

# Developing Research Involving Different Species: Opportunities and Empirical Foundations

A. V. Varfolomeeva, N. S. Tkachenko, A. G. Tishchenko

**Abstract**—In this study, we addressed the problem of weak validity, implausible results, and inaccurate reporting in psychological research on different species. The theoretical basis of the study was the systems-evolutionary approach (SEA). We assumed that the root of the problem is the values and attitudes of the researchers (in particular anthropomorphism and anthropocentrism). The first aim of the study was the formulation of a research design that avoids this problem. Based on a literature review, we concluded that such design, amongst other things, should include methodics with playful components. The second aim was to conduct a series of studies on the differences in the formation of instrumental skill in rats raised and housed in different environments. As a result, we revealed that there are contradictions between some of the statements of SEA, so that it is not possible to choose one of the alternative hypotheses. We suggested that in order to get out of this problem, it is necessary to modify these provisions by aligning them with the attitude of multicentrism.

**Keywords**—Epistemological attitudes, experimental design, validity, psychological structure, learning.

## I. INTRODUCTION

PSYCHOLOGICAL studies with non-human species have a common methodological basis, ensuring the creation of valid, reliable, representative, and falsifiable knowledge. In particular, it contains operationalization, research subject and object formulation, and research planning rules. As objectivity in the sense of intersubjectivity is an inherent value of the institute of science, enabling such vital processes as translation and capturing of knowledge, the researcher's compliance with the rules of publication appears to be equally important. To put it another way, research products can be evaluated by the community only if they are reported in a way that is relevant within the institute. Today the scientific community reflects the problem that includes such components as inexact subject and object formulation, methodic description, and results description [1]-[4].

Inexact reporting is potentially paired with the researcher's bias and epistemological reductionism. We understand reductionism as a sustained, simplified view of the research subject [5]. The simplification can be understood as, on the one hand, not conforming to methodological prescriptions and, on the other hand, not taking into account the data described in studies. Moreover, methodological inconsistency of such studies appears to be inevitably accompanied by an array of ethical issues [6], [2]. We argue that the root of the above-mentioned problem is not the methodological incompetence of some researchers or their deliberate violation of ethical

standards so much as their general worldview or type of rationality [7], [8]. Rationality is defined as “a set of accepted cognitive attitudes, beliefs, values, principles, and rules for the generation, selection, capturing, translation, evaluation, and transformation of knowledge” [8]. Above we described the classic type rationality, which is more commonly referred to in the literature as Cartesianism. We assume that its carriers are unable to take into consideration some threats to validity during the research planning procedure due to general attitudes. Below we note two of the most discussed. The first one is *anthropomorphism*, which is attributing to non-human species what they do not have or cannot have, that is, wishful thinking. The second one is *anthropocentrism*, which has at its core the idea of the dominant position of human (researcher) in relation to other biological species and his function as an actor in relation to all processes in which he is involved.

A necessary step toward addressing the problem is the formulation of the exact definition of the research object, subject, and their correspondence in a separate scientific study. The subject is a denotation of a hypothetical referent (entity) that is formulated for a generalized description of important properties of the research object and potentially has ontological status. The object is a set of exemplars (individuals or groups that constitute the population) which, according to some reasonable assumptions, are the carriers of the subject. For the field of psychology, the subject can be designated as intelligence in the sense of “mechanism of specific to living systems orientation in time and space” [9]. More formally, taking into account all its significant characteristics, the subject can be denoted as “structure of dynamic models of interaction”, “structure of individual experience” or “psychological structure” [10], [11]. Research object as an assumed carrier of the subject then can be denoted as “living system”. The general idea of the subject-object construction is that attributes of the subject as a theoretical and hypothetical construct are set in accordance with the object properties identifiable empirically through the application of methodics. The former then can be reconstructed as a result of empirically-based falsification of a cascade of alternative hypotheses deduced from a theory. Referring to the specific subject of psychology, it can be reconstructed from the products of research participants' interactions with the environment.

