, and indicate that the changes of the subsystems within this system are not proportional as regards time.

3. 2. THE MORPHEMIC SYSTEM

The network of the relationships in morphology – as I referred to it – is founded on far more components, and it is more complicated and on account of this, looser, than that of the phonemic system. This fact is independent of whether it is investigated on the basis of the traditional paradigmatic sketches or of the distributional analysis of Z. Harris, or of other theories. *The quantitative comparison is an impracticable task, because the numerical partial data do not reveal anything about the essence of the system.* Let me use as an illustration the noun declension of the Slavic languages as compared with Common Slav. The numbers of the cases are distributed according to the declensional numbers (singular, plural, dual):

	Singular	Plural	Dual
Common Slav	7	6	3
Russian	6	6	0
Ukrainian	7	6	0
Byelorussian	6	6	0
Bulgarian	3	1	0

Macedonian	3	1	0
Serbo-Croatian	7	6	0
Slovenian	6	6	4
Czech	7	6	0
Slovak	6	6	0
Polish	7	6	0
Lusatian languages	7	6	3

It is clear from this table that Bulgarian and Macedonian have undergone the greatest change, but the data do not manifest the immense transformation of the Lusatian noun declension in spite of its very archaism (conservation of dual). Though suffix morphemes of the two Lusatian languages (Upper and Lower) have considerably changed in consequence of a larger analogical process (Old Church Slavonic genitive plural *ženo* – Upper Lusatian *žonow* 'of the women'). The syncretism of the cases in dual has also changed:

	Old Church Slavonic	Lusatian
1. Case	Nominative, Accusative, Vocative	Nominative, Vocative
2. Case	Genitive, Locative	Genitive
3. Case	Dative, Instrumental	Dative, Locative, Instrumental

The accusative of Lusatian in the dual is formaly identical now with the nominative (inanimate nouns,) now with the genitive (animate nouns). But the table does not show the very different stages of development of the noun declension in the other Slavonic languages. These differences of development reveal themselves in the manner of how the Common Slav declensional stems are distributed according to productivity, how many suffixes and allomorphs represent the cases. The full transformation of the Bulgarian and Macedonian noun declensions (they became analytical in nature) get entirely lost among the figures, and they do not show the essential qualitative differences that distinguish modern Bulgarian and Macedonian from the other Slavic languages.

Noun declension is only one component of the morphological sys-

tem. *The morphology of adjectives, pronouns, participles* is different again. *The quantitative description of numerals also claims a distinct procedure. As to the conjugation of the verb, the following categories are to be quantitatively measured*: *person, number, tense, aspect, mood, derivation, etc.*

According to the principles of cybernetics we ought to pick out again the most important unit or units of the network of relations. This principle can here, however, be enforced to a less extent than in the domain of the phonemic system. The diverse paradigmatic subsystems are equal members of morphology, at the same time, they change often independently of each other. Whereas the noun declension of the Slavonic languages reveals the above mentioned sketch, the situation is quite different in the sphere of the conjugation. Whereas Bulgarian and Macedonian noun declension moved away to the highest degree from the Common Slav stage, they preserved the original verbal tenses much more conservatively (some new tenses developed in addition to them). The development in Russian is exactly the reverse of this: noun declension, and the declension in general has preserved, by and large, the Common Slav structure (though the vocative and the dual are lost), whilst the conjugation has been entirely transformed: one original tense has been left, the present tense; the past is denoted by a new form coming from the original participle (omitting the auxiliary verb), and so the category of gender entered the verbal conjugation; aorist and imperfect tense forms have perished in Russian. The two languages have developed differently also in another category, that of the aspect. As for aspect, it is well-known that this category has, by and large, the same formal and semantical manifestation in every Slavic languages. Nevertheless, the same category is highly different in some respects in Russian from that of in Bulgarian or Macedonian. In Russian, for instance, there is no more than one certain mutually excluding relation: the imperfective present tense denotes present time, the perfective present tense denotes future time (like in the other Slavic languages); the compound future tense can be formed only from imperfective verbs. In Bulgarian (and Macedonian), a part of the tense forms has either perfective

or imperfective meaning irrespective of the circumstance that they are formed in one or the other manner. Thus imperfect tense has an imperfective meaning, the aorist, on the other hand, has perfective meaning. From the point of view of derivation, Russian has developed the morphological structure of aspect further than Common Slav. In modern Russian generally four stages of aspect derivation can be distinguished apart from a few verbs: perfective verb can be formed from imperfective stem by prefixation, imperfective verb can be formed by suffixation, and again perfective verb from the earlier form by newer prefixation (*zakryt'* – *pozakryt'* – *zakryvat'* – *pozakryvat'*). In Bulgarian, the fourth stage is not used at all.

Isačenko (1960) illustrates the morphologic differences between Russian and Slovak by several examples referring to aspect among others. He cites, e.g. that the Russian imperfective verb *slat'* 'to send' has no adequate counterpart in Slovak, instead of it, the perfective verb *posielat'* is used (p. 172). Another example: while Slovak uses only the prefix *vy-* in a certain accessory shade of meaning, in Russian more prefixes are to be found, e.g.: Slovak *vyrabovat'* (*banku*) – Russian *ograbit'* 'to rob a bank'; *vypálit'* *dům* – *sžeč'* 'to burn a house' (p. 164).

These and similar complicated relations and divergences cannot be characterized in their totality by quantitative means, though each of them is very important from the point of view of the whole of the system. Neither of them can be neglected or reduced to one or a few basic relations.

There is a significant theoretical work in earlier linguistic literature that has attempted to reduce the manifold morphological relations to some basic ones. I am referring to the interesting conception of Brøndal (1943, pp. 15-24) entitled "Structure et variabilité des systèmes morphologiques". In case it were applied, the theory would enable us to quantitatively describe the differences of the changes of linguistic systems reduced to basic relations of dichotomic character.

The cardinal idea of Brøndal is that the very nature of the system-like relations consists in oppositions, as in the opposition of pho-

nemes in the phonologic structure. In the morphologic structure, the oppositions manifest in various forms, but in the last analysis a pair of oppositions can always be picked out. Such an opposition is represented by the relation of singular and plural, present and preterite, active and passive. These relations are of polar character, so they can be divided into positive and negative members. Besides polar oppositions, there are other relations too, like that of the neutral form with the positive and negative ones. The position of the neutral form is the same as the algebraic 0 and the 0 grade known in phonology. A neutral category is, e.g. the indicative out of the verbal moods, the third person out of the persons. To the notions of positive, negative, neutral another, a fourth is added: the complex relation which incarnates the positive and negative forms or relations in itself. In the morphological system, the optative from the verbal moods, the dual from the numbers, the inclusive from the persons are such complex forms. The complex optative coalesces the imperative and the conjunctive; dual is properly speaking a collective number comprising singular and plural. Within the complex relations now the negative, now the positive member comes into prominence, therefore negative and positive complex relations are discernible. Brøndal quotes the Hungarian verbal moods as an instance in point without expounding in detail what he means.

