



Rationality and Human Cognition



Reginald Adrián Slavkovský
Edition Cognitive Studies
fftu



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Introduction

The present era emphasizes significance of education, and our education system is founded on a rational approach to reality. The western society is the most advanced in a sphere of technology produced thanks to science. However, it cannot be said that we have successfully eliminated all problems; we cannot even be sure whether our approach will not lead us to a cul-de-sac of nuclear war, environmental destruction or economic collapse and great social disorders. Our education, lifestyle but also society management are shaped by rationality, yet, rationality itself remains largely non-reflected and thus it represents a call for more profound examination of rationality.

In the Axial Age, reflection of thinking and cognition connected with a possibility of critical distance from own beliefs represented an important step in a process of separation of a human being from nature. Throughout history philosophical examination of rationality was accompanied by a reflection drawn upon experience with contacts with a sacred, spiritual sphere. During the last centuries empirical scientific examination attempts whose most complex manifestation is an interdisciplinary approach of cognitive sciences were gradually added to these approaches.

This textbook combines all the mentioned approaches. It briefly introduces some outcomes of cognitive sciences concerning rationality, philosophical concepts which take this development into account, but also approaches pointing out to boundaries of rationality and openness to a dialogue with approaches arising from

spirituality. The text also offers plenty of questions upon which a reader can ponder as well as recommended literature one can follow if interested in more detailed study of particular topics. It is intended for master's degree students of the field *Cognitive Studies*, however, everyone who wants to get acquainted with an issue of rationality and cognition can use it.

The choice of topics is narrowed and covers only several rationality aspects. Except for basic terms and concepts we have also tried to insert in the text as many passages having not only informative but also practical character as possible. For me myself, questions of effect of convictions about understanding in communication especially when solving tense situations, cooperation of rationality and emotionality, and aspects (mainly those we are not aware of) affecting our decision making have been and still represent a challenge because they significantly influence my everyday life.

I hope that this text will help a reader not only to comprehend his own rationality better but also contribute to making him apply this exceptional ability of ours also more efficiently.

In Trnava, on July 31, 2012

Adrián Slavkovský

1. General Comprehension of Reality and Cognition

Keywords: *rationality, cognition, optimality, introspection, third-person access*

1.1 What is Rationality? What is Cognition?

An assumption claiming that a man is “a reasoning animal” is considered to be one of crucial characterisations of a human being since Aristotelian era. So, it is our use of brain that distinguishes us from animals. Therefore, at the beginning we can almost tautologically say that rationality is usually understood as a use of brain or at least a precondition for it. On the other hand, when we start to ask what it means more thoroughly, it shows that examination of rationality is not an easy task at all.

Rationality represents one of those concepts thanks to which we describe important phenomenon but at the same time it is not an issue one could easily point out to. To start with the opposite of rationality is also of no use. Sometimes we tend to call behaviour, belief, desire or decision of a man as unwise. If unwise could be defined without problems, it could help us with comprehension of rationality. Nonetheless, also in this case we would quickly come to the conclusion that to find general criteria of unwise is beyond our powers.

Let us list also other characteristics in order to describe rationality. One widely used approach says that rationality represents a means how people come to conclusions when they intentionally

ponder (and at the same time consciously or unconsciously apply certain rules of proper thinking). Harmony between beliefs and reasons for these beliefs should be a manifestation of rationality similarly as harmony between an action and reasons for this action.

Rationality is a word of Latin origin. "Ratio" represents its stem and can have various meanings in Latin. The main groups of meanings are:

- reason, thinking, thought, comprehension, explanation, reason, condition, conclusion
- number, calculation, calculating, proportion, budget, account
- order, procedure, theory, system, means, method, rule, statement, study, teachings
- rate, relation, respect, connection
- property, state, nature, naturalness
advantage, interest, measure, thing, issue.

The term "rationality" is used in various areas a little bit differently. For instance, a rational decision does not only mean that it is a decision of reason but in an ideal case, it is such a decision which is optimal for achieving of a goal or solving of a problem. Searching for such a decision and especially an analysis of a procedure leading to it represents one of the interesting issues of cognitive sciences. We apply introspection, observe people in similar situations, explore how brain acts during them and also attempt to create and improve artificial intelligence which could perform the given task. All these aspects help us better comprehend our rationality.

A definition introduced by Jozef Piaček in his philosophical encyclopaedia represents an attempt to summarize the mentioned aspects: It is *"an ability of a human being to think and act on the basis of rational norms; harmony between action and intellectual principles whose observing represents a pre-*

requisite for achieving of a goal. Rationality can be comprehended as a relatively stable set of rules, norms, standards and etalons of a spiritual and material activity as well as values generally accepted and unequivocally understood by all members of a given community (social, professional or ethnic group, bracket, class, etc.)" (Piaček, 1999)

On the contrary to "rationality", "cognition" is a new word not frequently used in Slovak, however, it gradually gets naturalised in professional circles. They represent close concepts and their meanings even overlap. Through application of the term "cognition" more complex and technical or empirical approach to knowledge and comprehension promoted by cognitive sciences should be emphasized. I am to introduce several characteristics and dictionary meanings of cognition.

Cognition represents a process in which knowledge and comprehension get developed in mind.

Another view increases an emphasis: in the broadest sense of the word, it is an act or ability of cognizance including perception and comprehension, not emotions and will. In more specific sense, it represents also an act of proper recognition of an object of perception. It is as well a result of an act of cognizance: a percept, image or idea.

Cognition can be further understood as a group of mental processes including attention, memory, formation of a language, its comprehension, learning, thinking, solving of problems and decision making (*Oxford English Dictionary, 2009*).

Cognition or cognitive processes can be natural or artificial, conscious or also unconscious. We use the very same term „cognition" not only for description of human phenomenon but also for processing of information by computers when creating machine simulations of human cognition. Recognition of a face can

be used as an example. In the 1990s, a system of face recognition by brain was described for the first time. According to this description, a specific cerebral section with a Latin term “gyrus fusiformis” located in Brodmann area 37 plays a vital role (Sergent — Ohta — MacDonald, 1992). Concurrently, algorithms for machine face recognition were being developed and at present, they are considered to be so reliable that they are gradually launched as means of personal identification (for instance: at airports). Among such algorithms we can mention: SVM (support vector machine), RBF (RBF network) and MLP (multi-layer perceptron) (Ban, 2010).

1.2 Why to Concern with Rationality and Cognition?

It might seem that just successes of science and technology embody a sufficient reason for supporting of development and research of concepts from rationality to artificial intelligence. However, it is not so simple at all. Except for praise of rationality, there have also been voices in history which are critical towards it. Those voices have become stronger especially since the 19th century, since a human being has been strengthening consequences of his behaviour — those good as well as bad ones still more significantly via machines and technologies he manufactured thanks to his rationality. Konrad Lorenz asserts that if any ideally intelligent creatures without instincts could watch the humankind as a whole, great shifts occurring within it and wars and destruction permanently taking place, and would not see individuals, it would never come to their mind that people are also creatures endowed with rationality and that their behaviour follows responsible morality (Lorenz, 2000, p. 199). This led Vlastimil Rollo to an even harsher statement about rationality. According to him, it is possible to “*diagnose a man as an animal which fell ill with reason*” (Rollo, 1993, p. 188). Certainly, it is necessary to take into consideration plenty of negative symptoms pointed out by him as well as by others and comprehend them as challenges. And thus, one of the motives for

examination of rationality and cognition might be an effort to comprehend ourselves and these aspects of our humanity more deeply, face to face to destructive consequences of a human activity in order to minimize these consequences and support those positive ones. Because it is becoming more and more apparent that thanks to rationality we can develop as well as destroy ourselves, we can get harmonised with environment but also devastate it.

While at the beginning of the interest in rationality there might have been curiosity, today, it is a challenge of the era.

The society has become more and more complex and more dependent on proper functioning of products of our rational thinking. They represent not only computers and technology but also means of organisation of society in a field of politics, economy and education. A human being is not only a creator of all of these items but also the one who is retrospectively affected by them. “*Educators would like to know the substance of mental processes taking place in student’s heads in order to improve teaching methods. Engineers and other designers need to know how product users will think.*” (Thagard, 2001, p. 17).

The development of science and technology and a change in the society as a motive of examination are even more related to cognition. Development of computers, information science and artificial intelligence but also progress in neuroscience and brain research have encouraged new intensive examination of all aspects of cognition.

1.3 Who and how Examines Rationality and Cognition?

At the beginning, people might have used language and thinking only for practical purposes of survival. Yet, later after a period lasting for millennia, they started to ask questions about their origin and destiny. This type of cognition was led by amazement, fascination arising from a possibility of comprehension also of issues which were not related with a necessity of survival. According to Karl Jaspers, a shift occurred in manifestation of rationality in the Axial Age which completely modified a character of the whole human society. An accentuated ability of self-reflection became that small nonetheless significant shift. Through our language we started to ask what language is, we began to think about thinking, cognise our cognition and be aware of the fact that we have a mind. Introspection and a philosophical discussion represented a simple examination tool. Philosophy of mind later termed it a first-person access. This is the way how philosophy deals with rationality.

Only a rapid development of science and technology taking place in the 20th century brought new dynamics into this eternal asking of ours. We could get to know the brain structure in more details — even to a level of micro-world and also take first steps in a research of direct observation of processes taking place in brain thanks to modern imaging methods — especially computed tomography and magnetic resonance. This approach was termed a third-person access. Except for that computers with still increasing performance enabled us to create artificial simulations of various aspects of rationality and cognition. It has shown that it is appropriate to add also other approaches into a more complex image which has been developing in this way. It concerns especially the following disciplines: logic, linguistics, theory of information, psychology, sociology, anthropology, artificial intelligence and neuroscience. Through integration of their knowledge on aspects of rationality and cognition cognitive science as an interdisciplinary study not only of human cognition but also of any system with an

ability of cognition and processing of information was formed towards the end of the 20th century.

The three phases of our asking we have introduced might be briefly summed up as follows:

1. Inner and outer world of a human being represent a subject of rationality, however, rationality does not cognize itself.
2. Rationality examines also itself yet it does not have any other tools for cognition except for itself.
3. For deeper cognition of rationality a human being uses tools which he created through to it and thanks to them he acquires knowledge which mere rationality could not gain.

Two different approaches can be distinguished from the point of view of examination of rationality: **Normative approach** attempts to answer a question: What represents substance of rationality? This approach is connected with standards and criteria on the basis of which we could assess which manifestations of a human being are rational and which irrational. Do universal criteria of rationality exist? The second one, **empirical approach** seeks replies to the following question: How do people actually think? These two approaches are not strictly separated; research outcomes based on one approach frequently influence tendencies of the other and vice-versa.

1.4 The Role of Philosophy and Cognitive Sciences in Examination of Rationality

The birth of philosophy is connected with a turn of rationality towards itself. Over the course of history, philosophy came with plenty of theories of rationality which at the beginning proposed

a structure of rationality, its elements, relations taking place among them, important processes within a system and alternatively also a means how it develops especially on the basis of self-observation. It represented an analysis of such phenomena and processes as thinking, mind, memory, perception, learning and decision making.

