The Hierarchizations Consistency of the Potential Sources of Work Satisfaction: Methods of Achieving and Assessing Hierarchic Orders

Cătălin Mamali[*]
Gheorghe Păun[**]

Abstract: *In social life, people try to know, to build, to maintain, to change, to destroy and to avoid hierarchies. At the social level, the hierarchical systems are considered to be desirable for their capacity to increase efficiency, communication and control in the human actions, and undesirable for generating stratification of social actors, impeding participation and democracy. In this paper we focused on the consistency of the hierarchies, answering to the question of what happens when one and the same person hierarchizes the same set of objects using two different ways. We applied this in a particularly research field - the work motivation – being interested to study the consistency of the hierarchies of satisfaction sources. We used a list of 24 factors of work satisfaction and motivation that we applied to a group 56 young workers in an enterprise, asking them to fill an indirect hierarchization questionnaire in which all the factors were compared among themselves (resulting 276 diads), and a direct hierarchization, by asking the subjects to select, in order, the most important five factors for generating work satisfaction and the most important 5 factors for generating work dissatisfaction. We found that the highly trained subjects are more "coherent" than the low educated. Scalar hierarchization seems to be more natural, because more subjects are consistent in this case, compared with pairs examination. Finally, the respondents violated independence condition with the same ease as they produce Condorcet paradoxes, making us think at the cost of avoiding such paradoxical results when dealing with complex data.*

Keywords: scalar hierachizations; pairwise comparison; consistency; Condorcet paradox; sources of work satisfaction.

Cuvinte-cheie: ierarhizare pe scală; comparație în perechi; consistență; paradoxul lui Condorcet; sursele satisfacției cu munca.

[*] Loras College, 1450 Alta Vista StDubuque, Iowa 52001. E-mail: Catalin.mamali@loras.edu

[**] University of Bucharest, Division of Systems Studies, Str. Academiei 14, 70109 Bucureşti, Romania. Email: george.paun@imar.ro.

Introduction

The diversity of hierarchies is associated with a diversity of reactions towards hierarchies. People (both scientists and laymen), many times, search to know, to build, to maintain, to change, to destroy and to avoid hierarchies. Even these reactions are sometimes hierarchized.

At the social level, the hierarchical systems and processes seem to be a very controversial problem. The hierarchical systems are considered to be desirable at least for their capacity to increase efficiency, communication and control in the human actions, and undesirable at least for generating stratification of social actors, impeding participation and democracy. It would be useful to make a list of the benefits and the costs for the human life of the hierarchical processes and systems.

Taking into account the controversial character of the problems raised by the hierarchical processes and structures and the wide areas in which we are confronted with the hierarchical structures and processes, it is meaningful to ask questions like these: what do believe different categories of people about hierarchies and hierarchization? What do they understand by a hierarchy? How do they build hierarchies? Is hierarchization a widespread behavior in the everyday life? How do people perceive the hierarchies built by themselves? Which are the characteristics of the hierarchies built by the individuals themselves? How do people proceed in hierarchizing different objects and which are the characteristics of the resulted hierarchies? These questions are focused mainly on *the subjective ways of generating hierarchies* and on the assessment of these hierarchies. They are important because the social actors build hierarchies, are involved in hierarchical structures, use the hierarchies they build, but also because we know very little about how these hierarchies are constructed, and about their characteristics (stability, consistency, etc.).

It is possible to observe, we are anticipating a bit, that scientists have been much more interested in the hierarchical networks and processes which exist outside or inside of the individuals and in the influences of these hierarchies on the individuals than in the ways in which the individuals themselves are building hierarchies.

We shall present some of the general characteristics of hierarchies which are relevant for our study.

The ontological status of the hierarchical order

Many hierarchies have an objective character. Hierarchy as an order of complexity is considered by many authors as an ontological property. “We presently see the universe as a tremendous hierarchy, from elementary particles to atomic nuclei, to atoms, molecules, high-molecular compounds, to the wealth of structures (electron and light-microscopic) between molecules and cells (Weiss, 1926), to cells, organisms and beyond to supra-individual organizations” (Bertalanffy, 1968, 27).

An important effort has been dedicated to elaborate schemes of hierarchic order and to build theories for the intra and inter-systemic hierarchies (Boulding, 1978; Bertalanffy, 1968; Jantsch, 1975; Miller, 1978). Why is the problem of hierarchic order so important? The problem of hierarchic order is deeply related with that of the development of living systems in general and of the human systems especially: “The question of hierarchic order is intimately connected with those of differentiation, evolution, and the measure of organization which does not seem to be expressed adequately in terms either of energetics (negative entropy) or of information theory...” (Bertalanffy, 1968, 28).

Hierarchical order is considered to be essential for the processes of self-control and self-organization: "The ultimate task of human design may thus be recognized in the enhancement and reinforcement of the hierarchical bonding between the levels of evolutionary organization" (Jantsch, 1975, 252).

All these approaches assume a distinction and a correlation between hierarchic structures and hierarchic functions. In relation with this topic we consider that it is important to distinguish also between hierarchic processes which generate hierarchical structures and hierarchic processes which generate non-hierarchical structures. It is also important to take into account the possibility that some non-hierarchic actions and processes might generate, under certain conditions, hierarchic order.

The hierarchy as a major social invention

It is interesting to remember that the word ίεραρχία, which "does not occur in any classical Greek writer, owes its present extensive currency to the celebrated writings of Dionysius – Aeropageticus" (Oxford Encyclopaedia) and it was initially used in ecclesiastical language to denote the graded organization of angels and of clergy.

Why becomes hierarchy necessary in human society? This is a very difficult question which overpasses our endeavourment. An answer to this question will include among the key terms the following ones: labour division, coordination and communication. Boulding (1978, 214–215) says: "In a non-hierarchical organization everybody has to communicate with everybody else. This is not too difficult among six or eight people, though even of six people there are 30 possible message relations and 15 possible pairs. With 100 people there are 9,900 possible message relations and it is impossible for everybody to talk with everybody else. Hierarchy is a method of economizing communication. There is a famous principle of the „span control", which states that one person can communicate effectively, at least in giving orders and seeing them carried out, with about ten other people… The major social invention was the development of hierarchies with three, four, five layers, which gave rise for the first time to large-scale organization. How this was actually done is still something of a puzzle".