After all, every grammatical relationship can be summed up in six types of relations:

neutral,
negative,
positive,
complex,
negative-complex,
positive-complex.

The relations provided with positive or negative sign presuppose reciprocally each other, the neutral and the complex relations can exist, however, without the others. Considering these conditions 15 relations can be in existence, on the whole. Brøndal is of the opinion that the development of the modern languages reveals a

trend removing the positive and negative relations, that is, instead of complex forms neutral ones begin to be dominant. The optative, iterative, dual, inclusive person, etc. are therefore lacking in the modern western languages.

The ingenious theory of Brøndal has many grave weaknesses. The six basic relations are too few, if we take account of all language systems of the world, though they are sufficient for the analytic systems founded on few forms in the modern Indo-European languages. Although Brøndal concedes (pp. 45-46) that the oppositions must not be treated as an inflexible dogma, nevertheless he cannot eliminate all difficulties. The procedure of reducing the oppositions to a few basic types can be right only in the case if the relation is unmistakably identifiable with one of the oppositions, hence, if its qualification is not artificially and arbitrarily made. It is to be regretted that some of Brøndal's illustrative examples demand an imagination exceeding the sphere of the logical symbolism in order to identify the oppositions. For instance, why the preterite tense contrasts with the present in the case of the existence of the future, when present denotes temporary action as against durability expressed by the other two tenses? Altogether, the present often can denote other tenses, future or past, even timeless action (praesens absolutum). Brøndal does not mention neuter gender. In spite of the inviting identity of the denomination it has no neutral character in the languages where there are three genders because there all genders are equal in value.

Let me cite as an instance the Finnish noun declension concerning the difficulties of the estimation of the relations of more than six forms. In modern Finnish, 14 or 16 cases are usually distinguished, if these forms may be called cases at all. One can try to divide them into groups in any manner, it is not possible, however, to arrange them in the opposition groups of Brøndal's. If the units are managed singly, the endeavour fails from the very first owing to the fact that the number of the cases is the multiple of the 6 basic relations. We have to experiment with dividing them first into smaller groups. It is obvious that we can establish two tripartite groups, the group of the interior and of the exterior local case:

Interior Local Cases	Exterior Local Cases
Inessive	Adessive
talossa 'in the house'	*talolla* 'at the house'
Elative	Ablative
talosta 'out of the house'	*talolta* 'from the house'
Illative	Allative
taloon 'into the house'	*talolle* 'to the house'

Granting that the inessive and the adessive cases represent the neutral relation then the elative and the ablative would represent the negative, the illative and the allative the positive cases (or inversely?) within the two groups. The other cases, however, would scarcely be divided into groups. Let us say the nominative case is opposed to the partitive (*talo* 'the house' – *taloa* 'house'), from another point of view, it is contrasted with the genitive (*talo* 'the house' – *talon* 'of the house'), but the nominative, the genitive and the partitive cannot be placed in a tripartite relation of any kind, because although the genitive could express both definiteness and indefiniteness, thus it could be complex, it is, however, always opposed to the nominative, and it can be of equal value to the partitive as to the syntactic relation (as direct object): *näen talon* 'I see the house' – *näen taloa* 'I see a house'.

As for the rest of the cases not mentioned, what kind of relation can be stated between essive, abessive, comitative and instructive? What kind of relation can be revealed between them and the members of the other groups, one by one? How would the four groups be related to each other? Which would be the positive, which the negative, which the neutral and which the complex member?

Brøndal's conception based on logical relations cannot be applied for theoretical reasons: *the relations of linguistic elements are not identical with the logical ones, though the two relation types are often analogous.* Otherwise the theory would have had a rational seed of the quantitative measurement of morphological changes.[4]

[4] As Brøndal points out, diachronic research has to pay attention to the changes that involve modifications in the structure (e.g. instead of negative and positive the rise of complex element). The figure of these so called "mutations" is given from the possible number of all relations: $15 \times 14 = 210$.

Greenberg (1960) following Sapir, attempted to draw quantitative conclusions concerning the typological differences of languages from message data, and by this he prepared the way for the quantitative method of the typological investigations of languages. But even if the investigations by the author (of short texts that extend to 100 words) is applicable to the characterization of some typological features, this method cannot be used either to solve our problem, because it results in the same diffuse and unequal picture which we have seen in Section 3. 1. Let me illustrate, in Table VI, the situation by the first four columns of Greenberg's table showing the data of Indo-European languages (including Sanskrit).

The average obtained by some procedure from the figures, which are all important and characteristic in themselves, would falsify the very essence of the differences among these languages.

Morphology is less suitable for quantitative analyses due to its special character, *than the phonemic system* that consists of fewer components.[5]

TABLE VI

	Sanskrit	Anglo-Saxon	Persian	English
Synthesis	2.59	2.12	1.52	1.68
Agglutination	0.09	0.11	0.34	0.30
Compounding	1.13	1.00	1.03	1.00
Derivation	0.62	0.20	0.10	0.15
Gross Inflection	0.84	0.90	0.39	0.53
Prefixing	0.16	0.06	0.01	0.04
Suffixing	1.18	1.03	0.49	0.64
Isolation	0.16	0.15	0.52	0.75
Pure Inflection	0.46	0.47	0.29	0.14
Concord	0.38	0.38	0.19	0.11

3. 3. THE SYNTACTIC SYSTEM

The accusation of the cyberneticians that linguists are not familiar enough with the object of their discipline, and so quantitative analyses cannot be carried out is valid for the most part as

[5] See the similar views of Axmanova (Axmanova-Melčuk-Padučeva-Frumkina, 1961, p. 8).

regards syntax. There is no denying that syntactic structure is still the least familiar domain of linguistic science. The difficulty lies essentially in the extraordinarily large number of units and in the complicated coherency of the syntactic phenomena. Neither have the basic principles of the syntactical researches been cleared up yet. The well-known work of Ries (1927) treats the contradictory and unsolved problems of the research principles, but his own efforts cannot be regarded as successful. The bulk of the syntheses published on syntax so far can be characterized by the fact that they are of much more limited extent as compared to morphology and phonemics, further that there is no unity among them concerning the method of treatment. The new linguistic methods have emphasized the need of syntactical research, but the endeavours have not as yet altered the situation apart from some useful works of detail. Chomsky's (1957) transformational method cannot be applied for our purpose either. The thorough-going study of syntax has become very important from the point of view of mechanical translation, but the machine breaks down just here, because the almost infinite number of the syntactic rules makes it impossible that the machine should work more effectively than the nonsencial or howler-like translations which it often produces.[6]

It is evident from all that has been said that even *the possibility is remote to find out on which kind of syntactical components or re-*

[6] Chomsky (1957, pp. 19-25) himself calls attention to the difficulties of the syntactical analysis. But in general, no attempts made towards the symbolization and quantification of syntactic structures can go beyond an enumeration of several basic (simple) cases. Hiorth (1963, pp. 10, 15, 83-85) himself, the author of a symbolizing method has doubts whether a symbolization of the syntax of a natural language can be ever used in practice, and besides, whether the entire syntax can ever be formalized. Cf. also Bar-Hillel's (1953) endeavour of mathematical symbolization of syntax where the author points out that it does not cover all the syntactic structures. The same author (Bar-Hillel, 1963) is still more sceptical concerning the possibility of a high-quality machine translation. There are some recent attempts to formalize certain syntactical phenomena that may be suitable also for quantitative analysis like the method of Lekomtsev (1964, pp. 46-80). However, such procedures can give a comprehensive characterization of the syntax of the compared languages or linguistic stages to an even lesser extent than in morphology owing to the multiple aspect of this linguistic level.

lations the basic principles of a quantitative measuring should be built. There is another difficulty, namely, that *it depends on the length of the written records to what extent the syntactic system of the earlier linguistic stages can be recognized.* Concerning languages with scantier writing traditions in the past, we have generally less knowledge about the syntactic stages and their changes than about the phonemic and morphemic systems.

