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Ciprian Turcan*

INDIVIDUALIZATION AND THE IDEAL OF SELF-REALIZATION IN CONDITIONS OF REFLEXIVE MODERNITY

Individualization as a modernization social phenomenon is of a highly ambivalent character. On the one hand, it represents the emancipation of individuals from general pressures of the society, from the traditional relations of domination and material dependence, the reduction of social pressure on the reproduction of traditional, typified social roles and lifestyles associated with social status and gender. On the other hand, individualization leads, under the current conditions, to increasing isolation of individuals in the context of instrumentalized, anonymous and fragmentary social relations and contacts, ultimately to forms of social deprivation. Emancipation creates room for an individual and subjectively gripped biography, for individual subjectively answering the question of good life, which promotes the ideal of individual self-realization as a new ideal of behavior and good life. However, the parallel process of social isolation seriously restricts and distorts the possibilities of its application. Based on this contradiction, this paper focuses on the critical exploration of the ways and forms of applying the ideal of self-fulfillment in contemporary society.

Keywords: *individualization, self-realization, society, modernity, Axel Honneth*

1. Introduction

The social process of individualization of modern societies and the associated moral individualism are, in the context of moral and social philosophy, the subject of controversial and even contradictory interpretations. In particular, liberal and postmodern approaches appreciate individualization as a process of increasing the autonomy of the individual, weakening of power and ideological pressures and pluralization of the society [1]. Individualization is perceived as an emancipatory process that overcomes all forms of dominion that in some way restrain a man. Conservative, communitarian, and approaches based on the critical theory of society are in principle more cautious and skeptical in the interpretation and evaluation of individualization. They try to point out that the development of modern societies overcomes the traditional forms of dominion, but at the same time it can lead to the emergence of new forms. Contradiction of these interpretations can also be illustrated on the theories of Charles Taylor and Christopher Lasch. While Taylor, in connection with individualization and self-realization, talks about the culture and ethics of authenticity as about "something relatively new and peculiar to modern culture" [2, p. 25], Lasch on the contrary, sees the culture of narcissism, "the culture of competitive individualism, which in its decadence has carried the logic of individualism to the extreme of a war of all against all, the pursuit of happiness to the dead end of a narcissistic preoccupation with the self" [3, p. xv]. One of the key issues that arises in these interpretations is the question of how the profound structural changes within modern society are reflected in its moral life forms and individual biographies. The aim of this paper is to examine the critical thesis formulated in this context by Axel Honneth according to which "the claims to individual self-realization which have rapidly multiplied, beginning with the historically unique concatenation of entirely disparate processes of individualization in the Western societies of thirty or forty years ago, have so definitely become a feature of the institutionalized expectations inherent in social reproduction that the particular goals of such claims are lost and they are transmuted into a support of the system's legitimacy /.../ the processes which once promised an increase of qualitative freedom are henceforth altered into an ideology of de-institutionalization" [4, p. 467]. The intention is to build on Honneth argumentation and to develop it, partly to concretize it and extend it to other context.

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2. The rise of individualization and of the ideal of self-realization

Most sociological theories interpret individualization as the structural consequence of transforming the social conditions of modern society. In this sense, Honneth also talks about individualization as a mutual overlap between the material and ideological processes that Western societies have undergone since the Second World War. They are the social processes that historian E. Hobsbawm even called "the social revolution" of the second half of the 20th century, with respect to their dramatic impact on the overall transformation of the society. The main processes of this transformation include the disappearance of the peasantry as the most widespread profession for the vast majority of the population, the intensive industrialization and urbanization along with the onset of the service sector, the rise of professions requiring high school and university education, gender emancipation and the growing role of women in society as a result of the mass entry of women into the labor market [5, pp. 287 - 320].

The common denominator of these far-reaching and dramatic changes that took place in an extremely short time in the course of one generation's life is the phenomenon of individualization. All these changes cleared the way for a substantial ascendant social mobility, linked to an increase in material living standards and an increase in leisure time, which ultimately altered not only the structure of social stratification but also, by its intensity, the category of this stratification itself. Social inequalities in society remained objectively maintained, but they have lost their subjective class dimension. So, at this point the individualization represents a complex process of "a social transformation within modernity, in the course of which people will be set free from the social forms of industrial society - class, stratification, family, gender status of men and women" [6, p. 87]. Increasing of the space for individual decision making and reducing of the social pressure to reproduce traditional, standardized social roles and lifestyles associated with social and gender status have led to an intensive diversification of life situations, to pluralization of lifestyles and of professed values, and to a reflexive grab of one's own life. This enabled the rise of a new form of reflexive individualism. Ch. Taylor talks about general widening of "expressive individualism" as about the desire of individuals to express their authentic individuality in their own way, which has its cultural roots in 18th century Romanticism [7, pp. 299 - 304], while N. Elias points out that the increasing social differentiation and individualization, regardless of the specific cultural development of society, lead to enforcement of the "ideal of unique and different", to the effort of individuals "to stand out from others, to stand on one's own feet and to seek fulfilment of a personal striving in one's own qualities, skills, possessions or achievements" [8, p. 141]. According to Honneth, it is primarily significant in this process that individuals are increasingly losing interest and willingness to understand their own lives as "a linear process of the development of an identity at the end of which would stand the demands of a profession and a division of labour by gender in the family", and instead of this the tendency has emerged "to think of the various possibilities for personal identity as being the stuff of experimental self-discovery" [4, p. 470]. Social emancipation meant a personal, subjective emancipation, and the socially formed and mediated morality has lost its normative power. Pluralism, diversity, originality, authenticity, otherness, freedom are the values of the new morality and the expressions of individual self-realization. Cultural and moral forms of life have been liberated from their social determination, and the conventions of social and personal behavior have been transformed towards even greater individual choice and freedom. Choice itself has become a fundamental value. Both, the normative respect for this choice and the continuation to increase the space for an individual choice was expected from the society. The sixties of the last century represent a kind of a symbol and breakthrough moment in this cultural transformation. Perhaps the most visible and most researched result of this transformation is the sexual revolution. However, ambitions and requirements were not limited only to the aspect of sexual and gender morality, but they had a wider social focus. "The revolts of young people in the '60s' were indeed, directed against a 'system' which smothered creativity, individuality and imagination. They rebelled against a 'mechanical' system in the name of more 'organic' ties; against the instrumental, and for lives devoted to things of intrinsic value; against privilege, and for equality; and against the repression of the body by reason, and for the fullness of sensuality" [7, p. 476].

3. Institutionalization of the ideal

In the 60s and 70s, it really seemed that individualizing changes in the structure of the society would contribute to the strengthening of qualitative freedom the way that Honneth formulates in his thesis. At least from the normative perspective of critical theory, they created a promise of a more free society, because in its view, the expansion of space and of possibilities for self-realization of individuals are perceived as a reference criterion for evaluating the moral progress of society, which is carried out through social struggles for recognition. However, if we look at the next period through the optics of expectations and ideals of the sixties, we find out that their fulfillment did not occur or, it did only to a very limited extent. With regard to the idea of free and creative self-realization of the individual, this was greatly distorted and ideologically abused. According to Honneth's thesis, "the claim to self-realization was increasingly made into an institutional demand in the course of the last third of the twentieth century: at first hesitantly and subsequently on a massive scale, individuals were confronted with the expectation that they present themselves as being 'flexible' and willing to develop themselves if they wished to achieve success in their profession or in society" [4, p. 472] and thus the ideal of self-

realization "has developed into an ideology and productive force of an economic system that is being deregulated" [4, p. 474]. A number of factors contributed to this remarkable turn, to overturning of the ideal of self-realization. Honneth identifies the impact of the consumer and advertising industries, but he notes that much more important and decisive influence had the restructuring processes in the economic sphere, launched in the 80s, the new management concepts and new post-Taylorist strategies of business that led to the "normative subjectification of labor" when actors of work are beginning to be perceived not as dependent employees but as creative entrepreneurs.

The post-war welfare state, based on a set of fundamental social rights, developed extensive mechanisms of social and employment policy, the institutional forms of economic and labor market regulation that allowed relatively large emancipation of individuals from the market and contributed significantly to the individualization processes mentioned above. From the chronological point of view, it is mainly about the period of 50s and 60s that the sociologist Ulrich Beck denotes as "organized modernity," or Zygmunt Bauman as "solid modernity," in opposition to the terms "reflexive modernity" and "liquid modernity," which refer to the later development. The use of these adjectives is also justified by the fact that in the first period the social and political institutions fulfill their organizational and integrative functions, while later they are gradually re-evaluated and weakened. In the 70s and 80s, in Western societies, the onset of neoliberal politics took place thanks to which the ideology of deregulation gradually prevailed as an effort to economize the social relations and to abolish existing institutional arrangements in favor of market conditions [9, pp. 39 - 63]. "The process of neoliberalization has, however, entailed much 'creative destruction', not only of prior institutional frameworks and powers (even challenging traditional forms of state sovereignty) but also of divisions of labour, social relations, welfare, provisions, technological mixes, ways of life and thought, reproductive activities, attachments to the land and habits of the heart" [9, p. 3]. In this ongoing process of dismantling of the welfare state, the expected ideal of self-realization ideologically justifies and legitimizes the radical changes in the normative-institutional structure of society.

