American Journal of Science and Technology
2016; 3(5): 131-139
http://www.aascit.org/journal/ajst
ISSN: 2375-3846

American Association for Science and Technology

Science as a Form of Human Activity: Its Role in Prognosis of Social Future

Vladimir Romanenko[1], Vyacheslav Fomenko[2], Galina Nikitina[3]

[1]Head of Scientific Council-North-Western Branch of Academy of Information Technologies in Education, Saint-Petrsburg, Russia
[2]Retired, Freelance Consulting, Ashdod, Israel
[3]General Scientific Secretary, Vice-Chairman – North-Western Branch of Academy of Information Technologies in Education, Saint-Petersburg, Russia

Email address

putyatino1941@gmail.com (V. Romanenko), fomenko.vyacheslav@gmail.com (V. Fomenko), ladogalake@gmail.com (G. Nikitina)

Citation

Vladimir Romanenko, Vyacheslav Fomenko, Galina Nikitina. Science as a Form of Human Activity: Its Role in Prognosis of Social Future. *American Journal of Science and Technology*. Vol. 3, No. 5, 2016, pp. 131-139.

Keywords

Forecasts,
Foreseeable Future,
Observe Effects,
Rashomon Effect,
Reductionism,
Reorders of Facts,
Uncertainties

Received: September 11, 2016
Accepted: September 21, 2016
Published: October 11, 2016

Abstract

Each living body needs to forecast the changes in its environment and explain the observed phenomena. Unlike animals, people try to use the experience of previous generations in their forecasts. This experience is stored in science and religions. It is stored in memory of living systems. They are brains for individuals and special institutions for social systems. The input flows of different facts are put in order with the help of science. The new signals are compared with the facts stored in memory systems. The sets of actions which put in order the flows of input facts are Scientific methods. The results obtained with their help have various uncertainties or inaccuracies of input facts. There are four groups of these inaccuracies. They depend on the position of the human observer. The effect of predictions depends on people's goals and is a serious problem in social systems. Different areas of human knowledge are studied from positions of possible uncertainties of Science predictions.

1. Introduction: A Brief Historical Overview

The human differs from other types of animated matter by the presence of specific forms of its activity. The activity of each living body is connected with the needs to forecast the changes in its environment and explain the observed phenomena. These forecasting actions are denoted as *Expectation* [1, 2], *Foreseeable Future* [3] or *Probabilistic Prognosis* [4]. Animal forecasting is based only on previous experience. Unlike animals, people set more challenging objectives. Over time the human behaviors, i.e. a sequence of actions, began to be tied up with the specific goals [5, 6]. A human tries to not only predict future situations. It needs to find reasonable explanations for the previously observed events. With the evolution of mankind, the requirements for results of such studies increase. People need to give predictions and explain events more distant in time and more complex in nature. In all cases, the inaccuracy of forecasts and explanations does not disappear. To improve the quality of such results, people have to create models. It is well known that any model cannot be created without an improvable hypotheses. It follows from so called *Theorem of Incompleteness* by Gödel [7]. Our ancestors did not know this. However, when comparing the number of events, they had to deal with the need for their interpretation. This interpretation depended on the level of knowledge of that time. This level was usually insufficient for a good explanation of observed events.

Let us illustrate this with a simple example. Ancient people knew that leaves began to move with the wind. Now we can explain this phenomenon by changes in atmospheric pressure that cause movement of air masses. At the same time, many phenomena related to the weather are still unclear. Our ancestors had similar difficulties. Of course, they could not formulate them so clearly as our contemporaries do. Regardless of age, people who have similar challenges have three principal ways to solve them. The first one is to recognize the impossibility of explaining a phenomenon and agree to wait until they get the necessary knowledge. This way is the most natural. However, in the history of mankind it is rarely followed. This is because of people's tendency to create a complete system for the description of reality. Two other ways are widespread. One of them is to give an explanation of a phenomenon based on existing knowledge. The other comes from the desire to describe the unexplainable by mystical (mysterious) ideas. This is not a coincidence. The explanation of observations and events is based on the human need to understand the essence of each phenomenon. The other humans need the explanation of the phenomena. This need is stronger that the first one [8]. If the explanation of a phenomenon is difficult, one has to turn to mysticism. Both mentioned ways develop with time. Over time both of these ways diverged. One of them generates science. The other gives rise to religion. It is important to note:

Both science and religion solve the same task. The difference between them is tied with the basis of used explanations.