3. 4. THE WORD-STOCK

Quantitative measurements and comparisons of vocabularies were attempted by the propounders of lexicostatistics. The object of their investigation is not the entire vocabulary – its quantitative measuring is an insoluble task as I said before – but the basic word-stock, that is the relatively constant layer of it. The adherents of this method did not contemplate to examine this relatively little stock in entirety, but only a small part of it on the basis of a 200 and later a 100 word list. The method has failed in its original form in the original programme. In a modified form, however, it is applicable for sub-grouping of cognate languages and dialects. Let us disregard for the present the original purpose of glottochronology, that is the measuring of time interval between two stages, and let us apply the same method in theory for the solution of our problem. In my paper on glottochronology (Fodor 1961*b*, pp. 332-334) I made a proposal for the word material to be increased (to about 500 items), and I suggested that not only one meaning but the full lexical field of each item should be taken into consideration. Accordingly, languages whose written records are of small extent in the given epoch, also the hypothetical parent languages, are unfitted for measuring the rate of linguistic changes from the very first. Thus Old Church Slavonic and Common Slav are not amenable to the comparison of the change quantity of the Slavonic languages. The Old French and Old English linguistic records which are more extensive, are more suitable for carrying out such investigations.

It is very interesting that *the word-stock* consisting of the most numerous components and being the most loose structural network of language *should be more suitable for quantitative comparisons with the other levels of the language*, e.g. the phonemic system which consists of the least numerous components and is the most closed structure. *This paradox may be explained* if one considers *that the looseness of the system* (the sign-like nature of the relations) *allow managing the items of the word-stock as countable units.* At the same time, *the word material compared in this manner is only a rough index of that which is called change of vocabulary.* Earlier I mentioned full synonymics which are to be taken into consideration in the comparisons of the word items. This synonymics is in reality far from the synonymy in the proper sense of lexicology. Such an aim would be impossible to set ourselves. I only mean by this term that a few synonyms of roughly the same meaning are to be included in the material of the identification. It would be just as fruitless to select only one word meaning for the scoring of the word items.

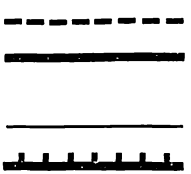
4

THE MATHEMATICAL MODEL OF THE RATE OF LINGUISTIC CHANGES

So far, we have surveyed the role of the factors that underlie the rate of linguistic changes and the possibility of measuring the difference of the linguistic changes by quantitative means. After the qualitative analysis with words I propose now to outline the diagrams and formulae supplying by this the mathematical model of the process only for the sake of illustration.

4. 1. THE OPERATORS

The arrows in the diagrams which indicate the direction of the effect refer also to the speciality of the factor. The (x) in the following formula and the ---- line wish to indicate in this case that the effect of the factor does not always result; the peripheral lines of the squares which contrast with the normal one indicate the ranks of the quantitative measurability:



cannot be measured by quantitative methods at all

measurable only from our days, or cannot be measured according to our present knowledge

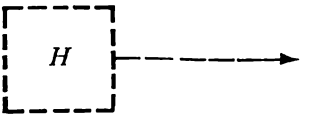
largely or partly measurable

measurable only in smaller part

4. 11. *The Historical Operator* (*H*)

Historical events, upheavals, revolutionary transformations usually accelerate the linguistic changes, but this effect does not always ensue. The volume of the historical events cannot be measured by quantitative means. The representation of the historical factor may be as follows:

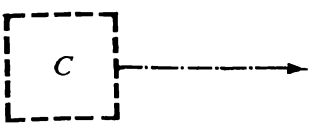
H (x)



4. 12. *The Cultural Operator* (*C*)

The significant cultural events, transformations, technical innovations usually slow down the linguistic processes after an initial larger momentum. Conversion to a new religion following the spread of a new liturgical language impedes the evolution of the national language in certain cases, that is, it retards much more the rate of change, but in other cases, it does not put a brake on the rate of change. The incipient accelerating influence of the cultural factors can be observed in the change, in the increase of the word-stock. Besides, the volume of the cultural factors cannot be measured by any quantitative means because the statistical data are frequently incongruous with the qualitative changes of the language. The symbolization of the operator is as follows:

C (y)

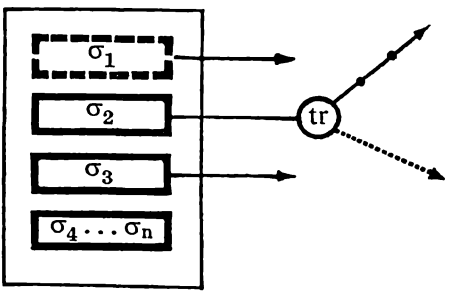


4. 13. *The Social Operator* (*S*)

The rate of the linguistic changes is accelerated by the social transformations attendent on greater perturbations (revolutions, changes of social conditions, etc.) [σ_1], accelerated by the horizontal demographical changes (internal migrations of the population and, in consequence, intermixing of dialects) [σ_2] before the general diffusion of the literary language and the technical revolution or industrialization (tr), but slowed down by the vertical demographic changes (urbanization) [σ_3]. Besides the foregoing, we have to make allowance for the effect of other, still unknown factors [$\sigma_4 \ldots \sigma_n$].

The word-stock is very responsive to social changes, it is enlarged with the addition of new names, while older notions and their names become gradually obsolete, but the quantitative measurement of this process cannot determine the volume of the effect. We possess no more detailed data about the other linguistic changes. From the social factors, we can acquire statistical data only on the demographical changes mainly of the more recent times (as to the historical epochs, we can have only uncertain inferences). The social operator can be symbolized as follows:

$S[\sigma_1, \sigma_2 (t\text{-}t_{tr}), \sigma_3, \sigma_4, \ldots \sigma_4]$

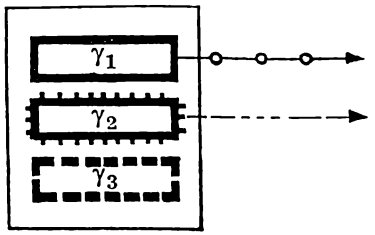


The line —•—•—•— indicates the time before tr, the line ..... the time after it.

