Intelligence: Researches of psychologists from the Slovak Academy of Sciences

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Summary

The necessity to expand traditional researches on intelligence is discussed. The dual model of pragmatics and mechanics of intelligence is failing mainly because of a low ecological validity of traditional measurements of intelligence. Therefore, we are proposing to consider the reflexics of intelligence, a mental process enabling subjective representation of cognitive activity in the experiencing of an individual. Further, the structure of implicit theories of intelligence was studied. Another subject of discussion is the analysis of intelligence through perceived attributes and constructs similar to them (creativity or wisdom). The author presents his own research findings. In the conclusion, several generalizations about the advantages and limits of implicit theories are given.

Key words: Psychology, intelligence, wisdom, implicit theories, perceived attributes

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Introduction

From its philosophical roots, the study of intelligence was carried out on a theoretical as well as a practical level. These differences come from two different traditions in European philosophy – the pragmatic tradition and the ontological tradition. While applied fields of psychology are associated with the pragmatic tradition, basic theoretical fields are tied to the ontological tradition. On the one hand, we are trying to analyze the basic cognitive architecture of knowledge (abstract intelligence) and, on the other hand, we are studying intelligence as a behavior regulator in real situations of everyday life. However, gradually, the long dominance of abstract intelligence (with its focus on the analysis of information processing and problem-solving in artificial, laboratory conditions, represented on the outside by the IQ construct) is diminishing. In real situations of everyday life, the regulatory role of intelligence is becoming quite evident (Ruisel, 1999).

A state of affair

Nowadays, intense discussions prevail concerning the substance of intelligence. Howard (1993) considers three different concepts of intelligence. The first one represents the classic Spearman's g-factor and is based on the presumption on interindividual biological differences which correlate with the performance in mental tasks. This concept is similar to the one of fluid intelligence according to Cattell and Cattell (1963) and the type A intelligence according to Eysenck (1988). Eysenck considers g as an expression of „nervous effectiveness" while Jensen (1987) connects g with „mental quickness".

The second concept of intelligence is based more on adjectives than nouns. Intelligence represents the characteristics of behavior which can be more or less intelligent. Anastasi (1986) also stated that intelligence is more an entity than a quality of behavior.

The third concept of intelligence defines it as a set of abilities. Jensen (1987) tends to define intelligence as a „sum of all mental abilities" and „a total repertory of the individual's knowledge and abilities. The paradigm of cognitive sciences is based on such an understanding of intelligence. For instance, Simon and Kaplan (1989), believe that cognitive science concentrates on the „study of intelligence" and they define intelligence as a „varied set of abilities".

Baltes et al. (1984) proposed the so-called dual model based on two components – mechanics and pragmatics of intelligence. The mechanics of intelligence operate with the basic cognitive architecture of information processing and problem-solving. Information processing takes place regardless to the content and context and it has a universal and biologically conditioned basis.

The pragmatics of intelligence integrate content and elaborations of intelligent behavior flowing from concrete knowledge. The pragmatic approach lies in the effectiveness of processing previous knowledge and using it in solving „practical life problems". This approach broadens the traditional concepts by adding such variables to abstract or academic intelligence as reasoning, common sense, insight, wisdom, etc.

Similarly, Sternberg (1985) points to the expansion of the original concepts of intelligence by adaptive aspects of intellectual functioning of an individual. The pragmatics of intelligence includes such relatively generalized and automated knowledge systems as language and general knowledge. Furthermore, it analyzes specific knowledge systems as a result of the

process of specialization (for example, professional area, relaxation, family life, etc.) Both types of knowledge systems, the general and the specific one, consist of a declarative and a procedural component (Anderson, 1983).

However, the dual model of pragmatics and mechanics does not completely exhaust the problems of intelligence. We think, it is necessary to point out other variables which significantly regulate the processing of cognitive reality by an individual.