Rationality manifests in a form of opinions and beliefs, goals and values, preferences, judgements and choices which define directions of our lives. The way we express ourselves and a society through rationality indirectly tells also about this rationality. Therefore, for philosophy, accumulation of experience and knowledge represented still new stimulus for re-evaluation of concepts of rationality. Today, philosophy cannot ignore scientific knowledge connected with rationality. However, it does not mean that science has replaced philosophy. It is still and will be necessary to return to foundations and think anew about significant concepts, seek relations — and do likewise also beyond a boundary which science does not cross in its asking. For instance, artificial intelligence comes all the time with new applications such as e.g. the already mentioned face recognition. And in connection with that philosophy asks whether and how it affects our comprehension of rationality.

Cognitive science brings especially a great amount of empirical scientific material concerning detailed examination of various aspects of cognition and cognitive abilities of a human being, but also different living creatures and artificial systems. The main task of cognitive science is to reconnect knowledge of specific sciences, search for new relations emerging in interdisciplinary perspective and give it a homogenous framework through a collective terminology.

“Rationality” embodies more philosophical than scientific concept. Nevertheless, a lot of aspects of rationality can be analysed and empirically examined to a relatively good ex-

tent. Cognitive science focuses just on those aspects of rationality which can be accurately termed and scientifically researched.

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2. Concepts of Rationality

Keywords: *rationality, consistency, reason, standard, adaptiveness*

2.1 Concepts Based on the Criterion of Consistency

As it has been introduced, the word “rationality” is used in various contexts, it does not have unequivocal meaning in ordinary language and not a single concept of rationality exists even in professional circles. Raymond S. Nickerson in his book on rationality introduces an outline of the main approaches of various authors (Nickerson, 2008, pp. 13 — 32).

Comprehension of rationality as consistency with self-interest represents the first concept. According to this approach, rationality means to think and act on the basis of one’s own best interests. It sounds quite reasonable, however, and immediately a question emerges: How do we know what is the best for us? Is what we want at the moment the best for us? It frequently happens that we retrospectively become aware of imperfection of our desires as well as decisions. For instance, when it shows that what we wanted and what we might have achieved was not the best, although at that time it appeared to be so and we were even convinced about that.

Self-interest can be understood as everything what one considers to be the best for him. Self-comprehension plays a vital role here because one’s belief can lead someone to hurting others while someone else’s to altruism or even self-sacrifice. It seems that a line of

thinking through consistency with self-interest leads to a dead end because according to it eventually every action would be rational.

Such comprehension makes rationality something too subjective. What one would comprehend as rational would be irrational for someone else. Nonetheless, this is just how it often happens in practice. People are not able to come to an agreement although everyone believes that his approach is perfectly rational.

Although this concept has its weaknesses, it still points out to something important. Interests, which we either do not realize at all or underestimate their influence on our thinking, decision making and actions, might be hidden behind arguments which we defend before ourselves as reasonable.

Comprehension of rationality as consistency of actions with own preferences or goals represents a similar concept. It seems to be more acceptable because preference or goals of a human being do not have to be restricted to self-interest. The so-called Victorian comprehension of a rational behaviour can be taken as an example: rational people decide on the basis of analysis of information, not whims, emotions or habits. They try to maximise wealth and beneficial effect. The concept of instrumental rationality embodies a different example. According to it, rationality is assessed on the basis of efficiency of means in relation to an intended goal. However, that would mean that only the means not goals can be assessed as rational or irrational.

The concept of instrumental rationality understood in this way does not seem to be consistent with common sense because some goals would not be seen by majority of people as rational (for instance: an attempt to secure against any possibility of fatal accidents).

Thorough examination of goals is not only a subject of ethics and aesthetics but it is also much more important than assessment of means. To be rational means to pursue defensible goals.

2.2 Concepts Based on the Criterion of a Level of Thoroughness

Comprehension of rationality as optimal analytic choice behaviour represents the third concept. According to it, a rational behaviour is the one which includes thinking through possible consequences of decisions (choices) by quantitative means and on the basis of this assessment an individual chooses the choice leading to achieving of an intended objective. A tool of this concept of rationality can be, for instance, an investment and payoff matrix (table). The table rows represent a certain action alternative, while the columns embody states of the world. Each matrix cell stands for payoff assigned to a choice and world state. A final decision arises from some normative rule (for instance: to maximise gain). Payoffs might be quantified variously. Except for a financial value, for instance, a benefit effect can be used instead which brings an element of subjectivity also into this concept.

Comprehension of rationality as satisfaction with at least some reasons is a milder version of the previous concept. According to some authors, people pursue rather satisfaction than optimisation. It means that when people want to comprehend a situation or think about a solution, they are satisfied if they find some reasons. According to research outcomes, they do not attempt to achieve the best possible comprehension or decision but the one which will satisfy them. Some thinkers consider tendencies to be satisfied also with a little to be a weakness and a cause of immature conclusions and decisions of people. They express it by branding people cognitive misers or intellectually lazy organisms.

A question then is how much of cognitive effort has to be made in order to be possible to call given thinking in a certain particular situation rational. How close should a perspective or a solution be to the optimal one in order to be able to call it rational? Yet, this approach does not answer these questions.

2.3 Concepts Based on the Criterion of Sensitivity and Cognitive Effort

The fifth concept is **comprehension of rationality as reflectiveness**. In this case reflectiveness should be understood as truth sensitivity, willingness to examine issues from various viewpoints, fairness of thinking which carefully considers prerequisites and a conclusion, critical thinking not quickly jumping to conclusions but requiring examination of its procedures and also an ability of self-criticism. Self-cognition, cognition of own limitations, i.e. humility (in contrary to intellectual arrogance) is also a part of reflectiveness. There is no stability of reason; it is constantly in motion, in search for substantiated truth.

This comprehension of rationality assumes cognitive effort to be an important element. To be rational means to invest intellectual energy, not to be satisfied with what is offered by itself but to look what is behind the given, to scrutinize what is below the surface of an action. Impulsiveness represents the opposite of reflectiveness. Excessive reflectiveness might lead to excessive indecisiveness. And thus, it shows that an ability to evaluate an amount of thinking proportional to find a good solution in a given situation is a significant aspect of rationality.

Awareness of means we apply or which affect us during logical arguments is likewise an important part of reflectiveness. These might be media, expectations, values or basic beliefs. Their recognition and assessment is much more demanding than in case of logical arguments. **Comprehension of rationality as responsiveness to reasons** is the fifth concept. According to it, rationality of belief or action is a matter of responsiveness to the reasons for and

against, and also of the process in which these reasons originate. It attempts to describe a way how we substantiate something for ourselves. Sometimes we tend to neglect this evidence. Especially in difficult situations people underestimate evidence. Nonetheless, it is difficult to evaluate rationality characterised from this point of view because we would have to penetrate into mental processes of others. Someone could act in such a way that his deeds would be viewed as rational, however, in accordance with this criterion, they would be really rational only if their doer had proper reasons to perform them.

2.4 Concepts Based on the Criterion of Conformity

The seventh concept is represented by **comprehension of rationality as conformity to standards** i.e. to some normative system, such as logic or probability theory.

Human beings have plenty of limitations: they are not omniscient and endowed with infinite mind or performance. Except for that they differ in extent of their limitations: children and adults, geniuses and less intelligent people... Does it, indeed, mean that according to this concept every human being should conform to some other normative system? Then further questions are generated: Where did norms come from? How can we cognise them? How can we substantiate them?

Economists provide the normative model of an economic man according to which rational behaviour is defined as conformity with certain rules concerning costs and benefits.

It might seem that such a model is even descriptive; however, a lot of studies confirmed that people do not frequently act according to what is economically the most profitable for them. Basically, own thinking and behaviour is often tacitly considered a standard

for rationality. For instance, a left wing view on politics might seem to be irrational to supporters of a political right wing and vice-versa.

Standards might be also based on widely accepted behaviour.

Irrationality would then simply be a deviation from the usual.

The last concept to be mentioned here is **comprehension of rationality as pragmatic adaptiveness**. Many observers believe that human cognition is adaptive, i.e. it developed in order to assure the species survival. However, some thinkers point out to the fact that evidence well adapted to survival does not have to be oriented to search for truth at all. Sometimes it might be more effective to avoid some mistakes.

A condition of adaptiveness is certainly necessary for rationality, otherwise we could not even think about it, because we would not exist. Yet, it is questionable whether it is also a sufficient condition.

It is true that so far we have survived as species. But the question still is whether our life has higher quality than the one of animals. We can further ask: Do we live in a way mutually supporting ourselves in the quality of life? Do we head towards a long-term survival or rather to near extinction? These questions doubt comprehension of rationality as adaptiveness.

In addition, it is necessary to point out that adaptiveness has two levels. One of them is the biological level representing our genes, while the second one embodies cultural level and concerns our memes. Today, cultural conditions modify so quickly that we can react to them only on the same level.

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3. Types of Rationality

Keywords: *typology of rationality, evidence, communication, transcendence, non-relativity of rationality*

3.1 Diversity in Manifestations of Rationality

If rationality is ability typical of a human being, questions are generated whether every man is endowed with this ability to the identical extent and whether it is manifested in the same way. We tend not to consider all decisions of other people as reasonable and we also do the same when evaluating the way someone copes with his life from a long-term perspective. Rationality is assigned to all people through a general consensus; nonetheless means of its application can vary. Someone can be, for instance, an excellent theoretical chemist, but at the same time very impractical at housekeeping.

Every scientific discipline needs to make its research subject more comprehensible, create types, classes into which its research subject can be classified. Also the typology of rationality represents an approach attempting to describe complex phenomenon from various viewpoints. Through this, common but also dissimilar aspects and manifestations of rationality get foregrounded.

Every classification proceeds from a certain criterion. There is no simple rule for finding a suitable one; it is a matter of invention. Yet, some classifications are natural or established to such an extent that they are also commonly used. Others do not have to be directly known intuitively but might represent exactly the contribution to more profound comprehension of studied phenomenon. Within the typology of rationality, we are to introduce here only several examples.

3.2 The Most Common Classifications of Rationality

The first ordinary used categorisation of rationality is its division into **theoretical and practical one**. The theoretical rationality is concerned with our beliefs and judgement. Logic, principles of logic and especially logical consistency represent its formal foundation. Its material base consists of our senses and ability to perceive and interpret (mainly) external reality built on them. The practical rationality deals with decision making and strategies when achieving goals, from the simplest ones to management of one's life from the point of view of its overall meaning. Decision theory represents its formal base while the material one is formed by human nature (from physiological point of view located in genes).

Other culturally established types of rationality are **scientific** and **common sense rationality** to which Jiří Nosek dedicated one whole book (Nosek, 2007). According to the author, both types are characteristic of reflection on conceptual thinking which includes abstractness and generality.

The scientific rationality is defined by a requirement of strict verification of its assertions. On one hand, it represents a requirement of their substantiation, and on the other hand, a requirement of their verification, i.e. search and elimina-

tion of possible mistakes and prejudices (Gálik, 2009, p. 8). The common sense rationality is based on social communication taking place on a level of ordinary language and world of everydayness. Both of these types mutually need each other and also partially overlap.

The common sense rationality has a wider scope than rationality of science achieving its accuracy only thanks to a certain narrowing of a subject and methods. Common sense covers wider context, for instance, a context of moral, cultural and social values. Contrarily, rationality of science is more profound than the common sense rationality just thanks to systematic and detailed examination of a specific object.

