

SCIENTIFIC CONCEPTIONS AND HEURISTICS IN CROSS-CULTURAL COMMUNICATION AND EDUCATION IN TERMS OF A JOINT PROBABILITY DECISION MAKING



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ABSTRACT

In contemporary cross-cultural communication and education processes the human decision making and heuristics are often mistakenly evaluated by means of a certain standard scientific conceptions. For example the tendency to consider human estimations of joint probability as the Conjunction Fallacy may be regarded as a form of scientific illusion. The transcendental psychology approach to perception makes it possible to substantiate co-representation probability models which are compliant with human perceptual psychology and heuristic judgment under uncertainty. Presented pilot cross-cultural experiment provides for possibility to influence a person's decision making process in predicted direction varying perceptual and semantic situational parameters according to theoretical assumptions connected with co-representation model of events.

Key words: Scientific Conception, Heuristic, Transcendental Psychology, Perception, Co-representation, Probability, Conjunction Fallacy, Illusions, Cross-cultural Experiment.

1. INTRODUCTION

In the present-day world scientific conceptions play an important role in social and vital activity of the people. Scientific knowledge and models are of great value in cross-cultural communication and international educational standards. They actually often objectify universal cross-cultural truth, which make it possible to create explanatory models, integrate social medium, predict phenomena and results of experiments, produce comparative studies and so forth.

Norm anchoring as general scientific method lies in objective norm determination and their correlation with phenomena under consideration. In particular this is done in psychological diagnostics, where individual qualities are compared to normative sample. Most tests used in psychological practice are norm-referenced, i.e. the subject's test scores are judged against typical test scores from a representative group of individuals (norms). This involves the application of the test to an appropriate group of subjects and the construction of normative data. The process of setting up normative data is called test standardization.

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It's possible to state that in mathematics normative knowledge is manifested in most general form. Mathematical knowledge has universal character and often may be implemented in various sciences and fields of practice. Especially it is widely used in education. In this connection mathematical models in an even greater extent become normative. For example the model of probability of joint random events (or joint probability model) is often used for calculation of accidental chances and as a matter of fact has become a norm for evaluation different causal occasions, which have one or another uncertainty of their appearance. Joint probability model is widely used in contemporary education and is regarded as universal explanatory mean in educational attainment of very different cultures. It is known also that education is rather conservative element in different cultures and keeps many rules and norms for a long time. So revealing and understanding of these conservative things is a matter of topical interest.

At the same time on the whole heuristic decision making in differently presented real circumstances disagree with probability theory model [8]. Therefore it is reasonable to count that this model should not be used as unconditionally normative model for evaluation of human behaviour in uncertainty conditions. More than that - we argue against common set that this model is suitable for evaluation of human decision making.

Thus we would like to show the limits of a joint probability model's application as a normative cross-cultural model using as basis theoretical provisions of cross-cultural communication [6] and platform of transcendental psychology [5]. The last approach presents a general foundation for critique of a product basis paradigm and for development of a novel constrictive methodological paradigm. We consider psychologically valid mathematical model of joint probability of co-represented events and carry out pilot cross-cultural study of estimated probability of accidental events in the circumstances of predisposition to interpretation these events within the model of co-represented events.

2. HEURISTICS AND SCIENTIFIC DISCOURSE

Subsequent to the investigations of Tversky and Kahneman it is well known that judgments under uncertainty are often mediated by intuitive heuristics [12, 13]. Heuristics as intuitive judgments occupy a position between the automatic operations of perception and the deliberate operations of reasoning. So they deal with the concepts as well as with the precepts, can be evoked by language and are not bound by specific scientific natural laws.

According to prevailing explanation when people rely on representativeness or availability to make judgments, they are likely to judge wrongly because the fact that something is more representative does not make it more likely. Thus it can result in neglect of relevant base rates based mainly on standard probability models (as for example coin tossing or throw of dice). Instances of a specific category can be easier to imagine or to retrieve than instances of a more inclusive category. Conjunction can be more representative than one of its constituents.

The so called representativeness and availability heuristics [13] therefore can make a conjunction appear more probable than one of its constituents, which breaks the most basic qualitative law of probability – the Conjunction Rule: The probability of a conjunction, $P(A\&B)$, cannot exceed the probabilities of its constituents, $P(A)$ and $P(B)$, because the extension (or the possibility set) of the conjunction is included in the extension of its constituents.