Personal intelligence versus intelligent behavior

According to Kováč (1985), revealing the principles of psychologically regulating behavior, represent the final goal of psychology – to come as close as possible to revealing the basis for psychological phenomena. As we have stated above, intelligent behavior of an individual in a real context, along with stable performance invariant (defined mainly by the mechanics of intelligence) is influenced by declarative and procedural knowledge base (pragmatics). However, we assume that, so far, not enough attention has been paid to the broad variety of subjectively represented personality-cognitive, self regulatory, metaintellect and implicit variables (reflexics). Since enough research deals with the description of mechanics and pragmatics, we focuse our attention on the analysis of variables summarized under „reflexics".

Reflexics represent a mental process enabling subjective representation of cognitive activity in the experiencing of an individual (Ruisel, 1994). We pressume that reflexics is formed on the basis of information coded from four problem areas: 1. by means of personality-cognitive regulators of performance (failure), 2. intellect self-regulation, 3. an individual's implicit theories, 4. metaintelligence.

Personality-cognitive regulators of performance (or failure) influence the coding of information as early as the level of perception input (extra-introversion, affective reactions, social sensitivity, cognitive styles, cognitive schemata, etc.).

Intellect self-regulation identifies the qualitative and assessing aspects of experiencing the activity of the intellect. It is based on the use of information leading from the self-assessment of specific and generalized cognitive competencies (for example cognitive effectiveness).

Implicit theories supply the individual with declarative knowledge about the basis, strategies and context connections of intelligence.

Metaintelligence combined with value orientation of an individual forms the basis of the wisdom phenomenon as the knowledge of limits and conditions of the real existence of man, mainly in solving „ill" defined problems.

As we have already mentioned, reflexics represents an effort to identify those variables which retrospectively influence the quality of intellect performance as well as the representation of cognitive activity in the experiencing of an individual. That is why we expect that along with mechanics and pragmatics, reflexics takes an important part in forming the so-called personal intelligence. We define personal intelligence as the ability of an individual to subjectively represent the objective aspects of cognitive activities in experiencing and, based on a long-term concept of one's self-image, to adequately regulate behavior and choose optimal strategies of solving-problem situations (Ruisel, 1994).

In the following, we will try to analyze partial variables which significantly contribute to the representation of the process of reflexics and thus of the construct of personal intelligence. Among these variables, personality-cognitive regulators of performance or failure are of

utmost importance. Because there is a great variety of these variables in this case, we will limit ourselves to an illustrative definition of some characteristic results, which were made in our laboratories. First of all it concerns the role of cognitive styles, affective relations, cognitive effectiveness, and implicit theories of intelligence.

Personality-cognitive regulators of performance (failure) – Cognitive styles

To date, cognitive psychology has a growing interest in the analysis of information processing by means of cognitive styles. According to Sarmány (1994), it concerns the study of individual preferences of the reactive system of personality which are relatively stable and are manifested in processes on which cognition is based.

In our conditions, Sarmány (1994) analyzed the relationships between partial intellect activities and cognitive styles categorization width and heuristic vs. algorithmic orientation. He found a higher level of risk decision-making in individuals with heuristic orientation and wide categorization. If the practical solving of a problem situation is to be new, creative and effective it must come to terms with uncertainty and vagueness. Fixation on irrelevant aspects can interfere with reaching optimal solutions and that is why flexibility as well as the ability to take optimal risks are important preconditions for a successful practical solution to a problem and for coping with a situation.

Affective reactions - anxiety

Cognitive strategies, their selection and use can be influenced, to a great degree, by affective reactions of an individual. Anxious reactions in the course of a complex social interaction can be very inhibiting to a socially anxious individual. Also, affective reactions can significantly affect the effectiveness of future activity. Negative assessment of one's own success creates relatively negative expectations for the future. Prokopčáková (1993) found a significant negative relationship between anxiety level and behavior control. Individuals with a higher level of anxiety usually have a more negative perception of their own cognitive competence. Based on this, we can expect that under the threat of failure, people modify their problem-solving process. A perceived success (enforcement) or failure (punishment) regulates cognitive processes and subsequently influences future behavior and problem activities.