3.3 Other Types of Rationality

Within the analysis of a relation of scientific and common sense rationality, J. Nosek introduces other two types of rationality being a part of the scientific as well as common sense rationality (Nosek, 2007, pp. 22 — 38). The **functional type of rationality** represents the first one. Nosek introduces construction of Egyptian pyramids in line with the same principle as an example. In general, an operation which can be understood as a means always leading to the same type of objective is substance of this type of rationality. The functional rationality developed into an abstract form in mathematics especially through the concept of function. The mathematical function relates to objects from one set (inputs) the objects of the other set (outputs) through the same operation. An equation $y = x^3 + 2x - 4$ as a function in a set of real numbers can stand as an example. Gottlob Frege (1848 — 1925) universalized this approach and applied it to the field of logic. And thus, predicate logic and virtually the whole modern logic could be born. Predicate logic

relates one of the two truth-values: *truth* or *falsehood* to every language expression fulfilling certain prerequisites. Frege was aware of narrow applicability of its proposal because it was mathematical proofs what he primarily wanted to express more convincingly. This approach was later applied in a wider extent and thanks to this success some scientists were led by it to attempts expanding it to a whole scientific language or even to natural language. However, it successfully resists such attempts.

The **analytic — constructional type of rationality** represents the second additional type. It is based on experience of decomposition and composition which already our nomadic ancestors living in tents had. The vocal writing decomposing language into its most basic cornerstones and subsequently re-composing them embodies an example of use of this type of rationality. Although this knowledge seems to be more abstract and not enough practical in comparison to an invention of tent, in the end, it meant more because it enabled to develop cultural memory into the extent unimaginable previously and also represented acceleration of cultural development. As to rationality and cognition, this approach represents an attempt to comprehend a whole from explanation of its parts, structures and functions. Especially cognitive sciences follow this way and focus not only on cognition as such, which is to say from within, but also on its physical base and its manifestation in language and society. J. Nosek points out to the fact that this type of rationality is a method of concretisation. *“No sooner than with formation of the analysis, a problem appears whether there are such things as, for instance, human freedom which defy concretisation. Through a contrast with the constructional analysis, an issue of freedom acquires a new dimension.”* (Nosek, 2007, p. 38)

Jürgen Habermas promotes the concept of **communicative rationality** and advocates its necessity. He approaches it through an analysis of emptied rationality of current decentralised world and within it we can distinguish three types of reason:

1. cognitive-instrumental reason concerns science, and prediction of phenomena and their control is expected from it
2. moral-practical reason concerns moral and social decision making, and
3. aesthetic-expressive reason deals with art.

He is most interested in the second field. Since nowadays people do not live in the world of collectively shared basic beliefs, the answer to the question: How should we live together? is more complicated than it used to be in the past. Communication and argumentation represent a path leading to it.

However, means of application of knowledge are more important than its acquisition. Habermas does not base his comprehension of rationality on the abstract out-of-time sphere but on the one of everydayness and means through which human thinking, speaking and actions are manifested in it. That is the reason why his concept of rationality is not relativistic although it also emphasizes significance of a context and history. He finds rationality standards in cerebral depth structures by examining aspects of everyday communication.

3.4 Rationality and Transcendence

Non-relativity of rationality can be emphasized also through its link with transcendence.

When transcendence is mentioned, connections with religion usually emerge among first connotations. And it is true that mainly complex forms of religions have also their rational aspect in a form of theology. However, the question still is what a connection of

rationality of religion and rationality of other spheres of life is. At first sight, it might seem that spheres like religion and mathematics got gradually more and more removed from each other and therefore relatively individual rationality got created within each of them. Nonetheless, Ladislav Kvasz points out to a common base of rationality and parallels in development of these two spheres (Kvasz, 1997). Both religion and mathematics cross the world of phenomena and experience and refer to something what surpasses this world. We can notice certain parallels when observing development of forms of transcendence in these spheres. The first one of them to which L. Kvasz draws attention is a significant break point or breakthrough in mathematical thinking representing a transition from concrete calculation instructions in Egyptian mathematics to an idea of proof in Greek mathematics. Ancient Egyptians were able to calculate also relatively difficult problems (such as, for instance, a volume of truncated pyramid) without a clear idea why the instructions work. For them, they represented something like a recipe in a cookbook for us. On the contrary, proofs provided by Euclid in his *Elements* offered argumentation and insight into a problem. The instructions and proof are two dissimilar forms of mathematical transcendence. In L. Kvasz's view, it has its parallel also in religion. The mathematical calculation instructions correspond to religious ceremonies as activities with a symbolic meaning through which one turns to transcendence. In both cases a certain activity is performed and delivered without deeper comprehension of its functioning. On the other hand, a religious prayer corresponds to the mathematical proof. Both represent more immediate insight into an event. The proof is an anticipation of logical principles in the background of seemingly random thinking and belief in them, while the prayer is an anticipation of a sphere of trust and meaning in the background of a seemingly chaotic world and faith in this sphere of transcendence.

One could continue further in similar parallels. Yet, the principal issue we want to imply is the connection of rationality with

transcendence. First of all, rationality is born from exceeding of empirical conditions. The world of the immediately perceived is broadened by rationality into a richer mental area including also memories, projections about the future and search for invisible (unperceivable, transcendent) links. Individual forms of transcendence have their structure and manifestations. They can lead to reconstruction of a conceptual apparatus or even to modification of a world view, change of a paradigm. Although, it can be manifested differently in every sphere, it focuses on a common cultural base from which they arise and which is founded on rationality as essential openness to transcendence.

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4. Standards of Rationality

Keywords: *standards of rationality, logic, intuition, infinity, essentials of mathematics,*

4.1 The Search for Standards of Rationality

Without standards of rationality, referring to it becomes disputable. However, how can we call any belief, decision or action rational (or irrational), if we cannot advert to any standards which would be generally considered as a norm and according to which evaluation would take place? Every theory of rationality requires some standards. Thus, if there are such standards, what constitutes them? Where did they come from? How do they earn respect and what makes them to be accepted as standards? What confirms their authenticity?

As the first, logical principles seem to be suitable for a role of standards of rationality. Logic has been strengthening its position of science about proper thinking since Aristotelian era. With mathematisation of science and development of information systems bringing breathtaking changes to the whole our way of life, the position of logic has got even more consolidated, because it constitutes a framework of these approaches. However, when we start to search for the origin of logical principles and a cause of their

authority or efficiency, we find out that logic thanks to its self-reference reaches its boundaries. It is not able to provide to itself what it requires everywhere — logical evidence.

We can figuratively say that logic represents hinges on which our pondering is hung. Therefore, if we wanted to substantiate logic as such, we would need argumentation, thinking, i.e. some substantiated logic and this approach would represent an infinite regress. Lewis Carroll, the author of *Alice's Adventures in Wonderland* whose protagonists are Achilles and a tortoise similarly as in the famous Zeno's paradox, described it with a certain amount of humour, playfulness and nonsense. The tortoise is willing to accept two assumptions, however, in order to accept also a conclusion it requires Achilles to add the third assumption explicitly determining a logical principle that if two propositions are true, the conclusion is likewise true. Nonetheless, the problem then is that three assumptions emerge, so the distrustful tortoise demands another logical principle solving also this situation. Yet, such a process cannot be terminated (Carroll, 1895). Douglas R. Hofstadter borrowed L. Carroll's characters, Achilles and tortoise, as well as something from his playful style and used them in his book *Gödel, Escher, Bach*. It is an impressive work on substance of rationality and mind repeatedly leading us to the problem of self-reference (Hofstadter, 2012).

Except for the fact that we cannot substantiate logical principles, they are not viewed as automatic in our mind. If someone decided not to follow them, we do not have means to persuade him about anything because every argumentation stands or falls on the willingness to follow logical principles with inference.

4.2 Rationality and Intuition

In most cases, logic textbooks do not speak about the origin of logical principles (after all, logic does not even set it as its objective). František Gahér in his logic textbook discusses this issue at least

briefly: “A process through which we can grasp logical concepts, accept some judgements as true and some opinions as logically correct seems to be almost the most mysterious from all.” (Gahér, 2003, p. 26) He terms the fundament of this process metaphorically as a sixth sense, logical vision or in accordance with the Stoic tradition *cataleptic (prescient) logical fantasy*.

If we do not create standards of rationality but discover them, where should we focus our attention, if we want to uncover them? If we discover them, how do we know that we have done so (and not something else)? If we form them, according to what do we do so? What standards do we use? R. S. Nickerson asserts that all attempts of thinkers to answer questions concerning substance of rationality finally explicitly or implicitly refer to intuition (Nickerson, 2008, p. 39).

When referring to intuition, some thinkers appeal to common sense, that is to something what should be generally acceptable, others to intuition of the best, qualified individuals. However, who should evaluate who is qualified? Such a man would have to be even more qualified in order to be able to assess qualifications of others.

4.3 Disputes on Foundations of Mathematics

Also discussions and disputes present in science, especially in mathematics, show that it is not so simple with intuition.

Some important concepts of ours are intuitively acceptable for some people and not for some others. The infinity embodies such a concept in mathematics. Already Zeno’s aporias implied strangeness of the concept of infinity. On the one hand, he substantiates impossibility of division of time and space ad infinitum in them,

but on the other hand, also the opposite assumption of final divisibility of time and space leads to a dispute (Zlatoš, 1995, pp. 75 — 77). When paradoxes in set theory were discovered at the turn of the 19th and 20th centuries, it was viewed as doubting of foundations of mathematics and thus also the ones of science. Again, the infinity was in the picture. That fact inspired formulation of three programmes in order to overcome this crisis: logicism, intuitionism and formalism. Representatives of these trends struggled for the concept of foundations of mathematics not only through a peaceful discussion but sometimes also through passionate quarrels which negatively affected the mathematical community. Leopold Kronecker’s dispute (1823 — 1891) with Georg Cantor (1845 — 1918) and later Luitzen Egbertus Jan Brouwer’s one (1881 — 1966) with David Hilbert (1862 — 1943) became the most famous. This second dispute in which Brouwer defended a position of intuitionism and Hilbert formalism influenced a significant part of mathematical community of that era. A magazine *Mathematische Annalen* represented its most important periodical. Brouwer put an emphasis on intuition and on its basis he refused to use other than finite quantities. For Hilbert, consistency was the most crucial and therefore he did not see any problem in work with the infinity, as long as formal notations containing the infinity were non-contradictory. Both of them were afraid about future of mathematics to such an extent that they started to consider each other to be a threat to its development. It resulted to such a state that in 1928 the editorial board had to be dissolved for a certain period (Barrow, 2000, pp. 194 — 221).

When even in mathematics representing a shop window of rationality it is not easy to come to an agreement, how much more difficult it is in other fields. The search for standards of rationality continues and rationality as well as intuition

participates on it. At the same it shows that on one hand, we share rationality because otherwise we could not discuss it, but on the other hand, rationality of every human being has its subjective elements and thus it is always rationality from a certain viewpoint.

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5. Consistency

Keywords: *consistency, intellectual modesty, closeness and openness of thinking*

5.1 Consistency as the Condition of Rationality

The law of the excluded third (tertium non datur) has always played a vital role among logical principles. A condition of consistency embodies its generalisation for thinking and rationality.

