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STUDY XXVIII

Typological study using the Wroclaw Taxonomic Method

(A study of regional disparities in Venezuela)

by

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## 1. THE CONCEPT OF TYPOLOGY AND ITS PROPERTIES

A typology is a model which defines the position of each element pertaining to a given set in accordance with whether or no certain characteristic features are present in that element. This position may result from the definition of certain relations of order, or relations of equivalence governing the set in question, or even both at once. As such, the typology is a simplification of reality, excluding as it does certain features thereof, and accentuating others.

The elements of the set are grouped in types which in turn form the constituent components of the typology. The individual types, and the typology as a whole, constitute structures whose component parts maintain reciprocal relationships.(1)

In order to gain a better idea of the concept of typology, let us first consider its mathematical and logical basis.

Let us take a set  $X$ , made up of a series of regions (or States, in the present case) of a particular country.

$$X = (x_1, x_2, \dots, x_n)$$

Let us also assume that all components of the set  $X$  are mutually comparable in terms of certain previously defined criteria. On the basis of these criteria, two types of relationship governing  $X$  may be distinguished: one of order and one of equivalence.

The relation of order may be defined as follows: if, for example, the criteria by which we are comparing different regions require us to rank these by level of educational development, then it might be found that these levels in no case coincide. In this case, a relationship of strict total order will have been defined, whose properties are the following:

(a) irreflexive:  $x_1$  cannot be more highly developed than  $x_1$

(b) transitive: since,

if  $x_1$  is more highly developed than  $x_2$

and  $x_2$  is more highly developed than  $x_3$

then  $x_1$  is more highly developed than  $x_3$

(c) anti-symmetric: since,

if  $x_1$  is more highly developed than  $x_2$

$x_2$  cannot be more highly developed than  $x_1$ .

Thus, the relationship of strict total order yields an ordered series of elements which, when compared by pairs, makes it possible to establish for certain whether one is higher than the other.

It is, however, possible that certain regions might all be at the same level of educational development. In this case, the order will be partial and the property of anti-symmetry will not be a necessary condition. Clearly, the relationship of partial order yields a far less clearly defined hierarchy than that of total order.

The relationship of equivalence is different to that of order. Let us assume that the components of the set X have been arranged in a relationship of strict total order. Now, our concern, however, is to compare these components in terms of certain characteristics of their educational structure which do not necessarily express differences of level. In this case, we work on the hypothesis that structural disparities do not necessarily translate differences of level. The aim is here not to order the different components but to identify relations of similarity and to determine which regions possess the same type of educational structure.

The relationship of equivalence possesses the following properties:

(a) reflexive: if  $x_1 \in X \longrightarrow x_1 R x_1$   
each element of X is similar to itself

(b) transitive: if  $x_1 R x_2$   
and  $x_2 R x_3$   
then  $x_1 R x_3$

(c) symmetric: if  $x_1 R x_2 \longrightarrow x_2 R x_1$

where R means "possessing an educational structure similar to ..."

The relationship of equivalence yields a division of set X into disjunctive classes or sub-sets disjoined by pairs. The division of a set is termed a "family of parts (called classes) of X such that each component of X pertains to one and one only of these parts".(2)

The classes of equivalence obtained thereby are mutually exclusive; this may be expressed as follows:

$$\text{if } x_1 \in C_1 \longrightarrow x_1 \notin C_2$$

$$\text{and } C_1 \cap C_2 = \emptyset$$

where  $C_1$  and  $C_2$  are two distinct classes.

The result thus obtained is a classification and not a ranking, as was the case in the relationship of order.

We have chosen to distinguish between levels of educational development and types of educational structure. The two types of relationship might also be combined to yield a more comprehensive picture of the situation. If, in fact, a relationship of strict total order were to be established for the  $C_1$  set of classes of equivalence  $C_1$  of X, an ordered classification or typology<sup>1</sup> would be obtained. It is not, however, the  $x_1$  elements of X but the  $C_1$  classes of

equivalence of X which determine the properties of the relationship of strict total order; the class becomes the basic unit of comparison. In the present case, we have worked on the contrary hypothesis to that set forth above and have supposed that equivalence of educational development levels reflects a similarity of educational structures. In the present study we have worked essentially on the first hypothesis. The second is outlined simply to illustrate alternative methods of constructing typologies.

In conclusion, a typology, as we have defined it, requires, as the pre-condition of its existence, the identification of a relationship of equivalence throughout a given set. In fact, it is the classes of equivalence which enable types to be identified, the hierarchical order of the components of a set not in itself constituting a typology, since it does not directly define the qualities of these components. It is, as has been seen, possible to identify an order throughout the classes of equivalence, and even within each class. This will yield ordered and non-ordered typologies. The relationship of equivalence will, however, always be a prerequisite for the construction of a typology, and this latter must determine the properties of such a relationship.(3)

## 2. TYPOLOGY, AN INSTRUMENT OF RESEARCH AND PLANNING

The recent expansion of research activities in the field of economic and social development planning has led research workers to recognize, implicitly or explicitly, the great diversity of levels and qualitative characteristics of the phenomenon in question. This has prompted a growing concern to gain a fuller knowledge of the realities of the situation obtaining in each country, in order that general planning methods may be tailored to individual cases.

Once the diversity of the situations in which the development process is occurring is recognized, the importance of typologies at once emerges. The number of social and economic development typology construction projects that are at present being carried out is quite considerable, and it is not within the scope or purpose of this study to make a detailed examination of each one. "Such projects are generally designed to define empirically the economic and social development levels of developing countries. Efforts may also be focused on making an interpretation thereof, in order to work out development strategies for each group of countries..."(4)

With respect to our own specific field of study, an obvious symptom of this concern is to be seen in the work being carried out by Unesco and by UNRISD, an agency set up specially by the United Nations to promote the study of economic and social factors in the development process. Unesco's own programme is one of relatively recent origin. In December 1967, a meeting of experts was held in Warsaw, under Unesco's auspices, whose main purpose it was to conceptualize a methodology of human resources development.(5) This initial effort subsequently crystallized in the formulation of what came to be known as the programme to establish a system of human resources indicators. The following were the aims of this programme: "(a) to bring about a conceptual clarification as regards the scope and content of the human resources concept; (b) to identify well-defined, quantifiable components of the human resources complex for which indicators should be constructed; (c) to elaborate a method of aggregation of these component indicators into a complete index (or indices); (d) to demonstrate the workability of such indices for international comparisons and grouping of countries, as well as for research on the relationship between human resources

and economic growth".(6) On the basis of these objectives, several seminars were organized to carry out depth research into the subject.

UNRISD was set up in 1964 by the United Nations to undertake research on social development problems and policies as well as on the relationship between various kinds of economic development in countries at different stages of economic growth.(7) Similarly, the French organization IRFED has provided for a research programme to study the question of social quantification and the methods of analysis of living standards.(8) Mention should also be made of the studies carried out by OECD concerning the relationship between levels of economic development and occupational and educational structures(9), and of various individual projects undertaken under the auspices of national and regional institutions.(10)

These individual and group studies all testify to the important rôle played by typologies in research and planning work. Typology is a tool of research in that it enables us to gain a knowledge of the general and particular features and phenomena of a particular situation. The type-casting of a situation yields a more sophisticated knowledge thereof, and makes it easier to adapt general principles to each specific case. Moreover, if it is granted that typology is based on the comparison of a series of components of a given set, by reference to a variety of criteria and indicators, it can also constitute an aid to planning. In theory, planning is a rational operation the purpose of which is to apply a set of means to obtain a set of objectives.(11) The problem of choice arises when there exist a number of different objectives and a range of means of achieving them. Thus, planning can also be defined as a process of choice and decision-taking. In all decision-taking, account must be taken of a set of criteria which will enable both objectives and means, and the situations and problems likely to be affected by the decisions, to be classified and ranked by order of importance. Clearly, the concept of typology is implicit in this process. It helps - or should help - to rationalize decision-taking with respect both to preliminary research and to subsequent planning.

It is, however, at the regional level, within the individual country, that typologies acquire their major value and importance. The validity of typologies formulated at the international level is frequently limited by the extreme diversity of the characteristics of the countries compared. Moreover, the specific features of each country are all too frequently disregarded. The measurable components of an educational system (school attendance rates, drop-out rates, graduation figures, and so forth) are arbitrarily taken out of their particular educational and social context, while the differential significance of these components in this same context is overlooked. This occasionally results in attempts being made to compare what cannot be compared, and in failure to compare what does lend itself to comparison.(12)

At the national level, however, there is greater scope for comparative analysis, since the uniformity and homogeneity of the components of each country's profile are greater. The basic statistics and standard characteristics of a country, which generally serve as the basis for international comparisons, are too rough and ready to give a clear-cut picture of the specific features of individual countries. Such parameters reflect only an average situation, and do not express the disparities existing between one area and another in each country. They do not take account of a whole range of levels and kinds of development - a failure which may sometimes lead to the reformulation of the working hypotheses and to the rethinking of the conclusions reached on the basis

of these indicators. We do not dispute the necessity or the utility of international typologies, or indeed of comprehensive surveys carried out at the broadly national level; we do consider, however, that the conclusions drawn from such studies, and the planning decisions based upon them, should be accompanied by more searching studies of the individual regions of a particular country. Furthermore, the depiction of the realities characterizing a country must not be divorced from its situation in the international context. The proper approach would be to enlarge the focus progressively, first situating each region in its national context, then considering the country within the international or continental framework, and finally surveying the situation in global terms.

### 3. GENERAL TYPOLOGY

Let us now examine some of the results obtained by applying Hellwig's taxonomic method to the different States of Venezuela. Lack of space prevents us from describing this method here. However, Hellwig's own study, as also various other works<sup>(13)</sup> may usefully be consulted.