Thus so called "Conjunction Fallacy" is false belief that two events have greater chance of co-occurring than either event by itself. This phenomenon was regarded as cognitive illusion and demonstrated in a variety of contexts including estimation of word frequency, personality judgment, medical prognosis, decision under risk, suspicion of criminal acts, and political forecasting [8].

In the well-known Bank Teller Study [13] subject receives description of the following situation.

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. The question is: Which of the following alternatives is more probable?

A) Linda is a bank teller.

B) Linda is a bank teller and active in the feminist movement.

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Most participants picked – B and have fallen prey to the Conjunction Fallacy. It is not possible for two events to be more probable than one of the events by itself.

As it was mentioned previously [4] the systematic character of violations of the conjunction rule makes it absolutely unclear - why such inadequate behaviour takes place and occur so often? The common answer to this question is contrasting heuristics and intuitive inferences to specific mental logical operations and specific scientific gains as the rules of statistics and the laws of probability. These laws are then used as objective measure of the perceptual and cognitive processes. Fallibility of this approach was studied in our work [4]. The error here is common to the positivist way of thinking when scientists make abstract truth more concrete or real reifying it as a law of objective reality and then anchoring to it concrete events or phenomena. For example, when “culture” is described in positivist ways, it is reified or essentialized [6].

Following this line it is possible to state that opposition of scientific discourse and heuristics is not right neither from the point of view of their difference as being similar, nor - of their similarity in being various. The opposition as such emerges when researchers fix the different results of two psychological processes within equal environmental conditions. On closer examination it is possible to notice that context situations for logical mental and perceptual intuitive operations are different and these psychic processes have very distinct nature. Thus simple comparative judgment model is hardly applicable in this case.

Behaviour according to scientific model may be more or less easily achieved as a result of special education, while on the whole this is not the same for heuristics. Science itself relies on numerous intuitive grounds and heuristic operations (discrimination, identification, association and so on). It is also known that being distinct from the scientific discourse heuristics are existed since the beginning of time and people relied on them long before scientific laws have been discovered. Depending upon intuitive judgments, often presented in the form of specific legends and myths, people during a long road of their historic development have been in many ways quite successful in their life activity both in relations to nature and interrelationship.

On the basis of myths’ analysis clinical psychologist J. Peterson concluded that “the only alternative to presuming that everyone unfortunate enough to live prior to the dawn of the scientific age was pathetically ignorant, despite their incontrovertible success at surviving”, is to suppose that “objective world is something that has been conjured up for us recently – absurdly recently, from the perspective of evolutionary biology” and “the environment of human beings might well be regarded as “spiritual,” as well as “material” [10].

Methodologically this way of thinking comes from constructive approach in sociology [14], which assumes the fact that “observer interacts with reality via his or her perspective in such a way that reality is organized according to the perspective”. In culture theory “the constructivist paradigm avoids the reification of culture, either in its objective sense of the institutions or in its subjective sense of worldview”. “People ... are constantly in the process of interacting with the world in ways that both express the pattern of the history of their interactions and that contribute to those patterns” [6].

Special constructive approach in psychology of perception was developed by A.I. Mirakyan (1929-1995) and his group at the Psychological Institute of the Russian Academy of Education. It was called the transcendental psychology approach and implies special methodology [5]. It was developed to overcome crucial limitations and contradictions inherent in traditional approaches to perception and is strongly methodologically correlated with embodied cognition and enactive approach [2, 3] and understanding of psychic activities as “an ability to strongly feel in mind” (kansei) [4].

Transcendental psychology methodology focuses upon the underlying transcendental processes and upon the principles that support the flexibility needed to create complex, coherent representations under different stimulus conditions. The central idea, that the generative perceptual processes are different from emergent psychological processes dealing with perceptual images and may be based on universal formation of relations, suggested basic principles that can be applied to all perceptual processes, regardless of their modality [5].

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The constructive approach makes it possible to see that scientific norms used for evaluation of human behaviour are not impeccable and when real human reasoning or performance and normative competence (rational computation) diverge, more often there is something wrong with the norms, not with the reasoning [4]. In regard to conjunction fallacy it is not of course the case that probability theory is wrong. Rather human behaviour is more complex and the model used for its evaluation is too rigid. The transcendental psychology approach makes it possible to substantiate other probability models which are compliant with the human judgment under uncertainty.