In logic, consistency of a set of assumptions means that this set does not contain contradictions and they cannot be logically deduced from it. In the figurative meaning, consistency as a personal quality then represents a consonance or harmony of elements of life or human behaviour. It might mean that what one speaks about, should also perform. Or that his statements taking place at different times should not mutually contradict because it is the only way how one can prove stability of his principles of thinking and actions.

In majority of societies, the harmony of words with deeds and stability of thinking enabling prediction of reactions of a human being are considered to be an ideal towards which we should aim. Their appreciation practically predestines consistency to be a suitable

candidate for the standard of rationality. Already small children can recognize obvious inconsistency in speech or deeds of their parents (although they cannot give reasons). Further, we consider it to be ethically incorrect, if someone applies one type of benchmark to himself and different one to others. Generally known saying “Practise what you preach” represents its manifestation.

5.2 Closeness and Openness of Thinking

However, it is not so simple either with consistency. The requirement of complete consistency of all own beliefs would probably surpass potential of majority of people due to time and intellectual reasons. Even if it were possible, there is still other objection concerning intellectual modesty. Raymond Smullyan formulates it as a dilemma. Either one considers all his beliefs to be true what is perceived as intellectual arrogance, or accepts that he might be mistaken in his assumptions. In such case, he virtually accepts that some of his beliefs which he considers to be true is false — and that represents inconsistency (Smullyan, 1986, p. 182). As an analysis of phenomenon of fanaticism shows, it is not only a theoretical problem. In a fight for one’s identity, a human being has to overcome doubts about himself and values and beliefs with which he identified. Under certain circumstances, it happens extremely. Functioning of psyche moves to a mentality of fanaticism and has destructive consequences. Günter Hole defines fanaticism as “*personal belief with a high level of identification preserved or followed with considerable intensity, stability and thoroughness, co-determined by a personality structure and related to limited contents and values. Incapability of a dialogue and compromise with other systems and people with whom it is fought as with an external enemy, with use of all means and in line with own conscience persists.*” (Hole, 1998, p. 27) Through prism of consistency, fanaticism shows to be such thinking and actions which extremely prefer own consistency regardless of any effects of external environment. Negative

consequences of such ways of thinking were shown also by the boom of ideologies taking place in the 20th century. On the basis of researches, a lot of thinkers come to an idea that consistency of our beliefs is rather local than global. In most cases, a group of close beliefs shows consistency, i.e. our thinking follows this tendency also without our special effort. However, consonance of all beliefs is much more demanding and seems to be not required for survival.

The criterion of consistency may be problematic also due to a simplified means through which we would like to apply it to everything. It is justifiable to consider it to be a manifestation of rationality, if we insist on the fact that it is not possible for table to be and not be present before me at the same time. If instead of the table we ponder about justice, it might seem that not much has changed. Then there is the question whether there is or is not justice in the world. Both stances can be supported very well by arguments. In situations discussing such complex issues it is much wiser to jump over narrow boundaries of rationality insisting on consistency of beliefs which represent only a simplified model of reality and to be open to what exists. Openness of thinking then means that we do not assess and perceive a current issue only in a light of previous beliefs but accept a fact as it is given to us.

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6. Intelligence and Artificial Intelligence

Keywords: *intelligence, intelligence quotient, computational theory of mind*

6.1 Intelligence

„Intelligence“ is a relatively vague term. Dictionaries and encyclopaedias present its various meanings: the ability to manage himself and learn in situations where direct and complete instructions are absent, abstract thinking, understanding, self-awareness, ability to communicate, thinking, ability to learn, emotional cognition, remembering, planning, problem-solving.

To emphasize its vagueness and also from a humorous point of view, another “definition” is sometimes presented, according to which intelligence is what is measured by intelligence tests (IQ tests). The etymology and history of the word proves its rooting in our culture. The word originates from the Latin word “*intelligere*”, which means understand, comprehend, recognize, know, think. This Latin term is already a compound word, therefore we can search its even further origin: prefix “*inter-*” means: between, and the verb “*legere*” means: collect, read, select. In the Middle Ages, the word “*intellectus*” became an important philosophical term. It

denoted understanding and was used as a translation of the Greek word „*nús*“.

In the modern times this word was popularized mostly thanks to psychology. It is understood as an effort to measure the successful coping with specific tasks focusing on mental abilities. Indirectly, this approach has been present within the culture for a long time and it is manifested in the appreciation of unique persons. However, the debates of experts show that the relation between intelligence and the personality strength is more complex.

The second area, in which the term has undertaken and become popularized, is the research and creation of artificial simulations of human mental abilities — artificial intelligence.

The term „intelligence“ is sometimes used also in wider context, in which intelligence is assigned not only to people and computers, machines or robots, which were created by humans, but also to animals and plants.

As an equivalent to the mental abilities measurement, various forms of other skills measurement were proposed: coping with emotions, success of social contacts, ability to learn foreign languages and other. In connection to this, there are other types of intelligence discussed; most of all, these are presented: logical-mathematical, spatial, linguistic, bodily-kinaesthetic, musical, interpersonal, intra-personal and existential.

6.2 Intelligence Tests (IQ Tests)

The idea of testing human mental abilities reaches far into the past. The first system of this type used widely and long-term are the tests for hiring people to clerk positions in state administration in ancient China (around the 2nd century BC). The first modern intelligence test was published in 1905 by French psychologist Alfred Binet, nowadays called Binet-Simon’s test. Its main goal was to identify pupils who needed special assistance with their studies.

Today there are several types of standardized intelligence tests. The test result is expressed by a number which indicates the person's intelligence in comparison to the rest of the population. The name "intelligence quotient" has been used to represent this number (abbreviation IQ). The tests are standardized so that approximately 95% of population can reach IQ within the limit 70–130. The research proves that IQ distribution in sufficiently big population can be modelled by the normal division.

Intelligence tests became popular in the 20th century, in one period even overrated, when they were considered quite uncritically during selection procedure. Even today IQ is used as one of the factors based on which it is roughly possible to predict success in studies or meeting the demands of certain profession. However, bigger significance is also given to the influence of other potential factors that can increase or decrease the success rate during completing the tasks or mission. Among such factors are also: stamina, creativity, self-discipline, ability to communicate with other people, emotional stability, ability to concentrate.

6.3 Artificial Intelligence (AI — Artificial Intelligence)

Artificial intelligence is a scientific discipline dealing with creating machines or systems (e.g. software), which will use such procedure when solving specific task, that would be considered as a sign of intelligence if used by a human.

The first complex vision of artificial intelligence was introduced by Alan Turing (1912 — 1954) in his famous article Computing

Machinery and Intelligence (Turing, 1950). There he proposed a criterion, fulfilment of which could assign intelligence to the computer. The lecture at Dartmouth College, USA in 1956 is considered the birth of artificial intelligence field. The main leader was J. McCarthy, who is the author of the name Artificial Intelligence (in short AI). Other important participants of the lecture were: Marvin Minsky, Allen Newell and Herbert Simon. The first successful results of AI led to exaggerated optimism. Herbert Simon stated that in 20-years time all machines will be able to do everything, that human can do. Today, the biggest success of artificial intelligence is the expert systems, neurone networks, logistics and deep data analysis (data mining).

6.4 Philosophical Questions of Artificial Intelligence

When we look back into history, we can find many philosophers, who prepared the thinking basis for the technical implementation of artificial intelligence. Let's present some philosophers, who prepared the way to the thinking viewed as a computation, calculation.

Thomas Hobbes (1588 — 1679) stated that thinking is nothing else than calculation.

Gottfried Wilhelm Leibniz (1646 — 1716) developed the logic so it could be possible to create a calculation that would represent how our mind handles the thoughts.

According to David Hume (1711 — 1776) perception has certain structure and its basic elements are the perceptive impressions.

Immanuel Kant (1724 — 1804) offered an analysis of human experience, which shows, that human experience is led by formal rules.

Hilary Putnam (*1926) introduced the idea of functionalism into the thinking about mental states (which he later rejected). According to this idea, it is not the physical nature of the mental state what is important, but its location within the structure and causal relations among other states.

All presented ideas became the basis for elaboration of theories, algorithms, and later technical solutions, which enabled effective simulation of many aspects of thinking using machines and computers. The prevailing approach within artificial intelligence is the computing theory of mind. According to this theory, the relation between the mind and the brain is an analogy to the relation of running programme and computer.

With the formation of artificial intelligence, questions exceeding the “technical” aspect of the matter arose: Are there any essential limits of machine intelligence? Is there any fundamental difference between machine and human intelligence? Can machines think or have consciousness? Can machines feel?

Various types of answers to these and also similar questions represent different philosophical attitudes to AI. We will present some of them, mostly those, which stimulated wide discussion.

According to A. Turing, we do not need to define what it means that a machine thinks (not even that what it means when a human thinks). We need to decide if a machine can act as intelligently as a human. This approach is the basis of Turing’s test.

Another attitude represent the hypothesis from Dartmouth: Every aspect of learning or any other sign of intelligence can be described so precisely, that based on that a machine, which will simulate the activity or ability in question, can be created.

Newell and Simon’s hypothesis states, that intelligence consists of formal operations or symbols, therefore the physical system of symbols has the necessary but also the sufficient possibilities of intelligent action. Opposite opinion was presented, for example, by Hubert Dreyfus.

Some attitudes are based on the results of Gödel’s incompleteness theorem. In line with them (sufficiently complex) formal system

cannot prove all true statements. According to Roger Penrose this forms a limitation to the machinery intelligence.

A well-known and widely discussed argument is the “argument of Chinese room” from John Searle. He uses it against the possibility of strong artificial intelligence. This name represents the hypothetical physical system of symbols, which would have a mind and mental states. According to Searle, there is no room for mind in “Chinese room”, it is only a mechanical manipulation with symbols.

Optimistic approach is represented by “argument of artificial brain”. Hans Moravec, Ray Kurzweil and other argue that it is technologically feasible to create hardware and software copy of brain. The brain activity is possible to be precisely simulated.

The authors of sci-fi genre in art went even further. In literature and films they can present such progress in artificial intelligence development and such situations, which are currently impossible. In them people colonize the space, robots are their equal partners, or they get out of people’s hand and start to threaten them, it is possible to manipulate people’s minds. Through their works these authors ask important ethical questions and also the questions about the purpose of our ambition to improve intelligence and gain control over it.

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7. Beliefs

Keywords: *belief, propositional attitude, causal factor, confirmation bias, metacommunication*

7.1 Beliefs and Issues which Inspire

Beliefs are undoubtedly among the most crucial aspects of rationality. Belief is usually understood as something that we can imagine as an assertion which one considers to be probably true or would consider it to be of such a nature, if asked about that (Nickerson, 2008, p. 113).

Beliefs do not have to have a form of assertions and to believe in something does not inevitable mean to think about a given thing actively, to have it in mind at that moment. In contemporary analytic philosophy, a belief is characterised as a certain type of “propositional attitude”. It represents a mental state within which we somehow connect to a real or possible state of an issue in which the given proposition is true. Except for a belief, the propositional attitudes include doubt, hope, desire, fear and faith. (Schwitzgebel, 2011).

Beliefs are one of the factors forming a way how we experience our lives. Therefore, situations when identical external circumstances are experienced variously by different people are possible. For instance, a serious illness or traffic accident can be taken

as a punishment, challenge, peacefully, nervously or furiously and in each of the mentioned means beliefs concerning some basic human questions play their role.