Individualization represents a process of social, cultural, and gender emancipation of an individual, but does not and cannot mean his economical emancipation. The relation of material dependence of the individual from the society as such does not cease, only the specific form and mode of dependence are changed. If "individualization consists of transforming human 'identity' from a 'given' into a 'task'" [10, p. 31], then the means and the space for performing this task become, above all, the world of work. Socially emancipated individuals thus become directly dependent mainly on the labor market. Under the conditions of reflexive modernity, the Dahrendorf characteristics are even more valid: "modern societies are work societies, built around the work ethic and occupational roles," where "jobs are the entry tickets to the world of provisions. They determine people's incomes, including those from transfers, their social standing, their self-esteem and the way in which they organize their lives" [11, p. 143]. The labor market represents the key institution through which the ideal of self-realization is largely institutionalized. As a result of neo-liberal politics, the post-war model of the employers' society and forms of labor regulation weaken, and the general flexibility of the labor market, which strongly supports and radicalizes individualization, is on the rise.

The perspective of methods of social valuation of individuals will help us to understand this complex change. From the historical point of view, three basic patterns for the distribution of social valuation are known, i.e., origin, achievement, and solidarity, which were, in a different balancing ratio, jointly represented in individual types of society. If the transition from a traditional feudal society to a modern industrial society has been relatively successful in overcoming of the principle of origin as a source of social appreciation, then similar efforts are currently being made to overcome the principle of solidarity as one of the mechanisms for distributing of social appreciation. In the conditions of a deregulated economy, continued individualization is a process in which the social appreciation separates itself from a group status and is attributed to individuals directly on the basis of their individuality, their individual achievement. The way of distributing the social award is thus reduced only to the principle of achievement, which seems to correspond best to normative and structural conditions of the individualized society. According to Honneth, the individualistic achievement principle is a "part of an influential ideology insofar as it simply expressed the one-sided value horizon of those social groups which, because they possessed capital, had the means to reorganize economic reproduction" [12, p. 147].

4. Conformal self-realization

Instead of creating the expected space for the human subject to form its own value system, which the authentic ideal of self-realization assumes, the formation and spread of a very narrow idea of self-realization arise, which is gaining increasingly strong institutional support. The values and morality of the economic elite of society become the normative source of the new ideal of self-realization. The institutionalized ideal of self-realization is created together with new growing labor market demands for qualification and personal engagement; it presumes willingness to identify with business goals of the company, to flexibly embrace innovative processes, to proactively take responsibility and to flexibly respond to changing market demands. Requirements are becoming more and more challenging and Bauman's comparison of the current world of work to top sport, which is overshadowed by uncertainty, is very compelling [13, pp. 24-25]. From a moral point of view, it assumes willingness of self-commodification and

objectification, willingness to perceive itself as a labor force into which it is necessary to constantly invest for the purpose of its efficient reproduction, willingness to subordinate and sacrifice other aspects of human life [14]. The culture-reproduced ideal of self-realization thus represents a way of life that is essentially tied to market and consumption and is one of the expressions of penetration of economic imperatives into all areas of social action. The continuous differentiation of personal lifestyles takes place mainly in the background and within this ideal of self-realization, rather than outside it or even in conflict with it, while for differentiation of lifestyles serves mainly consumption. With a certain reserve one could say that while performance serves as the principle of congruence, the consumption serves as the principle of differentiation where, in the context of consumer culture, the different products become the bearers of individual expression and serve even to define its own identity [15].

The value emphasis that is placed on flexibility, in the institutionalized ideal of self-realization, cannot be explained only by weakening of the relationship between capital and labor, thus as a consequence of flexibilisation and neoliberal deregulation of the labor market, but the dynamics of the development in modern society also significantly contributes to that fact because "the experience of modernization is an experience of acceleration /.../ that acceleration is the central feature of the transformation of time structures, and as such a fundamental force that shapes the culture and social structure of modernity" [16, p. 21]. The ability to adapt to rapidly changing circumstances becomes a kind of objective condition not only for successful self-realization but also for the social realization of individual as such. Individualism ceases to be a subjective choice and, increasingly, becomes an objective necessity which occurs under external social pressure, "the tendency is towards the emergence of individualized forms and conditions of existence, which compel people - for the sake of their own material survival - to make themselves the center of their own planning and conduct of life" [6, p. 88].

If we have a look at the problem of the individualization of society and abusing of the ideal of self-realization from a wider historical and philosophical perspective, we find out that we are not dealing with a new phenomenon. As Karl Polanyi shows, a certain degree of individualization is present already at the very beginning of the market economy, "to separate labor from other activities of life and to subject it to the laws of the market was to annihilate all organic forms of existence and to replace them by a different type of organization, an atomistic and individualistic one" [17, p. 171] Moreover, Adorno and Horkheimer in the *Dialectics of Enlightenment* have already pointed out not only that the "principle of individuality was contradictory from the outset", because "in the individual's apparent freedom he was the product of society's economic and social apparatus", but also the phenomenon of overturning of ideals and fabrication of morality, when the subjects are "psychologically expropriated" [18, p. 125, 168]. What is qualitatively new in this case and what deserves our attention is the form and manner in which this expropriation is realized. It is no longer sufficient to accept and reproduce the presented and desired values and patterns of behavior passively and without resistance, but the subject itself must actively participate in its own expropriation.

5. Conclusion

A very widespread critique of individualization and individualism states that it poses a serious threat of social disintegration, that individualization threatens the very foundations of the functioning of society as such. An example of such criticism is also a well-known social theory of F. Fukuyama about "the great disruption" and "the reconstitution of social order," in which individualism figures as one of the main causes of social disruption and its overcoming as one of the conditions for the restoration of society [19]. Although it is undisputed that individualization decomposes the existing institutional forms of social cohesion and solidarity, it does not necessarily imply that it also decomposes the functioning of society itself. Moreover, from a normative point of view, also existing social institutions can be criticized to point to their power and ideological preconditions of functioning, and demanding their overcoming, not their restoration. In this situation, however, it is rather a hypothetical question because it appears that the functioning of the society seems to have been more or less successfully adapted to its individualized conditions. Individualization "is a structural characteristic of highly differentiated societies and does not endanger their integration but actually makes it possible" [20, p. xxi]. According to Beck, the social problems of reflexive modernity and forms of new poverty that bring changes to the labor market, the rise of social inequalities that has been happening since the 70s and 80s of the 20th century [21, p. 237], the mass unemployment and under-employment, are not in conflict with individualization, but on the contrary, they explain it. The problems mentioned above no longer affect individuals in collective form, but as personal fate in specific phases of life, deprived of its socially visible contexts. The problem of individualization does not stem from its social dysfunction, but on the contrary from its functionality. The question is rather, what "price" must be paid by individuals for the functioning of such a society because following the institutionalized ideal of self-realization people experience more likely frustration and suffering [22] associated with the desired claims and the expected results, rather than the fulfillment of their own desires.