Contemporary cross-cultural studies of geography of thought specific to different people of the world obviously show that the scientific form of thinking has gone through long way of development and scientific norms are not ubiquitous and equally intrinsic to different ethnic groups of people. More than that specific scientific conceptions are not uniquely true and their application is often connected with natural, cultural-historic, socioeconomic and other peculiarities of evolution and education conditions of various nations [9].

3. CO-REPRESENTATION PRINCIPLE IN PERCEPTION AND MATHEMATICAL MODEL OF JOINT PROBABILITY EVENTS

The transcendental psychology of perception states that perceptual processes include co-existence of different alternatives providing the flexibility needed by any multifunctional perceptual and cognitive system [5]. This assumes that the nature of perceptual cognition is more complex and quite different from common probability logic. According to the perceptual reality for any object it is more reliable to have many defined and related features than just one feature. Thus perceptual processes (unlike thinking processes) display that the object with many simultaneous features belonging to it is in fact more valid and actual than abstract object with just a few abstract or random features.

The co-representation principle in perception means that images and their characteristics are the products of underlying formation of relations and the work of multiple mutual (unconscious and conscious) tendencies. So image features are all connected and united within the process of their creation and have all the time connection to the person to whom they are presented.

Thus the appropriate simple probability model suitable for explanation of human behaviour under uncertainty should be done with a glance of co-representation idea. Instead of taking a probability model connected with tossing a coin or throwing lots we suggest for instance the usage of a locket. Let us consider a tossing of the locket, which can be opened, holds nothing and imitates a coin outside. It gives 4 incompatible states (A -head, B-tail, A&B, Nothing) with possible roughly equal chances (Figure 1). It is easy to see that in this model conjunction event of opened locket has equal chances with any of separate locket coin states: $P(A) = P(B) = P(A\&B)$. Here P is probability of the events in parentheses.



FIGURE 1. THE EXAMPLE OF A LOCKET IN FOUR STATES

It is clear that calculation of chances depends on a whole space of elementary events as well as on favourable set of events. They are in their turn determined by logical and other operations which are often implicitly feasible on the sets. If we consider also the logical conjunction (A&B) and disjunction (A∨B) operations on A and B events, then probability of just one event A or B is still equals $\frac{1}{4}$ and

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probability of two A and B events may correspond to $A \vee B$ situation and so will be equal $\frac{3}{4}$. That is 3 times higher than $P(A)$. The disjunction of A and B events corresponds to perceptual reality of objects in the sense that if two features are thing specific then each of them are also specific to this object. More over in other case the existence of just one A or B event will be in principle impossible.

Thus in psychological perceptual model of events' probability perfectly reasonable is to suppose that A and B events are more probable than separate A or B events. In the standard probability model we deal with separate random events while in presented psychological model the events have common origin or common representation medium.

The two models serve very different spheres of reality. The standard model comes from the lack of knowledge about objective situation, while psychological perceptual model presuppose a certain understanding of the situation starting from the self of a person. Tossing of a coin then assumes that only one possibility of two (head and tail) is possible each time while we know that two sides are simultaneously presented on a coin. To consider the chances of A and A&B events in this case is not correct. These events do not belong to the same set of elementary events.

As we see here the knowledge about A and B events include multiple meaning and the number of events connected with logical operations may be increased too. We have both ambiguity of conjunction and disjunction operations and multiple events in disjunction operation. This results in expansion of the number of favourable events for A and B association and so provides in this case for higher estimation of chances.

It may be noted that this ambiguity is not specific just for psychological situation and is observed in quantum physics, where it leads to difficulties in quantum measurements. Researchers need to "take into account that the general physical operational situation for two measurements is the situation where they cannot necessarily be carried out at once (or together), which in quantum jargon means that they are incompatible". "In this case, the conjunction for these properties, of which one is measured by one of the measurements and the other by the other measurement, still exists as an operational property, but the disjunction does not necessarily exists as an operational property" [1].