Since beliefs significantly influence quality of our life, it is stimulating to raise questions connected with them: In what forms are beliefs present in us? Do beliefs have “all or nothing” character or can they be graduated (it is connected with other propositional attitudes)? How are they formed? To what extent are they reasonable? According to what criteria should we assess own beliefs or have doubts about them? How do they influence our thinking and actions? How do we reassess our beliefs? Can we concede existence of beliefs which cannot be expressed in language? Can we say about someone that he has certain beliefs although he is concurrently not aware of them? How false and extreme beliefs are created? Do beliefs affect quality of thinking? Does quality of thinking influence beliefs?

7.2 Approaches to Beliefs

Approaches to beliefs are virtually certain beliefs about beliefs and therefore thanks to self-reference they succumb to the same asking as beliefs. In spite of that we probably do not know better way than to enumerate such approaches and discuss them.

From the point of view of **representational approach**, beliefs are entities with a form of mental representation. This approach can vary in details, for instance, according to ontological character of representations, the way they are present in mind and so on. The representatives of this approach include: J. Fodor, R. G. Millikan, E. Dretske, R. Cummins.

According to **dispositional approach**, to believe in something means to have certain qualities required for performance of an action related to given belief. Belief is then a pattern of actual or potential behaviour. Representatives of this approach are: R. B. Marcus, R. Audi, E. Schwitzgebel.

An **interpretive approach** is similar to the dispositional one but puts an emphasis on observability of actions (on its physical aspect). Its representatives are: D. Dennett, D. Davidson.

From the point of view of **functionalist approach**, it is causal relationships to sense stimuli, behaviour and other mental states what characterises a mental state (and also belief). This approach is compatible with the representational and interpretative one. Its representatives are: D. Dennett, D. M. Armstrong, J. Fodor, P. Pettit, S. Shoemaker.

Eliminative and instrumental approach refutes existence of beliefs as individual entities. The instrumental approach understands them as a useful way of description, however, it stresses that it is only a means of our speaking not a reality behind it. P. M. Churchland represents its representative.

7.3 Beliefs as the Causal Factor

The fact that our beliefs affect us is generally accepted. But the question is how and to what extent they do so. Some beliefs can contribute to improvement of thinking and quality of life while others can have the opposite effect. Owing to the fact that a scope of this issue is very wide, we are to mention here only several problems. We are to focus on a role of beliefs in communication in more details, especially on situations of dissimilar beliefs.

People routinely distinguish between an optimistic and pessimistic attitude. It might be a stance towards a concrete issue or a more permanent attitude. It may seem that it is enough just to (volitionally) decide for an optimistic concept of life. Nonetheless, experiences with disappointments show that we cannot easily manipulate even ourselves with our beliefs. Although optimism cannot be taken in a pill or cannot be trained within some crash course, reflection of own beliefs can represent a way to a gradual change (Slavkovský — Tavel, 2005).

Experts still more and more agree on the fact that beliefs affect a way of our judging in a greater extent than we would be willing to accept. R. S. Nickerson introduces the phenomenon of *confirmation bias* representing influence of beliefs on judging, when a way through which we search and interpret answers to certain questions represents (unconscious) support of the already existing belief. For instance, a membership to a group usually limits thinking of their members on issues which are generally held in this group (Nickerson, 2008, pp. 122 — 123).

When political parties have to express their attitude towards a new situation, it frequently happens that although coalition and opposition manifest an effort for objective examination, in the end, opinion groups agree on a discussed matter in accordance with political membership.

Psychotherapeutic trends in psychology point out to even deeper foundations of our beliefs. Many of them help people by providing means how to work also with (hypothetical) unconscious beliefs. The question of real existence of alleged beliefs is not the most important in such approach. A typical situation is a story of a man whose quality of experiencing got worse to such an extent that he asks for professional help. Let us introduce here an example of *the transactional analysis* operating with four basic implicit beliefs formulated in childhood: I am O.K., you are O.K. as wholesome belief and three other possibilities (I am O.K., you are not O.K., I am not O.K., you are O.K., I am not O.K., you are not O.K.) as manifestations of a deformation caused by “unwholesome” environment during early childhood.

7.4 The Role of Beliefs in Communication

Basic beliefs play a vital role in communication of individuals, institutions, current globalised world and also in entire cultural spheres. Our rationality leads us to the fact that argumentation plays still more important role in every type of dialogue. From logical perspective, argumentation is substantiation of some assertions by other ones. Nonetheless, such a way cannot substantiate a unit of beliefs because logic help verify only veracity of conclusions where there are prerequisites considered as true in advance. This fact makes communication of people with dissimilar beliefs more difficult and implies that apart from argumentation also other prerequisites for success of such communication are required.

The first important prerequisite of a meaningful communication in a situation marked with significant dissimilarity of beliefs is *a need for mutual respect*. It represents recognition of a human value of a discussion partner and challenge not to consider him to be inferior or not to degrade him to a tool for achieving of our objectives. *Good will willing to get to understand the other one* embodies another prerequisite. It is a decision manifested through an interest in the other. In order to get to understand each other in this way people would have to at least open to a relationship within which they would search for hidden reasons of outwardly expressed argumentation (to listen to a story of culture, family, religion... the other one, story of his childhood, crucial turns in his life...). The third prerequisite is the *reflection of one's own beliefs* because we do not come to the most important beliefs (whether it pays to do good and believe in justice, whether suffering makes sense, whether God exists...) affecting our lives and representing the basis on which we make the most crucial decisions only thanks to rational reasoning.

An appropriate extent of binding to own beliefs and freeing from them can then arise from reflection. *Metacommunication* is showing to be a new and still more required layer of communication. It means that apart from an originally intended topic of a dialogue, reflection of a communicative process itself comes into play.

Reflection of a communicative process and roles of basic beliefs within it can contribute to making interpersonal meetings enrichment for those who do not understand each other at the beginning, whose beliefs differ in a lot of aspects (Slavkovský, 2006).

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8. Rationality and Emotionality

Keywords: *rationality, emotionality, brain defect, self-knowledge, awoken consciousness*

8.1 The Impact of Emotions

Within rationality concept, behaviour, which will sooner or later have negative consequences for the person involved, seems contradictory. People know from their own experience that reciprocal conflicts can lower the quality of their lives and in worse case lead to mutual killing as it happens in wars and, nevertheless conflicts are still present within human society. We allow the anger and hatred to take control.

In society the awareness of emotions influence is present; one of its manifestations is, for example, the principle applied in judicial system based on which proven close relationship between two people is considered prejudice, and therefore is understood differently from a situation in which people involved are strangers. All highly developed societies are also fighting against corruption which in this context signifies that people mostly unconsciously trust the possibility to influence other people's emotions more than their rational judgement.

Despite this, can we consider people rational creatures? Many thinkers and scientists agree on one fact that life of humans is despite their rationality in many ways defined by more archaic layers

of psychic, among which emotionality has significant position. Big personalities of philosophy history such as Plato, Aristotle, Spinoza, Descartes, Hobbes or Hume offered theories of emotions mostly because of this.

On the other hand, as humans we have the experience of how emotions can improve the quality of individual's or community life. In state of joy everything seems to be in order, enthusiasm helps person to overcome obstacles and commit himself more, affection and love lead people to overlook their own comfort and interests, even to risk their lives for other people and for greater good. What does all this say about the relation between rationality and emotionality?

The aim of philosophic theories of emotionality always was the aspiration to understand how emotions influence our interests, motivation, thinking, decision-making process and action and what we can do to make them a harmonic part of our lives.

Similarly as there is not one definition, nor one theory of rationality, neither philosophers agree on the approach to emotionality. Among dictionary characterization of emotions we can find: violation of standard functioning of mind, feeling, passion, excited mental state. It is also such state of conscience which is connected with certain level of pleasantness or unpleasantness and differs from cognitive and volitive states (Oxford English Dictionary, 2009). In addition, subjectivity and bodily (biological, psychophysiological) signs are assigned to emotions. From the evolution perspective, emotionality can be understood as certain development stage of the living creature's adaptation to the environment (further details in Chapter 11). From the bio-chemical point of view, causality occurred between emotions and hormones and neurotransmitter (e.g.

dopamine, noradrenaline, serotonin, oxytocin and cortisol). We will discuss those aspects of emotions that are related to rationality.

8.2 Brain Defects and their Consequences

Even ancient civilizations noticed sometimes very significant impact of emotions on human behaviour. If someone feels anger, his facial expression, voice sound, muscle tension change, so he may even tremble. At such moment the person does not control the anger, but the anger controls him. From such observations the first ways of how to indirectly control the influence of emotions were derived. We will discuss it later.

Step by step, modern scientific methods disclose the mechanism of emotions functioning up to the level of brain activities and chemical processes within the body. Antonio Damasio, the American neuroscientist of Portuguese origin (born in 1944), is one of the leading personalities within the emotions research using the neurosciences. He published results of his research also in popularised books, in which he created a new perspective of relation between brain and emotions. His most famous hypothesis is the hypothesis of somatic markers about the influence of emotions on the decision-making process in complex situations including mutually exclusive choices. On the background of this research there are many true stories from people with brain damage.

One of his stories comes from the environment of stable healthy family with good relationships (Damasio, 2004, p. 177 — 178). The parents noticed that since she was three years old, their daughter did not react to verbal or physical forms of punishment the same way as her siblings. When she was fourteen, her behaviour became so anti-social that it was necessary to admit her to inpatient treatment centre. She did not follow the rules and engage herself in conflicts with others. She lied, stole, she became pregnant when she was eighteen and when she gave birth to her child she was not able to emotionally attend to its needs. She could not keep any job,

she did not feel any guilt for her improper behaviour, she never expressed any affection to anybody and she blamed others for her problems. The psychotherapy or medicine did not help her. She became dependent on her parents and unemployment benefit without any future prospects.

From the traditional point of view on rationality it is a tragic story of a person whose behaviour seems from the society perspective as a quite irrational. Parents, teachers, tutors, psychologists, who worked with her, could ask: did we make a mistake?

When the woman turned 20, her parents remembered that when she was 15 months old, she was injured, she was hit by a car, but she recovered in few days. The brain examination using magnetic resonance revealed damage of the brain pre-frontal areas. A team of experts led by A. Damasio had had a lot of experience with people having such defect.

As a typical example of such person, he presents a case of a patient with very similar brain impairment. For privacy protection reasons he calls him Elliot (Damasio, 2000, p. 41 — 54). Damasio describes his defect as follows: his ability to decide, ability to create effective plan for the upcoming hours, days, months was impaired. He was not able to learn from the catastrophic consequences of his mistakes. He was dealing with minor tasks but he was not able to focus on what was socially important. All other important functions were not impaired, therefore the first impression he made and short contact presented him as a healthy person, and so did the results of standard psychological tests. However, during longer contact he showed as a morally disturbed and socially unproductive.