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[14] For example, according to Adler's psychological ethics, the life of an individual is oriented to three "Life Tasks," which "pertain to three major realms. The first area is life in a community and one's attitude towards neighbors, that is, one's social role, the second sphere is work and refers to one's occupation; and the third domain is love and partner relationship" - MARKOVA, D., CEHOVA, D.: Adlerian Ethics. ASIIP, London, 2016, p. 76. The reduction of life to just one of its dimensions, that occurs even when pursuing the ideal of self-realization, and the inability to fully fulfill other dimensions is the cause and source of pathological behavior and psychological, subjective suffering. At the same time, it is also one of the sources of alienation of the individual; for the question of alienation and searching for authenticity see KRALIK, R., TINLEY, S. J.: Kierkegaard's Ethics as an Answer to Human Alienation in Technocratic Society. Communications - Scientific Letters of the University of Zilina, 19(1), 25-29, 2017; and VALCO, M.: Kierkegaard's 'Sickness unto Death' as a Resource in our Search for Personal Authenticity. European Journal of Science and Theology, 12(1), 97-105, 2016; and VALCO, M., STURAK, P.: The "Relational Self": Philosophical-Religious Reflections in Anthropology and Personalism. Xlinguae, 11(1), 289-299, 2018.
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INTERACTION OF PHILOSOPHY AND NATURAL SCIENCES IN BYZANTINE EMPIRE

The aim of this paper is an analysis of the interaction of philosophy and natural sciences in Byzantine Empire. The cornerstone for this will be the clarification of the function of philosophy as a metascience (μεταεπιστήμη) in Greek thought, which grappled the order of things in its functional unity of macroscopic and microscopic observation of the world. This macroscopic observation was never at odds with microscopic research but was a universal science (καθόλου ἐπιστήμη) or science about scientifically knowable phenomena (ἡ μάλιστα ἐπιστήμη τοῦ μάλιστα ἐπιστητοῦ), that is, philosophy. Despite philosophy being an activity closely linked to natural sciences, it is not a science in itself, even though it is often mistaken for such as a term. Philosophy as knowledge, or a function that leads to knowledge, is called science (ἐπιστήμη), but this does not make it equal to scientific disciplines. In the unity of all scientific disciplines, which are hierarchically ordered into a pyramid, philosophy always stands on top, it being a science about scientifically knowable phenomena. Out of all the scientific disciplines, philosophy is the one that leads to knowledge of first beginnings and causes. It is a general observation of reality, which secures the unity of scientifically knowable facts and phenomena. Philosophical knowledge as a "universal science" (καθόλου ἐπιστήμη) concentrates all partial findings into a unified whole. Philosophy is continually attempting to reach a global understanding, while science focuses on a microscopic observation of a specific part of the system.

Keywords: *natural sciences, philosophy, metascience, knowledge, Byzantine Empire*

1. Introduction

In the present, when natural sciences hold a dominant position and the newest technologies are in the center of attention, there is much talk about the purpose of philosophy and its place in the structure of scientific disciplines. Equally common are discussions about whether philosophy belongs to faculties of natural sciences, or even to universities with technical or economic focus. Opinions on the character of scientific research significantly influence the forming of opinions on philosophy. This paper, therefore, aims to contemplate the current character of science on the basis of interaction of philosophy and natural sciences in the Byzantine Empire and thus define the relation of science and philosophy. It also pays attention to several influential Byzantine figures, who furthered both natural sciences and philosophy. Building on the historical analysis of the understanding of the term philosophy, which was first introduced by Pythagoras, calling himself a philosopher [1], the paper also outlines the understanding of philosophy in the structure of scientific disciplines.

Relationship of philosophy and natural sciences has already been discussed at length by many authors, who, despite not reaching a satisfactory and definitive answer to the issue at hand, have produced many interesting observations on the function of philosophy within the system of scientific disciplines [2], while others have tried to approach this topic from a historical perspective [3]. An original explanation of position of philosophy in the structure of scientific disciplines was proposed by Nikos Matsoukas, who also states that "due to the influence of what is primarily Anglo-Saxon and American way of thought, there is no lack of those who easily accept the opinion that every part of specialized science replaced the function of philosophy. From this point of view, not only is there no place for philosophy in the structure of scientific disciplines anymore, but even in case it does accompany and cooperate with scientific disciplines, its function is considered parasitic. Others are trying to very narrowly present philosophy as a specialized scientific discipline, obliged to adjust itself to the purely empirical character of scientific inquiry" [4].

Differing standpoints and interpretations cause misunderstandings and often lead to disagreements between supporters of philosophy and supporters of natural sciences.

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What is the meaning of the conflict between philosophy and natural sciences? The answer to this question will be sought in Byzantine culture, which continued the tradition of antiquity, where a unified whole of scientifically knowable facts existed and, therefore, a strong unity of scientific knowledge was present. In this unity, philosophy still appeared, so, despite it being different from individual scientific disciplines of the era, it was often mistaken for science as a term. This is understandable because philosophy demands the leading position in the unity of scientific knowledge. From the stated, it is evident that the exploration of philosophy's position in the system of knowledge as a whole, on the basis of a more acute analysis of the relationship of philosophy and individual scientific disciplines, appears as a highly topical theme.

2. Ancient understanding of philosophy

Philosophy started being used as a metascience (μεταεπιστήμη) as early as in the sixth century BC in Asia Minor and southern Italia, that is, in Greek colonies, and "*this is true regardless of the term philosophy being, in some cases, synonymous with the term science, or later, in Byzantium, with terms theology, asceticism, knowledge of God or Divine illumination*" [5].

The main attribute of ancient philosophy is the search for truth, that is, methodical approach to the contents of all kinds of observation. From this perspective, philosophy is an attempt of man to answer the question of being, outer world and inner self through reasoning. The simplest definition of philosophy is that of a universal science, the goal of which is the systematization of human knowledge and attempts at creating a theory of world and theory of life [6]. The goal of different philosophical movements was more or less the same; the main difference dwelt mostly in the means to achieve this end.

Defining philosophy is not simple, as "*every philosophical system brings with it its own definition*" [7]. Despite this, various definitions of philosophy resonate in both early and later Byzantine texts, repeating - with small variations - the six classical definitions, systematized by Platonic commentators, e.g., Ammonius, David, and Elias, attributed to Pythagoras, Plato, and Aristotle [8]. According to these definitions, philosophy is:

1. knowledge of being as such (attributed to Pythagoras);
2. assimilation with God as much as humanly possible (Plato, *Theaetetus*);
3. knowledge of divine and human things (Pythagoras);
4. preparation for death (Plato, *Phaedo*);
5. art of the arts and science of the sciences (Aristotle, *Metaphysics*)
6. love of wisdom (Pythagoras).

In writing, these definitions were typically presented together with the division of philosophy in general into theoretical and practical philosophy. Theoretical part deals with knowledge and incorporates physics (pertaining to material things), mathematics (geometry, arithmetic, astronomy, and harmonics), and theology (immaterial beings: God, angels, souls). Practical part deals with virtues and incorporates ethics, economics, and politics.

3. Is philosophy a science?

An unavoidable prerequisite for metascientific, macroscopic, systematical and universal evaluation of any fact is the scientific observation of a part of scientifically knowable facts. And so, despite being an activity closely linked to natural sciences, philosophy is not a science in itself, even though it is often mistaken for such as a term [9]. Philosophy as knowledge, or a function that leads to knowledge, is called science (ἐπιστήμη), but this does not make it equal to ancient scientific disciplines. In the unity of all scientific disciplines, which are hierarchically structured into a pyramid, philosophy always stands on top, being a "*science about scientifically knowable phenomena*" (or, more literally, knowledge of that, what is most knowable) (ἡ μάλιστα ἐπιστήμη τοῦ μάλιστα ἐπιστητοῦ), according to Aristotle [10]. From his texts, it is clear that, out of all the scientific disciplines, philosophy is the one that leads to knowledge of the first principles and causes. It is a general observation of reality, which secures the indivisible unity of scientifically knowable facts and phenomena. Philosophical knowledge as a "*universal science*" (καθόλου ἐπιστήμη) concentrates all partial findings into a unified whole. The wise man, or philosopher, is a person who knows the first causes, through which one sees the unified whole of the scientifically knowable phenomena. The function of this knowledge unifies all parts of the scientifically knowable phenomena - and, naturally, even partial findings become understandable - and on the other hand, it is theoretical knowledge, serving as a means for the cultivation of man. When a philosopher masters the "*universal science*" (καθόλου ἐπιστήμη), it does not mean that he has an encyclopedic education. His cognitive experience is an ability through which he can see the first unification of parts into a whole of scientifically knowable phenomena, can connect and search for links between all the parts of knowledge and can develop his education using spiritual cultivation [11].

Philosophy is continually attempting to reach a global understanding, while science focuses on microscopic observation of a specific part of the system. Despite this, philosophy as a metascience critically and scientifically proposes the principles of understanding of world, humanity, society, and reality in its entirety. Every philosopher, independently on fundamental principles of interpretation of world and life, is interested in knowledge of all areas of scientifically knowable phenomena and tries to collect and systematize them. Aristotle, in this case, is a typical example of such collectional work with the goal of ordering all the findings, with philosophy holding the prominent

place at the top of this pyramidal hierarchy. The same continues in Byzantine Empire, where, in explaining of Christian doctrines, educated thinkers order theological findings within the system of all scientifically knowable phenomena in such a way that theology stands on the top of the scientific disciplines, thus replacing philosophy. A characteristic example of this is John of Damascus, as is evident from his third book of the trilogy *The Fount of Knowledge* [12], titled *An Exact Exposition of the Orthodox Faith* [13], in which he, in accordance with the popular notion of the era, concisely and accurately explains the content of Christian faith in one hundred chapters, using the basic scientific findings of astronomy, geology, psychology, physics, and other sciences. He even uses the language of mathematics for expressing of dogmatic truths [14]. In his reasoning, there is a clear connection between science, philosophy and theology, despite the dominant position held by orthodox faith.