More complex model of throwing the rhombicuboctahedron die may be even more demonstrative in regard to the rate of conjunction probability (Figure 2). The rhombicuboctahedron is an Archimedean solid with eight triangular and eighteen square faces. There are 24 identical vertices, with one triangle and three squares meeting at each. The rhombicuboctahedron can be seen as an expanded cube (or an expanded octahedron) and as such includes six square sides of an original cube from which it is generated.

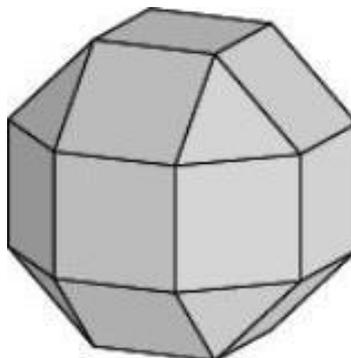


FIGURE 2. RHOMBICUBOCTAHEDRON

In throwing the rhombicuboctahedron die the chances to see from one direction a certain A&B combination of two facets originated from primary cubic die are in general three times higher than chances to receive just one facet of this die.

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If probability $P(\text{any side}) = 1/26$, then $P(A\&B) = 3/26$. So in this case $P(A\&B) > P(A)$. In principle the fall on the triangle side (probability P_3) may be less possible than the fall on the square side (probability P_4). Putting $P_3 = 3 \cdot P_4/4$ it is possible to calculate that $P_4(A\&B) = 2,5 \cdot P_4(A)$.

These modelling results clearly shows that $P(A\&B) > P(A)$ and they agree with human decisions made in numerous experiments [8] and with results shown in our work [4].

4. CROSS-CULTURAL EXPERIMENT

Strongly mathematical co-representation probability model, which is examined above, is suitable for explanation of human joint probability decision making and agree with human psychology of perception. To understand how it is working in reality we carried out pilot cross-cultural psychological research for joint probability judgments of co-represented events. According to the developed model we worked out special logical inventory for measuring probability of hypothetical events which can occur simultaneously and have different basic rates. The tasks were made similar to Linda Bank Teller Study shown above.

Herewith the number of choices was increased with the need to compare chances (more less or equal) of A and A&B together with two more variants: A and B, B and A&B. Situations in three different tasks were organized in a way that the chance levels (rarity) of A and B events were done either approximately equal or not equal: task 1 - $P(A) < P(B)$; task 2 - $P(A) > P(B)$; task 3 - $P(A)$ and $P(B)$ are together small. The chance level of co-existence of events was decreased from task to task. This was done with the aim to check how co-representation influences decision preferences of the subjects. Comparison objectives in each task included the following decisions: $P(A)$ as compared to $P(B)$ – more, less or equal; $P(A\&B)$ as compared to $P(A)$ and to $P(B)$ - more, less or equal.

The sample of observations included 20 Moscow students and 10 subjects from Taiwan. The engagement of two cultures had the purpose to receive more variants of subjects’ behaviour in hypothetical uncertainty conditions and to reveal cross-cultural similarities and differences in evaluation of events’ rates.

The diagrams with experimental results are shown on Figure 3 and Figure 4 for Russian and Taiwanese subjects correspondently. The columns show relative frequencies in percentages for A and B events in regard to the compliance and violation of the Conjunction Rule for Russian and Taiwanese subjects.

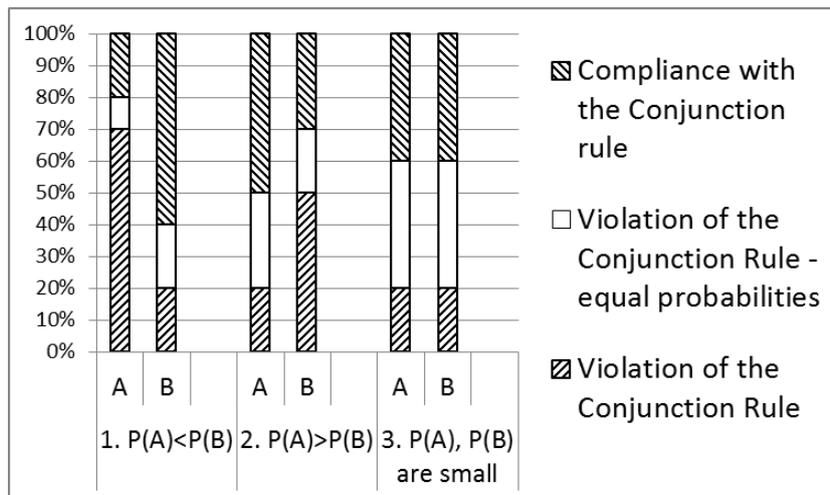


FIGURE 3. PERCENTAGE OF DIFFERENT TYPES OF ANSWERS SHOWING COMPLIANCE AND VIOLATION OF THE CONJUNCTION RULE - $P(A\&B)$ AS COMPARED TO $P(A)$ OR $P(B)$ - DEPENDING ON TASK SITUATIONS FOR RUSSIAN SUBJECTS.