The newest research including brain activity mapping indicates that reasoning and decision-making within objects, numbers and words area reside in different parts of the brain than reasoning and decision-making of personal and social sphere. Elliot's problems and to him similar patients can be summarized into terms "know" but not "feel". Damasio expects many arguments, which support the opinion, that emotions play more important role in

the way how we orient ourselves in existentially important situations. And according to various research ventromedial prefrontal lobe parts prove to be the place where the stimuli and reactions originating from rationality on one hand and emotionality on the other hand meet and together participate on how in the end the person acts in certain situation. Throughout our lives our brain evaluates important situation and categorizes it according to emotions they evoked. Based on that in similar situations it tends to adopt to specific type of solution — everything happens subconsciously. Sometimes we are surprised how fast we can react also in complicated situations, rational evaluation of which would take us comparatively longer. And exactly this ability is lost by patients with such damage as Elliot had.

Damasio's conclusion in Elliot's case was: his free will, and in that way also his responsibility, were limited. Thanks to his report Elliot got back his social support benefits. He explained to the authorities that the changes in patient's behaviour were caused by neurological damage not caused by him: a tumour damaged part of his brain. Before that he used to be a reliable, sociable, independent and matured person. Similarly, he explains also the problems of the young woman: her behaviour is a result of the defect of neural networks activities in brain.

If things work the way A. Damasio explains, it complicates our understanding of rationality and its relation to emotionality. If we experience socially unacceptable behaviour that hurts us or damages us, how can we know if we are experiencing an irresponsible and irrationally acting person or we are facing a victim of brain damage whose decision-making is limited and strongly influenced by something he is not aware of?

Other outcoming questions: Does the person with this type of brain defect have free will? Is he responsible for his behaviour? Is he aware of his handicap? Is he aware of himself in a way common person is? Is his soul "suppressed" or how does it work? A. Damasio's questions begin in the area of science but some of them get beyond it and become philosophical questions (Damasio, 2000, p. 27 — 50).

8.3 Emotions and Intellect

One aspect of emotionality, which results also from this type of research, that were described in previous subchapter, is its role within the decision-making process. If consistency in the opinion sphere and optimisation in the behaviour sphere are important for rationality, then there are too many possibilities left in every more complex situation. In cognitive science such problem is called "frame problem". Its idea is that when the consequences of the behaviour are considered within decision-making process, most of them are irrelevant to the decision-making, therefore, it is necessary to eliminate them before the start of the consideration process. This problem was first formed in the area of artificial intelligence but later its generalized form was widely discussed within cognitive science and philosophy. This aspect of emotionality can be viewed also in a way where emotions are an important mechanism, which directs our attention and prevent us from difficult examination of all possibilities, which rationality can offer us. (de Sousa, 2012).

Beside the question of responsibility of emotions, which was already presented in connection with A. Damasio's research, there is also discussion about the naturalness and authenticity of emotions. The recency of this topic is increased together with the knowledge of the chemical substances and certain receptors stimuli influence on our emotions. It includes

the use of alcohol, tobacco, drugs, antidepressants, gambling, internet pornography websites, advertising, ways of manipulation, etc. Such non-natural effort to support certain emotions or to avoid other ones, can lead to modified perception of reality and also self.

For example, an alcoholic can be an intelligent person, even doctor, whose reasoning and behaviour seems rational in many situations, but some areas of his life and mostly those related to alcohol, can be viewed by him in a deformed way and he could appear to his community as irrational.

Emotions are an important factor of self-knowledge. On one hand, it is said that emotions cannot be cheated, and therefore knowing your own emotional reactions to certain types of situations is a way to maturity. On the other hand, more and more research shows that emotions can contribute to false self-knowledge (and self-knowledge can evoke certain emotions).

An example of long known misinterpretation of knowledge and thinking is falling in love. In that period, emotions cause specific focus of attention in two aspects. The person in love selectively pays his attention to the person he loves, and he stops to perceive many things and people who he used to perceive. Besides he sees only the positive traits of the beloved one, while he omits the negative ones.

8.4 Function of Consciousness

Out of the ancient cultures the highest attention paid to harmonic integration of emotions into the unit of life living was in India. Although the different trends of Indian tradition were contradictory, with regards to cultivation of emotions they have similar approach. Consciousness and specific way of its direction during meditation play an important role. In Buddha's big speech on

mindfulness, the importance is given to conscious observation of emotions. At the same time it presents the experience with such practice. Who learns to monitor his own emotions in his consciousness, is not fixed on them, and becomes freer. (Buddha's Bog speech on mindfulness details, 1993). If a wave of anger arises in the mind of such person, he does not follow it, he does not become that anger but using the "reflector" of the consciousness he notices it like vigilant guard on the tower and he can decide what to do with the energy of the anger. Such approach uses conscious dealing with the emotion in contrast to suppressing, which does not process the energy of the emotion, it only does not allow its expression (only until the suppressed energy of several similar situation cumulates and suddenly surfaces, often unexpectedly). These old "techniques" are adapted also by some streams of current psychology and are interconnected with modern methods.

In connection to the presented tradition the significance of consciousness is emphasized also by contemporary spiritual author Eckhart Tolle. He considers as real human emotions those emotions that represent reactions of our body to our thoughts. He does not deal with such situation where external stimulus causes that the person gets scared. Behaviour of (healthy) person can be closer to ego-state than to the state in which the role of ego diminishes or disappears.

The ego is such state, in which person excessively identifies with his thoughts and emotions, so they control him and for his "self". In line with the tradition of meditation and vigilance the liberation from the ego-state is not performed by the striving of rationality dominance over emotionality but the effort to transfer the centre of attention to the consciousness.

Therefore, besides emphasizing consciousness he speaks about **presence** and he gives her specific deeper meaning. He says: "Our

identity resides in Presence, not in our thoughts and emotions." (Tolle, 2010, p. 99) Thoughts and emotions have the tendency to lead us in theory direction. They are like an offer to bet on a comfortable train and let it take you away. If we try not to think about anything and just observe the content of our consciousness, we can notice how emotions, images and with them connected feelings just emerge inside of us. E. Tolle began to notice this inner voice when he travelled by train and the lady travelling with him was speaking to herself aloud. Suddenly he realized that such process occurs in every one of us, only it is hidden, we do not speak aloud. To remain in presence, to be aware means to perceive all these inner tendencies but not to board any train (any thought or image), just to observe every of them. He presents an example about emotions: "You are not devastated when you hear, someone's car was stolen. However, if it was your car, you would be angry. It is surprising how many emotions can be produced by such minor mental term as it is the word "my/mine"." (Tolle, 2010, p. 94)

Rationality can predicate about the experience of conscious presence and this predication can be recorded and saved in a computer, just like I am doing now. In the computer there is a precise representation of my thoughts and thanks to the possibility to simply copy and spread an electronic text, everyone, who will get to it, can read it. And still there is a difference between the situation, when someone is reading the text and understands it, and another situation when besides that he is also aware of that process of reading and understanding, when he, firstly from time to time but then more permanently, returns to the presence. Not to the thought of the presence but to the way of focusing his consciousness. According to mindfulness tradition, this minor difference, which many might not even notice, becomes the basis of harmonic integration of emotions into the context of life. The difference between "reading" and "I am aware that I am reading" can really be small. However, the difference between "I am angry" and "I am aware that I am angry" can be much bigger, it can be the difference between doing

or not doing something that anger drives me to do and that I might later feel sorry for.

Cognitive scientists admit that for contemporary concepts of cognitive science and artificial intelligence, emotions as well as consciousness are a too big of challenge. Therefore, they suggest extending the computing–representation understanding of the mind by the forms of selection, focus and activity, analogical tasks of human emotions and consciousness (Thagard, 2001, p. 163 — 178). If such effort will be successful or on contrary it will later show that this is an area, in which the uniqueness and difference of human race from animals as well as artificial intelligence is shown, is the question for the future.

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9. Rationality and Decision-making

Keywords: *decision-making, democracy, dopamine neurons, meta decision-making*

9.1 The Significance of Decision-making

Decision-making is a process between thinking and acting, and therefore it is an important part of discussions about rationality. Many minor decisions are made automatically, we do not even realise them: what to have for breakfast, what to talk about with our relatives, which article to read during coffee break. Other decisions can be hard for us and they are like burdens: to undergo an operation, although it is risky? Get involved in a conflict at work? Accept a job, which would mean separation from the beloved ones? Sell the parents' house or have debts? Go into war?

In the past the highest source of knowledge about decision-making was the reflection based on the backward consideration of the whole process and already known consequences. Today there is organised research which tries to monitor the decision-making process directly in laboratory conditions — from monitoring the people and the dialogues with them, through questionnaires, to the use of visualisation methods for brain activity monitoring. Moreover, there is a *theory of games* developing since the mid-20th century, which approaches the decision-making problem using mostly the mathematical methods. A. Demuth discusses the theory of games in a more detailed way (Démuth, 2013).

One of the important challenges of decision-making process monitoring is the form of modern society organisation. Democratic society was formed from the desire to ensure the most possible freedom for everyone. In comparison to the previous social organisations it is more difficult to keep the stability of such society if it wants to lower the threat of power exercitation, because strict power means the decrease of the room for freedom and decision-making.

9.2 Research Results

The wisdom of decision-making includes the ability to consider how much time to dedicate to the decision-making of particular matter, which criteria to use and today also the preparation for situations in which we will need to decide. Because of that it is necessary to know also those mechanisms of decision-making, which we are not completely aware of.

In his book about decision-making Jonah Lehrer presents the results of research related to decision-making in a popular way (Lehrer, 2010). One of the mechanisms that we have in common with the monkeys is the *functioning of dopamine neurones*. First, he presents the story of Lieutenant Michaela Riley, who served on a battle ship during the Gulf War in 1991. In one moment he spotted a moving dot on the radar screen, which could mean friendly combat plane or enemy missile. He had 40 seconds to decide whether to order its down shot. He could save the battle ship of his own army forces with hundreds of soldiers on or shoot down his own plane with two pilots. He decided to shoot the aeroplane down. When the captain asked him why he had decided that way, he said that he

simply knew he has to do it, although he did not have any rational argument. He decided correctly, it was an enemy missile. Later, a cognitive psychologist Gary Klein showed interest in his story. He played the archived recordings and in the end he found the difference: the missile appeared on the screen with 8-second-long delay because it flew lower. Ridley, because he was trained in the screen monitoring, subconsciously noticed this difference and became concerned. It was the sign of dopamine system functioning.

The research (mostly on monkeys), which J. Lehrer describes, shows that our brain knows more than we think it knows. The experience with repeated occurrence of similar situations forms “instinct” (automatic behaviour or feeling), thanks to which we decide quickly without consciously considering the alternatives. Everybody, who drives longer time or does some sport or regularly works on the computer, knows it from his own experience. Dopamine neurones register causal connections of events and based on them creates expectations, while frontal cingulum membrane is the tool of correction.

The understanding of dopamine system functioning has also practical usage. The method of learning from mistakes is used in the development of artificial intelligence. Research in schools also showed that it is better to praise students for their effort than for their intelligence. Despite seemingly small difference in the form of appraisal, it dramatically influences students' further motivation. Those, who were recognised for their effort, were willing to show much more effort. To praise the students for the effort is a way how to reinforce learning from mistakes (Lehrer, 2010, p. 53 — 78).

However, dopamine can also trick us. Lehrer also presents a story about a teacher with the onsets of Parkinson's disease, who became a gambler. Neurologist prescribed her a medicine, which increased the levels of dopamine. The symptoms of the disease receded for some time, but she became addicted to gambling, although she had not been interested in gaming before. The dopamine system of the brain has the tendency to look for relations also where there are not any (computer games, lottery, and stock exchange).

