A METHOD OF MEASURING STRUCTURAL PATTERNS OF DYADIC INTERPERSONAL INTERACTION[1]

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The need of shifting sociological research orientation from the use of individuals as a unit to the emphasis on interpersonal relationships and interactions *per se* was noted by Coleman (1958). This urge primarily calls for a recognition that individuals are not socially independent and isolated from one another. Social world is essentially a complicated set of interpersonal relationships. Thus, the examination of structure of interpersonal relationship and interaction becomes one of the major concerns of sociological study.

The emphasis on the need for structural analysis of interpersonal interaction was empirically and conceptually provoked by Blau (1962) and further elaboratd by Rogers and Bhowmik (1970-71) with a specific reference to the study o human communication. This paper is to continue those previous efforts with two main purposes: (1) to elaborate the types of interpersonal interaction in terms of attributes of person and (2) to construct a method to measure the relative strengths of different structural types of interpersonal interaction.

Fundamental Unit of Interpersonal Interaction

The dyad has been used repeatedly as the basic analytical unit of interpersonal interaction (Coleman, et. al., 1957; Lionberger, 1968; to name a few), even though it is quite apparent that social world always constitutes more complicated interpersonal relationships than merely the dyad. Surely, dyadic analysis of interpersonal interaction is far from adequacy to encompass the whole structure of social interaction. And, researchers have called for an attention to study the aggregate of interaction at a given time as a whole. For instance, Harary, et al. (1965) adopted graph theory to analyze structural characteristics of interpersonal interaction among aggregates of people and demonstrated successfully the varieties of structural patterns of human interaction in terms of modes of interaction. Yet, this approach poses a methodological difficulty in a situation where the main research concern centers around the attributive relationship (e.g., man chooses a woman as a partner) with respect to a general question about "who chooses whom for what" one of the central issues in the study of information diffusion and communication.

In the study of "who chooses whom for what" in terms of attributive relationship, one of the main research interests is to find ont whether people tend to choose other people of their own kind or instead they are inclined to choose other persons either quite different from themselves or with a particular categorical attribute regardless of the choosers' own attribute. This particular research interest leads to start structural analysis of attributive relationship from the dyad (Yablonsky, 1955).

Structural Typology of Dyadic Interpersonal Interaction

Even though the behavior of choosing other persons for a particular purpose can only be understood within the total frame of socio-psychological reference, some points of reference are surely more important than others. There is thus a matter of discrimination and categorization essential to the behavior of choosing others (Sherif and Hovland, 1961; Sherif, et. al., 1965). Regardless of the actual complexity of psychological process in the articulation of choosing behavior, *discrimination* and *categorization* primarily involve a process of comparison between at least two candidate interactors (Festinger, 1950, 1954). Indeed, a comparison - from discrimination, categorization to the final choice - is a process of selection with a particular set of internal frame of reference or standard of judgment, but attributes (e.g., age, sex, nationality, social status, etc.) which a potential interacting candidate externally appears to a chooser is the most crucial structural cue. Of course, the salience of a particular attribute as a cue for choice depends on many factors such as past experience that the chooser has had with the whole set of cue stimuli, nature of choice, anchoring effects, degree of ego involvement and etc. But, one thing for sure is that attributes embodied with a person are always perceived as a representing set of the extrinsic self of that person. The social position and utility for certain interactive purpose of that person are then defined on the basis of attributes which he seems to own and appear particularly salient and significant to choosers. Particularly where there is no other feasible basis of comparison, attributes of a person become an extremely important external cue to determine "who should be chosen". Such an attribute-anchoring determination of interpersonal choice constitutes the main assumption to assess the exploration of structural patterns of interpersonal interaction.

There are two ways to assess the structural patterns of interpersonal choice in terms of attributes. One way to do is to examine a single attribute at one time; the other way to do is to consider an aggregate of attributes at one time. The *single attributes* consideration is to allocate the general structural patterns of single dominant attributes regardless of the possible joint interaction with other attributes; whereas, the *aggregate attributes* consideration is to determine how attributes combinatively structurize interpersonal choice. Ideally the *aggregate attributes* consideration is much more closely to describe social reality than the *single attributes* consideration. But, it is the single attributes being concerned in this paper. An attempt to examine structural patterns of interpersonal choice by analyzing aggregate attributes can be found in a study by Lionberger, Yeh and Copus (1975).