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The Russian subjects better than the Taiwanese differentiate the rates of A and B events in the situation of task 1. So B event is regarded in Russia much more probable. Therefore the probability of conjunction of events A&B in Russia is more strongly differently estimated for A and B events.

In the situation of task 2 when $P(A) > P(B)$ and coexistence of events in principle is less possible the zone of violation of the Conjunction Rule with equal probabilities of two and single events is much broader. Cultural differences specify that Russian subjects better discriminate probabilities of single A and B events.

Characteristic is task 3 situation when both A and B events are unlikely. Here the conjunction of these events is also hardly probable. In this situation the Russian subjects show no difference between A and B objectives at all while the Taiwanese – show very little difference and in both cases the percentage of answers compliant with the Conjunction Rule is more than twice higher than that of violation of the Conjunction Rule.

The diagrams on Figure 5 shows relative percentages of answers' preferences for one (A or B) and two (A&B) events depending on task situations for Russia and Taiwan. In both countries in accordance with theoretical background the portion of subjects having preferences for two events is less for the third task than for the first task. The Taiwanese subjects are more oriented towards one event preference and so are more unyielding to the Conjunction Fallacy (rarely violate the Conjunction Rule).

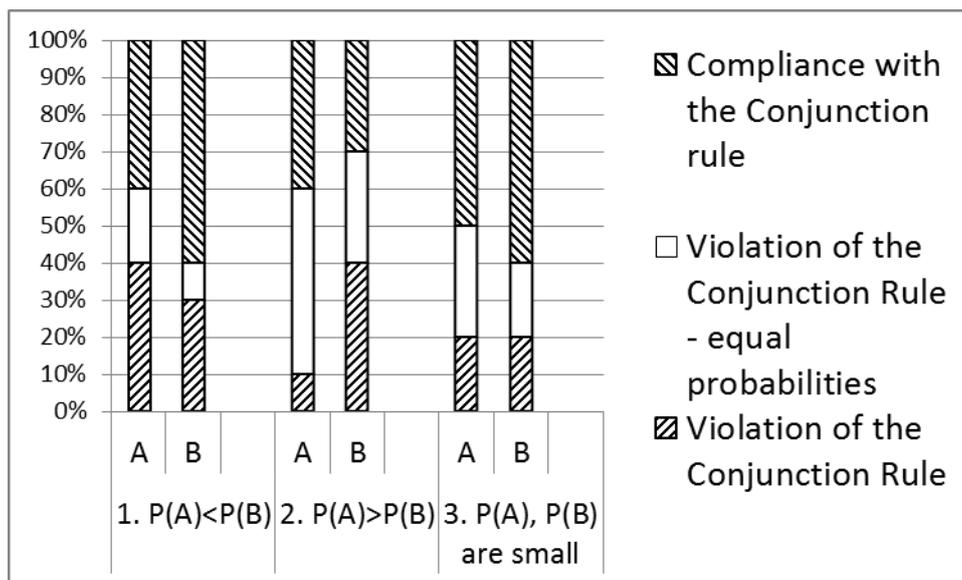


FIGURE 4. PERCENTAGE OF DIFFERENT TYPES OF ANSWERS SHOWING COMPLIANCE AND VIOLATION OF THE CONJUNCTION RULE - $P(A \& B)$ AS COMPARED TO $P(A)$ OR $P(B)$ - DEPENDING ON TASK SITUATIONS FOR TAIWANESE SUBJECTS.

At the same time the number of people which prefer either one event or two events as well as people having no this preference stay relatively large in all tasks. This in our opinion means that different tendencies of perception coexist in population providing variability of human behaviour in similar situations.