The theoretical framework of the present study is the system-evolutionary approach (SEA) [12], [13]. SEA includes the provision of the above-described unity of logico-empirical organization of scientific investigation, which is critical to the

A. G. Tishchenko is with the Russian Academy of Sciences, Russia (e-mail: antongtishchenko@gmail.com).

creation of plausible knowledge. Another important provision describes the relation between psychological and physiological. "The nervous system existence makes it possible the exchange between an animal and its environment not only with matter and energy (life) but also with information because in behavior the relationships with the environment are realized through the memory, i.e., the totality of adaptive behavioral acts which were collected in trial-and-error processes and were accumulated in neural cells specializations" [14]. The next provision is formulated as follows: the components of the psychological structure (models of an individual's interactions with the environment) are represented by groups of neurons. The unified process of actualization and generation of these models is accompanied by the realization of behavior and neural activity and proceeds as a selection within a population of neurons. This statement supports the ontological status of the psychological structures as it relates them to the neural substratum. The second provision, which argues the ontological status of psychological structures, is the evolutionary character of their formation. This process is defined as sequential stages of differentiation of structures' components from protoforms, while the structures themselves act as self-replicators [15], [16]. The above provisions allow to consistently match psychological structures and body as a whole, namely the former acts as a model for the construction of an organism-wide functional system in each specific behavioral act [16]. Conformation of physiological, psychological, and social aspects is achieved by introducing the concept of cross-individual psychological structures and institutionalized subject fields. Institutionalized subject field organization is represented by objects, artifacts, rules for addressing them, and the institutionalized community. Members of the latter interact with the subject content of the institutionalized subject field and among themselves. The community as a whole is the carrier of a cross-individual institutionalized psychological structure and each of its members is a carrier of some specific subset of this structure components. The latter enables communication within the community [17]. SEA suggests that laws formulated within it are similar for *Homo* and other species.

The given content of SEA is consistent with the conception of selective evolution, system (anti-elementaristic) approach, and experimental methodology and potentially represents the rationality alternative to the classic type (or Cartesianism), namely post-classic type rationality [7], [8]. We assume that these provisions can be used as a theoretico-methodological basis for researches on psychological structures in non-human species.

In this study, we try to outline a possible solution to the problem described in this section. The following research objectives were formulated: 1) to highlight alternatives of research procedures construction presented in the field of non-human psychology, taking into account the complexity and diversity of species' representatives' behavior and 2) to describe differences in the formation of instrumental skill in rats grown and/or housed under typical and/or enriched conditions.

## II. CRITICAL REVIEW

To achieve the first goal, we carried out the analysis of articles and monographs representing theoretical and empirical studies, the objects of which are representatives of different biological species. The selected material, of course, is not exhaustive, but is a concentrate of the indicated problem and provides possible grounds for reflection. We identified three potentially opposing groups of studies.

The first line of research is represented by studies in the field of comparative psychometrics, which uses tests to evaluate various psychological characteristics, such as personality, cognitive styles, and cognitive distortions, general intelligence, etc. in various species, taking into account "behavioral variability" [18]-[20]. To build learning trajectories, the analysis of errors made by research participants when performing tasks is used, as well as the analysis of characteristics and genesis of such errors.

Planning is the primary and key procedure before the research and acts as an immutable rule [21]. The results of studies that support behavioral variability or behavioral syndromes, as well as the diversity of personality, should be taken into account when planning psychological experiments, regardless of the species constituting the research object and the type of research [21]-[23]. It can be assumed that errors of the research participants not only characterize the variability in behavior, but also indicate the presence of various alternatives in achieving the goals of behavior, which may exist in the population, and, in turn, can be a source for studying psychological structures. It is also important to emphasize that studies of this group include the substitution of human psychology for the psychology of non-human species, which is one of the manifestations of anthropomorphism. Secondly, these studies take a simplistic approach to housing and experimental models due to the anthropocentric simplified view of the research subject and object. Such behavioral models imply assessing behavior as correct or incorrect, whereas for the reconstruction of psychological structures it is important to involve the individual in the subject field and to use undefined tasks with rich apparatus, which creates a situation of active construction of behavioral strategies and provides the opportunity of recording products of the participant's interaction with the subject field (i.e. capturing of research object properties) [24]. Another example is the use of food deprivation procedures. Hunger, which is a particular condition of the research participant and, importantly, a property of the object, is understood as an independent variable that the researcher fully controls. Although food deprivation is a low-cost way of forcing an individual to perform an experimental task, the food acquisition behavior of hungry individuals relates to only a fraction of all the problem situations carriers of psychological structures may encounter. Despite the limitation of these studies in formulating conclusions about the individuals' potential for experience formation, these conclusions are extended to the population. This is a serious threat to their external and ecological validity. Also, because hypotheses and conclusions are formulated in over-generalized terms (relative to the specific conditions mentioned), construct