Therefore, these two approaches are often complimentary. Let us return to the example of wind and moving leaves. Our ancient ancestors wanted to understand the relationship between these phenomena. For them leaves probably looked more tangible than the wind. Therefore, they created the idea that in each tree and bush there was a source that created this movement. Certainly they could not detect such a material source. As a result, they came up to the idea that inside each plant there were gods named Dryads. Here we can see a combination of scientific and religious approaches. Further development of study demanded an upgraded description of the phenomenon. The next stage of human understanding was the necessity to decrease the number of gods. So the god of winds, Aeolus, appeared in Greek myths. This also changed the pre-scientific view of the observed phenomenon. At this stage ancient people understood that the leaves on all trees moved because of a single external source. So, stage by stage, the model, which explained the observed phenomenon, changed and became more complex. We can detect similar development in all known areas of human knowledge. In modern times, scientific and religious studies are evolved so much so that one can study them independently.

In the XXI century people's knowledge is very complex. It is usually divided into practical independent fields. Each of these fields has its own methods and traditions. Accordingly, the results obtained in these areas can vary in their accuracy and credibility. Therefore, the comparison of results in the fields of natural sciences and humanitarian studies is very difficult. Some humanitarian subjects are closely connected with politics and many of their results change with changing political situation. In connection with this, one frequently asks in which sense it is possible to say that the results of studies in the areas of humanitarian and natural sciences fields have the same essence. One of the authors of this article, i.e. professor V. Fomenko, says: "*There are situations when the results of the historical studies are so undefined that it is practically impossible to treat them as scientific*". At the same time, there are no doubts that most methods used in historical sciences are connected with high scientific qualification of their authors. It is evident that scientific results in humanitarian and natural science studies have many major differences. Discussion of these differences is the main goal of this article.

2. The Wording of Questions

Preliminary discussions devoted to the problem mentioned above by V. Fomenko allow us to notice that results obtained by a studied set of events and observations in various areas of human knowledge differ by their degree of certainty. This fact permits us to word several questions about the nature of scientific results and descriptions. We called them *Fomenko Questions* or *FQ*. The first of them is:

First FQ: What are the total combined results of scientific studies in various areas of knowledge despite serious differences of their degree of uncertainty?

The search for an answer to this question leads to the next question:

Second FQ: What conditions are necessary and sufficient for the results of any analysis to be considered scientific?

This question actually boils down to finding the answer to another more general question: *What is Science?* Similar questions were previously discussed in several books of the well known English scientist John Ziman, (see, for instance [9]). Unfortunately, modern philosophical literature still does not give a clear and unambiguous answer to this question. This is not a coincidence. The reason of this is the fact that the general analysis of the notion of science is conducted from different points of view. The most common are the points that science is the main body of knowledge. On the other hand, science is a method of production of new knowledge. At the same time one can say that science is a view of social activity and a system of preparation of persons with specific sets of skills. One also can say that science is a special social institution. It is possible to continue this list. It is important to note that all these points are correct and interesting. The authors of this publication discussed this problem in detail in [10]. It is not difficult to notice that all denotations created based on these various points of view are not consistent, and do not have a single core which can link them between themselves. In our opinion, such a situation is not accidental. It can be explained if one takes into account that the main questions WHAT and WHY, which are usually sought to answer, do not affect the procedural side of the phenomenon of science [11-13]. In fact, it is a procedural side that the technological side of the concept is the main characteristic allowing us to give a clear definition of science. The general analysis of the notion immediately forces one to apply it to its procedural basis. Therefore, the most successful denotation of this concept can be found at [14]:

Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe.

This denotation is necessary to be upgraded. First of all, one needs to include it in a more stringent description of procedural actions. The second principal moment is tied with the fact that some fields of science, for example, paleontology, or theory of evolution are aimed not just at prediction of a future, but at an explanation of the past. Based on these considerations we suppose one of the more exact denotations of the concept of science may be:

Science is a set of actions (algorithm) which reorders the number of various observations, measurements, events, or independent statements further referred to as facts, into any order. This order permits us to build any models which help predict further events and explain previous facts. These results can have different uncertainties.