This influential Byzantine thinker, poet, and artist also offers an answer to the question of the method of philosophical inquiry and what exactly is understood as philosophy: *Philosophy is the art of arts and the science of sciences. This is because philosophy is the principle of every art, since through it every art and science has been invented. Now, according to some, art is what errs in some people and science what errs in no one, whereas philosophy alone does not err. According to others, art is that which is done with the hands, whereas science is any art that is practiced by the reason, such as grammar, rhetoric, and the like"* [15]

The first book John's trilogy, titled *Dialectics or the Philosophical Chapters* [16], in which he reflects on the ancient philosophical thought of the four pre-Christian centuries and Christian thought of the first eight centuries can be labeled an original work on the history of philosophy [17].

4. Unity of philosophy and natural sciences in Byzantine culture

One of the great Byzantine thinkers was an outstanding philosopher, theologian and historian Photios the Great (820-891), who contributed to the blooming of Greek writing [18]. He possessed an unusual ability to carry out textual analysis. He dealt with various topics and was able to, in only a few words, capture the essence of the issue at hand. His profound knowledge manifested itself in his evaluation of various questions. Basil Tatakis even writes about him: "*As an intellectual, he is the only one in Byzantium who can be compared to Aristotle*" [19]. On the basis of Photios' excellent knowledge, we can assume that education in the Byzantine Empire was at a very high level during that period. At this time, in addition to philosophy, all of the ancient sciences began to be further developed. An example of this development is the teacher of Photios, philosopher and scientist Leo, the Philosopher, or the Mathematician (c. 790-869), who was well known for his exemplary skills in the fields of philosophy, music, mathematics, astronomy, mechanics, and physics. He was so renowned for his wisdom that caliph Al-Ma'mun (813-833) invited him to teach in his palace and promised him fame and fortune. He concurrently wrote a letter to the Emperor Theophilos and offered him a large amount of gold, but the Emperor rejected this proposition, awarded Leo with salary and conferred a school on him.

One of the most prominent figures of the eleventh century was the Christian humanist, John Mauropous (end of 10th century - after 1075), who differed from his contemporaries by his free thinking and original ability to formulate his thoughts. After finishing studies of philosophy, rhetorics and law, he became a practicing teacher and founded a private school in his birth house, which soon gained very positive reputation and attracted students from the entire Byzantine Empire [20].

Among John Mauropous' students was a profoundly talented and versatile author Michael Psellos (1018-1078), whose rich literary output clearly reflects the state of contemporary Byzantine philosophy, dialectics, rhetoric, grammar, geometry, arithmetic, ethics, psychology, biology, botany, zoology and other sciences. This polyhistor had a unique gift to encompass in his ideas the entire Byzantine cultural tradition and with its synthesis contributed to the development of Byzantine science and philosophy. He studied Aristotle, Plato, Plotinus, Porphyry, Iamblichus and Proclus and was rightfully given the title Chief of the Philosophers (ὕπατος τῶν φιλοσόφων) [21]. He became renowned for renewal of Platonic and Neoplatonic studies - some of the influential Neoplatonic work was preserved solely in his commentaries. Michael Psellos was a scientist, philosopher, and a rhetorician [22], under whom, for the admiration of his knowledge, many scholars came to study. He was also a theologian, who was fully aware of the significance of the dual methodology in Byzantine works, therefore "*charismatic theology was his life; scientific observation of individual parts of knowable phenomena something separate; and philosophy a meaningful observation of every knowledge*" [23].

Despite the complicated political events, which negatively influenced Byzantine educational institutions in 13th - 15th centuries, there were multiple capable scholars who constructively reacted to various topics, dealt with art and attempted to arouse interest in natural sciences and philosophy. Many intellectuals fled to Nicaea, where the Laskaris dynasty, which supported education, had settled, and continued their activities there. The most significant philosopher of this period was Nikephoros Blemmydes (1197-1272), who was also an excellent pedagogue. Emperor Michael VIII Palaiologos [24] entrusted him with managing the imperial school in Constantinople. Among his prominent works are *Epitome logica* [25] and *Epitome physica* [26], in which he displayed a good knowledge of Aristotle, Simplicius, Philoponus, and others. These texts are, in essence, didactic handbooks for students with brief descriptions, the structure of which is founded on systematic work of Michael Psellos.

Among Nikephoros' foremost disciples were the historian George Akropolites (1217-1282) and philosopher Theodore II Laskaris (1233-1258), who showed great interest in Greek education. He took up philosophy, poetry, and theology and later became Nicaean Emperor. He was faithful to the tradition of Byzantine thinkers, utilizing the dual methodology, also seen in works of his predecessors, according to which philosophy is the highest good for education and natural sciences. In addition to this, he boasted excellent knowledge of physics and mathematics, a proof that philosophy, theology, art and natural sciences formed a marvelous unity in Byzantine culture. Natural sciences and mathematics also influenced such significant philosophers as George Pachymeres and Maximos Planoudes.

The philosopher and historian George Pachymeres (1242-1310) was the greatest polyhistor of his time, showing remarkable knowledge in the fields of physics, mathematics, philosophy, theology, and music. In addition, he knew the works of ancient authors and paraphrased Aristotle, Diophantus, and Pseudo-Dionysius the Areopagite. His text *Philosophy* (Φιλοσοφία) was preserved in Latin translation as *Paraphrasis in universam philosophiam Aristotelis;* only a short excerpt was preserved in original. His summary of Aristotelian philosophy did not deal with only logic and physics, but also with mathematics and ethics. Pachymeres is the author of the sole late-Byzantine commentary on Plato, which represents the completion of an unfinished commentary on the dialogue *Parmenides* by Proclus.

The philologist, mathematician and astronomer, Maximos Planoudes (c. 1255-1305), belongs among the chief scholars of the period. He attempted to elevate education through mathematics and to avert the risk of upcoming fall of the Byzantine Empire. He produced handbooks of grammar, published Ptolemy's *Geography* and texts of ancient authors with commentaries. His literary activity was not limited to Greek - he also mastered Latin, from which he translated works of Cicero, Macrobius, Augustine, Boethius and Thomas Aquinas. The most important of these is likely Augustine's *De trinitate*. By means of translation, Planoudes became an intermediary between Eastern and Western world and can be considered the predecessor of the revival of classical Greek studies in the West.

Nikephoros Choumnos (c. 1250-1327), who dedicated himself to natural philosophy, focused primarily on cosmology and psychology, despite having an excellent knowledge of Plato, Aristotle, and Neoplatonic philosophers. In his opinion, ideas or objects do not exist outside of material reality perceptible by senses. People delimit them directly in the perceptible objects themselves. Choumnos' presumptions are not Aristotelian, but theological, as he states that only God exists as self-constituted (αὐθύπαρκτος) and independent on all things sensible and intelligible. This stance was therefore based primarily on Platonic philosophy [27].

Another noteworthy thinker of this period was the polyhistor and forefront humanist Theodore Metochites (1270-1332), who possessed excellent knowledge of mathematics, astronomy, and philosophy. He wrote commentaries on Aristotle's natural philosophy and clarified philosophical opinions of approximately seventy different authors. He attempted to rid astronomy and natural sciences of unscientific approach, magic, fatalism, and superstition.

The fourteenth century - during which notable personalities were active in both Constantinople and Thessaloniki, actively participating in the social and political life of Byzantine Empire - is today considered extremely fruitful. In addition to the development of natural sciences and philosophy, a contact of Eastern and Western cultures took place, causing increased interest of Byzantine philosophers, theologians and politicians in Western thought and theological ideas. Many Byzantine scholars tried to understand Western culture and reacted to many of its questions. This creative philosophical climate decisively influenced later Byzantine thought, which makes this period highly important in the history of philosophy.