4. 14. *The Geographical Operator* (*G*)

Out of the three geographical factors, the density of population (γ_1) and the isolation (γ_2) operate in a definite direction: the more dense the population is, the more speedily the changes can take place, and the more sparse it is, the more slowly it proceeds; the more complete the isolation is from the geographical point of view, the more archaic the language is, and the closer the contacts with foreign peoples are, the more subjected the language is to changes. The effect of the third factor (γ_3) is not so unambiguous, the language of the population of the new territories can be more archaic, and more advanced as compared to that of the motherland, and these features can manifest now in one, now in other elements of the language in direction contradictory to each other. The operator can be symbolyzed as follows:

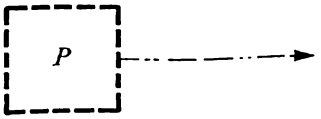
$G\,[\gamma_1, \gamma_2, \gamma_3\,(z)]$



4. 15. *The Impact of Foreign Peoples as Operator (P)*

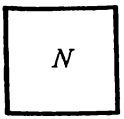
It can only be stated with more or less certainty that the less exposed the language is to a foreign people, the less it changes. This lawfulness does not prevail inversely, however. The outside effect manifests itself first of all in the vocabulary, in the syntax it is verifiable sometimes, but not always. In the sound system we may also reckon with foreign influence, but the morphology is susceptible the least of all of the influence of another language. As for vocabulary, quantitative measurements are possible, though the figures obtained do not mirror implicitly the speed of the changes. The symbolization of the operator is as follows:

P (q)



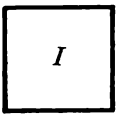
4. 16. *The National Character as Operator (N)*

Presumably, this feature plays a part in the rate of linguistic changes, but we do not know anything more particular about it, and the possibility for the quantitative measuring does not exist at present. The symbol of the operator is as follows:



4. 17. *The Inherent Laws of Language: The Internal Operator (I)*

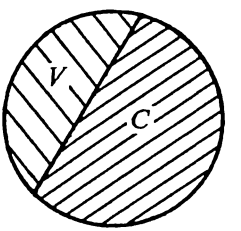
We know nothing about them except their existence:



4. 2. THE MODEL INDICATING THE SIZE OF THE CHANGES: THE DIFFERENCE BETWEEN OPERAND AND TRANSFORM

4. 21. *The Measuring of the Changes of the Phonemic System (ph)*

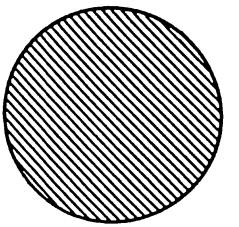
In the phonemic system manifold absolute figures and ratios can be compared in the relation of two linguistic stages, but mainly as regards the code. The quantitative differences of message data cannot be traced in general because reliable inferences may seldom be drawn from the written records. The manifold reckonings are rarely in agreement with each other, and we cannot select a group of data out of them that would characterize the whole phenomenon. Therefore, the obtained quantitative figures are not peculiar to the very nature of the changes. The phonemic system can be symbolized as follows (the V = vocalism, the C = consonantism):



4. 22. *The Measuring of the Changes of the Morphemic System (m)*

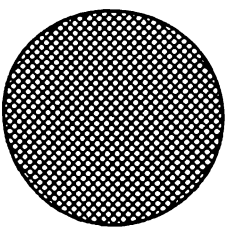
The number of the morphological components and their interrela-

tions are the multiple of the phonemic system, in other words, all that has been said there are valid here too: the manifold detail results of the quantitative comparisons are not in accordance with each other, and it is impossible to select any group of data peculiar to the whole of the changes in the system. The obtained quantitative results do not distinguish the real nature of the process. The symbolization is as follows:



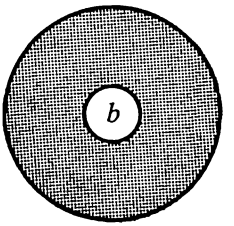
4. 23 *The Measuring of the Syntactical Changes* (*syn*)

The possibility is not extant for the quantitative analysis from the point of view of the present problem. The symbolization is as follows:



4. 24. *The Measuring of the Lexical Changes* (*lex*)

The changes of the word items can be measured by the modified method of lexicostatistics. The knowledge of the earlier linguistic stages of course, depends on the extent and nature of the written records. The symbolization is as follows (the b = basic word-stock):



4. 3. THE RECIPROCAL INTERDEPENDENCE OF THE OPERATORS PRODUCING AN EFFECT ON THE COURSE OF THE CHANGES: THE FEED-BACK

The classification described earlier *of the operators* that influence the rate of changes *is of a very artificial nature. The most part of the factors belong also to other groups, or are inseparable from the effect of some factors specified in other groups.* The great historical events call forth considerable social and cultural changes, the influence of foreign languages, to a greater or smaller degree than hitherto, demographical changes, etc., so that all these factors together may change the national character too. The Norman Conquest involved such radical and complex changes in the life of English society. The Arabic influence asserted itself in various forms in the life and development of the East African Bantu tribes from the Middle Ages and it resulted in Swahili as an intermediate language, as the East African "lingua franca", which has become a literary and official language superimposed on the Eastern Bantu dialects. The appearance of the Arabs in this territory of Africa was a historical event. It also went with social transformations, inasmuch as closer connections came into being among the Bantu tribes by way of the Arabic trading with them, the social composition changed too through the rise of a trading class. The cultural effect was represented by the spreading of the Arabic writing and the Mohammedan religion.

The impact of the various operators is not always equally strong. In Hungarian history the Turkish wars and the days of Turkish rule (16th-17th centuries) are of great importance. The historical

situation and events in the two centuries determined the destiny of the Hungarian people in historical, social, cultural, geographical, etc. respects in a decisive way. At the same time it is obvious that the direct cultural and linguistic effect of the Turkish wars and occupation is very slight as compared to the demographical, social, etc. effects brought about by the Turks. The proper Osmanli influence on the Hungarian language involved a few hundred loan-words,but this stock of the vocabulary was of peripheral character, and it disappeared from the Hungarian language with a few exceptions. Besides, some architectural monuments, some acclimatized vegetables (e.g. tulip) and horse species, etc. preserve the memory of the Turkish epoch. Nevertheless, the Turkish occupation entirely changed the settlement situation of a great part of the country in consequence of the migration of the population from the territories under Turkish rule, of the formation of large agricultural towns of the Great Hungarian Plain, of the rise of new settlements after the driving out of the Turks.

The 150 year long Turkish rule caused an enormous decrease of the population of the country and an immense loss in the natural growth too. But there are almost no traces that the connections with the Turks of a general negative stamp would have involved any effect on the formation of the Hungarian national character. By and large, Hungarians may have felt in the same manner towards the Turks, as the Anglo-Saxons felt towards the Normans, though in the Hungarian consciousness there remain today more favorable impressions from this epoch, mainly due to the influence of the great Hungarian novelist Jókai, and these are shared even by some Hungarian historiographers.