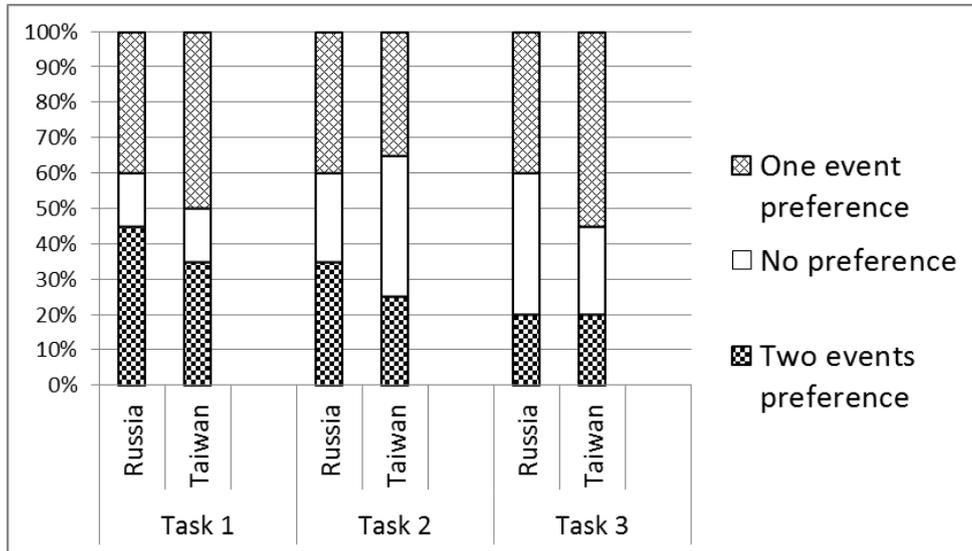


FIGURE 5. RELATIVE PERCENTAGES OF ANSWERS' PREFERENCES FOR ONE (A OR B) AND TWO (A&B) EVENTS DEPENDING ON TASK SITUATIONS FOR RUSSIA AND TAIWAN.

The results of the study are experimental and are based on pilot data. Nevertheless they may be useful for further research and improvement of the questionnaire.

5. DISCUSSION

According to presented cross-cultural study there are certain cultural differences between the Russians and the Taiwanese in the estimates of the probability of joint events. In particular, Taiwanese subjects generally demonstrated appropriate behaviour closer adherence to the Conjunction Rule. It may seem strange to the Chinese people, who from a cultural point of view, should be closer to a holistic way of thinking than the Europeans. The explanation for this peculiarity is the fact that Chinese people in Taiwan are already heavily Americanized and have quite embraced value attitudes of the Western world. It is known that many people of the East "strive to the West" and thus even acquire Western quality to a greater extent than is expressed in the West [9].

At the same time the variability of the Taiwanese behaviour is higher. For example, one of the Taiwanese subjects considered all the events in all the tasks equally probable, that is, in all cases has chosen equal probabilities. Among Russian subjects such behaviour was absent.

On the whole experiments show that variability of human behaviour is significant and that it is possible to adjust experimental conditions to receive people answers connected with higher or lower compliance with the Conjunction Rule. This has also been shown in our earlier experiment [4].

This behaviour in fact doesn't mean that human decisions specifically follow the Conjunction Rule. Probability judgments are mostly fulfilled on the level of rather broad specific set of criteria. Human judgments are based on a perceptual and affective tendencies expressed in a causal set of multiple notions like representativeness, importance, believability, applicability, correspondence, conceivability, trustworthiness, reliability, etc. [7]. In this cross-cultural experiment together with the perceptual co-representation of the events important reference for the test were the logical values of the ratio of answers offered for selection. All this leads to a wide spread in the sample response.

Thus it is possible to state that formal probability judgment may be the one but not necessary the most important and commonly used technique of choice. In assessing the probability people can intuitively consider the semantics of many situational factors and possible causal relationships, including

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the relative reliability, co-representation and the actual degree of occurrence (plausibility) of the respective events.