We shall begin by studying the general typology, formulated on the basis of the following indicators: (1) percentage of the labour force employed in non-agricultural activities, (2) percentage of the population concentrated in centres of 2,500 or more inhabitants, (3) percentage of dwellings installed with electricity, (4) percentage of dwellings installed with running water, (5) percentage of dwellings with sanitation, (6) percentage of the population aged between seven and 14 attending establishments of education, (7) percentage of the population aged 15 and over able to read and write.<sup>(14)</sup>

The most salient factors to emerge from an initial comparison of the three general typologies, illustrated by graphs IV-1, IV-2 and IV-3, are - taking as reference point the typology for 1961 (graph IV-3) - the following: firstly, a greater number of types (eleven) were obtained for this year, as compared with nine for 1941 (graph IV-1) and for 1950 (graph IV-2); secondly, a greater number of special types (consisting of a single State) were obtained (four, as compared with three in 1941 and in 1950); lastly, a greater number of "pairs", or types formed by two States, were obtained.<sup>(15)</sup>

In addition to these changes, the relationship of similarity and the pattern of association between the States altered significantly between the years 1941-1961. Let us briefly survey these changes. (1) Type II, which in 1941 was composed of the States of Aragua, Carabobo and Zulia, maintained the same pattern until 1950; from 1950 on, however, the pattern altered: Aragua and Carabobo maintained a reciprocal relationship, while Zulia moved closer to the State of Miranda; moreover, it ceased to be the image of the Federal District. (2) To type III, which in 1941 was formed by the States of Bolívar, Monagas and Anzoátegui, were later added Miranda and Táchira, joining together to form type IV in 1950; this link-up was followed by the all but total disintegration of the original type. In 1961, Anzoátegui and Bolívar became severed from the group and entered into a reciprocal relationship to form type IV of that year; Monagas also seceded and joined type VI of the same year. Miranda became the image of the Federal District and, in a reciprocal relationship with Zulia, constituted type II for 1961. Lastly, Táchira moved even farther apart, becoming a special type in 1961 (type VII). (3) Type V, which in 1941 was composed of the States of Falcón, Lara and Sucre, incorporated the Delta Amacuro in 1950, constituting type V of that year; in 1961, however, it lost Lara and gained Monagas, which in

1950 had belonged to type IV, thus constituting type VI in 1961. This type tended to disintegrate less than the previous type. (4) Type VI, which in 1941 was composed of the States of Mérida, Miranda and Táchira, disintegrated completely. In 1950, its disintegration was only partial, since Miranda and Táchira remained together, albeit not in a reciprocal relationship, becoming integrated with type V; Mérida linked up with Trujillo to form type VII in 1950. By 1961, the disintegration of this type was complete, its three original States each belonging to different types. (5) Type VII, as it existed in 1941, also disintegrated. It was originally composed of the following six States: Apure, Trujillo, Guárico, Portuguesa, Yaracuy and Cojedes. In 1950, Apure linked up with Portuguesa to become integrated with type VIII, while Guárico and Yaracuy joined together in a reciprocal relationship to form type VI. Trujillo meanwhile constituted, jointly with Mérida, another type altogether. By 1961, only Portuguesa and Cojedes remained together of the original type; to these, however, Mérida and Trujillo linked up to form type IX. Barinas and Apure drew apart from the group, to form the pair identified in 1961 as type X. (6) The original pair composed of Barinas and Delta Amacuro split up, each State becoming linked to a different type. (7) With regard to what in 1941 were identified as special types, the Federal District maintained its position and its image (Zulia) in 1950, but changed in 1961, moving closer to the State of Miranda. Nueva Esparta changed its image three times, while Amazonas changed its image in 1950, but did not change again in 1961.

The changes described above reflect a process of disintegration in the relationships of similarity linking the various States. By and large, it may be said that between 1941 and 1950 a trend occurred towards partial integration, while the period 1950-1961 was marked by a pronounced trend towards disintegration. A comparison of the two periods reveals that the latter was more far-reaching than the former.

Another conclusion to be drawn from the foregoing analysis is that this disintegration mainly affected those types composed of rapidly developing States, in which the country's major poles of growth are situated. We are referring here essentially to types II and IV as these existed in 1950 (graph IV-2). Moreover, the trend towards rapid expansion moved in inverse ratio to the duration of the association linking these States. In other words, these rapidly developing States maintained less lasting relationships with their images and with the other States forming their types. It is highly significant, for example, that the State of Miranda, which boasted the highest growth rate between 1941 and 1961, changed its image three times, becoming linked with three different types. Another significant phenomenon is the almost total disintegration of types II and IV as these existed in 1950.

Let us follow this brief outline of the evolution of the different types, characterized by the breaking down of the original relationships and the establishment of new ones, by tackling the problem of the intensity of these relationships and the strength of the structural characteristics of the types, basing ourselves on the distances between them charted in the graphs and on the average profile recorded for each type.(16)

Let us take as our example the typology for 1961 (graph IV-3). The taxonomic method enabled us to identify eleven types, whose profiles are represented in diagram IV-3. If, however, only the configuration of the profiles is considered, and not the distance separating them, then the number of types is reduced. It was noted on several occasions that the distance recorded by means of the

taxonomic index of resemblance is a general measure of the proximity of two States to each other. If the structural form or profile alone is taken into account, then a slightly different grouping is obtained.

Types I, II, III, IV, V and VII possess similar profiles but are situated at different development levels, thereby demonstrating that the relationship of equivalence between two or more States does not necessarily presuppose any correspondence in their ranking. In all the above-mentioned types, the economic modernization and urbanization sectors show higher development levels than those of the housing and education sectors. These types illustrate clearly six cases of structural imbalance generated by the time-lag between economic and social development. This imbalance is in fact the predominant feature of the country. Admittedly, these six types account for eleven States, half the total number; however, an examination of the remaining profiles reveals a striking lack of consistency in the ranking of the different sectors of regional development as a whole. In types VI, VII, IX, X and XI, the levels attained in the economic modernization and urbanization sectors are more or less on a par, the major fluctuations occurring in the housing and education sectors.

By and large, the greatest diversity in the structural patterns occurs mainly in those types which in 1961 were made up mainly of States which were underdeveloped in all sectors; the disparity in relation to the situation obtaining in 1950 and in 1941 becomes quite apparent. This indicates that the diversification of structural characteristics extended also to the underdeveloped regions of Venezuela. Secondly, States tended to move closer to their images; this, however, in turn fostered the proliferation of types which was a key feature of 1961. In other words, the relationship of similarity (its intensity) linking States pertaining to the same type became closer than formerly, but the types themselves tended to draw increasingly apart, in particular those composed of underdeveloped States. Among the more advanced States there was greater similarity of structural pattern.

#### 4. EDUCATIONAL TYPOLOGY

The educational typology was drawn up on the basis of the following indicators:

1. Ratio of the literate population aged 15 and over to total population aged 15 and over.
2. Ratio of the population aged between 7 and 14 attending school to total population of the same age group.
3. Ratio of the population aged between 15 and 19 attending secondary and higher educational institutions to total population of the same age group.
4. Ratio of the population aged between 20 and 24 attending establishments of higher education to total population of the same age group.
5. Percentage of the population aged 25 and over not having completed a single year of formal education.



6. Percentage of the population aged 25 and over having undergone at least one year of primary education.
7. Percentage of the population aged 25 and over having completed at least one year of secondary education.
8. Percentage of the population aged 25 and over having completed at least one year of higher education.

Indicator No. 1 is a general yardstick of the educational level of the population aged 15 and over. The other indicators refer to two different populations: indicators Nos. 2, 3 and 4 (the three school attendance rates) record the educational level and structure of the 7-24 age group; indicators Nos. 5, 6, 7 and 8 serve to analyse the educational structure of the population aged 25 and over, one that, in view of the part played by it in the production process, is of major importance.(17)

The comparison of graphs VI-1 and VI-2 reveals that the same number of types were obtained for 1961 as for 1950. Of these, four were special types, three types were composed of pairs and three others of between three and six States. As was the case in their general typology, the States tended to show increasing disparities. Moreover, transferences of image were fairly numerous in comparison with those observed in the economic and manpower typologies, which we were unable to take into account in the present study.(18)

In order to gain a clearer picture of the changes which occurred during the 1950-1961 period in the educational structure at the regional level, let us examine the different patterns of development recorded in graph VI-3.(19) The graph yields quite different results considered from the diachronic standpoint. Nine patterns of evolution were identified, with only two cases of concordance of image in relation to the synchronic typologies discussed above; these were the States of Aragua and Carabobo, which maintained their reciprocal relationship in the two typologies. The disparities between the synchronic and diachronic typologies appear even greater if it is considered that States which belonged to the same type in 1950 evolved in different ways and yet were still linked together in 1961; moreover, States which belonged to different types showed similar patterns of evolution, but diverged in the matter of their structural characteristics by 1961.

Moving on to table VI-6, let us now examine more closely the key features of the evolution of the educational structure. While the literate population increased in all our types, the growth rate differed from one type to the other. Types VII and V showed the highest rates, type III showed the lowest. In type V were grouped together the developing States.

Likewise, the school enrolment figures for the 7-14 age group increased in all types. The growth rates for school enrolment of the 15-19 age group proved considerably higher than those recorded for the lower age group, testifying to a major educational effort at the secondary level. Nevertheless, the disparities between the growth rates were far more pronounced.