It is clear that this denotation combines three concepts. The first one is the concept of algorithmic procedures necessary to achieve scientific results. The second concept is the concept of facts which are the basis of scientific knowledge. In order to include the facts in it, all facts have to be checked for accuracy. Inaccurate data cannot be the subject of scientific knowledge. Finally, the third concept is the concept of modeling facts in the system which always has a degree of uncertainty. This is a typical technological approach to determine this important term.

3. The Hierarchical Structure of Scientific Knowledge

First of all, the denotation given in the previous section focuses our attention on the set of actions which put different facts in order. The reliability of the facts themselves is not usually discussed. For natural sciences, technical problems, some chemical processes, and so on, the facts represent the results of measuring or controlled observations. In these cases one aspires to do all measuring actions and observations in accordance with defined rules. For these reasons, doubts as to the veracity of the facts are rare. In particular, this is due to the position of an investigator which is outside the active zone of actions. However, it is necessary to take into account that in this case all the generated facts have a set of, experimental errors. Usually, such errors affect the obtained results. Yet, the impact of these errors on principal results is not too strong. Opposite this, in the situation where an investigator is a participant in detecting new facts, the reliability and unambiguity of the obtained facts falls sharply. Therefore, even if the processing is right, the final results may be not fully correct, and sometimes they can be wrong. Thus, the quality of the science data depends primarily on the reliability of the facts. Consequently, the quality results of scientific research are determined primarily by the quality of the used facts. It is not difficult to understand that the reliability of used facts affects religious ideas too. Therefore, the study of the used facts quality is the starting point of both scientific knowledge and religious moral laws and recommendations.

The vision of the future i.e. *Expectation* ([1, 2], *Foreseeable Future* [3] or *Probabilistic Prognosis* [4] allows us to evaluate a sensible choice of personal properties or social development. It is necessary to take into account that the evolution never searches for the best or the most optimal solution. In practice, the most simple and easily achievable solution is implemented. For higher organisms and complex systems selected in this way a solution can be wrong or non effective. Unfortunately, it is not evident immediately. Therefore, the final selection of the optimal solution is achieved as a result of competition between various possible solutions. For biological species, this competition is described by Darwin's Natural Selection [15]. For individuals these processes are studied by the science of behavior [3, 16].

For the problem reviewed here it is important to assess ways of optimization of the adaptive group behavior. Some elements of these processes are known for bacterial colonies. This effect is known as *Quorum Sensing,* (See for instance, [17]. However, the most important decisions for humans are made in large social groups. In such groups the individual experience of participants varies. Because of this, there comes a very important mechanism for identification of consistent behavior of people with different experiences and opinions. After the prehistoric period, humans learned to share the accumulated average experience with new generations. At this time the first scientific and religious systems arose. Social processes are very complex. The number of factors impacting them is huge. Therefore, the evaluation of a society's reaction on external circumstances is always considered based on simplified models. The complexity of social life allows us to create different models to describe their behavior. The number of such models is not very high. In the theory [18] all possible models are implemented. These algorithms are the basis for creation, implemented in practice. However, their prevalence is different. It is known [19] that the source of information about external world and internal situations of an object are signals. In the case of social systems, the internal signals have paramount importance. All signals fall within the generalized memory of an object. Memory stores information about previous signals, system reactions on them (decisions), and results caused by these decisions. In general, in each system, whether it is technical, animated, or social, all incoming signals are processed. In social systems, the role of processor can be performed by certain institutions or expert groups. One of the main tasks of the processor is to compare the incoming signals with the data stored in the memory. In social systems, there may be multiple alternative comparison mechanisms. In principle, these mechanisms can be adjusted during the comparison process. This is possible because in some cases comparison operations in such systems can be long enough. The optimization of this process is a special issue. We are not going to address it in our analysis. The result of the comparison process is a decision. In real social systems, the processing institution can propose alternative decisions. It is therefore not surprising that in similar situations, systems with close behavior can react differently. As a result, in similar circumstances various systems can develop differently. The reasonableness of the selected system path is estimated by the rate of its development and the results achieved. In social life, the selection of the most successful pathways and system models is based on competition between different ways of development. As a quality controller for the system path are such phenomena as crises, revolts, wars, etc. Due to the complexity of most parts of modern social systems, the implementation of the decisions generated by the processor is assigned to the special management institution. Management institution in complex situations is based on the principle of so-called *Distributed Control* [3, 20] or *Distributed Control Systems – DNS*. In such systems, the hierarchical net, each part of which controls actions in the branches (sections) of the whole system, is used instead of a single control device. DNS are well known in technical and technological areas. Evolution has turned them into biological organisms [21]. For instance, the control functions of the intestines occur independently of the brain. Full discussion of these interesting problems is not included in our tasks. We want to restrict our analysis to consideration of the role of science in decision making and development of the systems with different complexities.