If hierarchic order had an important role in the growth of military organization (Sargon's case), can it still be useful for qualitatively different social activities and organizations? In the social life the hierarchic order can lead to very dangerous by-products as dominance and exploitative relations, alienation, dependency, etc. Galtung has developed a comprehensive image on the values associated to the vertical division of labor and respectively with the horizontal division of labor: "The higher in the vertical division of labor, the more central in the interaction pattern" (Galtung, 1980, 60).

If we admit as Boulding (1978, 213) suggests that in many cases the hierarchic order emerges under stress, then we can consider that hierarchies are methods consciously or unconsciously used by the social actors to deal with stress.

We are not going to discuss here the evils and the goods for the social life which are associated with the hierarchic orders, but we think that it is useful to make the following remarks. At the societal and individual levels, the study and the assessment of the hierarchic order have to answer questions like:

- Which is the meaning of a real or ideal hierarchic order for the human development? The hierarchic order does not have to become an end in itself, it has to remain a means for achieving human development (including self-actualization and self-organization).

- Which are the relationships between the bottom layers and the top layers in a given hierarchic order?
- Is it necessary for a given hierarchic order to use a value discrimination between "superior" and "inferior" elements, or it can work only with the distinction between more complex and less complex elements?

Hierarchic order in intra-group and inter-groups dynamics

The hierarchic order is an important indicator in the analysis of interpersonal relationships, intra-groups and inter-groups dynamics. Many concepts and hypotheses used in the field of social psychology of interpersonal relationships and group dynamics imply a hierarchic order, even when the characteristic of the hierarchical order are not explicitly discussed. A tremendous research effort has been devoted to: leadership, authoritarianism, social prestige, status-hierarchy, social rank, dominant and submissive relations, hierarchical structures in groups and organizations, social influence, etc. (Lewin, 1939, Neculau, 1977, Pelz, 1951). These problems have been analysed in connection with cognitive processes, values, beliefs systems, and decision processes.

It is interesting to underly a different research orientation which started later but which tends to become stronger and which is focused on: social cooperation, friendship, altruist behavior, solidarity, social justice, co-development (Berkowitz, 1972, Duck, 1973, Foa, 1974, Levinger and Snoek, 1972).

For our approach is important to mention two tendencies:

a) a transition from the studies focused on social structures and processes characterized by power relations, hierarchic order and competition to studies focused on social structures and processes characterized by horizontal organization, cooperation and co-development. This translation from the studies focused on the "bad" side of human life to the "good" side is frequently jointed with the translation from the manipulative methodology to the participatory methodology of research (Mamali, 1981).
b) a humanistic enriching of the concepts and theories initially focused on hierarchical structures and processes to include also non-hierarchical structures and processes. A very good example is that offered by the role-status theory. Initially, many authors have had the tendency to identify status with social rank. This tendency criticized many years ago (Aubert, 1967) is still present. In this field, we remark a very attractive approach which refers both to the hierarchically and non-hierarchically status characteristics (Berger et al., 1977).

All these changes in the field of research orientations imply, at the epistemological level, the destructuration of some hierarchic orders and the reconstruction of others.

The developmentalist perspective and the hierarchic order

The research on psycho-social growth and on developmental stages involves hierarchical structures, relations and processes. It is impossible to find relevant theories and empirical data on human development which do not assume the existence of development stages which are organized not only in a temporal order, but also in a hierarchic order of complexity. The psycho-genetic approach elaborated by J. Piaget (1932) in the study of cognitive processes and moral judgments has been extended to the study of moral development (Kohlberg, 1969), of social maturity (Warren, 1959), of life cycles

(Erikson, 1963), motivational development (Veroff and Veroff, 1980).

In relation to the developmentalist approach, we consider useful to distinguish between the hierarchic order of the developmental stages, on one hand and the development of the social actors' skills to perceive, build, assess and judge hierarchies, on the other hand. The last type of problems is very little known. J. Piaget has approached these types of problems in relation with transitivity. Piaget et al. (1960) have reported that after making two length comparisons, A>B and B>C, children below eight years were unable to infer the relationship of A and C. Bryant and Trabasso (1971) demonstrated that this failure was not due to either logical incompetence or linguistic incompetence, but to the inability to retain information from the original comparisons in memory. With more extensive training, so that the A>B>C relations were thoroughly memorized, the four year old children could make correct inference.

From a developmentalist perspective it is important to ask questions like: are the stages of development characterized by specific capacities to build and to assess hierarchic orders? Which are the relations between the capacity to make hierarchies and the meta-decision processes (Toda, 1982) in different life stages? Are some methods to produce hierarchies specific for certain life stages?

The relevance of hierarchic order for cognitive studies

Different studies had demonstrated the important role of hierarchic order and of centralization in the brain and in the mental function (Gilbert, 1957, Luthe, 1957).

Centralization and hierarchic order are "achieved by stratification" i.e. "by superimposition of higher "layers" that take the role of leading parts" (Bertalanffy, 1968, 213). Bertalanffy considers that in "contradiction to the principle causa aequat effectum, a small change in a leading part may by way of amplification mechanisms cause large changes in the total system" (p. 213).

Experiments by Bernstein (1967), Gel'fand (1971), Turvey (1973) have shown that there is a hierarchy of systems of "coordinate structures" that control muscular sensitivity, movement, and action.

Collins and Quillian (1969) elaborated and tested a model of the hierarchical organization of semantic memory. They consider that the items in the semantic memory are hierarchically organized into logically nested subordinate – superordinate relations. For example, the superordinate of canary is bird and the superordinate of bird is animal. Collins and Quillian postulated also a mechanism of "intersection search" for the polysemic words. This model has been improved (Rips et al., 1973) by taking into account that frequency ratings are measuring subjective semantic distance which, in some cases, differs and overrides the objective semantic distance represented in the model. Warrington (1975) showed that patients with some cerebral atrophy had selective impairment of semantic memory. For example, at the image of a duck the patients could answer the question "Is it an animal?" but not to "Is it a duck?" or "Is it dangerous?" showing that only the higher nodes of the semantic memory organization were intact.