While an appreciable increase in school enrolment figures occurred in all types at the primary and secondary levels, the same is not true in the case of the 20-24 age group enrolled in higher education courses. The figures for this school population dropped in almost all types and in almost all States. The

only types in which an increase was recorded were those grouping together States which possessed universities or other institutes of higher education. From 1953 on, major efforts were made to regionalize higher education, but table VI-6 shows that the creation of new universities and the expansion of established ones triggered off an influx of the student population into the areas in which these institutions were located.

Let us now consider the evolution of the educational pattern of the population aged 25 and over. The population lacking all formal schooling increased in all but type III. In those types grouping together the most highly developed States, this population increased, although in relation to the total population it tended rather to diminish. In this case, a negative growth rate is a positive element. The percentage of the population having completed at least one degree of primary education also increased in all but type I, the highest rates being recorded for types grouping together the more advanced States. The increase of this population is to be expected in the first stages of the process of educating the adult population, inasmuch as it is swollen by the newly literate population. In the long term, however, the aim must be to reduce this population in order that the educational process may be continued at the higher levels. At the secondary level, the increase was generalized, the highest rates being recorded for types I and V. On the other hand, considerable disparities in the growth rate occur at the higher educational level; extreme cases are type III, where this population decreased at an annual rate of -9.2%, and type V, grouping together States from the north-central region, the most highly developed of all the regions, where an annual growth rate of 5.7% was recorded.

In all types, the disparity is appreciable between the population aged seven to 14 attending school - the direct beneficiary of the educational progress achieved at all levels of formal education - and the population aged 25 and over, for the most part incorporated in the labour force. This disparity reflects the scant importance given to the education of the labour force and of the adult population generally during the period under consideration.

The developed States possess the major share of the country's skilled manpower; even here, however, the situation still remains very far from what might be considered the ideal, namely, a labour force whose every member possesses some kind of formal qualification. The marginal population which grew up in Caracas between 1950 and 1961 failed to receive adequate educational opportunities. This population comprised most of the workers affected by the critical unemployment situation which obtained in Venezuela and particularly in Caracas and in the other major urban centres in 1961.

## 5. SOME CRITICAL OBSERVATIONS CONCERNING THE TAXONOMIC METHOD

In this final section we shall draw a number of critical conclusions concerning the methodology used in our study. These are the fruit of observations made in the course of our research work, on the basis of different cases studied. They can be summarized as follows:

1. The taxonomic method is doubly useful in achieving the optimal partition of a set. The partition of the set being studied, or the standardization of types, is done by determining two critical points, an upper and a lower. The upper critical point enables groups of States to be isolated and those States which possess special features in relation to the entire set, or to States of their own type, to be identified. The lower critical point serves to effect not a separation but a grouping together of States whose distance from each other

is below this key point. The aim is, firstly, to obtain the maximum number of types thereby making the typology more exhaustive, and, secondly, to limit the number of elements to be compared, thereby greatly simplifying the subsequent work of analysis. In our own case, we were able to use only the upper critical point in order to identify the special types. The value of the lower critical point proved negative in most of the cases analysed; it is impossible, however, that the distance measured by the taxonomic method should be negative.

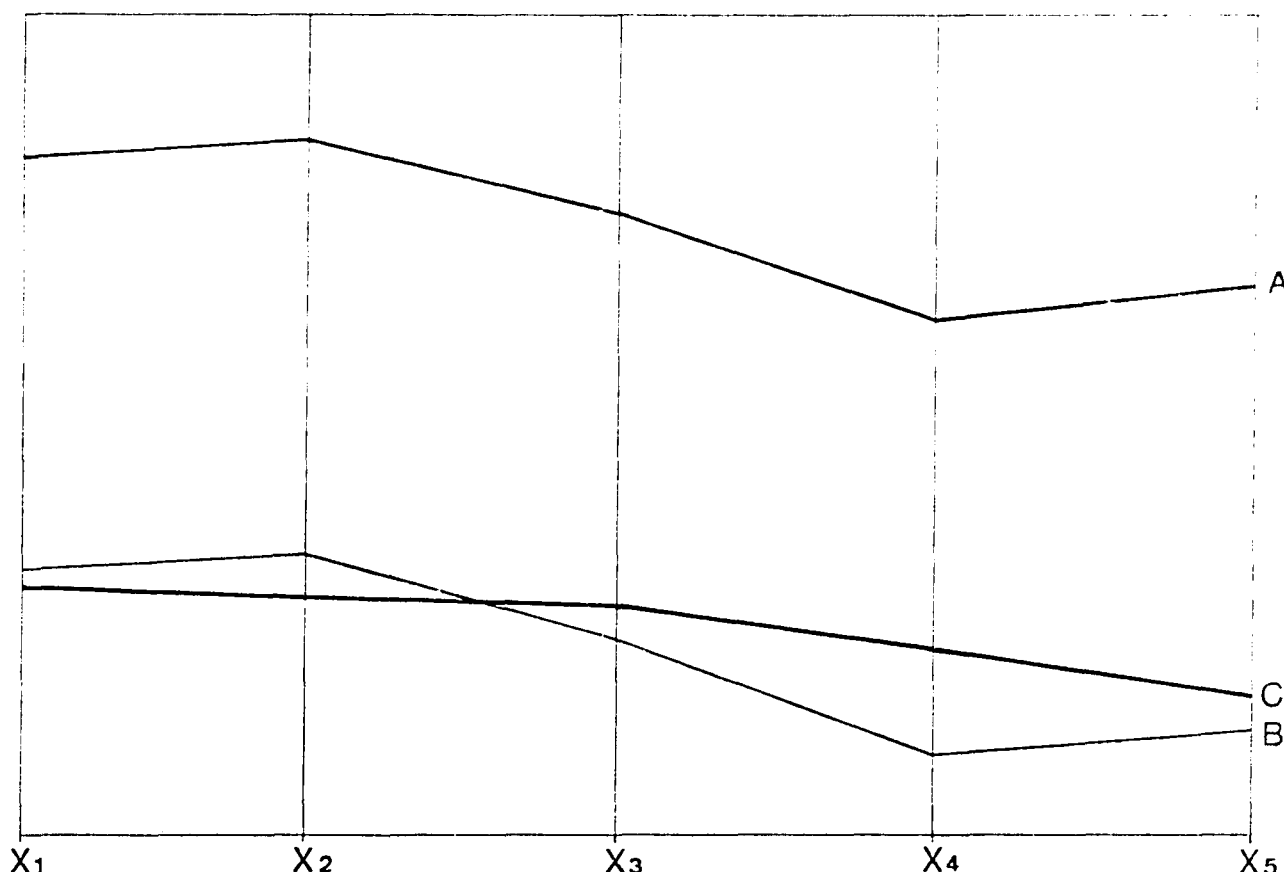
The chief drawback of this procedure is that it can be extended only to cases in which the minimal distances obtained conform to a regular distribution pattern. This difficulty could, however, in our view, be overcome in two different ways. Firstly, a technique could be devised for making a partition suited to each kind of distribution pattern, resorting to the  $X \pm 2 S$  test only when the distribution pattern of the distances is normal. However, the upper limit proved fairly well suited to the problems which we studied, enabling us to obtain typologies consonant with the realities of the Venezuelan situation. Secondly, inasmuch as this procedure is designed to achieve optimal partition of the set as also the standardization of types, a yardstick might be devised for measuring the degree of uniformity of the set of distances of each type. In this way, a specific degree of uniformity would be determined a priori and the curves of the graphs would be eliminated until this degree had been reached. We have adopted a yardstick of the degree of uniformity of each type by determining the value of the variation coefficient by reference to the mean distances of each State in relation to the other States of the same type. We used it, however, not as a means for splitting up the typologies but rather as a descriptive tool, providing us with a knowledge of the degree of uniformity of each type. On this basis, it should be possible to ensure the uniformity of a given type by setting as our target a specific value of the variation coefficient and to calculate this coefficient successively by subtracting a different State at each operation. Once this value was attained, the State or States (or the country) which constituted a heterogeneous factor within the type, in other words, those States whose mean distance in relation to the others belonging to the same type proved to be considerably greater than the other distances, would be isolated. The principle underlying this procedure is somewhat akin to that applied by Hellwig, but does not presuppose any particular distribution pattern. It has one disadvantage, however, in that the choice of the critical point is not made on the basis of any objective calculation but is arrived at quite subjectively by the research worker.

At all events, the construction and adjustment of typologies must be considered part and parcel of the work of optimization. In this field, the principles of operational research and multivariate analysis are likely to prove of great use.(19)

2. The taxonomic index of resemblance enables us to measure the proximity of two States, countries or elements which it is desired to compare by different criteria. The significance of the distance recorded is, however, relative and occasional ambiguities may arise in its interpretation. Similarity, or resemblance between two elements, can be either qualitative or quantitative. In our own research, we established the difference between the proximity of States and the similarity of what we have termed their structural form.

Let us, for example, take three States A, B and C. The following diagram shows that States B and C possess values that approximate very closely to one another in all four scales, but that the configuration of their profiles differs.

State B possessed a profile similar to that of State A, while nevertheless lying at considerable remove.



The taxonomic distance indicates only the degree of proximity of two States; it does not show the structural pattern of the indicators used. In order to supplement the information provided by this distance, we might suitably combine this method with graphic techniques.(20)

This limitation inherent in the taxonomic index of resemblance results, in our view, from the fact that the typological indicators possess their own implicit weight, deriving from the extent of their "presence" in the set of elements being compared. This was confirmed in the analysis of the typology based on the pattern of economic activities resulting from the breakdown, in percentages, of the population employed in the different economic sectors. For example, the percentage of the labour force employed in the petroleum and mining sector of the oil-producing and mining States is small in relation to the percentages of the population employed in the other economic sectors in these same States. In terms of the country as a whole, however, these States account for almost the entire labour force working in the petroleum and mining sector, a fact which has led to their being grouped together in the same type. Thus, the absence of certain characteristics in some cases, and their degree of

concentration in others, can be enough to ensure that the rare elements which possess them are grouped together to form a type, quite independently of the fact that these same elements may resemble one another in other respects.