As it was written above, each prognosis generated by any system is based on the comparison of external signals and facts stored in a system memory. The feature of memory is that the stored facts are in order and classified. Memory of an individual retains his (her) personal experience. With communities of people, a number of individual experiences of generations is averaged based on certain algorithms. These algorithms are the basis for the creation of a prognosis of the Foreseeable Future. One of these algorithms is Science. The other one is Religion. As it was already mentioned, both science and religion are based on facts collected by a previous generation of humans. Therefore, Science is frequently called *Publishing Knowledge* [11, 22]. We can add here that from this point of view Religion can be called *Public Morality* or *Common Morality*. Going back, one can say that from this analysis it follows that the number of collected facts is increasing progressively with time. Originally our ancestors were aware of this phenomenon, available to them in everyday life. Certainly, they did not use any research tools. Gradually the range of issues became more complicated, and the methods of analysis and observation improved. Basically one can say that the progress of mankind increased continuously and complicated the structure of facts stored in human collective memory. Since the Renaissance, the common human knowledge about its environment and its ways of interacting with it became numerous. As a result, it became impossible to have people who could operate with the entire system of accumulated facts. It is well known that beginning from this time the General Knowledge of mankind was diversified. Moreover, it became apparent that human knowledge has a hierarchical structure.

Historical development of the system of human knowledge from the relatively simple to the more complex perception led to the situation that the method of reductionism was developed in the first place [23]. This is connected because people have a tendency to study primarily more simple problems. Therefore, one usually prefers to simplify a situation and solve separate parts of an entire system. This is the main idea of reductionism as a method. The wide spread of rationalism is frequently associated with the fact that: *Human behavior is "basically rational"*[24].

The ideas of the opposite method named *Holism* were explicitly formulated in the XX century [25]. Both methods of Reductionism and Holism used Science and Religion to study Nature. One can say that reductionism is based on the integration processes of study. Opposite this, Holism is based on decomposition processes. Therefore, in Foreseeable Future forecasting, Reductionism and Holism are effective for different types of predictions in recommendations. As a result, these two types of methods are effective for different areas of human problems. Holism is more effective in moral forecasting and such fields as psychology. One can say that in relation to social problems of society, both methods, and therefore, science and religion complement each other. The effectiveness of decisions made by society based on forecasting with science and religion is verified by historical practice. For most people the role of scientific recommendations and predictions in the evolution of society is obvious. The study of the role of religion in the evolution of society is reviewed in [26].

At different levels of social hierarchy the usage of Foreseeable Future for effective forecasting requires various types of human experience. In everyday interpersonal relationships personal experience is of primary importance for Probabilistic Prognosis. When climbing to higher levels in the hierarchy a person needs to account for the average experience of the previous generation in his (her) prognosis, that is scientific knowledge and religious moral rules.

In the decisions made in the social field, the individual experience of participants is perceived based on averages. Proper averaging should be based on scientific methods of data (facts) processing. Briefly, the higher level of the hierarchy, the more important the role of science becomes in the choice of the necessary path of society development. As mentioned above, the various upheavals are the mechanism for the selection of solutions found through scientific forecasting. Therefore, the hierarchical structure of human knowledge is necessary for getting effective data based on various prognosis in a hierarchically built society.