The relations between higher order concepts are much more complicated. G. Cohen (1977, 130) considers that in the case of concepts like "democracy," "freedom" the disagreement is frequent, because: a) such concepts "rest on a substrate on underlying concepts in terms of which they are defined"; b) they "can only be acquired verbally"; c) are "more liable to be dependent on context than physical and functional ones".

In the humanistic psychology, the theory of personal constructs (Kelly, 1955) assumes also the existence of a hierarchic order of constructs. The person may or may not be self-aware of the hierarchical organization of his own constructs. Landfield (1979) studied the relations between high "cognitive complexity" and the capacity to hierarchically order one's constructs and concludes that "high complexity in the absence of integrative skills points to confusion rather than to a healthy complexity" (p. 142).

Hierarchies and action

The hierarchic order is very important not only at the cognitive level but also at the action level. A plan can be viewed as a hierarchically organized sequence of executions and tests (Miller et al., 1960). Taking into account the role of plans and decisions in the human behavior, M. Toda (1982) considers that "perhaps the only major distinction of human behavior from that of animals is the greater depth in the hierarchical organization of the former" (p. 187).

A hierarchic order may influence both hierarchic and non-hierarchic systems. For example, in our research on the intensity and structure of motivation we have observed that the higher the position of work in the hierarchy of personal values and sources of satisfaction, the greater will be the weight of intrinsic factors in the structure of work motivation.

We do not analyze here the issues related with the needs hierarchy (Murray, 1938, Maslow, 1970). These issues have been widely debated in the GPID Project (see Lederer, 1980).

Many of the discussed hierarchic orders are built in a natural and unconscious way. In many cases, the person is not aware how are built the hierarchies, which are their structures and how they work. In some cases the individuals are in the situation to build hierarchies. It is true that a hierarchic order may emerge under stress, but we think that even the construction of a hierarchic order is, in its turn, a stressor.

The purpose of the present paper

From this wide area of problems regarding the hierarchies we shall focus in this paper on the consistency of the hierarchies. What happens when one and the same person hierarchizes the same set of objects using two different ways? This question is related with many phenomenological and formal problems: How do people construct, perceive and interpret the hierarchies? When and why do they choose certain ways of hierarchization and reject others? How do people choose the criteria for hierarchization? Which are the influences of the number of objects which are hierarchized on the consistency of hierarchies and on the method preferred to achieve a hierarchic order?

Methods to study the subjective hierarchic order

To know the hierarchic structures of value orientations, interpersonal relationships, group networks, aspirations, motives or roles of different categories of subjects is an important task research. It is interesting to note that the subjective hierarchic orders are studied by very simple research methods which are very difficult to distinguish (and this is an important puzzle) from the ways used by the subjects themselves to achieve these hierarchies. We shall treat both problems.

The methods used to study the subjective hierarchic orders may be divided in two categories: direct and indirect. The direct methods confront explicitly the subjects with the task to hierarchize a given set of objects. From the beginning, the subjects are asked to build a hierarchy or to express the way in which they hierarchize a class of objects. These methods assume the

existence or at least the possibility to achieve a hierarchic order. The indirect methods do not confront the subjects with an explicit task to hierarchize a given set of objects, but with a sequence of operations which may or may not produce by additional operations (done by the experimenter) a hierarchical order. The intention to produce a general hierarchy is hidden to the subjects, at least in the phase of collecting the primary data. The achieved hierarchy may be a surprise both for subjects and for the researcher. In this category are included different techniques. One which is frequently used mainly in the study of the hierarchy of work motivation and satisfaction is the pairs-comparison technique (Bertram, 1976). This category of techniques assume that it is possible to aggregate a hierarchical order from non-hierarchized answers of the subjects, or to aggregate a total hierarchy from partial hierarchies.

The criteria for hierarchizing may be imposed to the subjects or may be generated by themselves. The subject may use for a given set of objects only one or more criteria of hierarchization. When there is more than one criterion, it is important to answer the following questions: How are aggregated by the same subject different criteria of hierarchization? When, why, and how do subjects select the hierarchization criteria?

Now it is possible to distinguish between two polar ways to approach the subjective orders: a) a manipulatory (directive) one, using direct methods and imposed criteria; b) a participatory (non-directive) one, using indirect methods and self-elicited criteria.

The most important danger in the first case is to oblige the subjects to build a hierarchic order not only when they do not have one (the danger is similar with that from opinion surveys when the questions may induce an opinion when it does not exist), but even when they believe that it is improper to achieve a hierarchic order for a given situation. In the second case there is the danger to postpone very much the representation of a hierarchic order which does really exist.

In a study on 12 groups (between 20 – 30 members each) of students it has been observed a strong discrepancy between the way in which people assess the formal criteria for the hierarchization of the professional competence of students ("the grade") and the professional hierarchical order built by the students themselves: on the one hand, the subjects consider that the grades to exams are not meaningful criteria to establish a true hierarchic order of the professional competence, but on the other hand, the competence hierarchic order built by themselves is quite identical with that provided by grades. The rank correlations between the formal hierarchic order provided by grades and that provided by students using sociometric tests is very strong (between 0.79 and 0.84). It means that sometimes people use in an implicit way the same criteria for hierarchizing a set of objects which are assessed by themselves as "bad" criteria. These results lead to the conclusion that the subjects do not have a control on the way in which they achieve a hierarchic order. It is possible to find subjects in the paradoxical situation to operate unconsciously with the same hierarchization criteria which are considered wrong by them: this is an inconsistency between the assessment of criteria and their practical utilization.