On the other hand the formal model determining the probability of random events is not exclusive and the only correct model for the estimation of probabilities as it belongs to a very simplified system of event. In this regard, one can question the use of this model and the rules for combining the probabilities as the basis for determining the correct behaviour when assessing the probability of hypothetical real events. In our opinion, the application of the criteria of the classical probability theory as the rules for evaluation of human behaviour in the face of uncertainty is not correct. In psychological practice we are faced with a different model of reality based on the perceptual heuristics, affective and semantic trends expressed in a variety of cause-related concepts and intentions, which include co-representation conditions, general causal schemes and situational hints (clues) as well as their intuitive and logical meanings [4, 7].

6. CONCLUSION

Heuristics and regulatory scientific judgments can be considered essential invariants of intercultural communication, which are formed in the process of education and contributed significantly to the ordinary psychological processes in different cultures, as well as the processes of scientific thinking in psychology and other sciences. In particular, the now-familiar scientific concepts are often used as standards and criteria in evaluating the truth of human psychology. It is noted that this is not always adequate to reality and can lead to a kind of scientific errors and illusions, which are persistent, due to the generally recognized the importance and significance of scientific and technological knowledge.

In particular, the normative model for calculation of probabilities of random events is used as a criterion for the correctness of the behaviour, which is defined by the availability and representativeness heuristics. [12, 13]. So, it is often stated that heuristics lead to incorrect results that they are opposed to scientific probability of judgment and are like the illusions of perception. This forms a misconception about heuristics, when their regularity is assessed in association with the mathematical model relating to a narrow group of phenomena a particular type or mechanism.

According to the concepts of transcendental psychology [5] the properties of perception as a basis of the representativeness heuristic ideas are to a large extent conditioned by the co-represented properties of the process of perception. This corresponds to a mathematical model, which theoretical implications are consistent with the experimental results of the perceptual heuristics.

The above shows that, from the point of view of the probability theory, the comparison of probabilities of an event A with the union of events A & B may be not on the right side depending on the definition of the overall set of elementary events. The developed mathematical model of co-represented events demonstrates that the probability of joined events may well exceed the probability of certain random events. Then the issue of verification of heuristics using standard scientific judgment has a different solution. The Conjunction Fallacy problem is removed on the basis of erroneous recognition of a classical probabilistic model as a universal model for probability estimations in the field of psychological reality. The proposed new mathematical model based on co-represented events is more consistent with the perceptual heuristic results and thus partly also can be used to explain them. In this regard, it can be argued that the Conjunction Fallacy is not an error of the people being tested. It is rather stereotyped researchers' error, taking a basic scientific theory as the norm, where its application is not completely justified. As shown in the work, the subjects in this case just perfectly logical and consistent in their beliefs about the probability of associated events: often quite naturally suggesting that two events have higher probability to occur than each of these certain events.

This suggests that the Conjunction Fallacy is a sort of scientific illusion. It may be regarded as an illusion as it is based on the wrong presupposition. The basic concept of illusion has been seen as a splitting between real performance and normative competence. Researchers often see classical models as norms against which human reasoning can be evaluated (rather than as codifications of it): when the two diverge, it is concluded that there is something wrong with the reasoning, not with the norms.

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This type of understanding of illusive phenomena is common in many sciences connected with psychic activities. When standard scientific conceptions differ fundamentally from common human behaviour it is reasonable to check the limits of scientific models which are used as a matter of right and valid norms. It means that for instance scientific probability norms of contemporary cross-cultural communication and education processes have to be adjusted to fit complex reality of human perception.

In general, we can conclude that human decisions under uncertainty is a multi-functional process that is characterized by the coexistence of different (conscious and unconscious) trends contributing to the perceptual and cognitive ability to perceive, understand and recognize the phenomenon of objects and situations, and to disclose the content of the outside ambient. Individual game and interaction of these trends in the case of poorly defined situations is manifested in the presence of a large variety of multi-valued variations in responses, significantly dependent on contextual influences.

The resulting probability values shown in cross-cultural and other experiments [4] are largely determined by situational preferences, taking into account various possible alternatives (including logical negative, neutral and positive situational conditions). These conditions are caused by the proposed description and presented features or retrieved directly from the proposed tasks. Without the presence of a special mathematical context different subjects naturally conceptualize the word "probability" in a multi-valued way. Therefore, the tendency to consider pure mathematical representation of the probability does not play a big role in decision-making. The model of reasoning according to the rules of probability theory, of course, may be presented among the above trends. However, this kind of thinking is not a priority because it refers to a specific group of phenomena of reality, and is unlikely to be evolutionarily significant. In part, it becomes socially relevant in modern education, yet this process is not widespread.