4. The Accuracy of the Scientific Facts

In Section 2 the authors gave a procedural definition of Science. In this definition Science (the scientific process) is considered to be as a transformation of random sets of facts in any ordered system. As all typical transformation processes this procedure can be represented in the triad form [27]:

RANDOM FACTS → SCIENCE → ORDERED FACTS

Random facts are raw data of partially unorganized simple items. They are practically useless before they are organized and structured. In general, processing of the facts involves collection and manipulation of items from existing unordered facts to extract all possible hidden data. These actions imbue them with meaning. One can say that processing creates new information [28-30]. Its contents contain empirical observations, models, hypotheses, laws, and regulations. This group may be called *Scientific Thesaurus*. It is continuously adjusted and, sometimes, seriously reconstructed [31].

All three domains of the described above transformation process are characterized by their own degree of uncertainty. Professionals who gather the input facts in the left part of this triad and professionals who create and use various methods of their fact processing have ideas about the various inaccuracies in these parts of the triad. At the same time, most people are only interested in the estimation of an inaccuracy (uncertainty) of input facts that is the uncertainty of ordered facts. These people usually need to know that the uncertainty of output facts depends on the uncertainties of input parts and uncertainty of the transformation process. Most people frequently do not take into account that the usage of output facts is tied with an additional uncertainty. This is due to the fact that data flow is largely associated with the peculiarities of individual perception of each subject [13, 32]. There are various reasons for these differences. Some of which are connected with the difference in characteristics of sensitive organs [33]. Individual characteristics such as life experience, the distance to the object, the ability to process signals and the others can constitute a critical difference in individual perceptions. An important factor that affects an individual perception is the complexity of an observed object or phenomenon, as well as its transience. Without going into detail, one can say that the results of a perception of objects and phenomena from different observers are usually different. As far as we know, this fact was first noticed by the famous Czech writer Carel Čapek. This was done in writing in 1934, the novel *Meteor* – see its translation into English in [34]. After the film of Japanese Director Akira Kurosawa *Rashomon* was released in 1950, psychologists studied this problem in detail. They found that when different observers recollected or described the same events or phenomena, their various perceptions could produce substantially different but equally plausible accounts of it. This was called *Rashomon Effect* [35]. Excellent brief psychological explanation of this effect can be found in [36].

Rashomon Effect is tied to personal characteristics of an individual and, as a consequence, their behavior. In the process of evolution, man learned to use the experience of other people. Without a doubt, this affects the characteristics and behavior of individuals. But it is more important to study the external effects of other individuals experience in a human community. In a small number of primitive tribes this was manifested by a direct exchange of personal experience between members of the community. In modern society the main experience of people is transferred to community members through science, ethical, and religious norms. The main goal of this publication is to discuss several problems connected with science as a form of human activity. Ethical and religious problems are not included in this study. We encourage readers who doubt that religion can influence the development of society to read [12, 26].

Previous paragraphs discussed possible uncertainties in the process of the system or personal memory. These accepted facts are non-ordered. Transformation of accepted unordered facts into any ordered system occurs in memory. Memory of man is tied with his brain. Memory of society is more complex. It is tied to its cultural and civilization mentality as well as different institutions. As it was written above, one of the most effective and useful transformation processes is science. Science as an algorithm or common method, was determined at the end of Section 2. This process is associated with certain simplifications and sometimes, errors. Therefore, ordering input facts causes inaccuracies (uncertainties).

The study of methods of facts processing began in antiquity [37]. The most striking and valuable methodological achievement of that time was the logic of Aristotle [38]. Starting with the Renaissance Period many great scientists focused their attention on this problem. Serious research in this area continues in our time. As a result, the study of methods of facts processing can be considered the best part of their ordering. In modern times articles and various textbooks describing scientific methods are widespread in most civilized countries. They are devoted to general questions, problems of scientific inquiry and practical recommendations in various areas of science, technique, and technology – see for instance [39]. For a number of reasons, the development of methods of scientific research in different areas of science has progressed at different rates. One of the most developed areas is chemistry [39]. In humanitarian areas of knowledge, methods of scientific inquiry are developed incompletely. However in these areas of knowledge, one can find excellent recommendations [40]. One can say that methods of scientific inquiry also create uncertainties. However, these uncertainties are well understood. Methods of their estimation are repeatedly tested in practice.