On the whole, *all external operators that have an effect on the linguistic changes appear interwoven with each other*, and one major transformation can scarcely be imagined without the contributory influence of some other effects. The concrete history of the investigated peoples and languages shows which operator had a greater part as compared to the others.

The case of feed-back is present not only among the operators, but it *can subsist between the operand and the operators* in some kind

too. In other words, *the stage and the changes of languages can possibly have a certain reaction on the development of the external factors.*

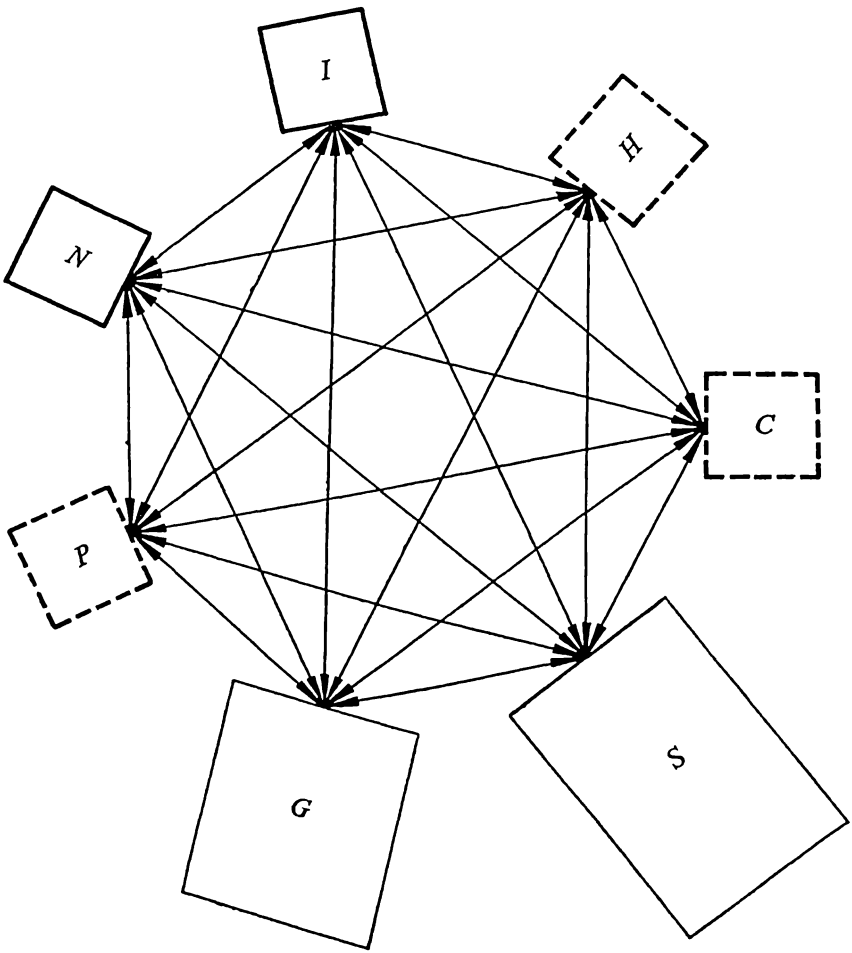
The linguistic effect mentioned in Section 2. 6 (the debatable Whorfian hypothesis) would be a case in point according to which the form of language crucially determines the mentality and world-view (and in addition to this the whole society, culture, etc. too). Undoubtedly, the establishment of writing and of the literary language aided by historical and social events reacts again on the development of the cultural and social life. Moreover, it is needless to detail what an important factor language ever was in human history and still is in world politics today. The friendly or hostile relations between countries and peoples were and are often the outcome of linguistic kinship or difference, thus language plays a significant part in the formation of history and society, though naturally it is not the sole factor. There are many precedents in the past and also in the present that inimical relations have sprung up between countries and peoples of the same or cognate languages, whereas fraternal connections can arise between peoples of unrelated and mutually unintelligible languages. The problem is so obscure that *I disregard it in the model.*

The feed-back situation between the operators of the linguistic transformations can be represented as in the figure on p. 68.

Later (in Section 4. 4.), in representing the whole functioning process of the operators their interrelations cannot be indicated by arrows because they would interfere with clarity, besides, they are to be divided there into two groups in order to show the direct effect of some operators on the vocabulary more conspicuously.

4. 31. *The Interactions of the Linguistic Changes*

Apart from the reciprocal coherencies of the operators, *the interaction of the levels of language can also influence the course of the transformations.* We cannot always, or, even rarely can we prove direct connexions between linguistic changes, though it is evident that in the most cases there must exist an interrelation between the



changes. Structuralist schools (mainly the Prague school) attempt to demonstrate such transformation processes starting from the basic principle that the change of some components of the system absolutely involves the transformation of the entire system too, but research has so far remained mostly at the level of the phonemic system. Nevertheless, still before the rise of the structural school, several interdependent processes of linguistic change were demon-

strated. The cessation of the law of the open syllables in the Slavonic languages brought about a number of new changes: the extinction of the reduced vowels (*ъ*, *ь*) in certain positions, their transformation into full vowels in other positions (Old Church Slavonic *dьnь* > Serbo-Croatian *dan*), the origination of new consonant clusters; the difference between indefinite and definite adjectival declension became greater so that the two forms are on the point of losing their morphological affinity (Common Slav **sъdorvъ – sъdorvъ +jь*, Czech *zdráv – zdravý*).[1] Aspect, as I mentioned before, develops in the Slavic languages intertwined with the category of tense, and in one case aspect forms the morphological, syntactical, semantical phenomena of tense, while in another tense controls the manifestations of aspect.

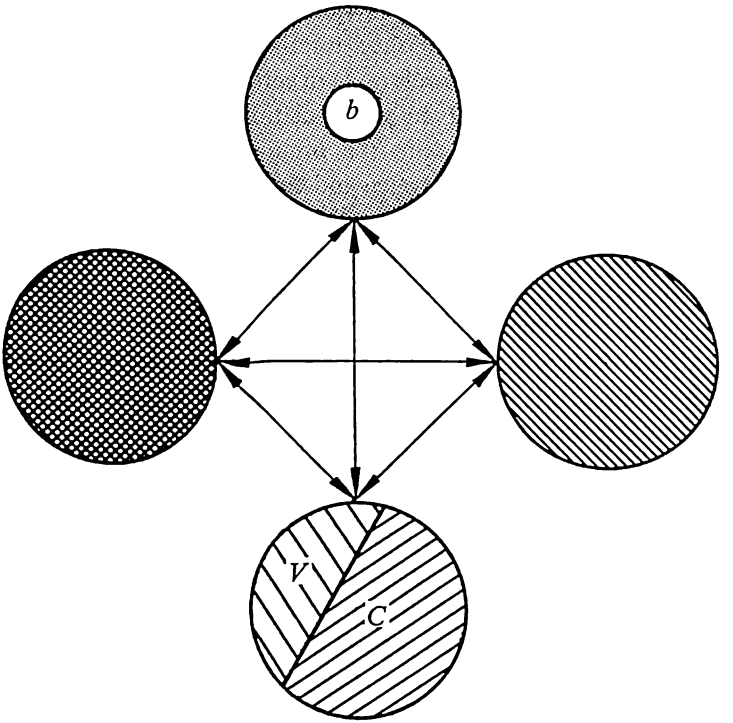
The changes that occurred in the Anglo-Saxon phonemic system during the 11th-14th centuries made an impression also on the development of morphology. The original suffixes were lost with the exception of some endings (*-s, -ed, -ing*, etc.), the synthetic nature of the noun declension turned into analytical, the number of the monosyllabic words multiplied owing to the loss of the endings, etc. This latter phenomenon increased the occurrence of homonyms, thus important changes arose in the lexical system too. The influx of the French loan-words exercised a similar effect on the whole of the English language. Apart from the adoption of new phonemes, great changes took place in the phonemic system, as the frequency and arrangement of the phonemes were modified, new clusters originated, etc. The *dž* phoneme, e.g. occurred only in the interior and in the ending of words, but through French borrowings it occurred at the beginning too (*judge, jealousy*).