In addition to graphic methods, a mathematical tool of greater precision might usefully be devised to enable resemblances to be identified in structural form, particularly with respect to the relative closeness of the values of two elements.

3. Let us now consider the possible use of the taxonomic method as a technique for forecasting and determining planning objectives. In this respect, the taxonomic method can, in our view, enable forecasts to be made of a type hitherto unknown. It should be possible to determine one or several ideal future situations for a set of States, countries or elements in general, and thereby to obtain a picture not only of the ranking of these States but also of the type of association and the network of relationships of similarity linking them together. The forecast could thus be formulated in consideration of both quantitative and qualitative factors. By working on different hypotheses of growth, alternative patterns of evolution could be obtained with regard to the relationship of order and of equivalence or resemblance. We should then possess the necessary data to enable us to judge whether the disparities are likely to increase, and whether the set will be governed by divergent or convergent trends.(21)

4. Linked to the problem of determining objectives is the concept of the "ideal" country (or "ideal" State in our own case). We have several objections to the use of this concept. The first one is of a statistical nature. If we take a State or a country as model, or a combination of indicators extracted from a single set considered as an ideal situation, and if we calculate the distance of each State from this point, we obtain a ranking based on the greater or lesser proximity of the States to the model, or reference point, at a given time. In other words, the image obtained will be static or synchronic. Furthermore, if a particular country possesses all the statistical requirements in order to be taken as model, we shall be unable to observe its specific characteristics inasmuch as it will form the zero point of the scale. We were initially confronted in our own research with this difficulty, having taken the Federal District as the "ideal" State, and assumed it to possess all the statistical requirements thereof. Subsequently, we observed that the pattern of the Federal District's indicators remained indeterminate and that its chief features did not constitute what might properly be considered an ideal development situation, in the normative sense of the term. This State is in fact characterized by a considerable measure of imbalance, resulting from the great disparity between economic and social realities. Accordingly, we preferred to drop several of the indicators used initially to construct the hierarchical indices and to apply only those indicators for which it had been possible to fix a maximum limit, considered as representing an ideal situation. This facilitated the process of diachronic analysis, since it enabled us to plot the trajectory of all States towards the ideal development point in all the aspects under consideration. Had we taken the Federal District as our ideal point, we should have obtained a profile of the evolution of the rest of the country exclusively in terms of the development pattern of this State. The number of indicators were, nevertheless, reduced, in view of the fact that an optimal ideal point cannot be determined for all aspects of development.

Our second objection is of a theoretical kind. In this connexion, we share the views expressed by Théotónio Dos Santos in his criticism of traditional development theories:

"... the model of the developed society is the result of an ideological abstraction (since it is formal and, hence 'ahistorical').... It has been generally claimed that it is possible to reduce development to a formal model whose content can admit of historical variation.... However, this assumption has no scientific value, being based on 'ahistorical' principles. Historically, it is quite impossible for certain underdeveloped societies to attain exactly the same development level as that reached by certain other 'developed' societies. Historical time is not unilinear, and one society cannot follow exactly in the evolutionary footsteps of another. All societies move concurrently and together towards a new society. The advanced capitalist societies correspond to a phase of historical evolution that is now over.... None of these specific historical conditions can be repeated today.... The developed socialist societies are the product of the historical experiment of creating socialism in a single country or in a single bloc.... Hence, existing models of development cannot recur, and models of developed societies are in no way the embodiment of ideals to be attained.... The development trend of present-day underdeveloped societies must, therefore, be analysed as a unique experience occurring in certain specific historical circumstances. Hence the need to define those historical conditions which constitute a viable framework for the process of development".(22)

We do not dispute the need to establish a development model, since we constantly project ideal future situations for purposes of planning and forecasting. What we do reject, is the automatic choice of developed societies as models, and their uncritical application to underdeveloped societies, based on a unilinear conception of historical evolution. This is a particularly valid point, we feel, in the case of regional development in Venezuela.

5. The taxonomic method offers considerable scope for diachronic analysis. For example, an ideal trajectory might be plotted on the basis of a given chronological series, and the respective distances of the States or countries calculated in relation to it. The same data can also serve to work out the distances separating one State from another and thereby to chart a typology of trajectories. In this case, the units of time (year, month, etc.) become criteria of comparison. The study of the chronological series might then be appreciably improved, since the phenomenon would be described at the same time in terms of relationships of order and resemblance between the elements being compared.

By linking the concept of the ideal trajectory to that of a correspondence of levels, we should be enabled to proceed farther in our diachronic analysis. According to this latter concept, the trajectory can be determined automatically on the basis of the hypothesis whereby two variables must attain equivalent values in the course of time. This should also enable us to transfer the concept of imbalance, as applied to the analysis of State profiles from the synchronic standpoint, to the study of trajectories. A State will have a more or less balanced trajectory in accordance with how close it lies to a line of correspondence of the values of the two variables in question, determined in advance. Hence the taxonomic hierarchical index is transformed into a yardstick of the degree of imbalance of a given trajectory.

However, the determination of the ideal trajectory by means of a line of correspondence presupposes a unilinear development trend. If other hypotheses of growth are introduced and if other trajectories are plotted, then different tables of the relationships of order and similarity linking States are obtained. In this case, the concept of the balanced trajectory is superseded by that of the optimal trajectory, which may or may not be balanced. All then depends on the definition of the optimal trajectory adopted.

6. The same procedure used to construct typologies of countries can be used to establish typologies of indicators; in this case, it is the distance between the indicators rather than that between the States which will be calculated. This reversal of the calculation makes it possible to identify those indicators which possess similar statistical distribution patterns, and to isolate those which possess distinctive or "special" distribution patterns. It would also be useful to apply the indicators to carry out an hierarchical analysis by defining an ideal statistical distribution pattern and by calculating the distance of each indicator from it. In both cases, the States become criteria of comparison and the indicators become units of analysis. This technique might be extended to the task of selecting indicators, provided that a limit is fixed and that only those indicators are chosen that are situated at a certain remove from the ideal distribution pattern, or between certain given limits.

## REFERENCES

- (1) It should be stressed that the concept of "type" used in this study is not to be identified with that of the Weberian ideal type. On the contrary, the types discussed here are constructed empirically by means of mathematical operations applied to a set of data, representing a set of elements.
- (2) Barbut, M. and Monjardet, B. Ordre et classification; algèbre et combinatoire. Hachette, Paris, 1970, Vol. I, p.9.
- (3) A fuller discussion of the concepts of order and equivalence and on the problem of classification is to be found in: Roy, B. Algèbre moderne et théorie des graphes. Dunod, Paris, 1969, Vol.I, Chap. IV.
- (4) Debeauvais, M. La mesure des niveaux de développement de l'éducation. OECD. DD/TC/4999, Paris, 1966, p.3.
- (5) Unesco. Progress Report I on the methodology of human resources indicators. Unesco/COM (SHC) CS/194/5. Paris, 1968, p.2.
- (6) Ibid, op.cit. pp.4-5.
- (7) UNRISD, Notes sur la recherche. Nos. 1, 2 and 3. Geneva, 1968, 1969 and 1970.
- (8) See: Revue Développement et Civilisations, IRFED, No. 36. December 1968. Paris.
- (9) OECD: Statistics of Occupational and Educational Structures of the Labour Force in 53 Countries. Paris, 1970.
- (10) See: Harbison, F. and Myers, C. Education, manpower and economic growth. McGraw Hill, New York, 1964. Russet, B. et al. World handbook of political and social indicators. Yale University Press, New Haven, 1964. Banks, A. and Textor, R. A cross-polity survey. The MIT Press, Cambridge, 1966. Merritt and Rokkan Comparing nations. Yale University Press, New Haven, 1966.
- (11) See: Ahumada, J. Notas para una teoría general de la planificación. Cuadernos de la Sociedad Venezolana de Planificación, Nos. 4-5. Caracas.
- (12) On this point, see: Bourdieu, P. and Passeron, H.C. "La comparabilité des systèmes d'enseignement", in, Castel, R. and Passeron, J.C. Education, développement et démocratie. Mouton, Paris - The Hague, 1967.
- (13) Hellwig, Z. Procedure of evaluating high level manpower data and typologies of countries by means of the taxonomic method, Unesco. COM/WS/91, 1968. Silvio, J.F. L'évolution des inégalités régionales en matière d'économie, d'éducation et de main d'oeuvre au Vénézuéla. Ecole pratique des Hautes Etudes. Paris, 1971. Doctoral ("Troisième Cycle") thesis (unpublished). Harbison, F. et al. Quantitative analyses of modernization and development. Princeton University, Princeton, 1970.