Blau (1962) articulated two main types of interpersonal choice. One type is the tendency that people are inclined to choose other people like themselves. This is defined as *segregation.* The other type of interpersonal choice Blau defined as *differentiation* which he, so far, did not furnish any formal definition. Instead, he used an illustration to show the concept. He said (1962):

> Let us assume that we have asked the graduate students in a large department which other students they go to when they want to clarify a problem, and we want to ascertain the influence of amount of graduate work on these choices. We might find that both pre-M. A. and post-M. A. students give a disproportionate number of their choices to others who already have their M.A. This would show that amount of training has a *differentiating effect* on consultation; it tends to differentiate the consultants, whose advice is generally esteemed, from students who do note occupy such a prestigeful position. (If, for some reason, both categories of choosers would overselect pre-M.A. students as consultants, this also would constitute a differentiating effect.)

According to the above illustration, Blau confined the concept of *differentiation* narrowly to the tendency to concentrate a choice on a certain point (or range) of attributive distribution. This conceptualization obviously does not exhaust all the possible structural types that the concept of *differentiation* might imply.[2] As a concept exhaustively opposite to *segregation, differentivtion* should be referred to as a tendency that a person is always inclined to choose others who are either selectively different from himself or in a specific category of attribute regardless of which cateory he, the chooser, falls in. Thus *differentiation* conveys several different sub-types. It may refer to the tendency that a person choose others with a characteristic opposite to his own. This is defined as *opposite differentiation.* It may refer to the tendency that a person choose others who are at a particular point or in a certain range on an attribute continuum regardless of where he himself locates on the attribute continuum. For instance, people constantly choose the "middle age" persons. This is then defined as *concentrated differentiation* which is the differentiation Blau (1962) specifically implied. Furthermore, differentiation may refer to the tendency that people constantly look upward or downward of attribute to choose others. These two types of differentiation are then defined as *upward differentiation* and *downward differentiation* respectively. These two types of differentiation were particularly emphasized in the previous studies of interpersonal choice (e.g., Coleman et al., 1957)[3].

In view of the above description, one immediate issue is how to operationalize and measure each of the alternative tendencies in order to determine the predominant structural pattern of attribute in an interpersonal choice. Also, it needs to clarify conditions that specific structural patterns might exist or might not. Let us start with a presentation of matrix of dyadic interpersonal choice.

Matrix of Dyadic Interpersonal Choice

First of all, three conditions should be generally assumed prior to the introduction of the measurement of structural pattern of dyadic interpersonal interaction. They are; namely,

(1) attributes apply singly to chooser and chosen, one attribute at a time,
(2) attributes are considered at the nominal or ordinal level of measurement, and
(3) the domain of maximum interaction among people is regarded as finite; i.e., composed of a specific number of individuals.

Our concern starts with an aggregate of dyadic persons who have indicated to whom they interact or choose for certain purpose. Operationally, with respect to a specific attribute at issue choosers and chosens can be conventionally divided into categories which constitutes a matrix of choice similar to a contingency table. Let us arbitrarily divide an attribute (say, age) into C categories for both of choosers and chosens. Then, for any interpersonal choice, there furnishes a C by C matrix illustrated as follows:

Chosen

		1	2	....	c	#of Total Choices	#of Persons
Chooser	1	N_{11}	N_{12}	....	N_{1c}	$N_{1.}$	P_1
	2	N_{21}	N_{22}	....	N_{2c}	$N_{2.}$	P_2
	.	.	.	....	.	.	.
	.	.	.	....	.	.	.
	c	N_{c1}	N_{c2}	....	N_{cc}	$N_{c.}$	P_c
#of Total Choices		$N_{.1}$	$N_{.2}$	....	$N_{.c}$	N	P
#of Persons		Q_1	Q_2	....	Q_c		Q

Where

N_{ij}: the total number of choosers with i in attribute X who interact with chosens with j in same attribute

$N_{i.}$: the total number of choices made by choosers with i in attribute X

$N_{.j}$: the total number of choices received by chosens with j in attribute X

P_i: the total number of choosers with i in attribute X

Q_j: the total number of chosens with j in attribute X

P: the total number of choosers making choices

Q: the total number of chosens receiving choices

N: the total number of choices made by choosers (or received by chosens)