In this regard, the acceptance of the rules of special and obviously a simplified common model of calculation of the probabilities of independent random events as the standard for assessing the psychological processes does not seem natural. Moreover the research shows that this norm does not correspond to multivalued reality. The use of this normative behaviour outside the bounds of its applicability and its acceptance as a universal criterion applicable to the reality of any accidental events is leading to the emergence of a scientific illusion. Regulatory scientific definition of rational behaviour is projected on the psychology of human decision-making under explicitly or implicitly defined uncertainty, i.e. in an area that is far from the direct applicability of this behaviour, and is regarded as actually correct behaviour that is universally applicable to any particular circumstances.

A person's ability to learn and acquire new stereotypes in this case acts as an additional factor in favour of the relevant law-making and the possibility to follow the scientific norm of behaviour that demonstrate people specially trained in probability theory. The general nature of scientific theory in this case is sufficient to justify the possibility of its universal application.

The considered alternative mathematical model of joint probability of co-represented events is more valid psychologically and may be useful for better assessment of the representativeness and availability heuristics (used when making judgments about the probability of an event under uncertainty) and setting scientific standards for evaluation of psychology of human behaviour - standards, which are commonly used in cross-cultural communication and education processes.

REFERENCES

- [1] Aerts D., Aerts S. (2004) Towards a general operational and realistic framework for quantum mechanics and relativity theory. In A. C. Elitzur, S. Dolev and N. Kolenda (Eds.), *Quo Vadis Quantum Mechanics? Possible Developments in Quantum Theory in the 21st Century*. Berlin: Springer, 2004.
- [2] Artemenkov S. L. (2005) Embodied Cognition & Transcendental Psychology: Understanding the underlying processes of embodied cognition plasticity requires a new methodological paradigm. *2005 International Symposium on Body and Cognition: A Multidisciplinary Perspective*. Taipei, Taiwan, NTU pp. 9-1 – 9-22.
- [3] Artemenkov S.L. (2005) The origins of sensory awareness: Perception as a generative system.

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Workshop on Action, Perception and Consciousness & The 10-th Workshop on Attention and Perception. Taipei, Taiwan, NTU pp. 16-17.

- [4] Artemenkov S L. (2006) Kansei Versus Extensional Reasoning: The Scientific Illusion of The Conjunction Fallacy in Probability Judgment. *Proceedings of the First International Workshop on Kansei, February 2-3, 2006*, Fukuoka, Japan, pp. 8-11.
- [5] Artemenkov S.L., Harris M. G. (2005) From Constancy & Polyfunctionality in Perception to the Transcendental Psychology approach: historical overview of a novel psychological paradigm. *Journal of Integrative Neuroscience*, 4(4), pp. 523–536.
- [6] Bennett M.J. (2005) Paradigmatic assumption of intercultural communication. Hillsboro: IDRInstitute. - URL:www.idrinstitute.org
- [7] Hertwig R., Gigerenzer G. (1999) The 'conjunction fallacy' revisited: how intelligent inferences look like reasoning errors. *Journal of Behavioral Decision Making*, 12, 275-305.
- [8] Heuristics & Biases: the psychology of intuitive judgement (2002) / edited by T.Gilovich, D.Griffin, D.Kahneman. Cambridge University Press. – 857 p.
- [9] Nisbett R.E. (2003) *The Geography of Thought*. Nicholas Brealey Publishing. London. – 263 p.
- [10] Peterson J.B. (1999) *Maps of Meaning: The Architecture of Belief*. New York: Routledge. 1999. – 544 p.
- [11] Piatelli-Palmarini M. (1994) *Inevitable Illusions*. John Wiley & Sons. – 242 p.
- [12] Tversky A., Kahneman D. (1974) Judgment under uncertainty: Heuristics and biases. *Science*, 185, pp. 1124-1131.
- [13] Tversky A., Kahneman D. (1983) Extensional vs. intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review*, 90, pp. 293-315.
- [14] Watzlawick P., Beavin J., Jackson D. (1967) *Pragmatics of Human Communication: A study of interactional patterns, pathologies, and paradoxes*. New York: Norton, pp. 48-71.