It is necessary to take into account that there are two additional sources which create uncertainties during processing. These are communications systems which transfer data between system memory and processor, and between processor and effectors, or executive institutions in the case of complex systems. The first of them is internal, and the second is external to the system. In all cases, impact on data flows input, and output from the system can be interpreted as filtering. Their action is convenient to describe uncertainties with the notion of a generalized filter [3]. Authors of this book studied in detail the filters in relatively small systems. Yet, in more complex systems as society the process of creating various inaccuracies is much more complicated. In relation to the economy, this problem was studied in [24, 41]. The possibilities of a single individual are so simple that it is necessary to understand the set of problems which the social institutions need for making decisions. Therefore, in many cases a valid part of data coming from a processor is not really used. In addition, many problems require much more time for finding solution that is acceptable in reality. As a result, in complex social systems, many decisions are made intuitively, or just by guessing [24]. In many cases one tries to simplify a describing model. This is often done without serious justification. Moreover, frequently it is possible to propose several different models. In such situations the choice of a model occurs without a good justification. This is rather a guess than scientific inquiry. All this generates numerous inaccuracies.

In this section, the authors used a traditional way of consideration. It means that all parts of a transformation chain were represented as a single unit. The real structure of memory or processor units was considered as single unit. We neglected their internal structure. Therefore, the actions of each part were studied in a so called black-box approximation. However, a more thorough analysis is required, taking into account the complex structure of each part. It is well known that Köstler's idea of holons [27, 42] is a very progressive interpretation which can be used for detailed analysis. This fact is accepted by most modern scientists.

Unfortunately, a detailed study about the impact of these representations on the process of processing facts in the studied case is still not done. Recently, this problem has been actively discussed in numerous publications by S. N. Grinchenko – see for instance [43]. These publications clearly indicate that the processing of data at different hierarchical levels of the system come at significantly different speeds. Unfortunately, in these articles and books there are no specific examples of how this is manifested in practice.

The result of the discussion in this section says that most likely the main source of final uncertainties in decision making of the system is inaccuracy of input facts. This problem will be investigated below.

5. Inaccuracy of Input Facts

In Section 2 the authors defined facts as a set of various actions which form the input flow of data (signals) entering through filters into the system memory. This data belongs to different levels of the knowledge hierarchy. The simplest data or the lower level of hierarchy consists of a description of observations, fixed event details, results of measuring, and stored recollections. Sometimes, this data is combined with the term: *Characterizations*. Higher levels include hypothesis, definitions and so on. This data possesses a certain degree of uncertainty. There are several sources of these uncertainties.

All facts are perceived by generalized sensors. It is a process of reflection. To completely strike out all properties of an object or phenomena is impossible in principle [27]. In other words, reflection does not possess the properties of completeness. Various systems reflect the same object or phenomena differently. In our terms this is the fact. The nature of the reflection of facts by any system changes when the conditions of the reflection (time, distance, properties on environment, etc.) are changed. Therefore, to get a reflected fact complete one has to make a set of independent studies (observations, measuring and so all). It is useful to change a registration system if this is possible. For this reason, resubmission, changing of measuring systems, and reprocessing of obtained results are the basis of traditional methods of reduction and evaluation of various data inaccuracies [39, 40].

Ultimately, all data entering into the system are meant for a human observer. In general, the changing of results is frequently called *Observer Effects.* They are known in physics [44], psychology [45] and other areas of knowledge. In addition, in psychology it is known that in observational research, obtained data can be changed or biased by the process of measurement itself. This is called a *Measurement Effect* [46].