- (14) The individual typologies (economic, educational, manpower) were worked out on the basis of a breakdown of indicators 1, 6 and 7. Lack of space prevents us from including any but the educational typology, which will be discussed in the following section.
- (15) In mathematical terms, a graph has no geometrical significance. However, in order to facilitate appreciation of the length of the curves, a scale has been adopted to chart the distance between a State and its image.
- (16) Each State profile was represented in similar diagrams. Lack of space prevents us from reproducing them here. For further details, see: Silvio, J.F. op.cit.
- (17) The starting point of our analysis of the educational typology was the year 1950. Adequate data were not available for 1941.
- (18) The same method was used to construct the typology of the development trend, this time applied to the growth rates of the educational indicators.
- (19) On this point, see: Bernard, G. and Besson, M. Douze méthodes d'analyse multicritère. Centre d'Etudes des Techniques Economiques Modernes (CETEM). Paris, 1971.
- (20) See: Bertin, J. Sémiologie graphique. Gauthier-Villars, Paris, 1967.
- (21) On the question of determining objectives by the taxonomic method, see: Gostkowski, Z. "The use of taxonomic measures in target setting based on international comparisons", in: the review Quality and Quantity, Vol.IV, No.2, 1970, Bologna, Italy.
- (22) Dos Santos, T. "La crisis de la teoría del desarrollo y las relaciones de dependencia en América Latina", in: Jaguaribe, Helio et al. La dependencia político-económica de América Latina, Siglo XXI. Mexico City, 1969. pp.152-153.

## LIST OF ABBREVIATIONS

## NAMES OF STATES:

DF = Distrito Federal  
Ar = Aragua  
Ca = Carabobo  
Mi = Miranda  
Fa = Falcón  
La = Lara  
Ya = Yaracuy  
Zu = Zulia  
Me = Mérida  
Ta = Táchira  
Tr = Trujillo  
An = Anzoátegui  
Mo = Monagas  
NE = Nueva Esparta  
Su = Sucre  
Ap = Apure  
Ba = Barinas  
Co = Cojedes  
Gu = Guárico  
Po = Portuguesa  
Bo = Bolívar  
Am = Amazonas  
DA = Delta Amacuro

## DIAGRAMS:

IGD = Index of General Development  
ECO = Index of economic modernization  
URB = Index of urbanization  
DWEL = Index of material conditions of dwellings  
EDUC = Index of educational development

GRAPH IV-1 GENERAL TYPOLOGY Year 1941

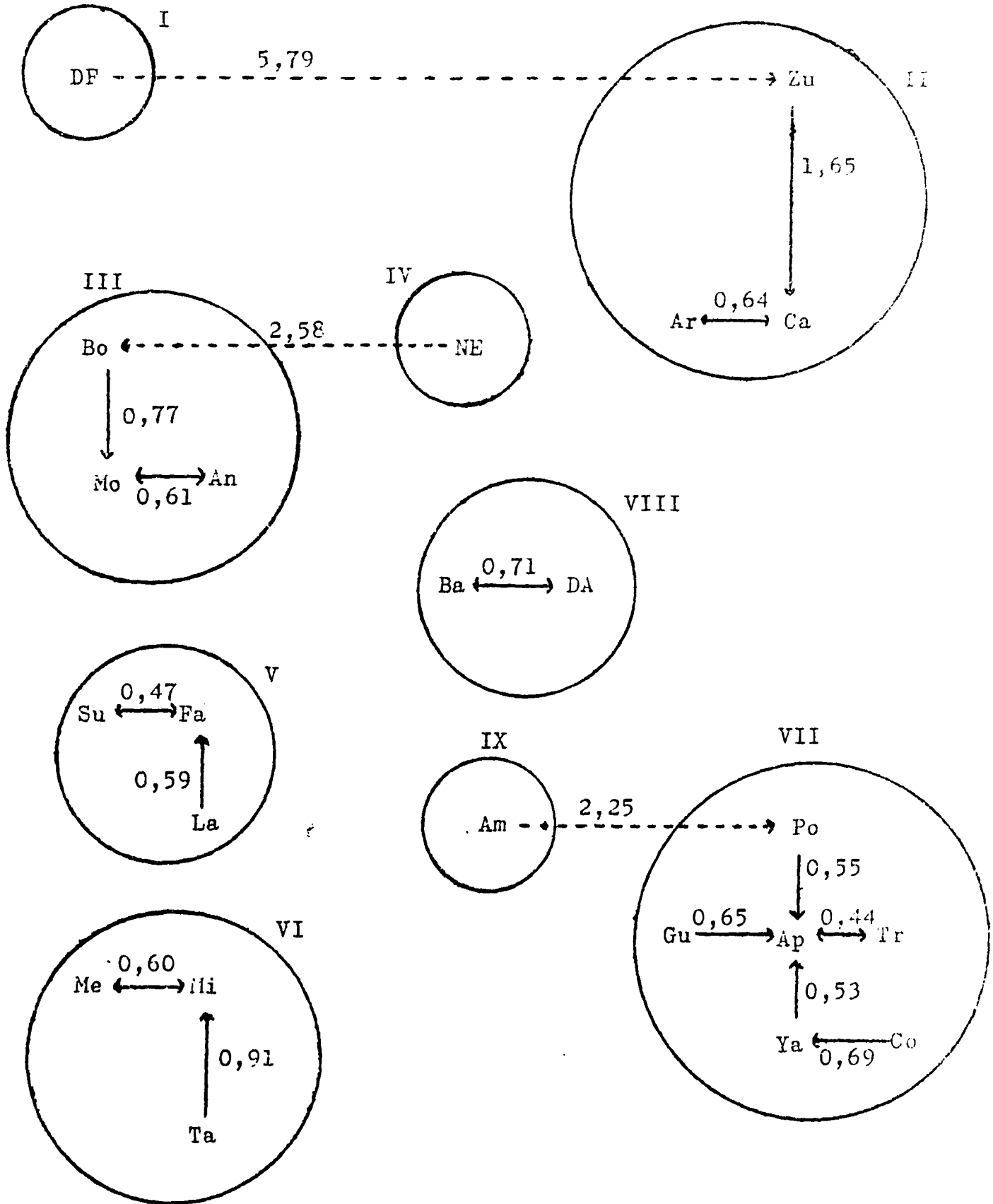
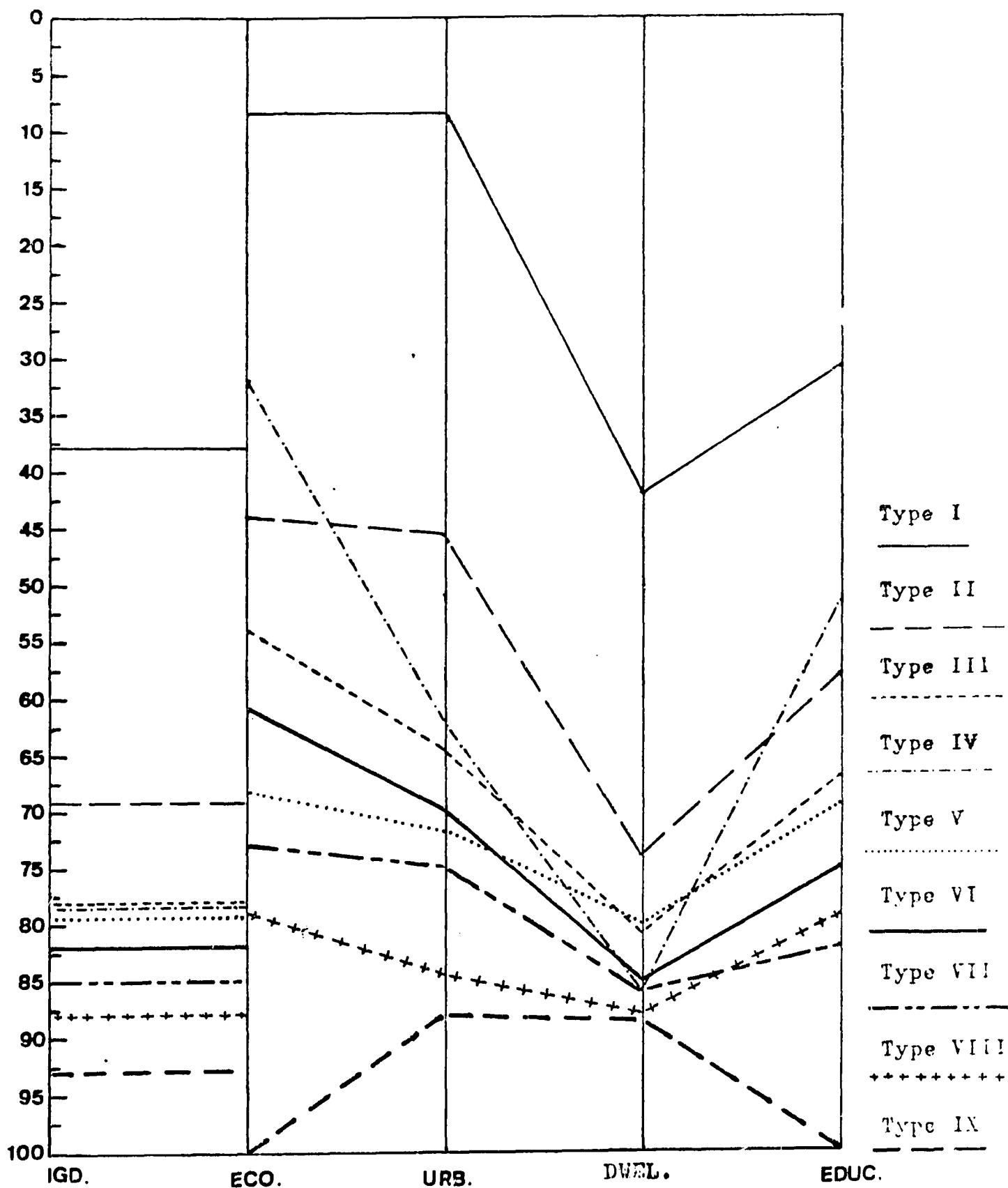