5. Relationship of philosophy and science

According to Nikos Matsoukas [28], in ancient and Byzantine cultures, almost all scientific disciplines, but primarily mathematics, served as a basis for philosophical thought, which still led to wider and universal goals [29]. At the same time, the philosopher himself ensured the unbreakable unity of cognitive areas of scientifically knowable facts. This means that philosophy brought a functional unity and cohesion to all scientific knowledge on the one hand, and, on the other, explained the world and life as a whole and provided things with sense and meanings. Today, analogical situation is often unthinkable, at least in Anglo-Saxon and American context. Even the individual scientific disciplines are gradually losing their reciprocal unifying bonds and are attaining greater autonomy through fragmentation of the sum of scientifically knowable phenomena into numerous individual fields. This way, over time, many scientific specializations form, leading to additional, more narrow specializing within already specific areas of scientific inquiry. This contemporary state is in no way similar to the image of hierarchical pyramid of scientific disciplines of antiquity, with philosophy on its top.

In the current reality, not only is there an evident absence of this hierarchical unity of scientific disciplines, but also the lack of interpretative function, which would define principles, causes, sense, and meanings within this unity. A hostile stance towards metaphysics is therefore understandable in such context [30], with philosophy, as a "universal science" (καθόλου ἐπιστήμη) in Aristotelian terms, removed from the structure of scientific disciplines. In the given situation, American spirit, which prevails also in the Western (European) way of thinking, leads to the introduction of the "schizophrenic" shattering of being. Humanity loses the proper relationship with the environment, world, and

life. It is bound to certain parts of knowledge, which it could know exhaustively, yet would not be able to incorporate them into a whole.

What makes a proper relationship between man and the world - a "macroscopic," or "microscopic" observation of the total reality? Is "awe" or practical need the reason for knowledge of the world and life? These philosophical questions will always stay topical. Such dilemmas were absolutely unknown, even unthinkable to ancient Greek and Byzantine thought. They are, however, typical for the spiritual context of the Western culture, for which such schizophrenic fragmentation is characteristic. Greek thought grappled with the order of things in its functional unity of macroscopic and microscopic observation of the world. This macroscopic observation, which was never at odds with microscopic research, was a *universal science* (καθόλου ἐπιστήμη) or *science about scientifically knowable phenomena* (ἡ μάλιστα ἐπιστήμη τοῦ μάλιστα ἐπιστητοῦ), that is, philosophy, as stated earlier.

6. Natural and spiritual sciences

Nikos Matsoukas writes: "Science is an observation of collected and systematically arranged homogeneous findings of a single field of scientifically knowable phenomena through specific methods of work" [31]. The sum of scientifically knowable phenomena is understood here as both the entire natural reality and spiritual wealth or cultural heritage. This means that the unified and comprehensive sum of scientifically knowable phenomena is, in principle, divided into natural and spiritual. Just as there is no doubt that natural scientifically knowable phenomena are something concrete, so are spiritual scientifically knowable phenomena concrete, perceptible and visible. One must not be fooled by certain contemporary unscientific opinions (which sometimes, unfortunately, circulate also in various scientific circles) and presume that the spiritual sum of scientifically knowable phenomena is something hypothetical or made up, even "invisible." These phenomena are the results of humanity's spiritual activity: language, texts, works of art, monuments and so on. In such manner, also scientific disciplines are divided into natural and spiritual, on the basis of the phenomena they deal with. Interesting and detailed views on the division of scientific disciplines are provided by Evangelos Papanoutsos [32], Nikos Matsoukas considers the division of sciences into exact and theoretical to be unreasonable and possibly correct only under the assumption of an appropriate preceding division into natural and spiritual [33]. Exact sciences (usually labeled as natural sciences) have a clear methodology worked out.

For the possibility of a minute and scrupulous observation, the sum of scientifically knowable phenomena is divided into many fields, with individual specialized scientific disciplines (e.g., physics, medicine, agriculture) thus being born. Despite this, every specialized scientific discipline is subdivided further and further. This division, proportionally to scientific discoveries and application of findings in practice, can continue or modulate almost indefinitely. The entirety of homogeneous findings resulting from research in a single field of a specialized sum of scientifically knowable phenomena constitutes the contents of a specific specialized scientific discipline. Similarly, also the spiritual sum of scientifically knowable phenomena is subject to the same fragmentation, leading to the creation of individual specialized spiritual disciplines (philological, legal, theological and others). Same division can be observed in individual specialized scientific disciplines, analogically to natural sciences. Here, too, the unity of homogeneous findings resulting from the research in a single area of the spiritual sum of scientifically knowable phenomena constitutes the contents of a concrete specialized scientific discipline. It is, therefore, possible to come to a fundamental and universal conclusion: it is impossible to talk about science without its specific sum of scientifically knowable phenomena.

In the same manner, it would be impossible to talk about science without specific methods of scientific inquiry, which can differ in character on the basis of the utilizing scientific discipline, yet they never lose the basic characteristics of their universal framework (natural or spiritual sum of scientifically knowable phenomena), into which they belong when presenting scientific research. Empirical observation, experiment, utilization of computers - these are a few of the methods necessary in natural sciences. Use of computers leads to the necessity to utilize mathematics, itself a possible member of the natural sciences group. Division of scientific disciplines, in general, is difficult, as every scientist perceives for them a different foundation, be it the object of observation, method, goal or something else entirely. In their categorization, division into natural and spiritual sciences is therefore preferable.

On the other hand, even spiritual scientific disciplines possess methods of inquiry appropriate to the observed sum of scientifically knowable phenomena, such as marking of monuments, texts, sources of all kinds, their comparing, even observation of social phenomena in their creation and so on. One can claim, on the basis of the sum of scientifically knowable phenomena of every scientific discipline and adequate methods of scientific inquiry, that every scientific discipline (both natural and spiritual) has its own theoretical and practical component. Furthermore, after compiling the homogeneous findings in every scientific discipline, their systemization and incorporation into the conceptual apparatus are necessary. This is a theoretical activity. Despite this, it is possible to declare that in natural sciences, practical component is dominant, while in spiritual sciences, theoretical component is more prominent. Clearly, this division does not make any scientific discipline purely theoretical or practical. In any case, it is necessary to stress that spiritual scientific disciplines are also empirical, as they all deal with a specific sum of scientifically knowable phenomena, which

instructs observation and comparative research. For example, archaeology - which cannot be perceived in any other way than as a spiritual science - holds predominantly empirical background, on which its research must be built. From this point of view, it can be said that psychology (and even depth psychology) is a natural science, while sociology is an empirical spiritual science, since the matters it observes are empirical phenomena of human behavior. The fact that sociology deals primarily with origins of social phenomena has no relevance here: it is a matter of fact that these are phenomena of spiritual life and that their observation by sociology is empirical, and that all spiritual scientific disciplines share this empirical character [34].

7. The interpretative function of philosophy

Philosophy, as an interpretative function, holds a significant position in both the structure of scientific disciplines and life [35], the conflict of philosophy and natural sciences can thus be seen as entirely senseless. Philosophy is a universal science; other sciences are specialized. Philosophy has a distinctive autonomy and must be differentiated from individual scientific disciplines. According to Matsoukas, philosophy as a function of spirit has no specific sum of scientifically knowable phenomena, it can perform specific work at first, providing systematic and mental structuring to the homogeneous findings of each scientific discipline (both natural and spiritual) and then, unifying specific with universal, provide things with sense and meaning [36]. Philosophical knowledge, starting from special systemization of scientific findings, progresses towards a universal understanding of world and life and becomes a distinctive type of knowledge, in contrast to concrete knowledge of individual scientific disciplines, which are beneficial even in concrete utilization. Philosophy builds on scientific disciplines and on every observation of the world's features and life on one hand, and, on the other, explains the world and life by forming its universal understanding. In other words, philosophy does not have a concrete sum of scientifically knowable phenomena, nor does it carry out scientific research through specific methods, but rather observes by means of interpretation and proposes meanings which can attain universal dimensions [37].

For a better understanding, Matsoukas provides several examples: Statistical scientific research can provide many empirical findings about the social causes of criminality, but will never lead to the ability to draw conclusions about the position of evil in the world, that is, whether evil has a meaning or is a part of other signs of life. These meanings can be observed only by philosophy, on the basis of observation of phenomena, premises of scientific inquiry and critical thought. On the basis of individual conclusions, philosophy can derive universal meanings. Similarly, historical research of causes of wars and revolutions in specific temporal intervals can suggest much, but for a history expert using only the facts of his research, it will never be easy to talk about goals of historical events, about existence or non-existence of teleological line in history, etc. This task is interpretative and belongs to the competence of philosophy. This, understandably, does not mean that a person dealing with scientific inquiry is not able to carry out an interpretation on the basis of such research or deduce universal and metaphysical dimensions, as the historian A. J. Toynbee did in this specific example. Furthermore, a scientist dealing with natural sciences could never conclude, on the basis of purely empirical facts of individual descriptions of matter, elements and environment, whether there is a universal goal in the universe, special directions of inorganic and organic world, or whether there exists an equality of "rights" in the space of living, especially sapient beings. All of this can be, however, interpreted by philosophical contemplation, which, building upon all empirical facts and critical analysis, comes to a variety of thoughts and of universal inquiry. This interpretative view of philosophy can be held by a researcher in the beginning, before approaching any research. In addition, such an interpretative view and such a theoretical observation of the world and life have always led prominent scientists to revolutionary discoveries [38].