Intellect self-regulation

In the course of real existence, based on personal experiences, an individual forms generalized images of him/herself, his/her abilities, expectations, virtues and limitations. Heppner and Krauskopf (1987) define four types of self-assessments: 1. self-esteem, 2. control localization, 3. problem-solving assessment, 4. self-efficacy. The beliefs are the product of concrete experiences which an individual has in a real context: the actual experience is then confronted with the content of one's own cognitive structure. These more global self-assessments in the process of problem-solving interact with other variables. For example, an individual's self-assessment, be it positively or negatively generalized, can influence the extent to which he/she will search for or refuse problem situations, the extent to which he/she considers a problem to be a challenge or a threat.

With our research conditions, we analyzed the self-regulatory aspects of intellect performance by means of the cognitive effectiveness construct. Cognitive effectiveness expresses objectively experienced competences of an individual in reaching optimal forms of intelligent behavior (Ruisel, 1994). The phenomenological aspects of cognitive effectiveness were studied using the Cognitive Effectiveness Questionnaire (CEQ). The questionnaire is oriented towards self-assessment of behavior in a broad context of cognitive activities. Based on a factor analysis, we identified five factors: 1. self-trust, 2. absent-mindedness, 3. self-criticism, 4. behavioral insecurity, 5. cognitive motivation (Ruisel, 1994). The questionnaire was given to several selected groups of adolescents.

We found out, that individuals who, according to the CEQ score, are assessed as being cognitively more effective, indicated a higher level of synthetic thinking and better retention of facts (determined according to ILP, Schmeck et al., 1977). In addition, they are more ready to accept arguments (according to the Argumentativeness Scale, Infante and Rancer, 1982). At the same time, they stated a higher heuristic competence, less frequent occurrence of accompagnying emotions, a more significant tendency towards optimal solution of problem situations and they refused, to a greater degree, the strategies of regression and resignation (according to KFST 3, Stäudel, 1988).

These trends are in accordance with some of our other findings. For example, individuals chosen according to their extreme score in the Problem-solving Questionnaire (Heppner et al., 1982) were given the Inventory of Learning Processes (ILP, Schmeck et al., 1977). We found out, that individuals who assessed themselves as more successful problem solvers, manifested a more significant tendency toward synthetic thinking and towards fac-retention. Thus, it stands to reason that subjective experiencing of cognitive effectiveness plays an important role in the regulation of intellect performance.

Implicit theories of intelligence

Implicit theories summarize and analyze the views and convictions of laymen about psychological phenomena as well as ways in which psychological concepts are represented. The study of implicit theories is rooted in the conceptions of Asch (1946), Bruner and Tagiuri (1954) who introduced the idea of „implicit theory of personality" which explains how people who have limited information form integrated opinions of others. Implicit theories are important for the understanding of psychological concepts and are used as bases for explicit theories.

Creating implicit theories is not self-serving but has an instrumental character. For instance, Sternberg et al. (1981) found that people not only form implicit theories of intelligence, creativity and wisdom but also use them in making conclusions about themselves and others. Neisser (1979) presumes that a man can be considered to be intelligent to the extent to which his behavior corresponds to the attributes which characterize the prototype or ideal concept of intelligence. In order to obtain an adequate picture of a prototype of an intelligent individual, it is necessary to analyze the laymen's perception of the representation of the very construct of intelligence, views of its biological-social conditionality, its effects and possible application in various situational contexts. As mentioned by Furnham (1992), theories can form schemata which filter and organize new material.

We can offer results of two research streams focused on the research of implicit theories. First, it concerns the intelligence as a perceived attribute, and second as perceived attributes of similar constructs.

Intelligence as a perceived attribute

This study concentrates on knowledge structure of intelligence, i. e. on knowledge which the individual has of a given problem. In order to identify an individual's knowledge structure, we compiled a list called „What I think about intelligence" (Ruisel, 1993, Appendix 1). It contains 22 statements about various aspects of intelligence. Some are of a theoretical character, others concern more practical applications. Several express racist stereotypes. Opinions on the connection to other psychological functions of man or on the possible hierarchy in the system of personality were also studied. Compensation for insufficient intelligence is also considered as well as possible prognostic applications. 109 subjects, mean age 21,3 years, took part in the research.