validity is threatened. Such effects of typical housing and learning practices associated with the studies discussed as chronic stress (or distress) and specificities of musculoskeletal development are not even an enthymeme, i.e. not assumed or seen as inessential while they are both characteristics of the research object. Thus, a research object is constructed that, firstly, has special properties that are not considered and, secondly, does not represent the population about which conclusions are formulated. This increases threats to the types of validity mentioned and adds a threat to internal validity in the form of uncontrolled extraneous variables.

Another line of studies is in the fields of social learning, prosocial behavior, and protoforms of culture in non-human species. The number of such studies has been significantly growing in the past 20 years. One of the early notes about this growth is in [25]; also see the literature review in [26]. The same authors have developed a model of social learning for food preferences [27]. Another study describes the formation of preferences for a sexual partner in *Drosophila Melanogaster* [28]. Such studies can be viewed via characteristics of cross-cultural studies, namely emic- and etic- approaches [29]. Both, first and second lines of research, address either universals (etic-) or highly variable characteristics (emic-) for each particular species. However, despite their effort to move away from classical conditioning and associative learning, studies using social learning models have limitations related to considering individuals in isolation and maintaining a mechanistic view of behavior, the idea of activity as a post-stimulus effect in particular. This is reflected in planning such experiments. For example, it can include one individual's stress level as an independent variable, affecting (as suggested by the authors) other individual's stress level as a dependent variable. Such research plans are the consequence of the methodological attitudes of instructivism, which explains individual development exclusively through external influences and denies the selective nature of the process, and both anthropocentrism and anthropomorphism manifesting themselves in the simplified notion that the development and activity of living systems do not have an inner aspect. More examples of such "creating empathy" research plans are described in [30]. It is worth noting that the studies of morality and empathy turn out to be the realizations of a general situation, which can be described by a phrase from an article [3]: "... scientific routine where killing rodents is such common practice that alternatives may sometimes fail to be considered".

The available literature on communities or cultures in human and non-human species, differentiated role organization, coordination of activities, and the formation of shared experience [31]-[37] not only raise the question of the actuality of researches with joint actions but challenges the very idea of studies with the participation of isolated individuals [38]-[40]. It is worth noting the possible phenomenology, which is not being recognized in studies of communities and cultures in non-human species. Authors of the analysis of studies published for about 40 years before its publication note that there is little data on the shelters in *Rattus norvegicus* [41]. From the results obtained in [42], it can be seen that no new information has been

recorded since then. Despite the scarce information obtained mainly in laboratory conditions in fenced areas or excavation sites, the organization of shelters in rodents has generally been reconstructed. While these shelters constitute complex systems of burrows, in particular highly specialized structures with division into nursery areas, foraging areas, and "bunkers" the potential for operation with abstractions and agency in this species group is largely left unattended.

Simplified ideas of the research object and subject lead to imposing experimental conditions and tasks on non-human participants against their interests and then to the formulation of artifactual conclusions about its properties (e.g. cognitive abilities). The problem with these conclusions is their speculativeness (which is primarily a consequence of Cartesianism-related attitudes, and only secondarily of the theoretical positions) due to methodologically irrelevant attribution of behavioral goals to the individual (e.g. pressing a lever to get food) that they may not form. Empirical procedures and apparatuses are themselves constructed in accordance with the simplified ideas ignoring known behavioral phenomenology (see above).

The third line of research, although represented to a smaller extent than the previous two, is studies in the fields of health psychology, welfare, methodological development of the principles of transhumanism, and formation of cross-species relationships, in particular between an experimenter and experimental participants [43], [44]. A key characteristic of these studies is behavioral models incorporating play as a type of behavior [45], for example, a "hide and seek" game and "alternate play" between an experimenter and rats [46]. However, other authors [3] note that unique behavioral models and often humanistic ideals contradict neurophysiological research objectives. Nevertheless, these studies emphasize the importance of social interactions, including those between a researcher and research participants (e.g., "Homo – Rodentia"). The latter can be modeled as a tickling game [47], which is beneficial for animal welfare [48] and can be useful for developing cooperation during experiments.