The concrete research field

In a field research on work motivation we have been interested to study the consistency of the hierarchies of satisfaction sources. One of the problems was to compare the consistency of hierarchies achieved through direct methods with those achieved through indirect methods, in two circumstances: one in which the number of objects which have to be hierarchized was

a larger one (24 objects) and other when the number of objects was smaller (12 objects).

The number of objects which are hierarchized is an important variable because it may favorize a certain style of hierarchization. We believe that the probability to use analytical and systematic styles will be greater when the number of objects will be smaller and the probability to use synthetic and impressionistic styles will be greater when the number of objects is greater. Also we consider that during a hierarchization process a subject may pass from one style to another. If the number of objects is great and the importance of the hierarchization is high, the subjects will feel a strong pressure to achieve a compromise between "the cost of thinking and the precision" and "must be content with some approximate solution" (Toda, 1982, p. 97).

The method

We used two lists, one of 24 factors of work satisfaction and motivation (see this list in the Annex) and one of 12 sources of life satisfaction. The first list has been applied to the same groups of subjects (56 young workers in an enterprise) in the following ways:

a) as a seven point scale repeated three times to measure valence expectancy and instrumentality for every motivational factor (intrinsic/extrinsic). We used the integrated model for the assessment of the intensity and the structure of work motivation proposed in Mamali (1981). Note that the 24 factors may be hierarchized on seven layers by the use of every scale. In what follows we refer only to the valence scale, but it is useful to mention that it is possible to achieve an indirect hierarchy, taking into account for every factor the three dimensions (valence, expectancy, and instrumentality). The results of such a procedure will be presented in a separate paper.

b) a complete list of compared pairs (276 pairs for all the dyadic combinations of the 24 factors). The 24 factors are hierarchized on a scale between 0 and 23 points (the number of pairs in which each factor "wins"). This is also an indirect hierarchization.

c) a direct hierarchization, by asking the subjects to select, in order, the most important five factors for generating work satisfaction and the most important 5 factors for generating work dissatisfaction.

We have to mention here that the questionnaire was so formulated that the first two (indirect) hierarchies refer mainly to ideal ordering of the 24 items, whereas the direct hierarchy refers to these items as actual sources of satisfaction/ dissatisfaction. This is a serious drawback from the point of view of the present study (this difference introduces an inherent inconsistency), and we shall be cautious when inferring conclusions on this ground. These two levels – ideal and real – can be integrated by the help of using a hierarchic order derived from all three dimensions, valence, expectancy, and instrumentality. As we have pointed out, we shall now treat this topic here.

The list of the 12 factors has been applied using only two procedures: pairs comparison and direct hierarchization (both referring to the ideal ordering of the items, which makes homogeneous the obtained hierarchies from this point of view).

From a "technical" point of view, the two types of indirect hierarchization correspond to two well-known methods of (multicriterial) decision-making and group decision: the scoring methods (known also as Borda's methods) and the majority rule in pairwise comparisons, respectively. Details on the "rationality" of these methods as group decision techniques can be found in Păun (1986). In fact, some of the results, questions and discussions which follow can be viewed as a continuation of that paper, as a "practical" counterpart to it.

Further questions dealt with

The examination of the three hierarchies we can obtain in the case of the 24 factors of work satisfaction can answer (or give suggestions in this sense) many further problems which can be added to the question pointed out in the previous paragraphs.

1) Which is the most natural indirect hierarchizing method, the scoring one (Borda), or the simple majority rule (pairwise comparisons)? How this depends on the number of objects to be hierarchized, on the subjects "resources" (available time, the very motivation to hierarchize, the level of instruction, etc.)? These questions are important per se, but also because . . .

2) It is known that the aggregation of hierarchies is faced with many inherent limits. For instance, the Borda methods violate the independence condition in celebrated Arrow theorem ("the final order of two objects should not depend on the presence of a third object"). Are the people conscious of this aspect? Are their hierarchies violating the independence condition? When a non-independence effect appears, are the people able to see that, are they disturbed or not?

3) Similarly, the majority rule can lead to an "irrational" situation known as Condorcet paradox: individual transitive hierarchies can lead by aggregation to non-transitive orders at the group level (to cycles of the form: A is preferred to B, B is preferred to C and C is preferred to A). Are the people conscious of that? Are they disturbed by Condorcet paradox?

4) Can we classify the subjects according to the answers to these questions and according to the concordance of the three hierarchies? What about these hierarchies at the level of the whole group, and about comparing the subjects hierarchies with the group hierarchy?

Technical reformulations of the previous problems

The ways to solve these questions (in the context of the mentioned investigation involving 24 factors) are the following ones:

1) The first problem supposes the comparison of the three hierarchies given by each subject and the evaluation of their concordance. Clearly, the use of a usual concordance indicator is not suitable for this case, because the three hierarchies are very different: the first one has at most 7 levels (and rich classes of equivalent objects appear), the second one can possibly have 24 levels and the third one can have at most 10 levels (a significant number of subjects have not specified the sources of dissatisfaction or only specified 2-3 such sources), with distinct objects on each (the hierarchy is incomplete, the rest of the objects are not ranked). Consequently, we have considered an ad-hoc indicator, namely the number of inversions among two hierarchies (pairs of objects appearing in opposite orders in these hierarchies).

It appears here a question: what we have to do with equivalent objects, those which appear on the same level in a hierarchy? An honest solution is that based on the principle of the maximum uncertainty: do not make any assumption and to ignore such pairs of objects (this equivalence could be the effect of our method to collect data – the scale 1-7, compared with the number of objects – and not a real equivalence). Another possibility is to consider such objects really equivalent and to count a half of inversion when they appear on different ranks in the other hierarchy.

The computer program we constructed for analyzing the data proceeds in both these ways.

2) The second problem is not completely solvable in this frame, because

the used questionnaire was not specially designed to this aim. However, some non-independence can be noticed by comparing the direct hierarchy with the pairs options of subjects (and this is more legitimate in the case of the 12 items, when both hierarchies use the same ideal criterion).