Based on the analysis of the basic statistical data, we can say that in the majority of the cases the selected subjects either slightly agree or disagree with the given statements. Therefore, we assume that the subjects with the given study major and age do not have unequivocal knowledge. Items 21, 17, 5 and 7 are the exception (for further data, see Ruisel, 1993). The subjects, in the majority, do not register the close relationship between intelligence and lateral preference, refuse intellectual inferiority of blacks and the hypothetical assumption that the computers will be more intelligent than people or possibly that intelligence is more important than character. On the other hand, there is a relatively high agreement with items 13, 6 and 14. That is why we presume that the subjects are convinced of the growing role of intelligence in modern times, about the intelligence of animals as well as the significance of intelligence in the activity of an entrepreneur.

On the basis of factor analysis, individual items were divided into four factors (for further data see Ruisel, 1993). The first factor summarized situations expressing functional aspects of intelligence in which the role of mental abilities in successful assertion in global human activities is generally emphasized.

The second factor analyzed the assessment of success in school, the relationship to studying, memory knowledge and intelligence. The results show that the great majority of our subjects presumes a close relationship between individual cognitive functions. While the first factor overlaps to a certain degree with the problem area of practical intelligence, the second one expresses more the basic characteristics of academic intelligence (e. g. Sternberg et al., 1981). Practical intelligence is often understood as problem-solving focused on tasks from everyday life with emphasis on technological or managing requirements (Dittman-Kohli and Baltes, 1990; Ruisel, 1992).

The third factor concentrates on stereotypes about the inferiority of selected social groups. The perceptions of the lower intelligence level of certain cultures have often been studied since the beginning of scientific psychology (e. g. Segall et al., 1990). The assessment of our subjects indicates a refusal of these perceptions about the presumed inferiority of selected population groups (blacks, gypsies, prototypical nations).

The fourth factor was specific for items 1, 2, 7 and 20. The greatest load was on items 1 („Men are more intelligent than women"), 2 („Intelligence is inherited") and 20 („Lack of intelligence can fully be compensated by tenacity"). It concerns more or less items summarizing the effects of biological-social invariance.

In our total assessment we think that the perceived attribute of intelligence sees it as a rather complex, multidimensional concept which is strongly expressed in various human activities. It has a performance character and conditions the success of man, not only in theoretical mental manipulations but also in practical activities of everyday life.

Intelligence and perceived attributes of similar constructs

Research of implicit theories (e. g. Sternberg, 1990) indicates that lay men have relatively stable ideas about the structure of intelligence. Spoken language in various cultures allows for relatively accurate descriptions characterizing the various forms of intelligent and unintelligent behavior as well as the prototype of an individual with certain mental functions and abilities. Intelligence, however, cannot be understood as a unitary entity. There are significant meaning variations mainly in mental representation of related but semantically different constructs such as practical, abstract, social and personal intelligence.

For our research, we have made an effort to probe into the implicit structure of the different forms of intelligence and wisdom in adolescents. The task of the subjects was to mentally form a prototype individual with a high level of abilities. These abilities were the precondition for success in everyday life situations. For this purpose, we defined intelligence as an observable, phenotypical and active variable which acts as a regulator in real everyday life situations. At the same time, we expected, that the evaluations will also be affected by the specifics of the sample of adolescent population.

In order to identify an individual's knowledge structure we compiled a list called „List of Mental Functions and Characteristics" (Appendix 2). This list comprises 26 items describing various intellect functions. The majority of functions represented cognitive activities (e. g. „logical reasoning", „generalization" and „abstract thinking"), some concentrated on more complex personality – social characteristics („esthetic feeling" and „practicality"). 238 subjects, mean age 16,8 years took part in the research. Five groups of subjects received the „List of Mental Functions and Characteristics" with different instructions (emphasizing practical, social, abstract and personality intelligence and wisdom). The instructions (e. g. for the group assessing characteristics typical for social intelligence) were: „Here is a list of characteristics of an individual with a high social intelligence. Your task is to assess the extent to which these characteristics are necessary for successful functioning of this individual's social intelligence. Use the key 1 – slightly, 2 – a little, 3 – fairly, 4 – quite a bit, 5 – very".