Studies with a game component do not impose restrictions on the freedom of actions which allows the formation of a wide behavioral repertoire. Secondly, they also allow the elimination of the "hunger" factor, which, as we discussed above, does not relate to the psychological problem in the fullest sense. The "motivational problem", namely the necessity to satisfy hunger motivation, is thus eliminated, but the cognitive motivation, i.e. interest in play, is preserved. Tickling or, as a more general form of play behavior, the game itself can act as a form of encouragement.

The *faulty practices* problem [1] seems to be common to many fields of research. In this regard, unaccounted and reduced ideas of the research subject can act as a source of errors in the research planning. The latter in turn appears to be a source of artifactual conclusions. The given results of theoretical and empirical studies allow us to formulate the grounds for modification of theoretical provisions, which is the realization of experimental methodology, i.e. the principle of unity of logico-empirical organization of research. We

established the coexistence of multiple alternatives of studies with the participation of non-human species representatives and determined the grounds for the scientific community's reflection. Based on the analysis, we suggest that the most acceptable alternative is the construction of research with the employment of play behavior, as it allows to get rid of deprivation procedures, the idea of researcher's domination and investigation of his "influences" on the research object, that is, to get rid of reductionism. Furthermore, the implementation of play behavior corresponds with the provisions of the system-evolutionary approach and is consistent with some of the statements made on the possible development of non-human species studies [1], [4]. Further, we give a scenario of such researches.

1. The observance of research planning procedures, the elimination of bias and reductionism, i.e. de-anthropocentrism and de-anthropomorphization, which apparently can imply multicentrism [49] and, as a consequence, not attributing speculative properties to the research object, but proving theoretical constructs and following rules for conducting empirical procedures [7].
2. Adherence to research ethics and ethical foundations of the work. A possible consequence for both the scientific community and the research participants could be, for example, a rejection of Cartesian ethics [50].
3. The consequence of the basis of these two propositions is a departure from the researcher's interests and desires so that the researcher does not harm representatives of non-human species and turns to them for help.
4. Teaching the representatives of non-human species involved in the study in a way that is free and accessible to them, taking into account their agency and activeness, which can be ensured by providing freedom of choice and formation of behavioral neoplasms, through all kinds of interaction with objects [49]. This forms the necessary program of environmental and behavioral enrichment.
5. Realization of studies involving two or more individuals, e.g. studies of the formation of intraspecific and interspecific relationships. It is the implementation of notions of the sociality of psychological interaction and simultaneous belonging of individuals to different social communities, which is inherent in the "natural environment" [11], [51], [52].

### III. STUDY 1

In two typical studies (with synchronous ECG and EEG recording, as well as tetrode recording of neuronal activity) with free-moving rats performing sequential pedal-feeder-pedal cycles, an additional series was conducted, the aim of which was to establish correspondence between the realizations of the sequential pedal-feeder-pedal cycle (SPFC) in the deprivation situation and after returning to *ad libitum* feeding. The need to conduct this series was due to the above-mentioned provisions about the specificity of this sample.

#### A. Hypotheses

The *ad libitum* diet will be accompanied by the change in 1.

The total amount of food eaten, but not the amount of SPFC. 2. The amount of both food eaten and the amount of SPFCs. 3. Amount of SPFCs but not the amount of food eaten. 4. There will be no change.

#### B. Materials and Methods

The study was conducted on adult male unstrained rats (weight range 350 g to 450 g.) divided into Group-1 (N=5) and Group-2 (N=3).

#### C. Apparatus

Experiments in Group-1 were carried out in an experimental cube-shaped cage with a rib of 60 cm. Each half of the cage had a feeder and a pedal in corners, which, when pressed, caused food to be automatically transported to the feeder. Rats were placed in the cage and had to learn to press the pedal to get a portion of food. Experiments in Group-2 were carried out in a special two-section cage bisected by a partition and equipped with photoelectric sensors for behavior control. The opposite angles of each section of the cage contained a feeder or a pedal (2 feeders and 2 pedals in total). The feeders were placed at the farthest corners of the cage, while the pedals were at the nearest ones. When the animals pressed the pedal, a special food tablet was automatically transported to the feeder; the experimenter could also activate the mechanism manually by pressing a button.