DIAGRAM IV-1. PROFILES OF TYPES Year 1941



GRAPH IV-2 GENERAL TYPOLOGY Year 1950

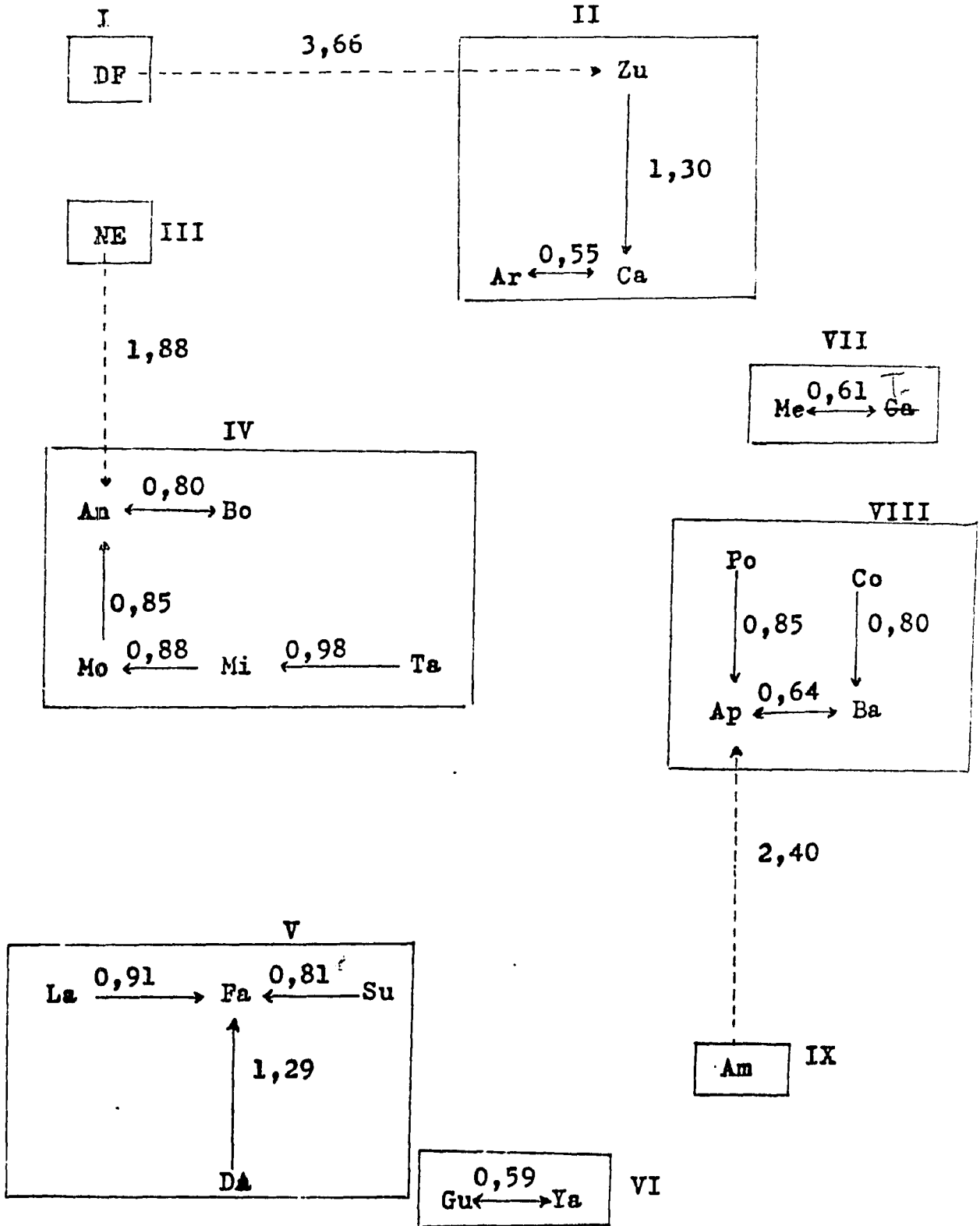
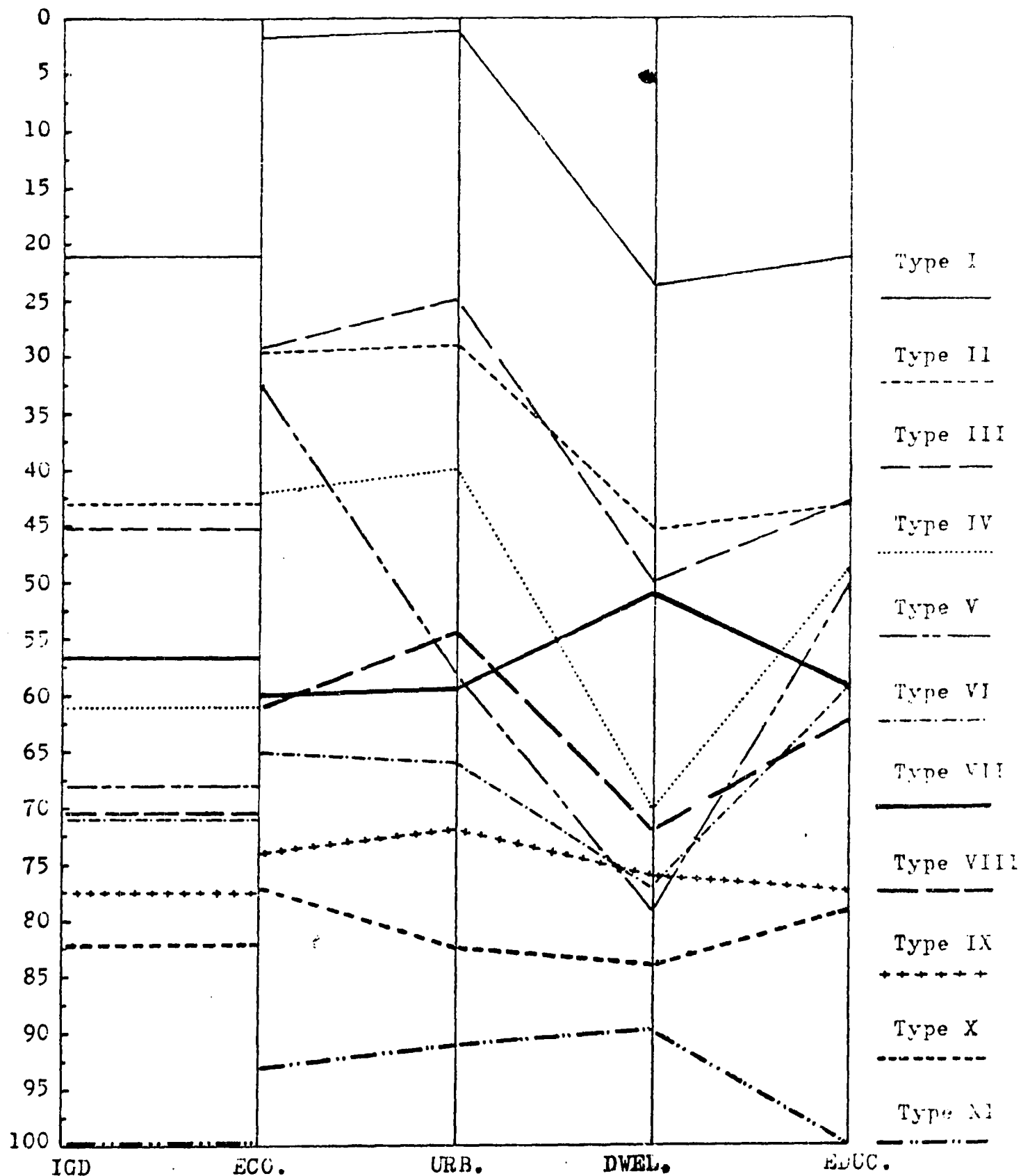