In reality, receiving of facts is a two sided phenomenon: on the one side one can see an operator and on the second side, a studied problem. The final participant of the measurement process is a human being. Opposite this, the studied system can be non-animated or it can include human beings. Therefore, there are three possible different situations. The first one is when an operator is outside of the studied system. This is realized when he or she measures or observes a non-animated matter. In this situation the operator is not interested in the impact of learned results. As a result it is possible and reasonable to estimate the inaccuracy of the received data. In this case a human factor can also be involved. These effects were studied by Irving Longmuir. He called these effects *Pathological Science* [47]. The description of this question is not a task of this article. This situation is realized in most natural sciences and partially in technical and technological studies as well. According to Herbert Simon we define natural science as *Knowledge about Natural Objects and Phenomena* [24, page 7].

The second situation also involves an operator who is outside of a measured system. In contrast to the previous situation, a human being is the part of the studied object or phenomenon. Medicine, teaching, law, advertising are a few among the various systems which correspond to this situation. In this situation the human behaviors are closely tied with the laws of non-animated matter. It is a so called *Combined Situation* [48].

In the third situation a human being operates to get necessary data about a system and at the same time, he is a part of a studied object, phenomenon or process. This is typical for such sciences as history or politics and others. This is a *Social Situation*. In both, Combined and Social Situations, where a human is a part of a studied system or phenomenon the human to human interaction or interaction between the operator and part of the studied facts is very important. It means that in these areas of knowledge it is necessary to take into account a set of human behaviors. These behaviors affect specific laws of non-animated matter. Probably the most important human behavior in the human to nature interaction is a psychological one. It is not difficult to understand that, for instance, if one needs to sell any goods, give medical advice, or adopt a new law, the action party has to take into account the psychology of people. There are various people behavior subgroups which are valid in many social areas of human life. Because of a lack of influence of human properties in natural sciences they may be considered as descriptive. Their only interest is to understand what things and phenomena are. In opposite, the Combined and Social Sciences also include such human properties as interests, goals, curiosity, moral norms, etc. It is necessary to understand that engineering and production technologies include the laws of inanimate nature, such evaluative concepts as demand, design, convenience of goods, and consumer psychology. Therefore, in many cases this may be attributed to Combined Sciences. Individuals and society as a whole get input flows of facts and data received with the help of all types of sciences: natural, combined, and social. Each of them creates specific types of uncertainty.

All resulting data must have uncertainties. It is a basic undisputed phenomenon. However, from the point of their obligatory presence, all possible uncertainties can be divided into four groups. The first group consists of uncertainties which, in principle, are impossible to get rid of. Uncertainties of this type were well studied in natural sciences. One can talk only about reduction of their sizes and sometimes about their possible compensation. The source of uncertainties of the second group is accidental and sporadic errors, various misunderstandings, inaccuracy of the imperfection models, and theories. Any of them can be eliminated after careful analysis. The third group includes various reasons caused by unreasonable passion of an operator or researcher, different incorrect ideas, etc. These problems are studied in Pathological Science by Langmuir and others authors. The majority of the errors and misunderstandings that cause these uncertainties is a lack of responsibility. One can say that all uncertainties of the first three groups do not pursue any specific goals.

It was noted above than in a Social Situation an operator or other action parties have their own goals. These goals can have an active impact on society or its individual groups. To this end, some action parties or an operator can consciously create mistakes, delete data, distort data and even design fraudulent information. Accordingly, the fourth group includes uncertainties which were made on purpose. Many deliberate uncertainties can be found in history, political sciences, and sociology. These are difficult to identify. Thus, one can speak about two groups of Sciences. The first group includes sciences where uncertainties and inaccuracies are not associated with the operators, researchers, or witnesses of events. The other group includes sciences which have a huge proportion of undetected deliberate distortion. The basis of this group is Humanities.

It is possible to carry out a reasonable division of Sciences into groups. We used the mechanism of the occurrence of uncertainties and inaccuracies in the results as a basis of this division. Let us note that the idea of dividing Sciences into groups is not new. Herbert Simon proposed to divide Sciences into two groups: *Science about Nature* and *Science about Artificial.* He labeled *Science about Artificial* as all Sciences in which the object of the study was created by people [24, page 6]. As a result of the analysis discussed in this section, one can say that the division of Sciences into groups according to the uncertainties tied with people, affects their results, and enables us to estimate the role of various sciences in the development of humanity as a whole.