First of all, we expressed the mean values and standard deviations in the questionnaire items for the entire sample, regardless of different instructions in individual groups. Significant differences between the items were found. The highest mean values were reached by the items „self-control", „verbal readiness", „responsibility", „perception" and „long-term memory". The lowest mean values were registered in the items „short-term memory", „generalization", „planning", „esthetic feeling" and „abstract thinking".

Factor analysis was carried out in order to identify the more general indicators of perceived attributes. We extracted 5 factors (further data in Ruisel, 1996).

The first factor combines functions which, according to implicit assessments, express noncognitive, personality modulated variables („tolerance", „esthetic feeling", „self-control", „self-criticism" and responsibility) and to a lesser degree (factor charge under .5) even cognitive activities („perception", „problem-solving" and „decision-making"). The first factor can be marked as the personality-cognitive factor.

The second factor combines six relatively related functions which significantly influence success in learning („long-term memory, „learning", „concrete thinking", „practicality" and decisiveness") and in practical application of intellect abilities. This factor can be marked as the learning factor.

The third factor comprises five items („generalization", „comparison", „making conclusions", „logical reasoning" and „short-term memory") which basically represent

the performance item of cognition and are, to a great degree, the indicator of cognitive effectiveness of an individual. That is why it can be called the cognitive effectiveness factor.

The fourth factor combines four items which are close to each other in concept („intuition“, „anticipation“, „accuracy of assessment“ and „imagination“) and which express the imagination item of intelligence. That is why this factor is marked as the intuition factor.

The fifth factor involves items expressing mainly abstract activities („abstract thinking“, „creativity“ and „planning“). It is marked as the abstraction factor.

The findings that we have commented on so far have dealt rather with generalized aspects of the studied intelligent prototype. At the same time, our aim was to analyze the differences between characteristics with respect to individual forms of intelligence. Based on the literature (e. g. Sternberg et al., 1981) as well as on our preliminary findings (Ruisel, 1996) we expected differences between prototypes characterized as practically, abstractly, socially and personally intelligent as well as wise. We analyzed the dispersion of five characteristics with the highest mean values (for further data Ruisel, 1996).

With respect to the prototype of a practically intelligent individual, subjects emphasized mainly characteristics which are considered to be a precondition for a successful behavior in real life („concrete thinking“, „verbal readiness“, „logical reasoning“ and „problem-solving“) or which possibly express a desirable regulatory action in concrete situations („self-control“).

A prototype of a successful socially intelligent individual should, according to the implicit ideas of the subjects-assessors, have a combination of cognitive („perception“, „problem-solving“) and personality („self-control“, „tolerance“, „responsiblity“) characteristics. We can expect, that both cognitive functions significantly contribute to a successful socialization of an individual, mainly in coding and processing information.

The subjects-assessors associate abstract intelligence with „long-term memory“, „self-control“, „responsibility“, „verbal readiness“ and „decisio-making“. Basically, these are variables contributing to a successful adaptation of an individual to the external environment. It is relatively surprising that the refused variables include „short-term memory“, „generalization“, „comparison“, „planning“ and „esthetic feeling“. To a great extent, these variables represent abstract mental activities which, however, the subjects-assessors did not consider to be important. Thus we can assume that adolescents in the given age group are not able to give a relevant representation of a prototype of an abstractly intelligent individual. The explanation may lie in the statement of Keating (1980) who said that for younger adolescents, mental operations characterized as formal, are not required for a competent performance.

The functions ascribed to the prototype of a wise individual represented a combination of personality („tolerance“, „anticipation“, „imagination“ and „self-control“) and cognitive („long-term memory“ and „concrete thinking“) characteristics. These are variables which represent mainly regulatory aspects of behavior which are in accordance with the defined concept of wisdom. Clayton (1982), for instance, defined wisdom as an ability which permits an individual to control human nature and which operates according to the principles of contradictions, paradox and change. Holliday and Chandler (1986) in their research of implicit theories of wisdom, identified relatively related constructs: excellent understanding, assessment and communication abilities, general competence, interpersonal abilities and social unobtrusiveness. A different view was expressed by our subjects who did not expect a more significant role of „short-term memory“, „planning“, „generalization“, „making conclusions“ and „comparison“.