3) In order to find a Condorcet paradox in the pairs preferences of subjects we have to look for cycles in the graph associated to these preferences (an arrow is directed from A to B when A is preferred to B in a pairwise comparison). Fortunately, the problem is much easier, because each subject had to examine all the 276 possible pairs with 24 objects, therefore the graph is total. The only non-cyclic total graphs are the linear orderings, hence those in which each vertex has a distinct number of dominated vertices. Thus, in our terms, a cycle there exists if and only if there are at least two objects (in fact, at least three) which win the same number of pairs. Clearly, this can be easily checked (this is, in fact, the mode of applying the majority rule, when we construct the hierarchy associated to pairwise options).

Of course, the occurrence of a cycle is more plausible for large sets of objects (and 24 can be qualified as "large"). Moreover a "short" cycle, a minimal one for example, is more important than one involving many objects (more disturbing, in principle, for our common sense). Fortunately enough, using again the fact that the preference graph is total, a simple remark exempts us from the task of finding such short cycles: in a total graph, if there are cycles then there are also cycles of length three (in a given cycle of length n, each two vertices are linked, hence a shorter cycle can be found, and so on, until one of length three is reached).

Therefore, in order to solve the third question, it is enough to find a cycle, thus to count the pairs in which each source of work satisfaction wins.

4) The fourth problem is not completely specified. Such a diagnosis/classification question is important and usual, but must be specifically formulated. For instance, comparing the group hierarchy (obtained by adding the score on the 1–7 scale) and the subjects' hierarchies and ordering these hierarchies according to the number of inversions could lead to a hierarchy of subjects. Which is the significance of such a hierarchy? We do not consider this question here.

Results

As we have said, a computer program was constructed to do the necessary calculations. We do not describe it here, but we specify the outputs it provides. All the data introduced in program are re-listed (in a uniform format), in order to check them. Finally, two tables are produced, in two variants each: one presenting each subject (in the decreasing order of the total number of inversions which appear in his/her hierarchies), with the corresponding number of inversions between each pair of the three associated hierarchies, and one presenting the group hierarchies of the 24 items. In the former variant, these tables are obtained ignoring the pairs of equivalent objects when calculating inversions (and taking into account only the direct hierarchy of five most important sources of satisfaction); in the latter, one counts as a half of inversion the pairs of equivalent objects which are separated in the other hierarchy and one takes into account also the five (when given) sources of dissatisfaction.

The cycles frequency

The program results (for 56 subjects) in the former variant are given in Tables 1 and 2, and in the latter one, in Tables 3 and 4. Let us first remark that all subjects introduce cycles when evaluating the pairs of objects. This means their preferences are

not transitive? Are they aware that the Condorcet paradox does not disturb them?

The result seems strange, but it is partly explained by the large number of items (hence of pairs) to be considered. It is indeed a hard task to avoid cycles when directly dealing with 276 pairs of items. On the other hand, there are frequent situations when are introduced cycles involving three neighboring items in the considered list, and this is unexpected. For instance, in the questionnaire filled up by subject 3032, we find a cycle among the first three items in the list! Figure 1 points out some cycles for this subject.

Figure 1. *Examples of cicles from subject 3032*

From these findings we are not allowed to infer that the subjects are not disturbed by Condorcet paradox, or that the individual preferences are not necessarily transitive. Probably the opposite assertions are true, as it indicates the case of the 12 life satisfaction sources hierarchization: in this case, eight of the 56 subjects choose items in pairs (66 pairs in total) without introducing cycles. A percentage of 14.7% subjects without cycles is quite significant. This strongly supports the assumption that the large number of items (hence pairs, hence effort of filling the questionnaire) has a sensitive effect on data, it confuses the subjects from this point of view (remember Toda's concept of "cost of thinking"). What it is happening when, let us say, six items are considered? A topic for further research: how the probability of cycles occurrence increases depending on the number of items to be hierarchized?

Table 1: *The order of subjects according to the number of inversions (method one)*

Subject	Score-Pair	Score-Direct (5)	Pairs-Direct (5)	Total	Cycle
71371214	169	12	25	206	Yes
71332224	152	31	19	202	Yes
71381194	140	22	38	200	Yes
30412243	154	7	32	193	Yes
77182194	131	20	27	178	Yes
30342262	161	11	5	177	Yes
83261183	134	17	23	174	Yes

Subject	Score-Pair	Score-Direct (5)	Pairs-Direct (5)	Total	Cycle
83252204	139	13	20	172	Yes
10252294	135	16	17	168	Yes
71361182	135	7	23	165	Yes
71461234	124	19	22	165	Yes
71392263	140	12	11	163	Yes
86171194	134	9	15	158	Yes
30402243	133	8	16	157	Yes
77171236	123	14	20	157	Yes
30442254	127	9	17	153	Yes
71422183	112	20	18	150	Yes
77201295	124	11	14	149	Yes
83241224	118	7	21	146	Yes
30351304	105	20	17	142	Yes
71432173	115	16	11	142	Yes
10241204	123	7	8	138	Yes
30362284	110	6	22	138	Yes
30382224	128	8	2	138	Yes
30452264	114	13	11	138	Yes
71402255	113	14	11	138	Yes
83181234	108	12	18	138	Yes
71512186	116	10	11	137	Yes
30332303	115	7	11	133	Yes
86181234	119	5	9	133	Yes
71352254	102	14	16	132	Yes
71491234	116	7	9	132	Yes
86191295	95	22	15	132	Yes
71471263	94	22	13	129	Yes
30432243	107	6	15	128	Yes
77212234	112	7	8	127	Yes
30322284	108	8	10	126	Yes
71482176	78	17	29	124	Yes

Subject	Score-Pair	Score-Direct (5)	Pairs-Direct (5)	Total	Cycle
83191274	95	18	10	123	Yes
71312294	85	9	14	108	Yes
71451244	61	18	18	97	Yes
83222255	55	15	15	85	Yes
10281325	69	4	10	83	Yes
83201265	46	18	16	80	Yes
30421204	72	3	3	78	Yes
86151254	47	15	12	74	Yes
71322275	61	7	5	73	Yes
30371284	54	7	11	72	Yes
83211265	42	11	15	68	Yes
10261265	41	12	13	66	Yes
83231295	31	16	13	60	Yes
71341254	43	6	8	57	Yes
71412275	27	9	9	45	Yes
86161274	33	5	4	42	Yes
71501275	22	10	9	41	Yes
77191294	20	5	10	35	Yes