#### D. Procedure

Rats learned to perform appetitive behavior during 30-minute experimental sessions. Rats were subjected to food deprivation, with a weight loss not exceeding 15% of the pre-study weight. In each session, the rats performed 70-90 "pedal-feeder-pedal" cycles of which 50-70 were discontinuous (DPFC), i.e. the approach to the feeder after pressing was not carried out immediately. After 5 days of reproducing the skill, the study participants returned to eating *ad libitum*. In Group-1 in the instrumental task 8 mm<sup>3</sup> pieces of cheese were used, and in Group-2 dustless pellets (25 mg, BioServ) were used.

#### E. Materials and Methods

The main diet in the home cage (460 x 300 x 160 mm) was pelleted feed (MEST). The criterion for skill formation was the achievement of a stable result (at least 15 SPFC).

#### F. Results and Discussion

It was found that in deprived rats the number of SPFC reached 20 per session, and after returning to *ad libitum* feeding in both groups this number did not change (SPFC = 17-20, group-1 N=1, group-2 N=2) or slightly decreased (SPFC = 13-17, group-1 N=1, group-2 N=1). The number of DPFC was also found to decrease when returning to diet *ad libitum* (DPFC = 25-45). Due to this, there was a change in the correlation of DPFC and SPFC, i.e., for the total number of cycles, the proportion of SPFC increased and DPFC decreased. In the deprivation situation, rats ate all the food obtained in the experimental cage, and after returning to *ad libitum* feeding, they also ate all the food.

According to the results, the most plausible alternative was that after the transition to *ad libitum* feeding the number of SPFCs will change and the amount of food eaten will remain the same (alternative number 3).

The results obtained in Study 1 suggest several options of explaining the observed phenomenology. First, the increase of the percentage of SPFC in the total number of cycles in the case of *ad libitum* feeding indicates that the structure of experience formed in this task actualizes under different conditions. At the same time, the organization of this structure and the possibilities of its further differentiation cannot be defined. Moreover, it is difficult to assess the limitations that exist for these conclusions due to the special conditions and the specificity of the sample.

Second, the behavior goal of *ad libitum*-fed individuals may not only be satisfying the motivation of hunger. For example, this behavior can be aimed at the enrichment of taste preferences, i.e. be a realization of appetite [53]. Alternatively, it may be aimed at obtaining, locating, and searching for food not normally available to participants outside the research [54]. However, it is necessary to treat the latter version with caution, as it implies that the centering on food is the only possible tool of “suppression” of motivations other than hunger and inclination of the research participants to fulfill the researcher’s desires, i.e. is anthropocentric. The focus on food as the only possible tool of “suppression” and inducement of one’s desires together with actions aimed at the formation of the research participants’ special states (chronic, persistent forms of organization), the severity of which requires special assessment, in particular with regard to the probability of their occurrence on the basis of primary organization. Thus, we conclude that the reconstructed fact is contradictory and subject to a special analysis.

An additional conclusion is that food can be a means of interaction between the individuals involved in the study, for example, in forming relationships (“Homo – Rodentia”) while participating in a heterospecific game [46]. This perception is convinced by the results of the review.

#### IV. STUDY 2

We designed new research based on the provisions given in the critical review. It was intended to evaluate the position that the rich primary behavioral repertoire formed in early ontogenesis facilitates the formation of new behavior.

##### A. Hypotheses

H1<sub>1</sub>: Research participants who are not deprived, placed in an enriched environment, and build supportive relationships with each other will not form the experimental skill. H1<sub>2</sub>: Research participants who are not deprived, placed in an enriched environment, and build supportive relationships with each other will form the experimental skill faster than the participants housed in typical conditions.

H2 was a hypothesis about the rate of instrumental skill formation in relation to home cage conditions (alternatives are shown in Table I).

TABLE I  
 ALTERNATIVE OUTCOMES OF THE HYPOTHESIS ABOUT THE RELATIONSHIP BETWEEN SKILL FORMATION, DURATION OF HABITUATION TO HOME CAGE AND TO STUDY PARTICIPANTS (TO BOTH RATS AND RESEARCHER).