Personal intelligence, as seen by the subject-assessors, is represented by variables ensuring cognitive effectiveness of an individual in external conditions. It concerns the following functions: „problem-solving", „logical reasoning", „responsibility", „decision-making" and „concrete thinking".

This overview points out, that individual prototypes are characterized chiefly by a combination of cognitive and personality characteristics. At first sight, it may be surprising that there is such a low number of cognitive functions given to prototypes in which a higher number of such functions was to be excpected (e. g. in case of abstract intelligence). This is probably caused by the fact that this phenomenon is not adequately represented in this particular age group (but we remind, that our research is oriented on the implicit theories, with high subjectivity).

Conclusion

In the presented material, we have briefly discussed the development of the views on intelligence. The theories and metatheories as well as the methods in the studies of this construct were changing. None of them are complex and thus cannot claim the right to universalness. At the best, they are complementary and cover only partial aspects of such a complex phenomenon as human intelligence. We discussed the importance of reflexics of intelligence, as a source of significant interindividual differences in intelligent behavior. Reflexics represent a mental process enabling subjective representation of cognitive activity in the experiencing of an individual. This is why an intelligent person pays special attention to problems that are relevant to him/her. At the same time, he/she has the metaintellect knowledge of his/her own competences and limitations and based on self-regulating mechanisms is able to compensate for his/her own insufficiency and limitation. In this process, the individual is assisted by implicit knowledge about the substance of intelligence. Implicit theories, which offer an individual declarative knowledge about the substance, strategies and context coherences of intellect abilities, are an important part of reflexics.

Adequate cognition is influenced not only by interindividual but also by intraindividual differences. Individuals are not equally impulsive or reflexive. In the same problem situations, they often choose different cognitive strategies (often on account of personality-cognitive regulators such as affective reactions).

It is relatively difficult to guess to which direction researches on intelligence will turn in future. However, we do expect that it will be necessary to devote much more time to the relationship between context and cognition. It will be necessary to overcome the narrow focus on „well" but often artificially defined problems and concentrate on „ill" defined tasks which, however, from the point of real life are much more relevant.

It is likely, that more exact methodological approaches will be required by research on the „prototype" of an intelligent individual and implicit ideas themselves. Knowledge gained in this area can prove to be very inciting mainly in the understanding of basic postulates of personal intelligence. It is precisely in the theoretical and practical specifications of this construct, that we see the greatest debt of current concepts of intelligence. So far, understanding intelligence as an isolated entity operating under abstract and artificial conditions is prevailing. It is time to replace it by an image of intelligence placed in the context of multidimensional often controversial, but real and active personality.

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Appendix l

„What I think about intelligence“
1. Men are more intelligent than women
2. Intelligence is inherited
3. The older you are the more intelligent you are
4. The more educated you are the more intelligent you are
5. Computers will one day be more intelligent than people
6. Some animals are intelligent
7. Intelligence is more important than character
8. Intelligence is very dependent on memory
9. The best students are usually the most intelligent
10. How successful one is in life depends on one's intelligence
11. Some nations are more intelligent than others
12. More intelligent people have an easier life
13. The role of intelligence in our modern time is increasing
14. A successful entrepreuner must mainly be intelligent
15. Intelligence can be measured exactly by intelligence tests
16. Intelligence is very dependent on knowledge
17. Whites are more intelligent than blacks
18. Gypsies are born less intelligent
19. More intelligent students learn easier
20. Lack of intelligence can fully be compensated by tenacity
21. Right-handers are more intelligent than left-handers
22. When choosing one's profession one should consider one's intelligence

Appendix 2

„List of Mental Functions and Characteristics"
1. Tolerance
2. Esthetic feeling
3. Self-control
4. Self-criticism
5. Responsibility
6. Perception
7. Problem-solving
8. Decision-making
9. Long-term memory
10. Learning
11. Concrete thinking
12. Practicality
13. Decisiveness
14. Verbal readiness
15. Generalization
16. Comparison
17. Making conclusions
18. Logical reasoning
19. Short-term memory
20. Intuition
21. Anticipation
22. Assessment accuracy
23. Imagination
24. Abstract thinking
25. Creativity
26. Planning