Table 2: *The Group Hierarchies (method one)*

Scores		Pairs		Direct 10-Hierarchies	
24	(354)	23	(804)	1	(126)
19	(343)	24	(764)	2	(72)
23	(342)	22	(757)	12	(48)
1	(336)	19	(751)	5	(36)
5	(331)	21	(745)	7	(28)
11	(328)	20	(722)	14	(24)
18	(328)	12	(706)	23	(22)
15	(324)	17	(705)	18	(14)
4	(323)	14	(705)	19	(2)
8	(323)	10	(682)	21	(0)
12	(323)	9	(656)	11	(-4)
6	(322)	18	(621)	4	(-6)
2	(321)	5	(599)	22	(-14)
14	(318)	1	(592)	15	(-20)

Scores		Pairs		Direct 10-Hierarchies	
21	(318)	16	(589)	3	(-22)
7	(316)	4	(588)	8	(-26)
20	(315)	15	(584)	9	(-26)
22	(308)	6	(573)	20	(-28)
9	(305)	11	(569)	13	(-74)
17	(303)	8	(567)	16	(-86)
16	(286)	2	(525)	6	(-98)
10	(278)	13	(497)	17	(-110)
13	(276)	7	(493)	24	(-114)
3	(273)	3	(405)	10	(-116)

Table 3: *The order of subjects according to the number of inversions (method two)*

Subject	Score-Pair	Score-Direct (5)	Pairs-Direct (5)	Total	Cycle
71371214	169	12	25	206	Yes
71332224	152	31	19	202	Yes
71381194	140	22	38	200	Yes
30412243	154	7	32	193	Yes
77182194	131	20	27	178	Yes
30342262	161	11	5	177	Yes
83261183	134	17	23	174	Yes
83252204	139	13	20	172	Yes
10252294	135	16	17	168	Yes
71361182	135	7	23	165	Yes
71461234	124	19	22	165	Yes
71392263	140	12	11	163	Yes
86171194	134	9	15	158	Yes
30402243	133	8	16	157	Yes
77171236	123	14	20	157	Yes
30442254	127	9	17	153	Yes
71422183	112	20	18	150	Yes
77201295	124	11	14	149	Yes
83241224	118	7	21	146	Yes
30351304	105	20	17	142	Yes
71432173	115	16	11	142	Yes

Subject	Score-Pair	Score-Direct (5)	Pairs-Direct (5)	Total	Cycle
30362284	110	6	22	138	Yes
30382224	128	8	2	138	Yes
30452264	114	13	11	138	Yes
71402255	113	14	11	138	Yes
83181234	108	12	18	138	Yes
10241204	123	7	8	138	Yes
71512186	116	10	11	137	Yes
30332303	115	7	11	133	Yes
86181234	119	5	9	133	Yes
71352254	102	14	16	132	Yes
71491234	116	7	9	132	Yes
86191295	95	22	15	132	Yes
71471263	94	22	13	129	Yes
30432243	107	6	15	128	Yes
77212234	112	7	8	127	Yes
30322284	108	8	10	126	Yes
71482176	78	17	29	124	Yes
83191274	95	18	10	123	Yes
71312294	85	9	14	108	Yes
71451244	61	18	18	97	Yes
83222255	55	15	15	85	Yes
10281325	69	4	10	83	Yes
83201265	46	18	16	80	Yes
30421204	72	3	3	78	Yes
86151254	47	15	12	74	Yes
71322275	61	7	5	73	Yes
30371284	54	7	11	72	Yes
83211265	42	11	15	68	Yes
10261265	41	12	13	66	Yes
83231295	31	16	13	60	Yes
71341254	43	6	8	57	Yes

Subject	Score-Pair	Score-Direct (5)	Pairs-Direct (5)	Total	Cycle
71412275	27	9	9	45	Yes
86161274	33	5	4	42	Yes
71501275	22	10	9	41	Yes
77191294	20	5	10	35	Yes

Table 4: *The Group Hierarchies (method two)*

Scores		Pairs		Direct 10-Hierarchies	
24	(354)	23	(804)	1	(126)
19	(343)	24	(764)	2	(72)
23	(342)	22	(757)	12	(48)
1	(336)	19	(751)	5	(36)
5	(331)	21	(745)	7	(28)
11	(328)	20	(722)	14	(24)
18	(328)	12	(706)	23	(22)
15	(324)	17	(705)	18	(14)
4	(323)	14	(705)	19	(2)
8	(323)	10	(682)	21	(0)
12	(323)	9	(656)	11	(-4)
6	(322)	18	(621)	4	(-6)
2	(321)	5	(599)	22	(-14)
14	(318)	1	(592)	15	(-20)
21	(318)	16	(589)	3	(-22)
7	(316)	4	(588)	8	(-26)
20	(315)	15	(584)	9	(-26)
22	(308)	6	(573)	20	(-28)
9	(305)	11	(569)	13	(-74)
17	(303)	8	(567)	16	(-86)
16	(286)	2	(525)	6	(-98)
10	(278)	13	(497)	17	(-110)
13	(276)	7	(493)	24	(-114)
3	(273)	3	(405)	10	(-116)

Here are some conclusions derived from Tables 1 and 2.

a) A half of subjects do not introduce inversions between the scalar hierarchy and the 5-levels direct hierarchy. However, only 2% of them do not introduce inversions between the pairwise comparison and this 5-level hierarchy. One can infer on this ground that the scalar hierarchization is more natural, more subjects are consistent in this case, compared with pairs examination.

b) The great number of inversions between the given 5-hierarchies and that obtained by pairwise comparisons indicates that the independence condition is not (implicitly or explicitly) taken into consideration. In fact, the simple number of inversions does not necessarily indicate the independence condition violation, but only

suggests that. In our case this suggestion is confirmed by comparing the pairs and the direct hierarchy: only two subjects have the same order in the 5-level hierarchy and in pairs and no subject has the same order when considering the 10-level direct hierarchy (including the dissatisfaction sources). The result is an expected one, in the sense that the laymen do not imagine the independence condition and violate it with the same ease as they produce Condorcet paradoxes. Again we have to think at the cost of avoiding such paradoxical results when dealing with complex data.