One of the phenomena that was discovered by the research and which influences our decision-making was called *fear of loss*. It can be characterised also as a discovery of one type of implicit convictions. If we are facing (statistically) the same dilemma, only differently formed (once positively, another time negatively), our brain reacts differently — higher intensity of negative feelings has the tendency to influence the choice. The patients with the emotionality defect that we discussed in the previous chapter are immune against this tendency. Lehrer also describes in details, how massive introduction of credit cards in America led many people into financial problems. When they paid in cash, the uncomfortable feeling related to imagination of losing the notes while paying prevented them from spending too much. Paying by credit cards weakened this feeling of loss and people started to spend more

Another mechanism inside of us was called *negativity preference*. Human mind perceives negativity more intensively than positivity. It has practical impacts: one critical comment in a relationship must be balanced by five positive and naturally in context implemented statements.

There are many experiments, which confirm, that from certain moment the accumulating information or alternatives deteriorate the quality of decision-making. Nowadays when we want to buy a car, a computer, good wine or anything else, we face tens of similar offers which it is difficult to choose from. In the end, many buy something that they saw in an advertisement or they decide upon one criterion, which can be irrelevant to the product quality (e.g. colour). This phenomenon is present in the life of society, mostly in post-communist countries. People, who were used to fewer possibilities, become paralysed. They would rather accept one single option of hard work in a factory to the environment of freedom, in which they have many options but no security.

9.3 Paradox of Meta Decision-making

In the previous chapter, only some results of the cognitive research on decision-making processes were presented. These processes are evolutionary set in certain way, while in some situations it makes our life easier because our brains lead us to the decision also without our conscious effort. However, because the life conditions in modern society have changed, some of our own inner mechanisms sometimes mislead us. This requires alertness on the meta-level: thinking about what is happening, what feelings occur in us, how we think, in what context it is happening. Based on such reflection we can decide better, which cognitive abilities to give priority during decision-making, whether to decide at the moment or wait, etc. In such way, the decision-making about decision-making becomes the new aspect of decision-making.

Also the decision-making about what the decision-making itself means belongs to the meta decision-making area, what creates regressive impact on the decision-making process as the recent research proves (Dennett, 2008, p. 130 — 131). What have I willingly based my decision on, what does decide willingly mean? It is one of the auto-reference vicious circles that we cannot exit completely. It is not a negative fact, it only says about freedom and decision-making that rationality can never embrace them completely into its webs of understanding, that in some way they remain a secret, there will still be present a paradox.

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10. Paradoxes and Boundaries of Rationality

Keywords: *paradox, hermeneutic circle, self-reference, openness, critical approach*

10.1 Rationality Cannot Substantiate Itself

Rebecca Goldstein, the author of a book on a famous logician, Kurt Gödel, relates the outcomes of his thinking, especially his sentence on incompleteness, with a means of his experiencing while taking into account mainly the fact that he suffered from paranoia during his whole life: “*Similarly as it is not possible to perform a proof of consistency of a formal system within that system, our rationality or even our mental health cannot be confirmed by rationality itself. How can one relying on a system of assumptions including assumptions on assumptions, get out of this system and find out whether he is rational?*” (Goldsteinová, 2006, p. 176)

Also scientific papers of various humanistic sciences point to the same direction. Some aspects of our behaviour originate in the sphere which is at first concealed to mind and rationality. That time one either does not understand its own behaviour or interprets it incorrectly. This is, for instance, confirmed when a client overcomes his problems whose rationality could not cope with thanks

to psychotherapy. On the other hand, historical experience with great ideologies of the 20th century shows that rationality of whole societies can get out of control. Only a time and space distance or societal collapse can illuminate that a society believed more in its own rational model than in stimuli brought by the lived reality.

An effort for rational comprehension of rationality is the application of rationality on a specific interest area which is represented just by rationality. We cannot “place it before us” and examine it impartially without the use of rationality itself. Except for that, in this case, own beliefs are taken as a quality. Again, we could examine them only from the point of view of own beliefs. We are enclosed within a hermeneutic circle or rather a spiral, in any case, the examined and the examining mutually determine, therefore we always only get closer to thorough and complete comprehension of rationality. Every theory of rationality is somehow affected by this self-reference and therefore we cannot escape from a paradox, incompleteness and relation with intuition.

10.2 Paradoxes and Their Role

Paradoxes and aporias are among issues which especially philosophers fervently discussed already in ancient Greece. The Liar Paradox or Zeno’s Aporia of Achilles and the Tortoise have become a generally known part of our culture.

The following definition of a paradox is written in The Cambridge Dictionary of Philosophy: “*It is seemingly correct substantiation based on seemingly true assumptions leading to a contradiction (or other evidently false conclusion).*” (Audi, p. 558)

On the contrary to other issues, paradoxes are interesting thanks to the fact that they resist our attempts to solve them. They represent not only a challenge to rationality but they

also say something significant about rationality through their existence.

Paradoxes find errors in thinking: either something is not all right with principles of thinking or assumptions. It causes a minor rationality collapse. Thinking running down on worn out tracks gets to a dead end. One can smile at such a situation, take it as a joke, game, nonsense and continue in an existing way of thinking. Or he can take it more seriously. This can bring a smaller or greater change of perspective on rationality and thinking while principles of thinking remain unchanged. It can even initiate reassessment and modification in the way of thinking as such and show also on behaviour of a given individual. Recognition of boundaries and fragility of rationality can represent one important aspect of modification.

10.3 Self-reference

The phenomenon of self-reference, a potential to refer to oneself, has caught attention of people probably a long time ago. We can assume it, for instance, on the basis of an ancient symbol of snake eating its own tail. The most famous one is known as Uroboros which is a Greek word and could be translated as the tail-eater. Traces of this symbol can be followed back as late as ancient Egypt and China. It is self-reference that plenty of paradoxes are based on, although every self-reference is paradoxical. Paradoxes got involved most into development of thinking and science at the turn of the 19th and 20th centuries as I have partially mentioned in chapter 4. The most famous is Russell’s paradox. In an abstract form, it can be expressed as a paradox of the set of all such sets that are not members of themselves. However, the problem is that such a set could and could not be a member of itself on the basis of this

definition. This paradox has its “popular” version known as the barber paradox. It goes as follows: The barber in military quarters was ordered to shave all those and only those which do not shave themselves. Can he fulfil this order? If he can, should he shave himself or not? Argumentation leading to a contradiction can be formulated as follows: If barber does not shave himself, he should shave himself, because he should shave those who do not shave themselves. However, if he shaves himself then he is among those who shave themselves and he should not shave those ones. If he shaves himself, he should not shave himself. If he does not shave himself, he should do so.

Even paradoxes do not discourage mathematicians from an attempt to build solid foundations of mathematics. Contribution to a humbler approach to mathematics, logic and rationality appeared no sooner than with Gödel’s incompleteness theorems whose proofs apply self-reference.

10.4 Openness and Critical Approach

In order to be able to serve as a good means of adaptation to environment rationality should enable corrections. Karl. R. Popper became well aware of it and considered a critical approach to be the most important property of rationality: “*One of the best properties of ‘reason’ and ‘reasonableness’ is sensitivity towards criticism — willingness to be criticised and to want to criticise itself.*” According to him, it is criticalness thanks to which science immensely develops our knowledge which “*...grows through experiments and elimination of errors and ... the main difference between pre-scientific and scientific growth of knowledge resides in a scientific level of conscious search for errors.*” (Popper, 1995, p. 111)

By resisting simple solutions, paradoxes support caution against excessively quick satisfaction and a feeling that this is the way how it is actually clear in a thinker looking for a solution of some problem. They help maintain openness of thinking, awareness of possibility of error and willingness to expose own solution to other argumentation.

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11. Rationality within the Development

Key words: *adaptability, cognitive development, post-formal thinking*

11.1 Rationality Phylogenesis and Ontogenesis

One of the presented theories of rationality emphasizes adaptability as an important characteristic and condition of rationality. Adaptability is closely related to evolution aspect. For example, according to V. Rollo rationality is the highest form of person's adaptability to the environment besides the vegetative level, which he shares with all living creatures, and emotionality, which he shares with mammals (Rollo, 1993, p. 13 — 23). Emotional level enables greater freedom of behaviour than lower vegetative level. The mechanism of emotions functioning is called valorisation. It is a process, which occurs outside the consciousness, only its result gets into consciousness. In this process there is certain level of pleasantness or unpleasantness assigned to every experience, based on its evaluation feedback of this level works as a system. In contrast to the vegetative level, which reacts only to the present, emotionality can process also the past.

From the biological point of view rationality can be understood as a relatively autonomous system, which originates from the mentioned lower development stages and refers to them but at the same time it differs from them. This system resides in neocortex and its processes use mostly electric characteristics of the mass (while

lower systems use biochemical characteristics). Rationality enables greater freedom of behaviour. Thanks to abstraction it is able to model the reality and anticipate the results of the interventions into reality. The evaluation of their success or failure creates the feedback of this level of adaptation. Thanks to modelling and anticipation, rationality can process the past, present and future. Rationality does not work with experiences but with terms, symbols and information. However, the content of consciousness is compact, information or outputs from all levels are interconnected there.

From the phylogenesis perspective, rationality is as a biological system of adaptation to the environment quite young part of the outfit. It is hundreds of years against tens million years of lasting emotionality and hundreds million years of vegetative level functioning.

During the evolution paradigm formation in science and culture in the 19th century, a parallel between the life development, specific species development and individual development was suggested. The first to notice was Ernst Haeckel in 1866 and this observation was called biogenetic law. According to this law, ontogenesis is a shortened and accelerated repetition of phylogenesis. Today this version of biogenetic law is considered too simplified but for pure needs it is sufficient, if we accept certain similarity in rationality development of us humans as a species and rationality of individual, and that from the biological basis point of view as well as from the important abilities perspective.

11.2 Piaget's Theory of Cognitive Development of an Individual

Since long ago people have been aware of the fact that rationality is not changeless ability, it develops gradually from minor beginnings to maximum development in maturity and possible decline in old age or as a sign of an illness.

The most famous theory, which in details examines the development of human cognitive abilities with emphasis on their continuous changes in childhood, was the Jean Piaget's theory (1896 — 1980).

He suggested four development stages, which can shortly summarized as follows:

1. Sensorimotor stage. A child perceives and identifies objects, later it can realise their lasting although they are not present. Rationality is represented in kinetic activities without using symbols. At the end of this period child is able to repeat words, it gives them meaning. This level covers the period from birth to 2 years.

2. Preoperational stage. Includes symbolic and demonstrative visual thinking. A child learns how to use language but the perspective is egocentric, it has difficulties to imagine perspective of someone else. It categorises objects according to one characteristic. It covers the period of 2–7 years.

3. Concrete operational stage. At this stage the logical thinking, analytic and synthetic reasoning start to develop. A child step by step acquires the concept of preservation of certain constants (for example, the same volume of liquid in differently shaped containers). Egocentric thinking is receding. This stage covers the age of 7–11 years.

4. Formal operations stage. Thinking includes abstraction, generalisation, formation of hypotheses, and distance from reality. However, according to the research, only 35% of graduates from high schools in the developed countries fully accomplish this level (Huitt, W. — Hummel, J., 2003). It is the period of adolescence and maturity.