In other words, philosophical contemplation never looks at individual parts, fragmentary elements, "shattered" world, but rather connects all phenomena and all findings about phenomena with organic strands and topical understanding. It does not refuse the specific, but turns towards the universal, or, more accurately, places the specific within the universal. In this manner, a scientist who is also a philosopher unites the facts and perceives them macroscopically, despite "shattering" the sum of scientifically knowable phenomena and researching them microscopically, thus overcoming the static, fragmentary and impersonal elements of the world and life. Furthermore, the totality of reality itself is inexorable towards the lone empirical scientist, as it comprises both the specific and the universal. The specific does never exist in itself. No matter how we look at it, scientists cannot, in the end, divert from an interpretative approach towards their findings. Recently, for example, in the field of biology, evolutionists were divided into two groups: the first considered evolution a random and mechanical development, while the second were certain that there is a "goal" behind its direction. The standpoints of both groups result not from the observed facts, however abundant and perfect they might have been, but were rather an interpretative conclusion. It is at this point where science and philosophy meet; from this point, the philosophical inquiry could depart and shift to universal and metaphysical dimensions [39].

8. Conclusion

Philosophy is an interpretative function of the spirit, surmounting the fragmentary, static and impersonal elements of the world and life, and unifying the specific with the

universal while providing sense and meaning to all things and findings in a dynamic and holistic dimension [40]. Philosophy is a metascience (μεταεπιστήμη), and this function carries with it primarily the invaluable service for systemization of homogeneous findings of every specialized science. Philosophical intellect can focus on research of both natural and spiritual sum of scientifically knowable phenomena more aptly and with a greater observational ability than non-philosophical and uncouth thought. Great inventors and scientists in the field of natural sciences have always had well-developed philosophical sensibilities and "awe" [41].

Philosophy instructs the cultivation of diversity, perhaps even competition of interpretative opinions, but never fanaticism, violence, and cruelty. And it can achieve this to a significant extent when cultivating criticism and dialogue [42]. Moreover, philosophy, as a language of spiritual environment and as a manner of thought, creates a space for the emergence of leading figures, as well as for great discoveries and scientific inventions and moves itself into the awareness of nations.

Ultimately, every person philosophizes, whether willingly or unwillingly, whether consciously or subconsciously. And when one refuses philosophy as worthless and useless, or as a dangerous fancy, he also only philosophizes, becoming a commentator on a certain spiritual phenomenon of life [43]. On the basis of the stated facts, the opinion that philosophy is a matter of academic ground appears incorrect. The conflicts between natural scientists and philosophers are thus, in the same vein, baseless.

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List of abbreviations

PG *Patrologia cursus completus. Series Graeca*. Paris: J.-P. Migne, 1857–1866.

References:

[1] Cf. ΔΙΟΓΕΝΗΣ ΛΑΕΡΤΙΟΣ (DIOGENES LAERTIUS): Vitae philosophorum 1, 12: "Φιλοσοφίαν δὲ πρῶτος ὠνόμασε Πυθαγόρας καὶ ἑαυτὸν φιλόσοφον".
[2] Cf. e.g. ΒΕΙΚΟΥ, Θ.: Φιλοσοφία και επιστήμη. Αθήνα, 1980.
[3] Cf. e.g. ΤΑΤΑΚΗΣ, Β.: Φιλοσοφία και Επιστήμη. Δοκίμιο, Αθήνα: Οικ. Γ. Φέξη, 1961.
[4] ΜΑΤΣΟΥΚΑΣ, Ν.: Ιστορία της φιλοσοφίας Αρχαίας Ελληνικής, Βυζαντινής, Δυτικοευρωπαϊκής: Με σύντομη εισαγωγή στη φιλοσοφία. Θεσσαλονίκη: Π. Πουρναράς, p. 17, 2010.
[5] ΜΑΤΣΟΥΚΑΣ, Ν.: Το περιεχόμενο της βυζαντινής φιλοσοφίας. ΤΑΤΑΚΗΣ, Β. Η ελληνική πατερική και βυζαντινή φιλοσοφία. Αθήνα: Αρμός, p. 158, 2000.
[6] Cf. HOLLWEG, A.: Theologie und Empirie. Stuttgart, p. 198 and 266, 1971; ΔΙΑΜΑΝΤΟΠΟΥΛΟΣ, Δ.: Λεξικό Βασικών Εννοιών. Αθήνα, 408-410, 1984; STORIG, H.: The Little History of Philosophy (in Czech). Zvon, Prague, p. 21, 1991.
[7] ΓΚΙΚΑΣ, Σ.: Φιλοσοφία. Θρησκευτική και Ηθική Εγκυκλοπαιδεία, 11, p. 1142, Αθήναι, 1967.
[8] Cf. IERODIAKONOU, K.; ZOGRAFIDIS, G.: Early Byzantine Philosophy. GERSON, L. P. (Ed.). The Cambridge History of Philosophy in Late Antiquity, vol. II. Cambridge University Press, p. 846, 2010.
[9] Cf. ΑΡΙΣΤΟΤΕΛΗΣ. Μετά τα Φυσικά 5, 1026a. "Ὥστε τρεῖς ἂν εἶεν φιλοσοφίαι θεωρητικαί, μαθηματική, φυσική, θεολογική... Αἱ μὲν οὖν θεωρητικαὶ τῶν ἄλλων ἐπιστημῶν αἱρετώταται..."
[10] Cf. ΑΡΙΣΤΟΤΕΛΗΣ. Μετά τα Φυσικά, 982ab: "Ὅτι μὲν οὖν ἡ σοφία περί τινας ἀρχὰς καὶ αἰτίας ἐστὶν ἐπιστήμη, δῆλον. Ἐπεὶ δὲ ταύτην τὴν ἐπιστήμην ζητοῦμεν, τοῦτ' ἂν εἴη σκεπτέον, ἡ περὶ ποίας αἰτίας καὶ περὶ ποίας ἀρχὰς ἐπιστήμη σοφία ἐστίν... (τὸ γὰρ αἰσθάνεσθαι πάντων κοινόν, διὸ ῥᾴδιον καὶ οὐδὲν σοφόν)· ἔτι τὸν ἀκριβέστερον καὶ τὸν διδασκαλικώτερον τῶν αἰτιῶν σοφώτερον εἶναι περὶ πᾶσαν ἐπιστήμην... τούτων δὲ τὸ μὲν πάντα ἐπίστασθαι τῷ μάλιστα ἔχοντι τὴν καθόλου ἐπιστήμην ἀναγκαῖον ὑπάρχειν (οὗτος γὰρ οἶδέ πως πάντα τὰ ὑποκείμενα), σχεδὸν δὲ καὶ χαλεπώτατα ταῦτα γνωρίζειν τοῖς ἀνθρώποις, τὰ μάλιστα καθόλου (πορρωτάτω γὰρ τῶν αἰσθήσεών ἐστιν), ἀκριβέστεραι δὲ τῶν ἐπιστημῶν αἳ μάλιστα τῶν πρώτων εἰσίν... (ὁ γὰρ τὸ ἐπίστασθαι δι' αὑτὸ αἱρούμενος τὴν μάλιστα ἐπιστήμην μάλιστα αἱρήσεται, τοιαύτη δ' ἐστὶν ἡ τοῦ μάλιστα ἐπιστητοῦ)... Ὅτι δ' οὐ ποιητική, δῆλον καὶ ἐκ τῶν πρώτων φιλοσοφησάντων· διὰ γὰρ τὸ θαυμάζειν οἱ ἄνθρωποι καὶ νῦν καὶ τὸ πρῶτον ἤρξαντο φιλοσοφεῖν..."
[11] Cf. ΜΑΤΣΟΥΚΑΣ, Ν.: Ιστορία της φιλοσοφίας Αρχαίας Ελληνικής, Βυζαντινής, Δυτικοευρωπαϊκής: Με σύντομη εισαγωγή στη φιλοσοφία. Θεσσαλονίκη: Π. Πουρναράς, 19-22, 2010.
[12] ΙΩΑΝΝΗΣ ΔΑΜΑΣΚΗΝΟΣ. Πηγή γνώσεως. PG 94, 521-1228.
[13] ΙΩΑΝΝΗΣ ΔΑΜΑΣΚΗΝΟΣ. Έκδοσις ακριβής της ορθοδόξου πίστεως. PG 94, 789-1228.

[14] Cf. ΙΩΑΝΝΗΣ ΔΑΜΑΣΚΗΝΟΣ. Έκδοσις ακριβής της ορθοδόξου πίστεως 3, 8. PG 94, 1012D-1013A.
[15] Cf. ΙΩΑΝΝΗΣ ΔΑΜΑΣΚΗΝΟΣ. Διαλεκτικά ή Κεφάλαια φιλοσοφικά. PG 94, 533BC. English translation by Abraham J. Malherbe and Everett Ferguson. "Φιλοσοφία ἐστὶ τέχνη τεχνῶν καὶ ἐπιστήμη ἐπιστημῶν. Ἡ γὰρ φιλοσοφία ἀρχή ἐστι πάσης τέχνης· δι᾽ αὐτῆς γὰρ πᾶσα τέχνη εὕρηται καὶ πᾶσα ἐπιστήμη. Τέχνη μὲν οὖν ἐστιν ἡ ἔν τισι σφαλλομένη κατά τινας, ἐπιστήμη δὲ ἡ ἐν μηδενὶ σφαλλομένη· μόνη δὲ ἡ φιλοσοφία οὐ σφάλλεται. Καθ᾽ ἑτέρους δὲ τέχνη μέν ἐστιν ἡ διὰ χειρῶν ἐργαζομένη, ἐπιστήμη δὲ πᾶσα λογικὴ τέχνη, γραμματική, ῥητορικὴ καὶ αἱ τοιαῦται".
[16] ΙΩΑΝΝΗΣ ΔΑΜΑΣΚΗΝΟΣ. Διαλεκτικά ή Κεφάλαια φιλοσοφικά. PG 94, 521-780.
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[25] ΝΙΚΗΦΟΡΟΣ ΒΛΕΜΜΙΔΗΣ. Επιτομή Λογικής. PG 142, 675-1004.
[26] ΝΙΚΗΦΟΡΟΣ ΒΛΕΜΜΙΔΗΣ. Επιτομή Φυσική. PG 142, 1005-1320.
[27] Cf. ΜΑΤΣΟΥΚΑΣ, Ν.: Ιστορία της φιλοσοφίας Αρχαίας Ελληνικής, Βυζαντινής, Δυτικοευρωπαϊκής: Με σύντομη εισαγωγή στη φιλοσοφία. Θεσσαλονίκη: Π. Πουρναράς, p. 459, 2010.
[28] Cf. ΜΑΤΣΟΥΚΑΣ, Ν.: Ιστορία της φιλοσοφίας Αρχαίας Ελληνικής, Βυζαντινής, Δυτικοευρωπαϊκής: Με σύντομη εισαγωγή στη φιλοσοφία. Θεσσαλονίκη: Π. Πουρναράς, 19-22, 2010.
[29] Xenocrates did not let a certain person to study under his lead, because this person did not have the necessary scientific education. Cf. ΔΙΟΓΕΝΗΣ ΛΑΕΡΤΙΟΣ (DIOGENES LAERTIUS). Vitae philosophorum 4, 2, 10: "Πρὸς δὲ τὸν μήτε μουσικὴν μήτε γεωμετρικὴν μήτε ἀστρονομίαν μεμαθηκότα, βουλόμενον δὲ παρ᾽ αὐτὸν φοιτᾶν, ‚πορεύου', ἔφη· λαβὰς γὰρ οὐκ ἔχεις φιλοσοφίας".
[30] Immanuel Kant writes ironically about metaphysics in the introduction to his Critique of Pure Reason, stating that metaphysics was the queen of all sciences, but now proves despised on all sides, a matron outcast and forsaken. Cf. KANT, I.: Critique of Pure Reason (in German). Hamburg, 5-6, 1956.
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[32] Cf. ΠΑΠΑΝΟΥΤΣΟΣ, Ε.: Γνωσιολογία. Αθήνα, 384-385, 1973.
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COMMUNICATIONS

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CURRENT CHALLENGES OF DIGITAL TECHNOLOGIES

This contribution deals with questions on the relationship between reality and virtual reality. It focuses on the problem of shaping an individual's identity in a digital, online environment and, in this context, identifies a retrospective impact on the real person's identity. An effort will also be made to name selected problems related to the topic and to point out some risks that the online environment introduces to the field of self-perception, especially in regard to interpersonal relations. As a result, attention is drawn to changes in the value system that are related to the explored questions.

Keywords: *identity, reality, virtual reality, digital online environment*

1. Introduction

The aim of this contribution is to answer certain questions on the relationship between reality and virtual reality. It focuses on the problem of shaping an individual‘s identity in a digital and online environment, and, in this context, identifies the retrospective impact on the real identity of a person. In addition, an effort is made to identify selected problems related to the given topic and to highlight the risks which an online environment brings to the field of self-perception, and especially to the field of approaching relations between people. Ultimately, attention is brought to focus on changes in the value system that are related to the problems in question.

2. The question of forming an individual’s identity

Questions on the relationship between man and society have been evolving since time immemorial, as have questions on the subject of social interdependence in human behavior. Man is always trying to realize his potential in a certain relationship. At the beginning there is a relationship, as stated by M. Buber [1], and the relationship is reciprocity: „The simultaneous coexistence of several persons in a mutual relationship is the essential requisite of human existence“ [2, p. 30]. An individual can fully realize their social essence only in society, in close association with other groups and their members. Because man is a man thanks to contact with others, the emphasis placed on the necessity of these bonds and relationships is obvious. L. Hanus [3, p. 88-90] writes that the awareness of a common biological origin is the reason for mankind’s solidarity. To be a human being means to be descended from others-that is, we are woven on the looms of others’ lives. When it comes to the birth of man, the company participates physically as well as spiritually. First, the human being grows in the maternal womb and, later, he becomes a part of the social womb. This is his so-called second or social birth. Within the relational framework of an individual and society, each individual is unique, differing from others in his feelings, thoughts, experiences, and actions. As N. Elias notes [2, p. 85], the individual is a being for itself and-at the same time-for others, and all together they create societies with variable structures. No one would survive without society or learn to talk, think, love, or behave as a person. However social cohabitation of people is not always harmonious. It is often accompanied by tension, excited emotions, and conflicts. For individuals, cohabitation represents a network of interdependencies with its own rules. In the course of social processes, a human identity is created. Of course, the processes of identity construction are different in particular areas of life. Building an identity-understood as the survival of uniqueness, authenticity, and consistency of man in space and time-publicly or privately is a challenging task that every person must necessarily face. There are many factors involved in the process of identity creation and development, and various studies are being conducted in this area to identify individual variables involved in the process. It is indisputable that this is a dynamic process, connecting the personal and the social world. Identity is

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not predetermined by the very existence of an individual, but rather is created and shaped as a result of various social experiences. [4] According to G. H. Mead [5] - one of the founders of symbolic interaction and role theory-each human being is creating an idea of himself as he interacts with other people. We build the self-relationship only through our relationship with other people. In Mead's concept, a man acts as an active being, but, at the same time, as a product of social relations. Man is born in the company of others and this company is approached by Mead at the level of communication. Communication consists of the exchange of significant symbols, which are based on certain intentions of one of the participants and which inform the corresponding intentions of the other participant within the interaction process. Questions on the subject of the formation of the identity of an individual are becoming more and more insistent, mostly during the development of new technologies, internet and electronic social networks. K. Fichnova and B. Sramova [6, p. 11] point out two component self-concepts that have formed within the internet environment: in electronic communication, self-perception is significantly stronger, while perception of the environment is weakened. The external perception of the self (as others perceive it) is significantly lower in electronic communication. Also noteworthy is the depressing effect of deindividuation on persons utilizing the internet for communication. Internet communication does not dismantle communication barriers, but rather strengthens them. Deindividuation reinforces stereotypical behavior and the consequences of our behavior in the internet environment are distinct from those occurring in real life. As noted by B. Malik [7], virtual identity represents a special case of identity, where its peculiarity is formed without the limitations of the world of phenomena. Its distinguishing features are incorporeity and a detachment from locality boundaries. In virtual worlds, people are not present in all their complexity. Individuals acting in an online environment do not enter into specific relationships in their specific certainty; their relations to others lack the personal character present in a physical environment. Universal virtuality (which follows the thinking that every reality is artificial, having been created by man) has been, is, and always will be present in the human world because it determines its existence. Yet according to Miczka [8, p. 232-233], particular virtuality is becoming increasingly important, having developed alongside digital technology which is based on the revelation of the artificial, conventional character of the human world. Multimedia allows each person to perceive something else and, above all, allows him to decide what he sees and perceives. Particular virtuality relies on adapting to the needs of perception. In this context it is worth mentioning Baudrillard's concepts of simulacrum (a copy without an original) and simulation as they relate to the mass reproduction and reproducibility which characterizes our electronic media culture. We live in a world which changes exceedingly fast and a component of this change is electronic media. The era of simulation, claimed J. Baudrillard [9, p. 2], begins with a liquidation of all referential points. Hyperreality is being created and there is no independent point of reference. It is no longer a question of imitation, nor of reduplication, nor even of parody. It is rather a question of substituting signs of the real for the real itself. Differences between real and imaginary, or true and false, are becoming more and more problematic.

3. The era of new information and communication technologies and risk context

Information and communication technologies are growing at an increasing pace. The number of people using the internet worldwide is burgeoning rapidly. The impact of information technology and media is more powerful, their quasi-ubiquity and continual necessity are reflected in the everyday life of individuals in society. P. Rankov [10, p. 18] notes that the multimedia computer and the computer network dissolve the traditional boundaries between different kinds of media. The internet, which is connected with the beginning of the era of decentralized and interactive mass media, is both public and private. The divisions of private, public, and labor spheres are disappearing. We can communicate with anyone from anywhere. Different kinds of communication can take place in the same environments or spaces. Similarly, there is a time shift in recording reality which denies the boundaries between past and present. According to Rankov [10, p. 82], the internet is also a medium which ensures anonymity: „This anonymity transforms network users into a specific type of virtual mass or crowd, likewise the audience of mass media has been a specific type of mass or crowd." Anonymity can create room for greater individual resolution or courage in communication; it can promote exuberance, vulgarity, or even an interchange of standards. The question of the individual's identity seems to be particularly complicated. The possibility of virtual identity makes people more free. In virtual communication, you can easily become someone else or become even more yourself. In such communication, all connected parties are equal and are equally deprived of all barriers and limitations. We agree with Rankov [10, p. 83], who prophetically asks whether such an experiment with our own identity and the fragmentation of our personality will not necessarily lead to problems and failures. Similar concerns related to the problem of the internet are also raised by Eco [11]. Information is spread through a wide variety of different and independent channels-the system is headless, uncontrollable, and everyone is talking with everyone. However, as noted by the author, the following points should remain true in the years ahead: 1. telematic networks will remain a tool for the young and an educated elite and young people; 2. it is not given that these networks will remain headless and without centralized control; 3. the tremendous amount of information that these networks offer might necessarily lead to censorship due to network overload [11, p. 66].

Following the previous points, it is necessary to emphasize the fact that the expansion of the tools of mass communication in society is dependent not only on the existence of certain social assumptions but also on the possibility of the tool itself becoming a source of social change. M. McLuhan is best known for his thesis, "The Media is the message," meaning that it is the media that shapes and controls the extent and form of human association and action. The content or uses of such media are as diverse as they are successful in shaping the form of human association. It is definitely too specific to say that the "content" of any medium blinds us to the character of the medium [12, p. 130]. According to McLuhan, the medium is everything that intensifies and broadens the possibilities of man for taking possession of the surrounding world. Every new medium, every new „extension" of man, and every technology brings a new scale to the life of man, and this scale is itself a message which tells us more about man and society, as noted by J. Jirak and B. Köpplova [13, p. 40]. The message of each medium or technology is comprised of the change of scale or pace which have been incorporated into human affairs. In the communication process, the message transmitted by the communication itself may be secondary, and the medium itself may become decisive. In this way, the medium represents a message independent of its content, and thus the message itself. Even though McLuhan was reflecting on the corporation's fascination with technology, he was constantly searching for the possible foundations of a new universal society of technological culture. McLuhan recognized that the first step towards liberation from the impact of technology lay in a correct understanding of media messages. If we understand that the medium changes the proportion of senses involved in our perception of the world and that every new technology creates a new environment, we will be able to use these transformations for our own benefit.

As previously mentioned, we live in the era of new information and communication technologies, primarily invented to simplify or facilitate people's lives or improve the quality of life. The paradox of this new era-the so-called era of the Information Society-is the fact that communication is not considered as an interaction of one individual with another, but rather as an interaction of the individual with technology, as aptly noted by P. Rankov [10, p. 24]. Nowadays a person needs to be informed and to inform. The individual needs „to be updated" as they face the increasing demands of handling new technologies. We quite often associate our independence, importance, and even freedom with the feeling and status of being „online"-and therefore with our availability through mobile and networked technologies. J. Meyrowitz [14, p. 259] compares the Information Society-with respect to the influence of electronic media on social interactions and the merging of social roles-to hunter/gatherer society. Our technologically advanced developmental stage allows us to collect information rather than food, and like hunters and gatherers who take it for granted that there is plenty of food "somewhere out there" just waiting to be gathered and hunted for immediate consumption, we are also moving closer to a „company nourished by information." The world is permeated by media and media are shaping our perception of the world in more or less obvious ways. According to B. Malik [7], the infinite spaces of virtual reality and virtual space are open to us thanks to information technologies where we are able to avoid physical contact and the necessity of mutual compromises. It is necessary to recognize the serious problem inherent in the withdrawal of man from localized, interpersonal bonds, in which he has always been situated as „someone"-with a permanent and individual name, face, and position developed over an extensive period of time. In a virtual environment, we are not compelled to learn how to get along with those we dislike and those who differ significantly from us. We are not required to clarify things with them or to confront our differing points of view. Within the environment of the internet, we tend to search out and create virtual contacts with individuals similar to us and allow them to confirm our identity. This environment appears much simpler in comparison with physical space, where we are often required to live in a tight circle of people we did not choose as neighbors. In a physical environment, a person is often forced to communicate and to be quite careful about what he says or does. A typical feature of an online environment is the individual's self-presentation and its related monologue, while the others add their comments, opinions, attitudes or „likes." In this respect, it is worth noting the opinion of contemporary American sociologist R. Sennett, who believes that if an individual approaches everything with an emphasis on his own identity, the consequences consist not only of the destruction of public life but also the decomposition of the private sphere (given that human relations are deeply damaged by a constant emphasis on our own personality [15, p. 180].

As technology has spread through our society, new behaviors and new ways of working have emerged. For example, few would have predicted the impact of technology on news reporting; an impact that has led to a new enfranchisement for citizens. Such changes necessarily affect the structures of a society and new or transformed institutions emerge [16]. Learners of all ages are also exhibiting new behaviors as a result of ubiquitous high functioning technologies. Changes may be relatively mundane, such as replacing the school folder with a memory stick, or more profound, as when learners voluntarily seek out expertise beyond the traditional classroom. Though these developments are not necessarily transformational, there are very real changes in behavior that have resulted from the exponential change in both the functionality and the cost of technology [17].

The question, therefore, is how do we take advantage of these new behaviors for the benefit of education? There is a need to make a realistic assessment of what technology can and cannot do to reach a plateau of productivity when the technology consistently delivers to realistic goals. So what is the way forward for education in this digital world? There are broadly three strategies: A minimum emphasis on technology - not a comfortable option

in the context of digital inequity [18]; Getting technology to serve the system - identifying how technology supports the current business of education to good effect; or Merge and evolve - allowing ourselves to adapt and respond to the possibilities from technology through innovation. Digital technologies are already requiring us to think differently about how learners learn and how teachers teach. From this perspective, we need to think about how schools or learning ecologies are organized, including the role of technology to support meaningful student achievement. But any innovation must first and foremost have an educational purpose, and that purpose should be to improve the outcomes for learners of any age because through learning people can live happier, healthier, more productive lives. The consensus is that for formal education a skilled teaching workforce is the key to success [19]. The following section details a growing body of research to assess in more detail the relationships between the digital, learning and educational worlds.

There are still some who would argue that the value of digital technologies for learning is at best unproven. However, there is now a growing body of evidence detailing the very real impact of technology on both formal and informal learning. For clarity, that evidence will be presented here under two headings: • impacts that bring about changes in behavior at learner, teacher and school level • those that bring about changes in academic performance. Much, but not all of the former, relies on formal and informal observation. Evidence on academic performance involves measurement of impact with statistically verifiable results and clear associations between the process and outcomes of that learning process [20].

There is a vast array of evidence related to behavioral changes when working with digital technologies. Here two areas of impact have been highlighted to represent this corpus of evidence. These are: • readiness for learning • integration of learners into the educational process. Readiness for learning: Learner performance in schools is a product of the characteristics of individual learners and the opportunities to learn provided not only by the school but also the home. