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Частина I
Системні концепції

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Essentials in S-method for process description

Annotation. The authors consider S-method as an universal research tool for human sciences. It involves describing of all possible processes and their components in the research subject, as well as sideways processes and their effects on the indicated subject. The research subject should be presented in accordance with the theoretical model constructed corresponding to the general set-theoretic form. Rules of applying the method are presented and illustrated with some types of psychological processes.

***Keywords**: process, S-method, modus of psychic (mental) representations, modus of non-psychic phenomena.*

Considering the relation between scientistic and humanitarian paradigms in the human sciences (including psychology), we support the scholars who defend the necessity of interaction [5; 9] and even the synthesis of those paradigms [4]. Such an approach is consistent with ratio-humanistic world-view orientation (see [1; 2]). When applied to human studies methodology it's requires – in addition to mutual tolerance and dialogues of competing paradigms' adepts – intentionally seek and apply the mediating tools in order to increase the productivity of dialogues. Such mediators may be formalized description of processes that are the objects of research.

Modern methods of formalized descriptions in human sciences can be grouped according to their development strategies.

The first strategy: on the basis of laws described in "humanitarian" language, to choose appropriate mathematical models, e.g. [6].

The second strategy: on the basis of particular types of mathematical models used in physics, biology and other natural sciences, to seek the possibility of applying such models in human sciences, e.g. [7; 8].

The third strategy: on the basis of the most general mathematical models, to seek possibility of their use in human sciences. This strategy seems to have not yet become widespread.

We use a third strategy. In our *set-theoretic method for process description* (S-method) the most general mathematical apparatus (set theory) is applied to the most general humanitarian concept of "culture", and components (modi) of culture are represented as algebraic structures.

In developing the S-method we aim, among other things, to the accessibility of the method for its use by experts in various human sciences. The most complete description of the method has been published in the book [3].

We proceed from the fundamental set theory statements, in particular from the concept of structure. To determine the structure (S), a relationship among elements is defined:

$S = <M; R_1, R_2, R_3, \ldots >,$ (1)

where

M – basic set, $M = \{a, b, c\ldots\}$;

R_1, R_2, R_3 ... – relations among elements.

General description of structures in set theory (1) we specify to describe the algebraic structures, using set-theoretic representation of *mapping*

The mapping, in general, is the following record:

Function : Prototype → Image

where the symbol ":" ties functional (*Function*) and matter (*Prototype*, *Image*) components of mapping.

For example, a mathematical function $y = x^2$ as a form of mapping is following:

Squaring a number : Set of numbers 1 → Set of numbers 2.

Non-mathematical transformation can also be described as mapping, for example:

Sociological science : Social practice → Scientific knowledge about social practices

Or

Science methodology : The phenomena of being → Scientific knowledge.

The components of mapping – *Function*, *Prototype*, *Image* – are presented as modi, interpreted as structured sets of elements. These elements can also be considered as modi below in the hierarchy.

A process is a change, it takes place in time. So, we assume that *Prototype* precedes *Image*.

Mathematical space of mappings covers all theoretically possible mappings, which involve modi considered by the researcher.

We use an algebraic record of math spaces of mappings. For example, the record of math space for ***the two*** modi *A* and *B* is the following:

{A; B} : {A; B} → {A1; B1} (2)

The elements of the set *{A, B}* are also regarded as sets.

We consider the math space of mappings as a structure in which:

1. Modi (sets) *A* and *B* in (2) are the main elements of the set structures as well as relationships defined on this set.

2. *Prototype* and *Function* are identical, as defined in the same time moment. Modus *Function* or some of its constituents is considered as an expression of the relationship between the components of this structure.

3. *Images*, in general, are different from the *Prototypes*, that is reflected by index numbers (*A1*, *B1*).

Equation (2) is a record of a complex mapping with *A* and *B* modi. It is also a generalized record of eight simple following mappings:

$A : A \rightarrow A1$	$A : B \rightarrow B1$	$B : B \rightarrow B1$	$B : A \rightarrow B1$
$A : A \rightarrow B1$	$A : B \rightarrow A1$	$B : B \rightarrow A1$	$B : A \rightarrow A1$

A complex mapping can be represented as a three-dimensional matrix (table), which is a graphic representation (Figure 1.) of math space (2).

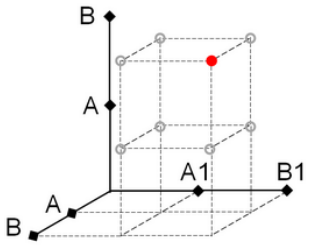

Figure 1.

This math space of mappings contains 8 points, red highlighted point corresponds to following mapping

$$B : B \rightarrow B1$$

Mathematical space of mappings may be further considered, in particular, as a theoretical model of the investigated phenomena.

In a specific study it is necessary to determine the most efficient set of modi – the components of processes focused by researchers.

Mathematical space of mappings which contains more than two modi can be obtained in a way of detailing 2-modi math space or in the very beginning of the study. The more modi are selected, the more points are in the space of mappings, the more detailed description of the scientific phenomena becomes, but the greater is the amount of data to be analyzed.

The procedure of method application

The focus of any investigation, according to the method, should be presented as a component or characteristic selected to describe the processes.

Each process should be presented as a change of certain modi according to certain laws.

The procedure for application of the method consists of the following steps.

1. *To select the components of the research subjects.* On the base of some theoretical approach (or at the investigator's decision) to select modi, presumably related to that object.

2. *To select the time interval (intervals) of these processes.* The time intervals may be chosen depending on the scheme and capacity of research.

3. *To construct a mathematical space of mappings.* Mathematical space of all theoretically possible processes mappings, components of which are previously selected modi, should be constructed on the general consumptions of the S-method.

4. *To select the mappings for describing the research subject.* The choice of certain processes from theoretically possible ones may be provided variously, but primarily according to the research subject.

For example, if a researcher's interest is only in change of modus B and only at one time interval, he/she may describing the only set of mappings (see also Figure 2.).

$$\{A; B\} : \{A; B\} \rightarrow B1$$

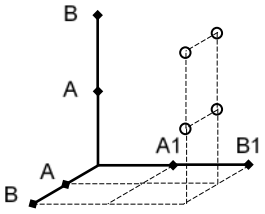

Figure 2.

However, if it is necessary to consider changes of B at two time intervals, it is necessary to describe A changes as well, because at the second time interval A, perhaps modified at the preceding interval, is one of the functions (one of the laws) of changing B.

Changes at the first stage:

{A; B} {A; B} → {A1; B1}

Changes at the second stage:

{A1; B1} {A1; B1} → B2

For visibility, at Figure 3. these stages are represented by two three-dimensional matrices.

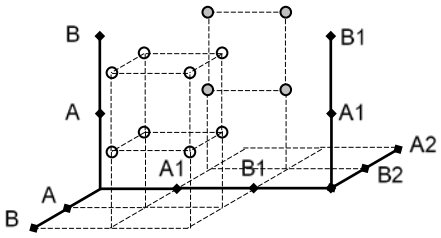

Figure 3.

The selection of mappings, which should remain in the theoretical model of the research subject, may be produced by other criteria, such as:

– presence/absence of a theoretical argumentation for a particular process / mapping;

– possibility of experimental verification of the feasibility of the process;

- possibility for researchers to analyze a large volume mathematical space.

5. On the base of the theoretical model to create description of the research subject. In order to obtain such description the researcher should:

- clarify the interpretation of mappings;

- compare this interpretation with a phenomenology of the research subject;

- formulate criteria for identifying types of that subject.

As shown above mathematical space of mappings may be further examined, in particular, as:

• a structure of the studied processes and its changes at different time intervals;

• the theoretical material for formulating hypotheses; in particular, each of theoretically possible mappings may be considered as a description of the real process.

Let us consider in more details the case when the researcher is interested in modus B2 as the result of a two-stage process with the original modi A and B (see. Above).

Modus B2 is formed by subsets (*partial modi*):

B2 = {$B_1$2; $B_2$2; $B_3$2; $B_4$2}

Partial modi comprising B2 are the images of the following simple mappings

B1: B1 → $B_1$2

A1: B1 → $B_2$2

B1: A1 → $B_3$2

A1: A1 → $B_4$2

6. *To repeat the previous steps with the changed composition of the considered modi.* The need to repeat procedure steps may be caused, for example, by realizing that the principle of separating the modi is not optimal for the research subject.

Space with psychic modi

To illustrate the application of 2-modi mapping in psychological studies, we denote modus of psychic (mental) representations as *Psy*, modus of non-psychic phenomena as *Ph* (phenomenal modus).

Then, as in (2), the record of math space with *Psy* and *Ph* modi will be the following:

{Psy; Ph} : {Psy; Ph} → {Psy1; Ph1} (3)

This math space contains 2^3 = 8 points, each of which defines one of the following simple mappings.

Psy : Psy → Psy1	*Psy : Ph → Psy1*	*Ph : Psy → Psy1*	*Ph : Ph → Psy1*
Psy : Psy → Ph1	*Psy : Ph → Ph1*	*Ph : Psy → Ph1*	*Ph : Ph → Ph1*

The mapping *Ph : Ph → Ph1* is not further considered as it is not a description of the process with psychic components.

The remaining 7 mappings can be considered as a simple typology of processes with psychic components.

We give some examples of processes described by these mappings.

1. *Psy : Psy → Psy1*. Processes in which the functional and substantive components of the mapping are Psi modi. These are, in particular, processes of thinking and reflection.

2. *Psy : Psy → Ph*. Processes described by mappings, in which components, in addition to Psi-modi, are other (non-psychic) phenomena: material modi of culture, extra-cultural phenomena. In this case, the functional and prototype components are Psi-modi, and the image component is other phenomenon (in particular, in practical activity). Possible examples include processes of motivational, volitional, emotional, value regulation of any practical activities.

3. *Psy : Ph → Ph1*. These processes are also described by mappings in which components are psychic and non-psychic modi, but in this case the functional component is Psi-modus, the prototype and image components are non-psychic modi. This process type may be attributed, in particular, to processes of manufacturing and scientific activity, as well as of work in arts.

4. *Psy : Ph → Psy1*. Processes described by mappings of various Ph-modi into Psy-modi in accordance with the laws carried also by Psy-modi. This type of mapping is applicable to the description of a wide range of cognitive processes, in particular of all kinds of perception.

5. *Ph : Psy → Psy1*. These processes are described by mappings of Psy-modi into Psy-modi in accordance with the laws carried by Ph-modi. These laws can determine changes in person's mental state as well as the psychological impact of a person on another one (or a social group on another one etc.). Examples: changes of person's mental state while external physical conditions (e.g., weather) vary; the transformation of the value system of a person or of a social group due to the content of a fictional book or of a legislative act etc.

6. *Ph : Ph → Psy*. Processes described by the mappings of the Ph-modi into Psy-modi in accordance with Ph-modi' laws. This may involve, for example, IT-based representations of education content as well IT-managing of an educational process or of psychological training.

7. *Ph : Psy → Ph1*. These processes are described by mappings of the Psy-modi into Ph-modi in accordance with Ph-modi' laws. For example, it can be a simplified description of financial incentives for persons involved in scientific, technical work as well as in work in arts.

This typology is also the description of two-modi mathematical space of mappings, it may be used in research in different ways, e.g. as a plan to develop the methods of hypotheses testing, of psychometric procedures application, etc. In these cases, records of such mappings might be helpful for identifying the processes which are research subjects of experimental studies, as well as for systemic description for the impact of additional factors on the measurement results.

Conclusion

S-method is aimed for description of psychological, and, more broadly, cultural processes. The method is not a theory, which models specific patterns, it is a means of systemic analysis of any research subject, this analysis being possible before such patterns are identified in subsequent empirical procedures.

We consider S-method as an universal research tool for human sciences. It involves describing all possible processes and their components in the research subject, as well as sideways processes and their effects on the indicated subject. The research subject should be presented in accordance with the theoretical model constructed corresponding to the general set-theoretic form.

The application of this method allows to organize the available knowledge about the research subject, to formulate hypotheses on this base and to outline a strategy for further research.

We developed the S-method for cultural (in the broad sense) processes, including studied in psychological sciences. But we do not see obstacles for its wider application. We consider the method may be also useful in different fields of natural and technological sciences, which study complexly determined processes if for them there are no known mathematical models, universal for those types of processes. Such, for example, are many biological, geological etc. disciplines.

From our experience of using S-method we conclude that it can be a tool to detect (and possibly to eliminate) of methodological deficiencies of texts in psychology and other human sciences.

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