The morphological changes often involve modifications in the phonemic system.[2]

I have to mention such instances, however, when the changes have proceeded independently of other linguistic phenomena. The

[1] On this coherency cf. Martinet (1955, pp. 349-369) and Jakobson (1929) who sets out to explain this chain process from the transformation of the reduced vowels.

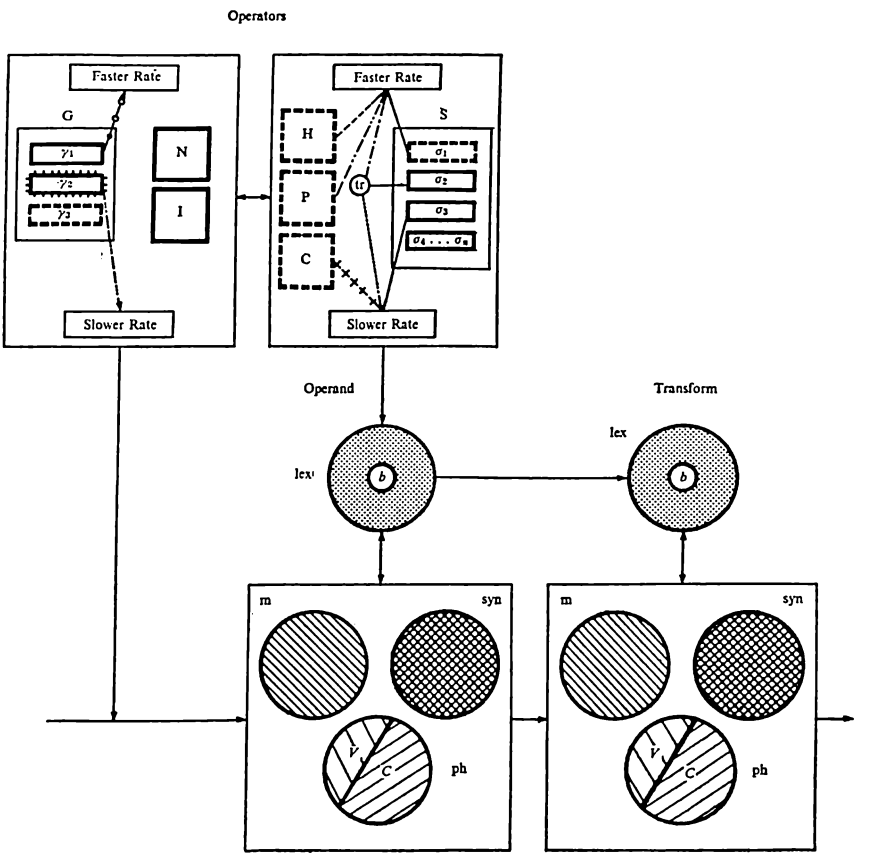
[2] The literature of this problem has been summed up by Klyčkov (1962).



development of the Hungarian sound system, e.g., has not resulted to our knowledge in any change in the development of morphology. The connection between morphology and syntax is questionable from a certain point of view. Word order is usually subordinated to morphology: in case of greater morphemic abundance, word order is, as a rule, fairly free, in case of the paucity of formal means, word order is bound to become more fixed. But the rise of the sentence types, especially that of the subordinate clauses is generally independent of the factors relating to form. The gerundial construction type of Ural-Altaic languages that characterizes also the modern Turkish and Finnish languages, has been totally transformed in Hungarian into one where a subordinate clause construction similar to the Indo-European type dominates.

Thus, *among the levels of linguistic system, that is the subsystems, a mutual connexion and coherency prevails, and the change of one level involves in some way the change of the other, though the interactions cannot yet be demonstrated by even indirect proofs.* This feed-back case can be symbolized as in the figure on p. 70.

In the diagram of Section 4. 4., the arrows are omitted again and the symbol of the vocabulary is separated from the others by reason of its special role.



4.4. THE MATHEMATICAL MODEL OF THE RATE OF LINGUISTIC CHANGES

On the basis of what has been said up to this point, the operators having an effect on the rate of changes and the system of the resultant linguistic transformations can be represented as in the figure on p. 71.

The mathematical model is constituted by the following interrelations:

$$v = v\{H(x), C(y), S[\sigma_1, \sigma_2 (t-t_{tr}), \sigma_3, \sigma_4 \ldots \sigma_n], [G\ \gamma_1, \gamma_2, \gamma_3 (z)] P(q), N, I\}.$$

The components of the vector v are: $v_{ph}, v_m, v_{syn}, v_{lex}$.

Further, $v = \frac{dA}{dt}$ where the components of the vector A are: $A_{lex}, A_{syn}, A_m, A_{ph}$.

Thus, the two equations can be constructed separately according to the mentioned components.

There are the following inequalities:

$$\left|\frac{\partial v_{lex}}{\delta H}\right| \quad \left|\frac{\partial v_{gram}}{\delta H}\right|$$

$$\left|\frac{\partial v_{lex}}{\delta S}\right| \quad \left|\frac{\partial v_{gram}}{\delta S}\right|$$

$$\left|\frac{\partial v_{lex}}{\delta C}\right| \quad \left|\frac{\partial v_{gram}}{\delta C}\right|$$

$$\left|\frac{\partial v_{lex}}{\delta P}\right| \quad \left|\frac{\partial v_{gram}}{\delta P}\right|$$

In the mathematical expressions, v denotes the rate of linguistic changes, A the prevailing linguistic stage, t the time. The inequalities show that the operators H, S, C and P exercise a more direct influence on the word-stock than on the other levels (gram) of language.

Neither the mathematical model, nor the diagram can represent the entire picture of coherencies. The component z in the G operator of the model indicates, but does not express the proportionality as it affects the rate of the changes; the inequality does not mean in the language of mathematics that the operators H, S, C, and P exercise a more direct influence on the word-stock than on the other levels, but it means that this influence takes place more rapidly, and the two are not the same thing. In the diagram I do not indicate all the various effects of the G operator either. Hence, *this mathematical model and diagram serve only to demonstrate* that the complicated and complex phenomena we are faced with cannot be constructed in simplified models like the glottochronologists have done.

5

CONCLUSIONS

5. 1. CONCLUSIONS AS REGARDS LINGUISTICS

From the model it is evident that *science is not able to quantify the very unequal rate of linguistic changes*, and *we cannot expect any improvement in this respect in the future*. Maybe, a few, today still unknown factors will become clearer in the future by thorough scientific investigations, as e.g. the today still subjective nature of the national character; many data of some operators will be exactly measurable in the future (density of population, certain cultural indices, etc.), though these quantitative data cannot always reveal the qualitative substance of the operator. The trouble however is not with this difficulty, but mainly with the possibility of finding the necessary data.

While the linguistic and statistical data (of the present time, and those of the future ages) which may not be always important, but not quite negligible, are or will be known by scientific methods becoming more and more perfect, *discovery of statistical and other data of the past can scarcely be expected.* Surely, some new linguistic records, historical documents will be found, but we cannot obtain fundamentally new data concerning our problem from the periods of several centuries ago. Nevertheless, *the collation of the data of the future with those of the present is not so valuable* in this connexion, *than that of the linguistic, social, historical, cultural, etc. data of the past with those of the present time.* Undoubtedly, linguistic change will never stop in the future centuries of the atomic e and space navigation so long as man lives, the most part of languages that exist today will go further on the way of development of human language, but *there is an immense difference between the na-*

ture of the linguistic changes till now and of the changes that are to be expected in the future. In the manner of living of the modern age, while the contacts are so close between the members of society in consequence of the enormous development of communication (railway, motorcar, aircraft, helicopter and then rocket) and telecommunication (telephone, wire, radio, television, tape recorder, telex, newspapers, books, etc.), *the languages of the educated, civilized peoples* which stand on a high level of industrial evolution *will change much slower than centuries ago*, in the time of horse carriage, parchment and manual printing machine. *The power of just those factors will increase that slow down the rate of changes.* Still the great historical upheavals which have had a considerable influence on the acceleration of linguistic processes will perhaps be eliminated or at any rate become rarer in the distant future (?!). Maybe, violent epidemics, the decimation of the peoples, all kinds of resettlements and deportations will not be a threat to future societies. As for the languages of the still non-civilized peoples, those of the former or still existing colonies, they will either become literary languages in some years or decades, and then they will share the destiny of the old literary languages or they will disappear and become extinct. The changing process of these languages becoming literary languages will furnish very precious data concerning the development of language, but it will be rather a matter of transformation in vocabulary and language reform. That is, *the processes of the languages in the future will yield very scanty data for the solution of the present problem.*

It is not out of question, however, that new operators will appear in the distant future accelerating the process of the linguistic changes. Such an operator may be world tourism that is growing enormously day by day. One can expect that this international movement will be still increasing in the coming centuries so that it will promote a mixing of languages, and thereby the acceleration of linguistic changes. For the time being, we cannot foresee, however, the effect of this and other, still unknown operators.

On the other hand, the hitherto recognized or recognizable data are not sufficient for achieving the quantitative measurements, and

neither linguists nor linguistic science can be blamed for this circumstance. The part of the operators having an effect on the changes and the essence of the connexions between *the factors might be recognized only by empirical means.* But very scanty data are available for drawing any inductive inferences. *From the approximately 3000 languages of the world the history of only 300 is known more or less,* because altogether about as many have had written traditions at all for longer or shorter periods of time. For the most part these languages are just those whose written records are very limited (Phrygian, Thracian, Venetic, etc.), or originated in the recent centuries (Vogul, Ostyak, Swahili, etc.), or though having longer written records the language itself became extinct long ago (Sumerian, Polabian, etc.); furthermore, even the writing itself or the meaning of the texts are not exactly deciphered and explained (Etruscan, Maya, etc.).

Besides, reliable knowledge concerning the history, social life, culture of these peoples are lacking. *For the quantitative computations the data of such languages would be needed in which the use of writing goes back to at least 600-800 years, the number and length of the records are considerable enough and are evenly distributed over the centuries. The number of such languages is about fifty at most. Still the computation of the data of 500 such languages would be required at least in order to demonstrate the role of the manifold external factors and their interconnexions in the linguistic changes.* With full knowledge of so many languages, the effect of the external operators could be separated from each other, and the linguistic changes of each type could be investigated taking the existence of several external circumstances into account.

As we have thorough knowledge of the history of only 50 languages, and owing to the fact that the external factors can be brought into connection only with one kind of changes, *each transformation is after all an individual case* (Norman Conquest and the history of the English language are incomparable with the Turkish Conquest and the history of the Hungarian language) that is *unfitted for drawing extensive and exact conclusions.* The situation will remain unchanged, however, until a wonderful human invention of some kind,

like the time machine of H. G. Wells, removes the cloak of obscurity from the past ages.

From all that has been said so far we have to draw the inference that *the rate of linguistic changes cannot be measured. Languages do not change at an equal rate, even the course of changes which varies from one language to another and from one level to another* within a given language, *cannot be measured by any quantitative methods, and no mathematical model of practical application can be devised.*

5. 11. *The So-called "Archaic" or "Conservative" Languages*

Linguistic science has always distinguished the more archaic languages from the less conservative ones, and I myself have used many times these attributes in the present paper. A contradiction seems to exist in my previous statements when I did not consider likely the measurement of the differences of the linguistic stages by quantitative means, on the one hand, while suggesting that these differences can be judged merely subjectively, on the other hand. The contradiction can be resolved, however, if one looks more closely into the question.

The more archaic or more progressive character of a given language or linguistic stage can be determined with the help of two (co-existing) criteria:

1. To what extent the given language or linguistic stage is intelligible for the present-day generation;

2. With the knowledge of the linguistic history, the absence or presence of such features which though extant in the parent language died out in the other members of the language family.

Anglo-Saxon is an instance of the first case, because these records are fully incomprehensible for the modern generation except for some occasional words. The second case can be characterized by Slovenian which have still preserved the dual.

As for the second case, we must admit that *it is a very subjective criterion*, especially, if we consider that in most instances the inclusions of the languages are made according to one or a few criteria of this kind. Slovenian has developed, e.g. entirely otherwise

conforming to other aspects (cf. the Slovenian sound system) than the other southern Slavonic languages, and in those respects it is less archaic. Still the very conservative Lithuanian has changed very much grammatically (the extinction of neutral gender).

The first case seems to be also of subjective character, for the moment, but it holds out a little more possibility of exact measuring.[1] *The written records could be tested by intelligibility method* according to which it should be examined to what extent the generation of today understand them (if the given language has a continuation in our days). But we cannot get completely reliable data from a quantitative point of view by this method either. *It would fail in cases when we have to compare equally incomprehensible linguistic stages.* Old English is quite so unintelligible for an Englishman of today, as Old High German for a German, though the two languages are not on the same level of development (cf. for instance the blurring of the personal suffix differences in the plural in Anglo-Saxon as against Old High German where this difference was preserved).