In fact, as the two hierarchies do not refer to identical data, we cannot say too much about independence/non-independence. The above violation could be an effect of a conflict between reality and aspirations and not a true non-independence in the Arrow sense. A somewhat unexpected result is obtained in the case of hierarchizing the set of 12 items: again all subjects violate the independence, which contradicts the findings from the transitivity case, but fits with domain literature, where the independence condition is the most controversial one from those in Arrow theorem (see Păun, 1986).

c) By ordering the subjects in the decreasing order of total inversions we find the expected result that the highly trained subjects are placed at the bottom, their hierarchies are more "similar", the subjects themselves are more "coherent" (the digit 5 on the last position of the 8-digit subject identification means "higher education"; 4 indicate "high school"). This agrees with the above discussion and with quotations from Toda, 1982 (such subjects have further "resources" to deal with the questionnaire) and also suggests that the higher educated people are more adapted to their work places.

d) Table 2, by the spectacular differences between the three hierarchies, stresses the remark that we have to deal cautiously with these data. It is likely that the complexity of the questionnaire, as well as the very procedure of filling it, have introduced some distortions. For instance, it is clear that the pair evaluation has favorized the items with greater current number, whereas the direct hierarchy favorized the items appearing in the beginning of the list.

Let us examine now Tables 3 and 4. Of course, the only differences have appeared in Table 3 and on the last column of Table 4. However, the results confirm almost completely the results in Tables 1 and 2.

For instance, there are 24 subjects who introduce less than 10 inversions between the scoring hierarchy and the direct one and only 12 subjects who introduce less than 10 inversions between pairs aggregation hierarchy and the direct one. Again, the scalar hierarchization (Borda) seems to be more natural.

The situation of highly trained subjects in Table 3 is the same as in Table 1.

Some impressive modifications appear in the third hierarchy of Table 4, compared with the corresponding hierarchy of Table 2 (items 6, 9, 10 fall down and items 12, 14, 18, 19, 22, 23 rise with many ranks). This can be interpreted as an improvement of data, because the favorization of "small" items is decreased in this case and, moreover, the number of inversions between this hierarchy and the first two decreases.

Final remarks

Of course, the reader can infer more conclusions on these tables. We do not insist here in this direction, but point out some meta-conclusions, mainly proposing some suggestions for further research.

As we have already emphasized, the complexity of the questionnaire has a definite influence on the collected data. For 24 items, no "rationality" condition (as those in Arrow theorem) on hierarchization is observed (they simply are not made conscious); for 12 items, a significant percentage of subjects do not

violate the transitivity. What about 10 items, six items, etc.? And what about independence? It is sure that for three items both independence and transitivity conditions will be observed. Start from three and increase the number of items, start from, let us say, 24, and decrease the number of items. What differences appear? Which is the "optimum" number of items to be evaluated in pairs? How these results depend on the training level of the subjects? Link these questions with Toda's ideas concerning the "cost of thinking", and the trade-off between that and the precision.

The main purpose of the present questionnaire was the work satisfaction and the hierarchization problematic was only a side-purpose. A special questionnaire deserves to be designed, taking explicitly into consideration the concrete questions of the field: the transitivity, the independence, the comparison of different hierarchizing methods. For instance, a necessary feature of data to be collected must be the uniformity of hierarchies: to involve all objects, to use the same criterion and to have, presumably, the same number of levels. (Here, the scoring in the 1–7 scale forced the subjects to produce hierarchies with at most seven levels, which is not natural. Ideally, the scale must be larger than the set of items – and odd – such that the items be considered equivalent because they are equivalent, not because we have not enough levels to separate them).

We shall incorporate some of these suggestions in a separate paper.

Note: This study was worked out within the UNU Project ECONOMIC ASPECTS OF HUMAN DEVELOPMENT. (GPID: Goals Processes and Indicators of Development). Coordinator: Johan Galtung. The Romanian Team (1986)

References

Aubert, V. (1967) *Elements of sociology*. New York: Charles Scribner's sons.

Berger, J., Fisek, H.M., Norman, R.Z. and Zelditsch, M. Jr. (1977) *Status characteristics and social interaction. An expectation-states approach*. New York: Elsevier.

Berkowitz, L. (1972) Social norms, feelings and other factors affecting helping and altruism, *Advances in Experimental Social Psychology,* 6, 63–108.

Bernstein, L. (1967) *The co-ordination and regulation of movements*, New York: Pergamon Press.

Bertalanffy, L. von (1968) *General systems theory*. *Foundations, development, applications*, New York: George Braziller.

Bertram, B. (1976) Zur Entwicklung eines Arbeitsmotivtests, in W. Friedrich and W. Henning (Herausgegeben), *Jugendforschung – Methodologische Grundlagen, Methoden und Techniken*, Berlin: Verlag der Wissenchaften.

Boulding, K.E. (1978) *Ecodynamics. A new theory of societal evolution*, London: Sage.

Bryant, P.H. and Trabasso, T. (1971) Transitive inferences and memory in young children, *Nature*, 232, 456–458.

Cohen, G. (1977) *The psychology of cognition*, London: Academic Press.

Collins, A.M. and Quillian, M.R. (1969) *Retrieval time from semantic memory*, London: Courtesy of Academic Press.

Duck, S.W. (1973) *Personal relationships and personal construct: a study of friendship formation.* New York: Wiley.

Erikson, E. (1963) *Child and society*, New York: Norton.

Foa, U.G. and Foa, E.B. (1974) *Societal structures of the mind*. Illinois: Thomas, Springfield.

Galtung, J. (1980). *The true worlds. A transnational perspective*. New York: The Free Press.