6. Conclusions

Looking at Science from the point of view of transformations, and ordering obtained facts allows us to clearly identify its processing part. This becomes possible if one represents Science in the traditional form of a *Transformation Triad* [27]. The central part of the triad represents *Scientific Method*. The Scientific Method is a common element of the various Sciences. One can say:

Modern correct Scientific Methods are the factors which can detect if any system of representation of different facts is really a Science. Scientific methods evolve over time.

One must take into account that the results of the application of Scientific Methods depends on the reliability and accuracy of the used facts. If the original facts are incorrect or inaccurate, even the most advanced and proper Scientific method will lead to incorrect results. As frequently repeated by Professor Alex Nashel'sky:

Scientific Method is like a chopper. Rotten meat of bad facts makes it impossible even with an excellent chopper to get a good cutlet of conclusions.

Alex Nashel'sky: Unpublished jokes.

The input facts which are the content of scientific knowledge always have uncertainty. One part of this uncertainty depends on the laws of nature. The other part depends on humanity: observer, action party, and philosopher. The most serious inaccuracies in the set of input data are closely tied with Humanity.

Each Science puts the flow of input data in order. This ordered data is stored in the system memory. Each system makes decisions based on information stored in its memory and flows of new facts from environment. So, one can say:

The Science is an active part of system memory which puts *in order the data which the system gets both from its experience and from experiences of previous generations. It means that Science is the necessary part of a mechanism which manages all system reactions and defines its development.*

In fact, Science not only predicts the future. There are some areas of knowledge which are based on the presence and former experiences which tried to describe past events. Archeology and history are a few among the sciences of such type. There is little data about the past. A number of them are false. Sometimes, a single new fact can completely change ideas about the past. So, for example, just one small bone found in a Siberian cave revealed the existence of a new extinct species from hominids [49]. Difficulties arise with the recovery of historical events. In history, as in some other social sciences, one can get false data. In many cases, on the contrary, some data is destroyed on purpose. In this regard, the question often arises about the extent up to which these areas of human knowledge can be considered as real science. The correct approach here is related to the need of the development and execution of special intensive programs to assess the reliability of the facts. The presence of several independent sources of information may indicate the reliability of the data about the past. It is best if they are obtained through studies done in different ways. Since this is a complex problem it makes sense to review it in a special publication.

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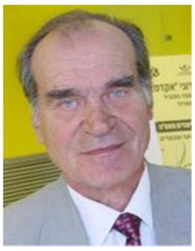
Biography

Vladimir Romanenko: Academician, Honored Scientist of the Russian Federation Born: January 14, 1931. Graduated as Master in Theoretical Physics: State Saint-Petersburg University. 1953. PhD in Physics -1962, as Doctor in Technical Sciences – 1966; 1953-1966 Researcher in Russian State Academy of Science; 1967- 2001 Head of Department of Physics (Higher Marine School, University of Architecture and Civil Engineering. 2001 – Vice-President; Head of Scientific Council- North-Western Branch of Academy of Information Technologies in Education.

Galina Nikitina: Academician, Honored Worker of Science and Education of Russian Academy of Natural Science. Born: March 13, 1932. Graduated as Master in Physics and Electronics at 1955 Saint-Petersburg Electrotechnical University. PhD in Technical Sciences – 1963; Doctor Science in Pedagogics 1992. 1955 – 1967 Researcher in Russian State Academy of Science; 1969-1998 Associated Professor, Head of Department – State Technological Institute, Higher Marine School. 1999- currently General Scientific Secretary, Vice-Chairman – North-Western Branch Academy of Information Technologies in Education.



Vitaliy Fomenko: Professor, USSR State Prize winner (1976), Honored Mechanical Engineer of Ukraine. Born: August 30, 1934. Graduated as Master in Automation and Remote Control, 1958. State Kharkov Polytechnic Institute and Master in Mathematics and Control Systems - Moscow State University (Second education), Ph.D. in Technical Sciences; 1973, Doctor Science in Control Systems, 1975. 1958 – 2000 Yuzhnoe Special Design Bureau. Promoted from Engineer to Deputy General Designer. 1996-2000 Dnepropetrovskiy State University. Head of Department, Professor. 2000 – currently Freelance consulting- Ashdod, Israel.