	Getting used to the study participants	
	Long	Fast
Long	Long (H2 <sub>1</sub> ) or fast (H2 <sub>2</sub> ) learning of the skill	Long (H2 <sub>3</sub> ) or fast (H2 <sub>4</sub> ) learning of the skill
Fast	Long (H2 <sub>5</sub> ) or fast (H2 <sub>6</sub> ) learning of the skill	Long (H2 <sub>7</sub> ) or fast (H2 <sub>8</sub> ) learning of the skill

##### B. Materials and Methods

The study was conducted on four 5-month-old rats (*Rattus Norvegicus*).

##### C. Apparatus

The **home cage** (63 x 43 x 95 cm, Petmax, China, m = 10.6 kg) had three tiers, plastic tray, and ladders. The **experimental chamber** was the same as in Study 1 for Group-2.

##### D. Housing Conditions

A simplified version of the model called semi-naturalistic cage [55] was used for the home cage. The home cage was filled with hammocks, soft seats, flexible perches, hanging house, hanging feeders, bowls, drinkers, treadmill, bedding material represented by aspen chips (Millamore).

##### E. Procedure

The rats were kept under typical vivarium conditions, in cages (460 x 300 x 160 mm) before the study. The diet consisted of feed mill. The rats were treated with anthelmintic before being placed in the home cage (toltrazuril, moxidectin, 20 ml), and for external parasites with selamectin.

##### F. Initial Manipulations

Before the beginning of the experimental series, the rats adapted in the home cage with an enriched environment and interacted with the study participant (researcher) by handling, tickling, and playing. The criterion for the rats’ involvement in the study was full habituation to the home cage, formed skills of interaction with its content (at least 7 days), and an “active desire to interact with the researcher”. Once this criterion was achieved, the rats were introduced to the experimental chamber.

##### G. Results and Discussion

The rats spent 14 days in a home cage, where they formed the skills of climbing, jumping, digging up bedding material, and running in a wheel. Then began the main part of the study, which took place in the experimental chamber. Sessions were conducted daily and lasted 30 minutes each. This part of the study continued for a period of 20 days.

While in the chamber, the rats were observed to freeze, cling to the floor, defecate profusely, and have reduced activity. Rats performed single pedal presses, prolonged grooming, examined the cage, and then froze near the pedal for the rest of the session. From day 10, procedures were conducted in a dark room (lights off and blackout on the windows), as the rats were not active in the situation of daylight or stationary lightning. The latter may

be due to the reflective and increasing the overall brightness material of the chamber. Rats have learned that food can fall into the feeder from the dispenser and formed the skill of pressing the pedal.

According to results obtained in Study 2, we can conclude that its primary observations are consistent with those formulated by the authors [56]. As has been shown, rats housed in enriched environments spend more time interacting with novel objects than rats housed in typical conditions. The results are also consistent with the conclusions made in studies of the freeloading phenomenon [57]. It has been shown that animals raised in an enriched environment are more likely to perform an instrumental skill to obtain food in the situation of free access to the latter, whereas animals raised under typical conditions show the opposite [58].

It is worth noting that the change in the rats' behavior when the light is on turns out to be a serious factor for the whole study. Rats under typical conditions firstly have a higher level of stress and secondly are deprived. In this regard, it should be relevant for them in which conditions they work, since the hunger motivation turns out to be more significant for the formation of instrumental skill.

Proving the exact reason why a skill takes a long time to form does not seem to be possible. The skill either takes a long time to form or does not form at all, or it is formed but not realized, as in implicit forms of learning. Additionally, it is worth noting that the specificity of the research object is also essential to explain the established phenomenology. Since the rats were transferred to enriched conditions from typical conditions at 5 months of age, the special problem is their general condition, whether there is chronic stress and what possibilities for further adaptation exist.

## V. GENERAL DISCUSSION

The results of the two studies are mutually consistent based on the food eaten in the experimental chamber in the situation of *ad libitum* feeding. Alternatives proposed to explain this may be considered.

The violation of the rules of the internal validity, construct validity in particular, occurs as a result of incorrect research planning, not considering the factors, weakened control, as well as irrelevant operationalization, which is the construction of a correspondence between the research object properties and the research subject attributes in accordance with certain prescriptions. The latter is important for construct validity. As we have already mentioned, the source of this violation may not so much be in the planning procedure, but rather in the attitudes and values of the researcher, which are the components of the classic type rationality.