When all is said and done *the terms "archaic" or "conservative' will remain rather subjective* also in the future as regards languages or linguistic stages.

True enough, the basic word-stock of the languages will be measurable by the modified means of lexicostatistics in this regard, but language does not consist of vocabulary only.

The view of universal tendency of linguistic development outlined by Tauli (1963), according to which the more synthetic and structurally complicated a language is, the more archaic it is, is a rather general statement, and it is not likely to be true.

5. 2. SOME FAR-REACHING INFERENCES

The domain of the application of mathematics and cybernetics is spreading under the influence of remarkable results gained in a short

[1] Cf. the researches of Voegelin-Harris (1951), of H. Hickerson-Turner-Hickerson (1952), of Pierce (1952), and of Biggs (1957). The latter three researches try two quantitatively measure the results obtained by psycholinguistic test method.

time in such disciplines where the employement of quantitative methods has been out of question so far.

The really imposing prospects of the new branch of learning has stimulated some researchers to cherish exaggerated hopes. It will be to the advantage of both cybernetics and the specialized branches of science if we put a stop to the ardent hopes by turning the investigations in a more sober direction. We have to begin with a revision of the theorems of the theory.

The opinions emphasized by many scholars, among others Claus (1961, pp. 178-179, 182 and 209-212), is partially true according to which the quantitative relations cannot be separated from the qualitative ones, that all things and processes constitute a unity of quantity and quality, therefore explaining them through their quantitative side one reaches qualitative manifestations too, and further, that every qualitative relation can be represented by quantitative, mathematical means. Without question, *qualitative relations do have a quantitative aspect, but their valid description cannot always be carried out by exact methods.* Claus is also in the right that many computations which could not be accomplished so far will be resolved in the future, and the solutions of many problems are to be expected from these investigations. *But there are still many more computations that can never be accomplished in default of the necessary quantitative data, or because the extant ones do not characterize the qualitative relations, processes or phenomena.*

As to the reproach of Claus (1961, 212) that the scientists of the specialized branches of learning do not exactly know their material, cannot exactly formulate what they want to investigate I have to reply that *the fault* does not always lie with them, but *rather with the nature of the very material of the discipline in question. The nature of the universe is such that it is too intricate, the black box is too large*, using the term of cybernetics,[2] *therefore it cannot be completely recognized.* Of course, our knowledge does uninterruptedly become

[2] Black box is such a mechanism, system the internal features of which are unknown, and so we can conclude its transformation only from experiences. If the box is too large, that is, its mechanism is too complicated, its nature cannot be fully recognized through experience either.

more and more perfect and broader, and several subsystems of the universe are not large black boxes. The phenomena investigated by exact sciences can be more easily recognized, as a rule, being the phenomena of the inanimate world less complicated in comparison with the phenomena of the animate world, and *the phenomena of society are the most complicated* within the living world. Undoubtedly, one part of the social phenomena is recognizable, moreover it can be formulated by exact laws. Claus (1961, pp. 450-485) cites some instances, among them the rule of the enlarged reproduction of capitalist economy set up by Karl Marx, that is a characteristic case of the models of cybernetics, according to the author. *Several social phenomena cannot be formulated,* however, *through an exact model: neither can a great part of the linguistic phenomena.*

As I stated in foregoing sections (3. 1 and 3. 2), dealing with the quantitative analysis of phonetic and morphologic systems, *one cannot always pick out the most characteristic link* from among the intricate relations of society that are composed of many units, because *such a link, maybe, does not exist, or it just remains obscure.*

The application of the mathematical methods often yields no essentially new results as against the inferences obtained by qualitative methods. This concerns the method of glottochronology too. Surely, the useless and unsuccessful investigations may often have important by-results that give useful new knowledge in other respects. Lexicostatistics, e.g. can be employed for quantitative subgrouping of cognate languages or dialects without claiming to programme genetic researches.

One of the founders of glottochronology, Swadesh (1952) himself pointed out that the rule of the unequal development of the languages manifested itself still in 19th century not through exact computations but rather through subjective observations. But this observation was based on experiences of the historical data of dozens of the various languages. *The thesis formulated without exactness established from subjective experiences has proved to be true,* however, and a century later the controlling quantitative computations of myself (Fodor, 1961b) and of Bergsland and Vogt (1962) have verified this lawfulness, This example demonstrates that – besides

the truly magnificent results of the application of cybernetics and mathematics – the methodical principle which I am quite ready to admit is still valid: *in many cases when the great number of the phenomena displays a trend of a certain kind without quantitative computations, the mere qualitative observation is quite enough.* In this case, so long as we want to describe the phenomenon only in its rough contours, the quantitative method is superfluous. If however, we want to go beyond appearance, and we are interested in the details from which the recognition of new rules can come, *the application of the quantitative method is indispensable.*

Let me cite a banal case in point. A tourist visiting Budapest (or any other city) can judge after a few days from a superficial looking around that the exploitation of the vehicles of public roads is not equal during the traffic hours. The number of the passengers almost exceeds the capacity of the vehicles between half past 5 and 8 o'clock of the morning and between half past 2 and half past 5 of the afternoon, in the other hours one can travel comfortably, even seats can be found. No traffic expert would wish to obtain a result of another kind by counting the passengers. Of course, the known fact is not yet sufficient for solving the problem, where the frequency of the runs ought to be enlarged, where new runs ought to be started, on the one hand, where the frequency of the runs ought to be reduced or some runs just discontinued. For the sake of solving such problems, the traffic experts usually make passenger counts, because the evidence of the subjective observations are no longer sufficient.

I wish yet to say something on the significance of mathematical models. In many cases, it is very useful to be able to give complicated coherencies a mathematical shape, thus regularities can be expressed more simply and clearly by formulae than by words. *Models*, however, *that want to reveal vulgarized, simplified rules disregarding the manifold quality of the phenomena can be misleading.* It is obvious that explicit rules that can be put into words can also be expressed in symbolized, mathematical language. *The mathematical method helps the special scientist with formulating more simply the rule discovered by him* in order to apply it, to perform com-

putations by it just in the other fields too. *Frequently, new, up to now latent rules emerge through the very symbolization.* In the case, however, *when precise quantitative knowledge of the phenomena is ruled out, the mathematical model is an empty form, if not a self-deception or false thesis.*[3]

Cybernetics and mathematical methods enable the special researcher to get many new results provided he does not abandon the firm ground of the scholarly investigations for the sake of phantasmagorias like glottochronology.

[3] Cf. the remark of Plath (1961, pp. 22-23), and of Zvegintsev (1963*b*, pp. 150-151). Referring to the applicability of the mathematical viz. algebraic methods Bar-Hillel (1963) expresses more doubting views. Concerning the limits of usability of mathematical and statistical methods in lexicology and semantics see Ullmann (1964, pp. 7-8 and 118-121).

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