Proceeding further with the issue related to the probability of choice (or being chosen) under random condition, let T_i be designated as the total number of persons in category i of a given attribute X in the total set of persons considered. Set $\{T_1, T_2, T_3, \ldots, T_c\}$ is identical to set $\{P_1, P_2, P_3, \ldots, P_c\}$ and set $\{Q_1, Q_2, Q_3, \ldots, Q_c\}$ if and only if all the persons considered at least choose one and all are chosen at least by one of the others. Yet, this is usually not the case. However, to assess probability of over or under selection in order to construct measure of structural pattern of attribute, a theoretical matrix under the random condition is needed. As a procedural matter in developing such a measure, an additional assumption should be made. That is, if the choices are random, the probability distribution of chosens' attribute with respect to each chooser is assumed to be identical to the probability distribution based on set $\{T_1, T_2, T_3, \ldots, T_c\}$. Based on this additional assumption and the preceding ones, a matrix of hypothetical distribution on each category of attribute for chooser and chosen can be illustrated as follows:

		Chosen					
		1	2	. . . .	c	#of Total Choices	#of Persons
Chooser	1	E_{11}	E_{12}	. . . .	E_{1c}	$N_{1.}$	P_1
	2	E_{21}	E_{22}	. . . .	E_{2c}	$N_{2.}$	P_2
	.	.	.	. . . .	.	.	.
	.	.	.	. . . .	.	.	.
	c	E_{c1}	E_{c2}	. . . .	E_{cc}	$N_{c.}$	P_c
#of Total Choices		$E_{.1}$	$E_{.2}$	. . . .	$E_{.c}$	N	P
#of Persons		Q_1	Q_2	. . . .	Q_c	Q	

where $E_{ij}=N_{i.} \times \frac{T_j}{T}$ and $T = \sum_{j=1}^{c} T_j$ for $i=1, 2, 3, \ldots, c$ and $j=1, 2, 3, \ldots, c$.

The rest of symbol is identical to the ones previously defined. Apparently set $\{N_{ij}\}$ is identical to set $\{E_{ij}\}$, if and only if the actual choice matrix is completely random. This is usually unlikely to be the case.

The Construction of Measures of Structural Patterns

Coleman (1958) invented a method to measure homogeneity and heterogeneity of interpersonal choice by using dichotomous attribute as a unit of analysis. The method being proposed in the following portion is essentially a modification of Coleman's method with an extension of 2 by 2 choice matrix to n by n choice matrix and more sophisticated conceptualization of structural alternatives.

Basically the measures of structural patterns are constructed based on two general considerations:

(a) the magnitudes of actual choices made by choosers in favor to a specific type of pattern (e.g., segregation) are considered relative to those corresponding ones under random condition, and

(b) the resultant magnitude from (a) is compared with the corresponding optimal magnitude that should be shown in a complete tendency toward (or away from) that specific type of pattern in concern.

The final index magnitude obtained through the above two genernal considerations for each structural pattern alternative then provides a basis to justify the pattern predominance of a given interpersonal choice.

(A) ***Segregation*** (E_s)

As defined by Blau (1962), segregation is a tendency that people choose others who are about like themselves. Referring to the matrix of actual choices presented in the preceding section, a complete segregation of choice simply means that all N_{ij}'s are equal to O where $i \neq j$ for all i's. and j's In. other words, the choosers in category i of attribute X only choose those others also in category i of the same attribute. Thus, $N_{ii}=N_{i.}$ for all i's from 1 to c. On the contrary, $N_{ii}=O$ for all i's if people constantly choose those others who are different from themselves with respect to a specific attribute. In this case, it shows an obvious complete tendency away from segregation. $N_{i.}$ is hence disproportionately distributed in N_{ij}'s where $j \neq i$. Otherwise, there is a gradation of segregating tendency between the above two extreme tendencies. It is such a gradation that measure of segregation (also apply to other structural alternatives) is primarily focused.