Here is a discussion of the formation of possible contradictory and non-falsifiable judgments and their implications and the potential contribution of anthropocentrism to them.

If the research subject is self-replicating psychological structure, then one could assume that the laws underlying the formation of new experience eliminate the problem of similarity of structures and form a consistent explanation for

both similar and different behaviors. Therefore, from the perspective of experimental methodology, we carried out experimental series with comparison groups, in which similarities and differences in the organization of instrumental behavior were investigated. Obtained results identified the unattainability of this objective. Firstly, control on the same individuals is impossible because have already formed the instrumental skills, and the set of possible explanations is extremely large. Secondly, results obtained on individuals raised in the enriched environment show that learning takes significantly longer in these conditions, as compared to typical conditions. Thirdly, the set of factors to be considered in order to construct this sample is impossible to be covered. Fourthly, the reason for longer learning in individuals raised in an enriched environment cannot be assessed. If we assume that the realization of behavior corresponds to the actualization of the psychological structure and that this structure is actualized regardless of the conditions, the three alternatives can be considered in explaining these results. Either the formed structures are different, or there is the same structure, whose organization has modified, or there is the same structure, but a fundamentally different order of organization of functional systems. Only two of these explanations can be consistent, since the third alternative forms a logical contradiction for the above-mentioned provisions about the same psychological structure corresponding to behaviors in all possible conditions, and different psychological structures corresponding to different behaviors in different conditions. The above reasoning also makes it impossible to conduct a study of neuronal activity, since the available propositions do not suggest in which structures to register. In the research conducted in accordance with the classic type rationality, it would be either the hunger center (for which no activity would be expected to be produced under the *ad libitum* conditions). The alternative would be the cortical areas registration (e.g., the retrosplenial cortex, cingulate cortex, hippocampus), but the available empirical evidence demonstrates that all of these areas are involved in the realization of almost every form of behavior [59].

If we assume that the psychological structure, the components of which are represented by groups of neurons and are models of specific cycles of interaction with a certain subject field, is formed similarly in interaction with any other subject field, then it should not matter which behavioral model is applied to study the formation of this structure. The arguments that are given in support of this conclusion are as follows: the results obtained on the 1) food acquisition behavior in rabbits and rats; 2) tic-tac-toe game with EEG recording in humans [60]; 3) potentiation of nerve fibers to study their properties and evaluate changes in potentials [61]. The picture of the psychological structures formation in the positional zero-sum game in two players is built on comparative data of the neuronal activity in rabbits and EEG potentials in people [10]. This is the basis for deducing the statement that there are similarities in the formation of psychological structures in interaction with different subject fields. However, the judgment that, for example, experience is formed uniformly in hungry and *ad libitum*-fed individuals is a potential threat to external

validity, firstly, because of the above-mentioned difficulties and, secondly, due to the provisions of information-energetic interaction and coordination of organism-wide functional systems [14], [62]. The latter leads to problems of a completely different kind and additional difficulties, which stem from the provisions of anthropocentrism and impose restrictions on the consistency of deducible consequences with the axiomatic provisions of the hard core [63]. These difficulties and grounds for refining the content of the study are the empirically established diversity of groups of research participants representing different trajectories of psychological structures formation. In addition, as a development of this line of reasoning, notions of the norm as a rule of substrate organization and the variability of the norm should be developed [64]. The duration of experience formation then may be presented as a property of substrate organization and is a particular research problem.

Firstly, the above does not allow SEA to be regarded as a complete alternative to theories based on the classic type rationality. Indeed, in its current form, the theory limits the implementation of the methodical options suggested in the literature review and is not consistent with the psychological research scenario formulated therein. Secondly, this discussion indicates possible internal contradictions of SEA (note that their existence can only be proven in a special study). We suggest that these problems can be resolved by modifying some of the theory's provisions and bringing them in line with attitudes opposite to anthropocentrism and anthropomorphism, that is, by implementing the scenario of psychological research of different species proposed in this study.

## VI. CONCLUSION

The actual problem of weak validity, unreliable results, and inexact reports can be defined as the manifestation of basic attitudes of rationality in professional research activity, the classic type rationality in particular. The alternative to this rationality is represented by multicentrism, evolutionism, systems approach, and experimental methodology. We assume that the problem can be solved by going through the full cycle from values and attitudes to research design and empirics.

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