Piaget considered the formal operations stage as the final one. As a model for the description of this stage he used sentential calculus.

11.3 Hypothesis of Post-formal Thinking

Piaget's theory significantly contributed to more exact examination of development aspect of rationality. However, due to certain bias of the focus on some aspects of rationality, it was also received with some criticism. For example, some authors point out that Piaget's theory does not distinguish individual areas of knowledge, while the newest theories give priority to the concept of possible specific development of individual areas and modularity of mind. Among other objections the following are included: Formal thinking excessively emphasizes the possibilities of logic during problems solving. It underestimates pragmatic quality of cognitive activities of real life. It is suitable only for solving of those problems which require scientific approach and logical-mathematical analysis. However, it is not suitable for social and interpersonal problems of everyday life. It focuses on closed systems and precisely defined problems, preferably those that have only one result. Formal thinking does not include relative nature of knowledge and the need of several reference frameworks.

The criticism of Piaget's theory inspired many philosophers to form theories, which consider the possibility of further stages of cognitive development after the formal operations stage (Commons, M. L. — Richards, F. A., 2003). All of them share the expectation of more complex forms of thinking than those which are characterized by formal operations.

In details they differ a lot, depending on whether they discuss only the need of higher logics or they try to incorporate various spiritual and mystical states into their approach. We will present some characteristics of post-formal thinking that several authors agree on: This thinking declares multiplied (non-linear) relativity and

several potential solutions. It is aware of incorrigibility of paradoxes; it accepts them as something positive. It admits that knowledge is not absolute. It accepts the contradictions as a basic aspect of reality. Dialectic reasoning belongs to this group. It can harmonize contradictory thoughts, feelings and experience. It approaches the problems solving contextually: it creates new principles on the go on the grounds of changing circumstances (and it does not try to apply the same rules to all contexts). It focuses on searching the problems. It originates from the experience of social and interpersonal universe as well as spiritual experience.

Theory of one type of postformal thinking was systematically elaborated by K. H. Reich. The type of thinking, that he discusses, is called relational and contextual reasoning. He considers dialectic thinking and also analogical thinking similar to this type of thinking (Reich, 2004).

11.4 L. Wittgenstein as an Example of Openness for the Thinking Development

The scientists, who deal with the works of Ludwig Wittgenstein (1889 — 1951) within the context of his life and times, have a difficult task to combine sometimes almost contradictory aspects of his work. On one hand, he contributed to the development of modern logics; he was admired by the members of Vienna group and on positivism oriented philosophers for his strict rigour of his thinking and the emphasis of rationality in the approach to reality. On the other hand, his work is with paradoxes from the beginning filled and many of his attitudes and life decisions seemed absurd for their cold rationality.

While cognitive development, described by J. Piaget, occurs without our conscious contribution, further development, if it is possible, should not be completely unconscious.

There are only few philosophers as significant as L. Wittgenstein, who would so radically re-evaluate not only some of their previous concepts, but also the basis of their thinking. Therefore, it is possible to view again his work also as he is leading the way to accepting the thought about the possibility of conscious development of thinking beyond the limits of Piaget's stage of formal operations. Wittgenstein did not use such terminology but in his work we can find implicitly present signs of similar approach.

Besides what L. Wittgenstein wrote, this interpretation is supported also by the ambition to understand his inner development and his outer life journey.

There are many points found in his works that imply the transition from formal stage of cognitive development to postformal. Here is one appropriate example, point 6.54, the one before the last point of the Tractate: „*My sentences are explained in a way where that one who understands me, considers them as meaningless, if he rises –on them — above them. (He must throw away the ladder, when he climbs it up.) He must overrule these sentences, then he sees the world correctly.*“ (Wittgenstein, 1993, p. 169)

This point must seem quite mysterious to formal thinking but it is not meaningless. What should we think about someone who says: If you are listening to me and if you understand me, you will understand that I told you only nonsense — but only then you will see the world correctly!?

This point is already a problem for formal thinking (hereinafter only FT) because of its auto-reference. It speaks about statements in Tractate and he himself is a part of Tractate. Who understands him, should be able to distinguish him as meaningless but at the same time as a part of the outcome for the correct vision of reality. For FT it is an unacceptable paradox: to understand the meaning of a sentence means to understand its meaninglessness; but to understand its meaninglessness it means to understand its (real) meaning.

If we think we can perceive text from the postformal thinking (hereinafter PFT) point of view, a question occurs, why does it

speak about meaninglessness of Tractate sentences. It is related to understanding of the borderline between speakable and unspeakable. Formally, he appreciated scientific thinking based on standard logic so much that everything that did not fall within it (value, ethics, meaning, God,..) he marked (and sometimes also said) as unspeakable. Here we can sense a huge inner struggle for how to think and how to view the universe. FT brought huge success, but most importantly, thanks to it and in it, it is possible to think systematically, without chaos. For a consistent philosopher, that Wittgenstein certainly was, this is a treasure. Everything that is covered by FT is speakable. On the other hand, Wittgenstein was too perceptive, sensitive and open person to think that there is not anything else. His thinking struggling between FT and PFT in the phase when it allowed itself “to climb the ladder” above FT, not only did he see universe different from the bare facts, but also bore testimony about it. However, respecting FT besides what it expressed, it always added also notification: this is (from FT point of view) meaningless effort to crash the barriers of language; this, what I am saying, is in reality unspeakable.

The struggle between FT and PFT can be sensed also in his life. When he reached the conviction that he solved philosophical problems, he became consequent and left the university. When the technical system used in academic text became a burden for him, he stopped to use it. It would be possible to present many other examples from his life: he voluntarily signed up into the army, he gave up his inheritance share, worked as gardener and village teacher. His decisions were not accidental, although his life “leaps” between different environments and lifestyles seem similarly strange as his diary “leaps” between logic and pursuit of meaning. He led the struggle between FT and PFT not only theoretically, in his work, but with all his being, although it led him to the boundary between life and death. Maybe he encouraged himself in this fight by these words: “*Who is happy, cannot feel fear. Not even of death.... Fear of death is the best sign of incorrect, bad life.*” (Wittgenstein, 2005, p. 109)

Thanks to his talent, respect of FT and his work on the logics development, which he let to absorb himself with, Wittgenstein earned respect from scientists, positivists, rationally oriented philosophers and those for whom FT has big significance. But with his struggle for PFT (although he did not name it like that) he speaks also to people, to which logic and mathematics are not close and who analyse the question of meaning, values, ethics and religion. His life and work included him to those who helped to build bridges between remote universes of strict and open rationality, and also those who made the way not only to theories about post-formal stages of cognitive stages but even more to life in congruence with them (Slavkovský, 2008).

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12. Comprehension and Wisdom

Keywords: *comprehension, wisdom, self-transcendence, metaknowledge*

12.1 What is Comprehension?

Comprehension forms a part of cognitive processes, nonetheless, we do not know too much about it. Again, we stand before the issue of self-reference: How to comprehend comprehension? There is a big difference in meaning of comprehension depending on complexity of an object: comprehend a sentence, situation, mathematical proof, picture, music composition, novel, scientific theory or other human being.

The word “comprehension” is frequently used as if it were clear what is meant by it.

We all have experience with ordinary comprehension but also with the one when we get to understand new connections. However, it is more difficult to describe such process. One of the possible characteristics says that: It is a mental process within which a man connects to a physical or abstract object as a subject of cognition through such means that he is able to think about that object appropriately or apply its knowledge for a rational action.

An important part of comprehension is classification of what should be comprehended into the context of the already existing structure of knowledge. A consequence of this approach is knowledge that comprehension of some new phenomenon requires acquisition of an understanding of all important terms and connections on which it is established (Nickerson, 2008, p. 324). For instance, for comprehension of the term *integral* in mathematics, it is necessary to comprehend essentials of arithmetic, geometry and also the term *limits*. Comprehension in communication means perceiving of an intention. When one wants to say something, he has some intention, but there are several ways how he can express it and also an extent of delineation can vary. However, not only the one who listens but also the speaker can have sometimes troubles with delineation of an intention what makes a communicative situation even more difficult.

The cognitive approach can understand comprehension as an appropriate mental model. It is such a type of representation with which we can work independently of phenomenon which it represents. For educational needs, it is useful to understand comprehension as a multiple representation. However, to learn a formula or abstract definition can be far from comprehension. It is ideal, if we find a way how to approach an issue from various perspectives and different connections. It seems that mainly visualisation of the most important aspects which should be comprehended helps most in a teaching process.

Peter Gärdenfors characterizes comprehension as seeing of patterns (Gärdenfors, 2010). Comprehension is described from the point of view of a result of process of comprehension in all introduced approaches. Nonetheless, neither of them represents a simple manual how to comprehend. Comprehension has often the wow-moment character within which what we focused on did not change but we found something we had not noticed before.

12.2 Concepts of Wisdom

Concepts of wisdom had developed in all cultures although their content was not identical. Wisdom was assigned to some exceptional individuals as an ideal of cognition and insight into basic human problems and also ability to live full-fledged life. After all, the word “philosophy” in Greek means “love of wisdom”.

When pondering on wisdom, various questions arise: Is wisdom given to a human being or can it be acquired? If so, how? Is wisdom measurable (similarly as intelligence)? Can be also a young man wise? How is wisdom related to rationality, intelligence and judging? Does wisdom make a human being happy?

Owing to a wide extent of the issue there are various concepts of wisdom. We are to introduce several of them. The first one represents comprehension of *wisdom as a cognitive process*. According to this approach, wisdom is concerned with the truth and most general aspects of reality. It embodies comprehension on the basis of which one can cope with a unit of his life and it helps him comprehend and decide well.

Wisdom can be viewed as *a virtue*. In this sense, it represented an ideal for Greek philosophers. In Plato’s view, wise people should manage a society.

Wisdom as self-transcendence represents another concept. Thinking and behaviour of a mature human being does not revolve (egocentrically) around himself but it is focused somewhere else. Thanks to it he acquires extensive intuition and empirical comprehension. He does not underestimate or overestimate anything. Ancient Chinese Taoist, Master Huang, says that a human being uses his mind and heart as a mirror which does not add anything to what emerges before it or does not hide anything.

Also another approach has developed in China: *wisdom as a balance between two contradictory approaches*. Taoists represented them by yin and yang, mutually complementing couple of opposites. There are plenty of other similar couples: mythos and logos, soft and hard style, right and left hemisphere, and so on.

Wisdom as metaknowledge represents cognition of cognition, especially limits of cognition (what might lead to caution in one situation while to braveness in some other) and finding of a balance between certainty and doubt.

Wisdom as stability of a perspective also embodies one of the concepts. Such an ideal is presented, for instance, by Boethius in his *Consolation of Philosophy*. A wise man can preserve internal serenity regardless of external circumstances (either they are perceived by others as “happy” or “sad”.) According to this approach, luck or bad luck does not lie in a situation but in a means how we perceive it.

Wisdom might represent *character traits*. A wise man can distinguish between real reasons and rationalisations, perceives human motives more clearly. He looks for an opportunity to learn and even from those who can seemingly teach him nothing. He can see things from various perspectives, even from those which seem to contradict. He has a clear judgement, sense of humour and his criticism is constructive.

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Rationality and Human Cognition

First edition

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