DIAGRAM IV-2 PROFILES OF TYPES Year 1950



GRAPH IV-3 GENERAL TYPOLOGY Year 1961

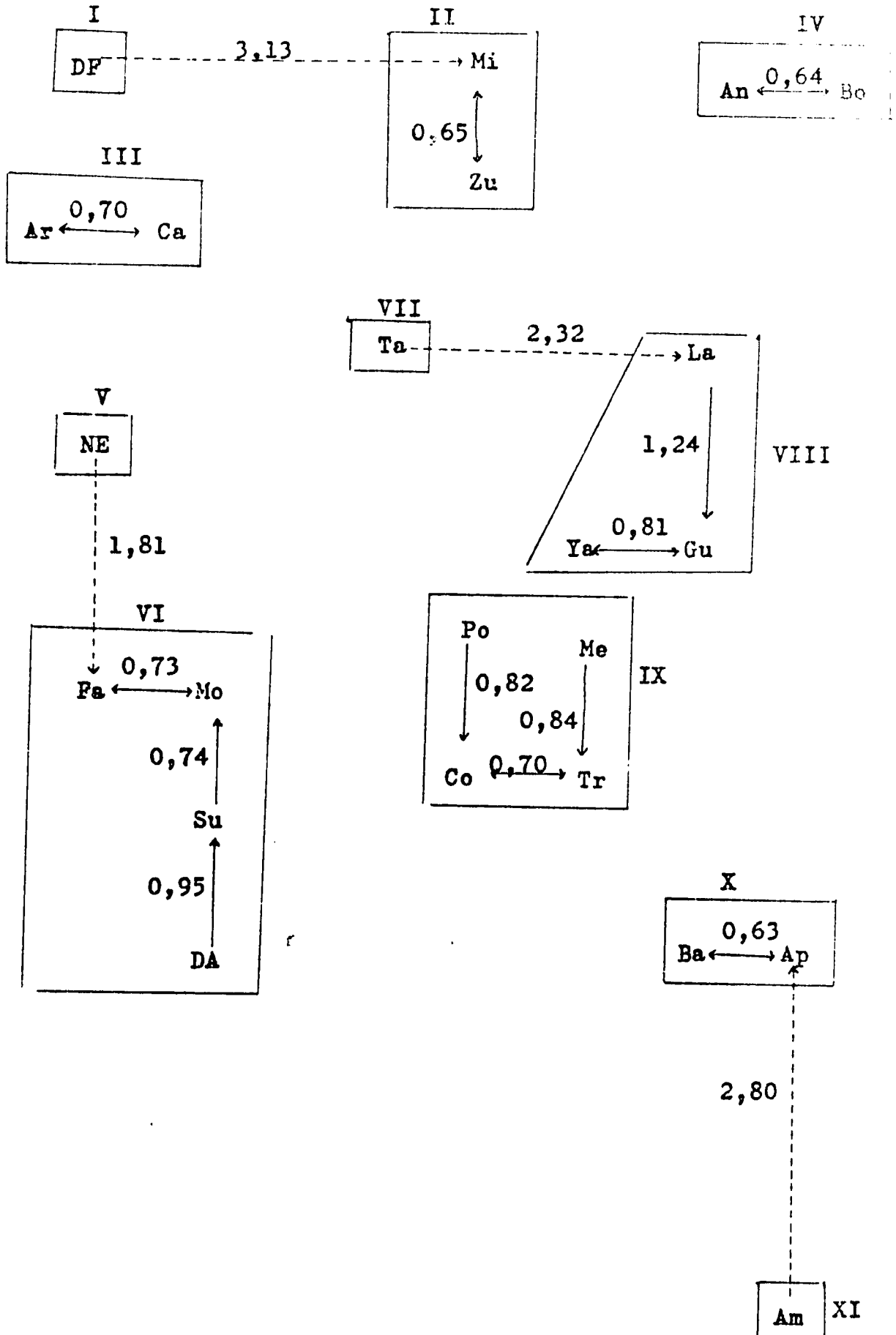
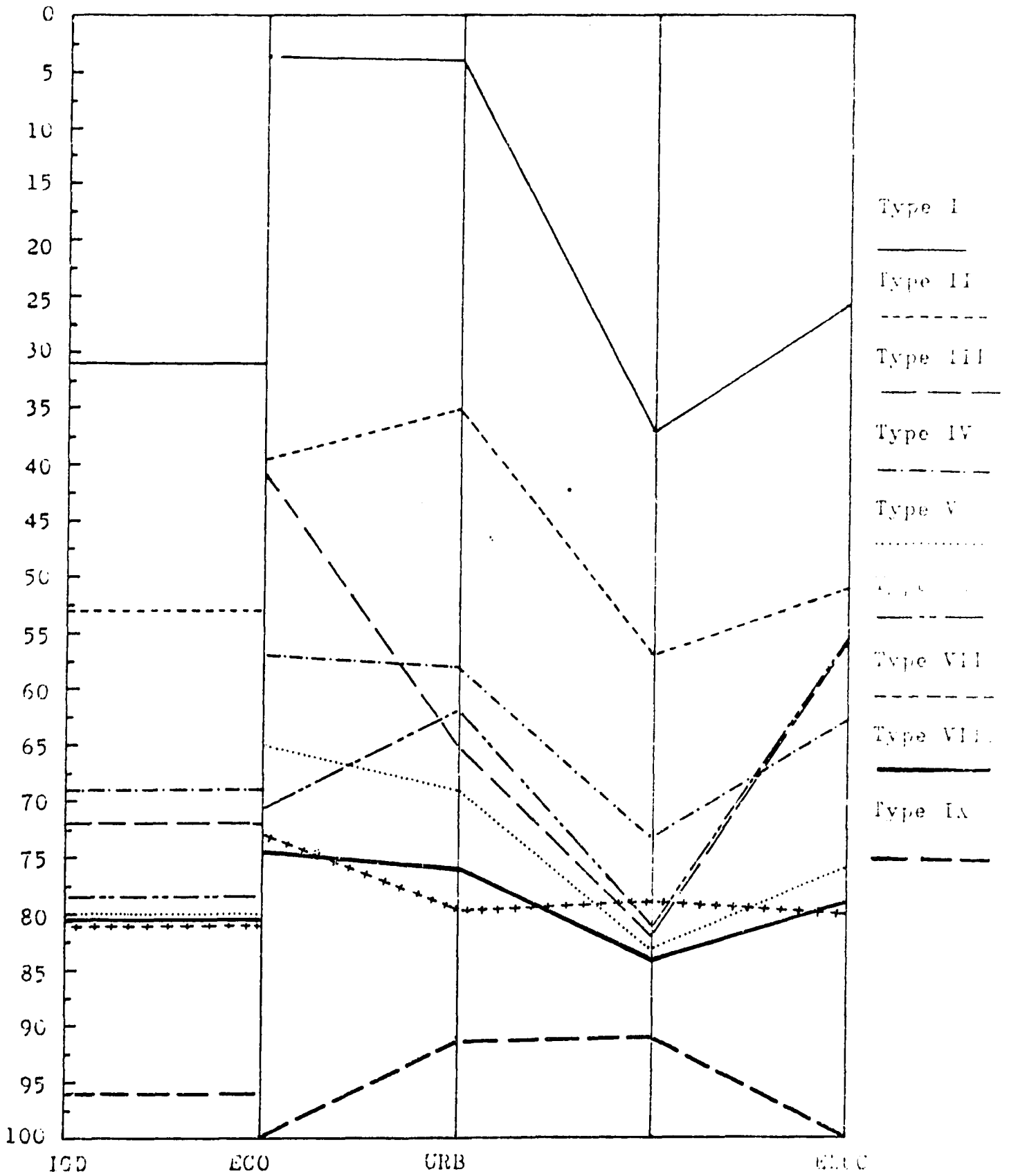
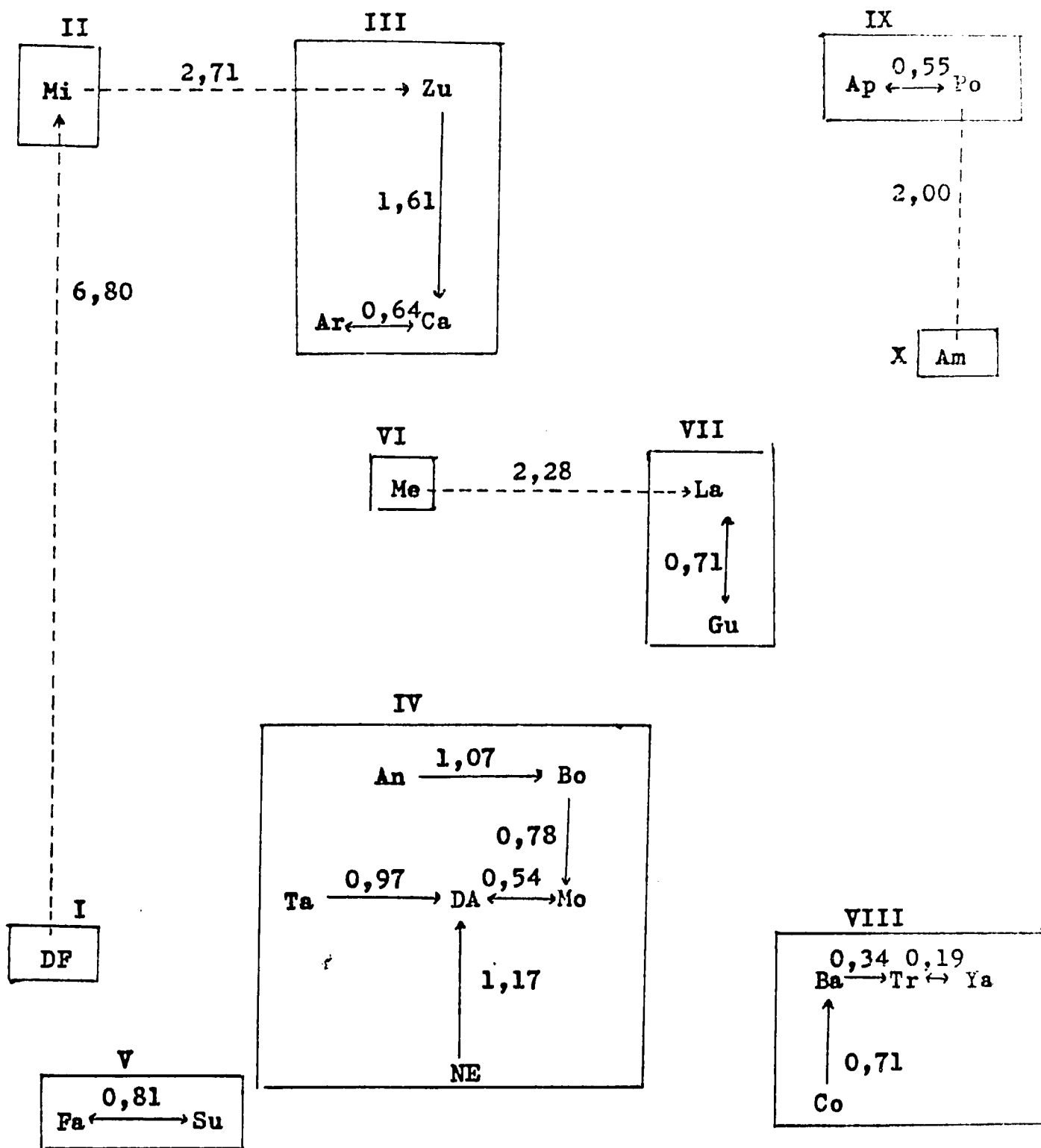