Gel'fand, I.M., Gurfinkel, V. S., Tsetlin, N. L. and Shik, M. L. (1971). Some problems in the analysis of movements, in I.M. Gel'fand, V.S. Fomin and M.T. Tsetlin (eds.), *Models of the structural-functional organization of certain biological systems*, Cambridge, Mass.: MIT Press.

Gilbert, A. (1957) On stratification of personality, in H. David, H. von Bracken (Eds.), *Perspectives in personality*, London: Tavistock.

Jantsch, E. (1975) *Design for evolution. Self-organization and planning in the life of human systems*, New York: George Braziller.

Kelly, S.A. (1955) *The psychology of personal constructs*, vol. 1 and 2, New York: Norton.

Kohlberg, L. (1969) The cognitive-development approach to socialization, in D.A. Goslin (ed.), *Handbook of socialization theory and research*, Chicago: Rand McNally.

Landfield, A.W. (1979) Exploring socialization through the interpersonal transaction group, in P. Stringer and D. Bannister (eds.), *Constructs of sociality and individuality*, London: Academic Press.

Lederer, K. (Ed.) (1980) *Human needs. A contribution to the current debate*, Cambridge, Mass.: Gunn & Hain Publ., Oelgeschlager.

Levinger, G. and Snoek, J.D. (1972) *Attraction in relationship: a new look at interpersonal attraction*, New York: General Learning Press.

Lewin, K., Lippitt, R. and White, R.K. (1939) Patterns of aggressive behavior in experimental created "social climates" *Journal of Social Psycholy*, 10, 271–299.

Luthe, W. (1957) Neuro-humoral factors and personality, in H. David and H. von Bracken (Eds.), *Perspectives in personality*. London: Tavistock.

Mamali, C. (1981) *Motivational balance and coevolution*, Bucureşti: The Scientific and Encyclopaedic Publishing House (in Romanian).

Maslow, A.H. (1970) *Motivation and personality*. New York: Harper and Row.

Miller, G.A., Galanter, E., and Pribram, K.H. (1960) *Plans and the structure of behavior*. New York: Holt.

Miller, J.G. (1978) *Living systems*, New York: McGraw Hill.

Mureşan, P. (1980) *The social learning. Theories, forms, processes, mechanisms*, Bucureşti: Albatros Publishing House (in Romanian).

Murray, H.A. (1938) *Explorations in personality*, New York, Oxford Univ. Press.

Neculau, A. (1977) *The leaders in groups dynamics*, Bucureşti: The Scientific and Encyclopedic Publishing House (in Romanian).

Păun, G.H. (1986) Participation, social choice, aggregation of preferences (hierarchies). Inherent limits, The U.N.U. Project Economic Aspects of Human Development, *working paper*.

Pelz, D.C. (1951) Leadership within a hierarchical organization. *Journal of Social Issues*, 7, 3, 49-55.

Piaget, J. (1932) *Le jugement moral chez l'enfant*, Paris : P.U.F.

Piaget, J., Inhelder, B., and Szemihska, A. (1960) *The child's conception of geometry*, London: Routledge and Kegan Paul.

Rips, L.J., Shoben, E.J. and Smith, E.E. (1973) Semantic distance and the verification of semantic relations, *Journal of Verbal Learning and Verbal Behaviour*, 12, 1-20.

Schwinger, T. (1980) Just allocation of goods: decisions among three principles, in G. Mikula (Ed.), *Justice and social interaction. Experimental and theoretical contributions from psychological research*, Bern: Hans Huber Publisher.

Toda, M. (1982) *Man, robot, and society. Models and speculation*. Boston: Martinus Nijhoff.

Turvey, M.T. (1973) Periphery and central processes in vision: influences from an information processing analysis of masking with pattern stimuli, *Psychological Review*, 80, 1–52.

Veroff, J. and Veroff, J.B. (1980) *Social incentives. A life-span developmental approach*, New York: Academic Press.

Vroom, V. (1964) *Work and motivation*, New York: John Wiley.

Warren, Q.M. (1959) *Interpersonal maturity level classification*, California, Y.A.C.

Warrington, E.K. (1975) The selective impairment of semantic memory, *Quarterly Journal of Experimental Psychology*, 27, 635–657.

Zamfir, C. (coord) (1980) *The human development of the enterprise*, Bucureşti: The Publishing House of the Romanian Academy of Sciences (in Romanian).

ANNEX: *The 24 sources of work satisfaction considered here*

1. The opportunities to utilize and develop my aptitudes and skills.
2. The existence of very good relationhips with other people, to have very friendly co-workers.
3. The relative prestige of the enterprise in which I am working in comparison with other enterprises.
4. The job security.
5. The job provides many chances to organize myself the work and to decide how to do it.
6. The job provides good physical environment.
7. The job provides the possibility to do a complete (a "whole" and identifiable) piece of work that has an obvious beginning and end.
8. The significance and importance of my work for the way of life of other people.
9. The amount of salary and fringe benefits I receive.
10. The opportunities and the chances to get promotion in my job.
11. The extent to which the job itself provides me clues and information about my work performance.
12. The opportunities to be creative and imaginative in my work.
13. The social prestige of my job in comparison with other jobs.
14. The opportunities provided by my job to use my personal initiative in carrying out the work.
15. The capacity of the job to "tell" me how much I progressed in my work or which are my mistakes.
16. The social and cultural facilities to which I have access because of my job (nursery, canteen, etc.).
17. The possibilities to have an equitable wages in comparison with other people.
18. The opportunities to achieve by myself a complete piece of work.
19. The chances offered by my job to improve my skills.
20. The importance of my job for the well-being of other people.
21. The variety of the job, the extent to which it requires me to do many different things using a variety of skills and talents.
22. The opportunities provided to me by my job to teach other people.
23. The opportunities provided to me by my job to learn from other people.
24. The unbiased (fair) character of the appraisals done by the direct supervisors on the work achieved by every colleague, and the respect and fair treatment from my supervisor.

Primit la redacție: iunie, 2011