With the consideration that the amount of choice found in Nii for all i's (which operationally represents the concept of segregation by definition) might be owing to the random result, the two general considerations - (a) and (b) - shown in the preceding page become imperatively important to the measurement construction. A measure of segregation is then defined as follows:

$$(1)\ E_s=\frac{\sum_{i=1}^{c}(N_{ii}-E_{ii})}{N-\sum_{i=1}^{c}E_{ii}},\ \text{if}\ \sum_{i=1}^{c}N_{ii}\geq\sum_{i=1}^{c}E_{ii}\ \text{or}$$

$$(2)\ E'_s=\frac{\sum_{i=1}^{c}(N_{ii}-E_{ii})}{\sum_{i=1}^{c}E_{ii}},\ \text{if}\ \sum_{i=1}^{c}N_{ii}<\sum_{i=1}^{c}E_{ii}$$

Equation (1) is then constructed to measure a tendency *toward* segregation with a range from 0 to 1. *One* indicates a complete tendency toward segregation where, in equation (1), $\sum_{i=1}^{c}N_{ii}=N$. This obviously only takes place if all choices made by choosers in each category of attribute are concentrated on the major diagonal of the matrix of choice. *Zero* implies no segregation at all which, more explicitly speaking, means a random choice with regard to the definition of segregation. In contrast, equation (2) measures a tendency *away from* segregation with a range from 0 to -1. Quite clearly, $E'_s=-1$ if and only if $\sum_{i=1}^{c} N_{ii}=0$; that is, all choosers select others in categories different from the one they are in—with respect to a specific attribute. However, the measure of segregation ranges from -1 through 0 to 1, if equations (1) and (2) are combined into consideration.

(B) ***Differentiation***

Generally speaking, this is directed to measuring the tendency to choose others in different categories of attribute from one's own or in a specific category regardless of which category the chooser is in. As already elucidated in the earlier part, several different sub-patterns are included in the general concept of differentiation. We are therefore to discuss one by one.

Opposite differentiation (E_o) It is fairly possible that people always choose persons opposite to self in regard to a specific attribute. This is exemplified in the mating partnership between male and female. However, where opposite differentiation might logically exist, it can be operationally defined by the following formulas:

$$(3)\quad E_o=\frac{\sum_{i=1}^{c}(N_{i\ c+1-i}-E_{i\ c+1-i})}{N-\sum_{i=1}^{c}E_{i\ c+1-i}},\ \text{if} \sum_{i=1}^{c} N_{i\ c+1-i}\geq \sum_{i=1}^{c} E_{i\ c+1-i}\ \text{or}$$

$$(4)\quad E'_o=\frac{\sum_{i=1}^{c}(N_{i\ c+1-i}-E_{i\ c+1-i})}{\sum_{i=1}^{c}E_{i\ c+1-i}},\ \text{if} \sum_{i=1}^{c} N_{i\ c+1-i}< \sum_{i=1}^{c} E_{i\ c+1-i}.$$

Equation (3) is formulated on the basis that, if the choice is completely signified by opposite differentiation, the choosers in category i will constantly select those others in category $c-i+1$ where $i=1, 2, 3, \ldots\ldots, c$. In other words, $N_{ij}=0$ if $j\neq c-i+1$ for all i's. Surely, if there is no opposite differentiating inclination, $N_{i\ c-i+1}=E_{i\ c-i+1}$ for all i's. Thus, the choice is random with respect to opposite differentiation. Moreover, equation (4) is -1 if and only if $N_{i\ c-i+1}$ is 0 for all i's. This is to say that people are inclined to avoid choosing others who are opposite to themselves. It is therefore apparent that the measurement construction for opposite differentiation is fundamentally same to the one for segregation. The interpretation of E_o and E'_o is exactly the same as for E_s and E'_s respectively. Such a fundamental sameness in constructing measurement will be also applied to the measures of other differentiating sub-patterns. Thus, the following presentations of measurement constructions will be directed only to the formulation of specific structural pattern without any further notice on this sameness.