DIAGRAM IV-3 PROFILES OF TYPES Year 1961

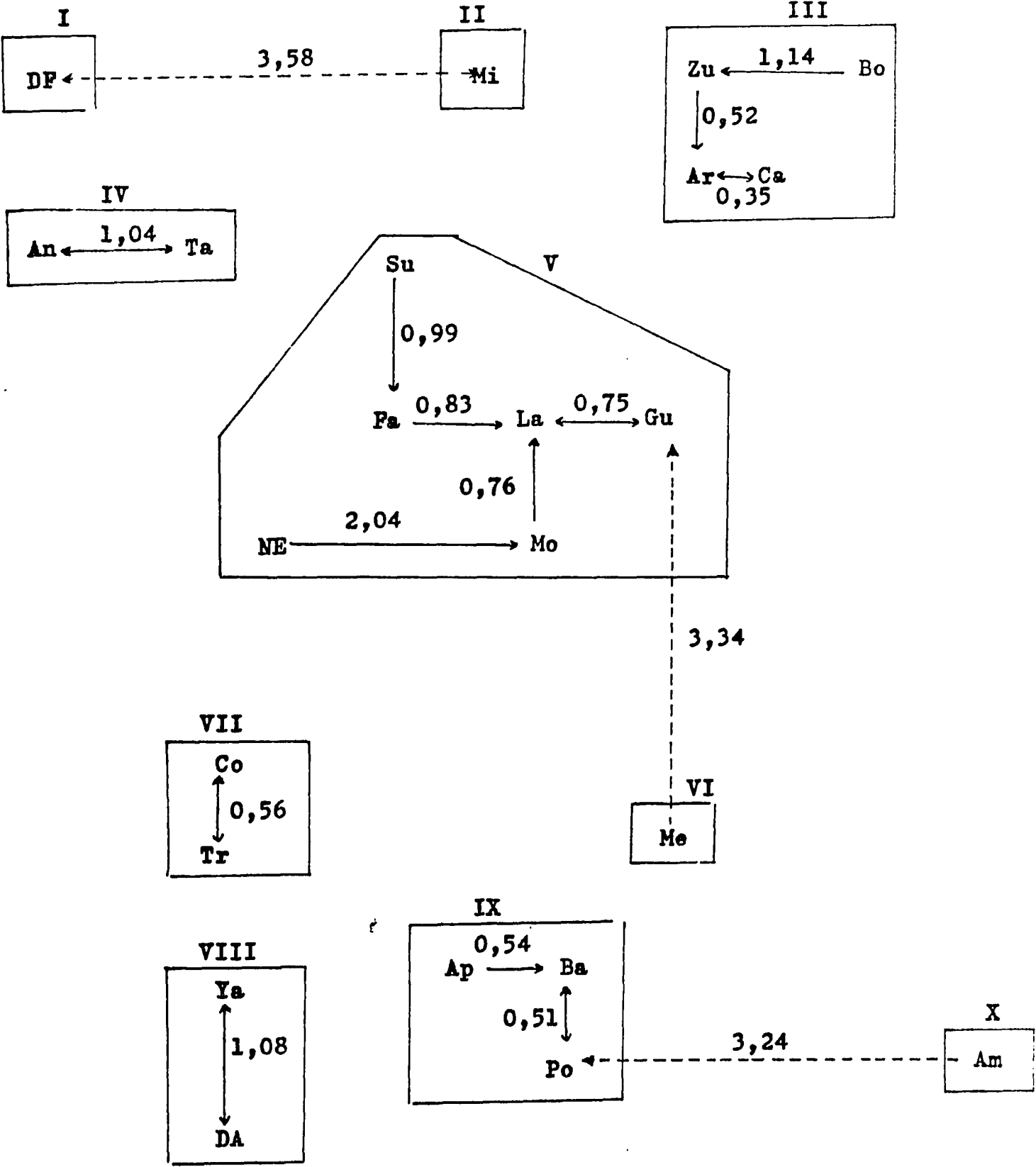




GRAPH VI-1 EDUCATIONAL TYPOLOGY Year 1950



GRAPH VI-2 EDUCATIONAL TYPOLOGY Year 1961



GRAPH VI-3 TYPES OF EVOLUTION. EDUCATIONAL STRUCTURE  
(based on growth rates 1950-1961)

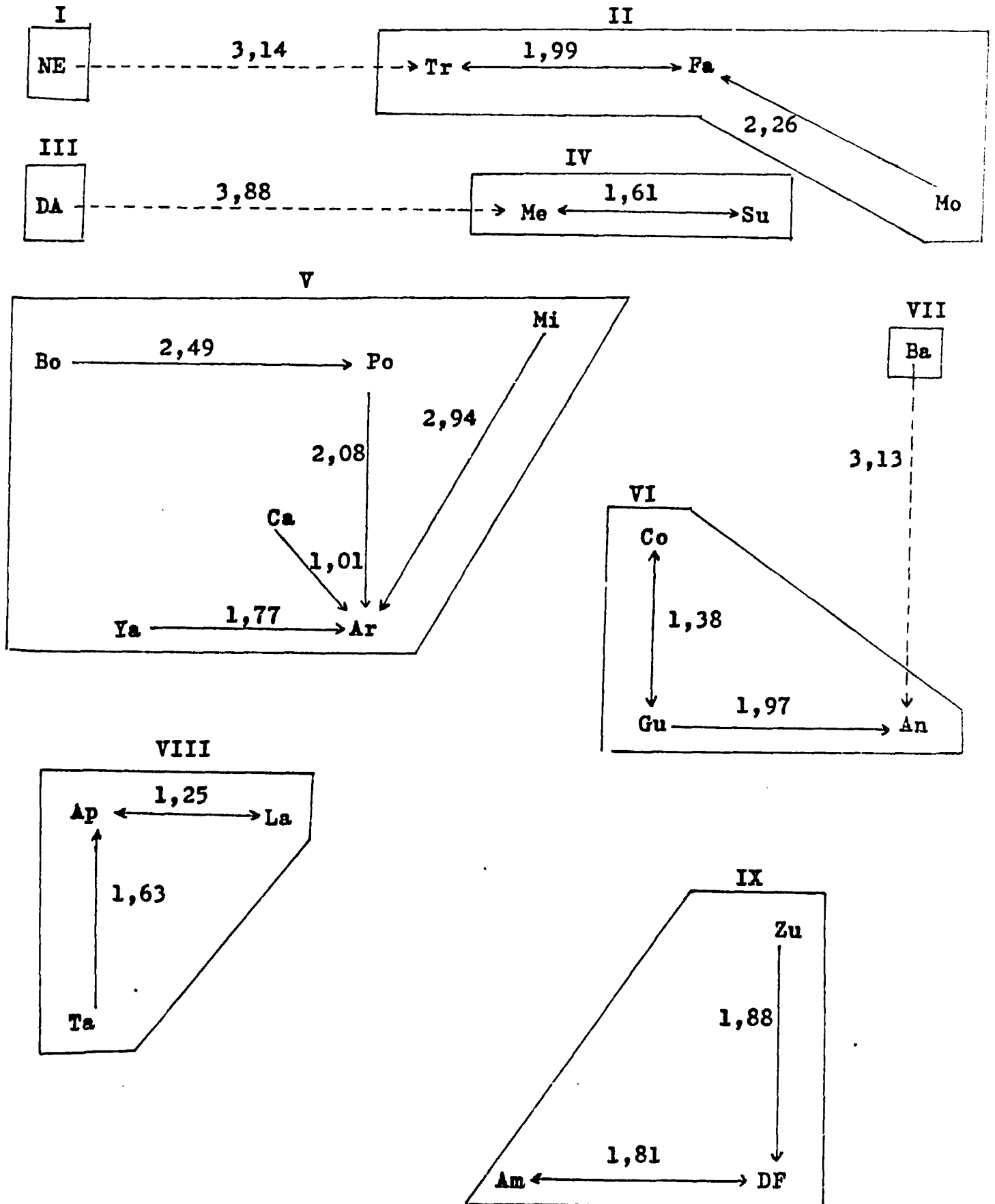


TABLE VI-6

Educational structure: types of evolution  
Growth rates 1950-1961

	enrolment rates			Pop. 25 years and over by educ. level				
	<u>literacy</u>	<u>7-14</u>	<u>15-19</u>	<u>20-24</u>	<u>no-level</u>	<u>prim.lev.</u>	<u>sec.lev.</u>	<u>high.lev.</u>
I	3,1	5,0	20,4	- 3,5	2,2	- 1,2	15,2	5,4
II	4,0	7,9	15,2	- 12,5	2,7	1,5	7,9	2,8
III	1,8	4,3	9,3	0	- 0,3	0,1	6,8	- 9,2
IV	3,9	7,0	9,1	8,1	2,2	0,6	10,0	3,1
V	7,0	9,3	12,9	4,6	3,0	4,2	14,0	5,7
VI	5,6	10,3	16,9	- 6,0	3,4	2,3	9,0	0,1
VII	7,6	11,1	10,6	- 21,0	4,5	4,7	6,8	5,6
VIII	4,5	8,3	8,0	- 5,8	1,4	2,7	10,6	3,4
IX	<u>5,3</u>	<u>8,7</u>	<u>7,7</u>	<u>2,5</u>	<u>7,8</u>	<u>3,7</u>	<u>6,8</u>	<u>0,4</u>

Types:

I: Nueva Esparta

II: Falcón, Monagas, Trujillo.

III: Delta Amacuro

IV: Mérida, Sucre.

V: Aragua, Bolívar, Carabobo, Miranda, Portuguesa, Yaracuy.

VI: Anzoátegui, Cojedes, Guárico.

VII: Barinas.

VIII: Apure, Lara, Táchira.

IX Distrito Federal, Zulia, Amazonas.