Concentrated differentiation (E_c) This is to measure the tendency to choose persons at a particular point or in a certain range of category on an attribute continuum regardless of where the choosers themselves stand. If this takes place, we say that the choice is concentrated on category (or point) i of attribute X. However, where this kind of differentiation is logically existent, the concentrated differentiation, E_c, on category k can be symbolically expressed as:

$$(5)\quad E_c = \frac{\sum_{i=1}^{c} (N_{ik} - E_{ik})}{N - \sum_{i=1}^{c} E_{ik}}, \text{ if } \sum_{i=1}^{c} N_{ik} \geq \sum_{i=1}^{c} E_{ik} \text{ or}$$

$$(6)\quad E'_c = \frac{\sum_{i=1}^{c} (N_{ik} - E_{ik})}{\sum_{i=1}^{c} E_{ik}}, \text{ if } \sum_{i=1}^{c} N_{ik} < \sum_{i=1}^{c} E_{ik}.$$

If total categories of attribute in concern are c, k is from 1 to c. Thus, in order to find out all the possible concentrated differentiations on different categories equations (5) and (6) have to be repeatedly applied by only changing k value in the formulas from 1 to c. However, for instance, if people, no matter where they are in terms of the categorical location of a particular attribute, consistently choose thoose others who are in category c, there is then a complete concentrated differentiation on category c. In this case, all N_{ij}'s are 0 where $i=1, 2, 3, \ldots,$ c and $j=1, 2, 3, \ldots,$ $c-1$. Or say, $N_{ic}=N_{i.}$ for all i's. The similar rule is applied to the situation where concentrated differentiation in category c is 0 or -1.

Directional differentiation (E_d) This can be either upward or downward. Where directional differentiation is meaningful to describe the structure of attribute in dyadic interpersonal interaction, upward differentiation (E_{du}) can be operationalized as follows:

$$(7)\quad E_{du} = \frac{\sum_{i=1}^{c-1} \sum_{j=i+1}^{c} (N_{ij} - E_{ij}) + (N_{cc} - E_{cc})}{N - (\sum_{i=1}^{c-1} \sum_{j=i+1}^{c} E_{ij} + E_{cc})}$$

$$\text{where} \sum_{i=1}^{c-1} \sum_{j=i+1}^{c} N_{ij} + N_{cc} \geq \sum_{i=1}^{c-1} \sum_{j=i+1}^{c} E_{ij} + E_{cc} \text{ or}$$

$$(8)\quad E'_{du} = \frac{\sum_{i=1}^{c-1} \sum_{j=i+1}^{c} (N_{ij} - E_{ij}) + (N_{cc} - E_{cc})}{\sum_{i=1}^{c-1} \sum_{j=i+1}^{c} E_{ij} + E_{cc}}$$

$$\text{where} \sum_{i=1}^{c-1} \sum_{j=i+1}^{c} N_{ij} + N_{cc} < \sum_{i=1}^{c-1} \sum_{j=i+1}^{c} E_{ij} + E_{cc}.$$

Quite clearly equations (7) and (8) imply that a complete upward differentiation happens if and only if people in category i of a specific attribute consistently choose those others who are in the categories greater than category i. That is, $N_{ij}=0$, if $j \leqslant i$ and $i=1, 2, 3, \ldots, c$ and $j=1, 2, 3, \ldots, c-1$. In contrast, if people constantly look down an attribute to choose others, $N_{ij}=0$ for $j \geqslant i$ and $i=1, 2, 3, \ldots, c$ and $j=2, 3, \ldots, c$. Thus, a complete downward differentiation is conceptually equivalent to a complete tendency away from upward differentiation. Where E_{du} (or E'_{dn}) is 0, $N_{ij}=E_{ij}$ for $j>i$ and both i and j are from 1 to c with also $N_{cc}=E_{cc}$. This is the case of random choice with respect to upward differentiation.

Here, one realistic problem should be noted; namely, when the chooser is positioned in the highest category of an attribute, there is obviously no room for him to choose upward if the setting of interpersonal choice is assumed to be finite. Thus, if an upward differentiation is dominant, choosers who are on the highest position of attribute will, by necessity, select only those who are on the same attribute level as themselves. The reader must recognize this realistic limitation in using this E_{du} measure.

Furthermore, a reverse provision for downward differentiation is needed. This is then accordingly defined as follows:

$$(9)\quad E_{dd} = \frac{\sum_{i=2}^{c} \sum_{j=1}^{i-1} (N_{ij} - E_{ij}) + (N_{11} - E_{11})}{N - (\sum_{i=2}^{c} \sum_{j=1}^{i-1} E_{ij} + E_{11})}$$

$$\text{where} \sum_{i=2}^{c} \sum_{j=1}^{i-1} N_{ij} + N_{11} \geq \sum_{i=2}^{c} \sum_{j=1}^{i-1} E_{ij} + E_{11} \text{ or}$$

$$(10)\quad E'_{dd} = \frac{\sum_{i=2}^{c}\sum_{j=1}^{i-1}(N_{ij}-E_{ij})+(N_{11}-E_{11})}{\sum_{i=2}^{c}\sum_{j=1}^{i-1}E_{ij}+E_{11}}$$

$$\text{where} \sum_{i=2}^{c}\sum_{j=1}^{i-1}N_{ij}+N_{11} < \sum_{i=2}^{c}\sum_{j=1}^{i-1}E_{ij}+E_{11}.$$

Quite obviously, this measure of downward differentiation defined by equations (9) and (10) faces a realistic problem similar to the one shown in the measure of upward differentiation. That is, when a chooser is at the lowest level of attribute, he definitely has no way to choose downward if the set of interactors is assumed to be finite. Thus again, if downward differentiation is predominant, choosers at the lowest level of attribute has to choose no one else but persons of their own kind.

Pattern Determination

First of all, there is an important issue about the logical feasibility of the various structural patterns in regard to the nature of attribute—in terms of its measurement nature; namely, nominal, ordinal, interval and ratio. Since the concern in this paper is confined to the categorical situation, interval and ratio attributs have to be collapsed into ordinal type of categorization for the practical purpose. Thus, only nominal and ordinal attributes are actually involved into our consideration.

As a matter of fact, the problem of logical feasibility of structural pattern does not happen to *segregation* ad *concentrated differentiation.* This is simply due to the fact that the concepts of *segregation* and *concentrated differentiation* can be easily extended to any kind of measurement nature without losing their meanings. Everybody would fairly agree that it is always logically possible that, for instance, male chooses male in some occasions, all of farmers like to choose middle-age farmers, or both of whites and blacks elect white as president.

Yet, it is something different in *opposite differentiation* in which the concept itself is confined by the nature of a specific attribute in concern. Even though *opposite differentiation* is logically feasible to be conceptualized in cases where attributes are at least ordinal in nature, it makes much more realistic sense in nominal attributes where they are essentially dichotomous in nature. It is obvious that *opposite differentiation* has no meaning at all in cases where attributes are something like race classified into "white, black and other" categories. Furthermore, it is for sure that *directional differentiation* becomes a meaningful pattern alternative only if direction and magnitude are accorded to the attribute in concern. To a nominal attribute there is definitely no implication of direction at all. Thus, *directional differentiation* is only applicable to those attributes which are essentially ordinal (or interval or ratio).

Moreover, there is no conceptual difference between *concentrated* and *directional differentiations* if attribute is ordinal and dichotomous. In this situation, an *upward differentiation* is operationally same to the *concentrated differentiation* on the category with greater amount. And, a *downward differentiation* is, similarly, basically not different from the *concentrated differentiation* on the category with smaller amount. This structural undifferentiation between *concentrated* and *directional differentiations* in dichotomous cases explains Blau's failure to define *differentiation* adequately as pointed out in the beginning portion of this paper. However, in such a dichotomous case, *differentiation* has only two sub-types—*concentrated* and *opposite.*

As noted previously, in the case of nominal attributes no *directional differentiation* is possible. *Differentiation* therefore includes three main sub-types only: (1) *concentrated,* (2) *opposite* in dichotomous cases and additionally (3) a type of differentiation away from segregation in cases of multiple attribute. To avoid confusion in terminology this last type of differentiation for nominal multiple attributes is then tentatively named as *divergent differentiation* (E_{dv}). Referring to the matrix of actual choice, the measure of E_{dv} has to be consructed based on the relative magnitudes of the cells of N_{ij} other than N_{ii} as compared to the cells of E_{ij} other than E_{ii} for all i's and all j's. By applying the same principle used to construct the measures of other structural patterns, this type of differentiation is defined as follows:

$$(11)\ E_{dv}=\frac{(N-\sum_{i=1}^{c}N_{ii})-(N-\sum_{i=1}^{c}E_{ii})}{N-(N-\sum_{i=1}^{c}E_{ii})}$$

$$(12)\qquad =\frac{\sum_{i=1}^{c}(E_{ii}-N_{ii})}{\sum_{i=1}^{c}E_{ii}}$$

where $N-\sum_{i=1}^{c}N_{ii}\geq N-\sum_{i=1}^{c}E_{ii}$

(or say, $\sum_{i=1}^{c} E_{ii} \geq \sum_{i=1}^{c} N_{ii}$) or

$$(13)\ E'_{dv} = \frac{(N - \sum_{i=1}^{c} N_{ii}) - (N - \sum_{i=1}^{c} E_{ii})}{N - \sum_{i=1}^{c} E_{ii}}$$

$$(14)\qquad = \frac{\sum_{i=1}^{c} (E_{ii} - N_{ii})}{N - \sum_{i=1}^{c} E_{ii}}$$

where $N - \sum_{i=1}^{c} N_{ii} < N - \sum_{i=1}^{c} E_{ii}$

(or say, $\sum_{i=1}^{c} E_{ii} < \sum_{i=1}^{c} N_{ii}$).

E_{dv} measures the tendency toward *divergent differentation* and E'_{dv} measures the tendency away from *divergent differentiation.* It is interesting to note that $E_{dv} = -E'_s$ and $E'_{dv} = -E_s$. Thus, *segregation* and *divergent differentiation* are conceptually complementary.

In the foregoing presentation it seems to assume that any interpersonal interaction can be described by one of the structural alternatives. Yet, this is not exactly true. Before interpretation can be made from the measures just described, we must take note of the frequency distribution of choice that may occur by chance alone. It is to say that the choices made by people may be completely random—in this case, all of the measures mentioned above are equal to 0. Thus, there requires a method to determine the exent that an actual choice matrix might deviate from what would be expected under randomness prior to a particular structural pattern is assured to be predominant (to describe a particular dyadic interpersonal interaction). For this, a modified chi-spuare test is suggested. With a reference to the two matrices of choice—one for the actual choice distribution and another for the hypothetical choice distribution under randomness—presented in the preceding section,

$$\chi^2 = \frac{\sum_{i=1}^{c} \sum_{j=1}^{c} (N_{ij} - E_{ij})^2}{\sum_{i=1}^{c} \sum_{j=1}^{c} E_{ij}} \text{ with } 2(c-1) \text{ degree of freedom.}$$

After the randomness of choice pattern is tested and it happens to show a tendency againt randomness, a simple"rule of thumb" is used to determine the predominance of a particular structural pattern among all those logical alternative patterns. As we may recall, all of the mentioned structural measures are uniformly constructed in such a way that the difference between the actual total for a particular structural pattern and the total projected random occurrence for that particular structural pattern is considered. Thus, all of the measures have a range from −1 through 0 to 1 and hence the predominance of one structural pattern over others can be assessed simply by comparing the score associated with each.

Remarks

Conceptually speaking, the typologies of structural pattern and their operational measures presented in this paper is useful to the study of fundamental human interactive structure. But, two limitations are noted.

First of all, where attributes are interval (or ratio) in nature and must be collapsed into ordinal categories, scores of same structural measures usually vary depending upon the way the data are categorized (Goodman and Kruskal, 1954). Thus, there is an important issue of how to collapse the data, if necessary, in order to show the most representative structural pattern.

Secondly, where an attribute is not dichotomous, some cells in the matrix of choice have to be used more than once to construct different kinds of structural pattern as defined previously. For instance, in the optimal case N_{ii} is used to assess *segregation*, *opposite differentiation* and *concentrated differentiation* on category i. We therefore ask: How much of N_{ii} should be counted for by each? If there exists such a set of different possible patterns to a variety of extent simultaneously, the frequency located in a given cell of a choice matrix is a joint result of all possible associated structural patterns and, probably, their interactions. At this stage of measurement construction, no attempt is proposed to deal with this problem.

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FOOTNOTE

1. This paper is revised from a part of the author's Ph.D. dissertation, Department of Sociology, University of Missouri, Columbia, Missouri. The author would extend his thanks to Professor Herbert F. Lionberger. Without his encourgement this paper will never be completed.

2. For a detailed critique on Blau's method of measuring structural patterns, see Yeh (1973).

3. It should be noted that the typologies shown here do not reject the possibility of other typologies that might be also properly conceptualized and useful to describe the structural patterns of interpersonal choice. It is rather that the conceptualization presented here has its unique sociological meaningfulness to understanding the structure of interpersonal interaction which is repeatedly demonstrated by researchers.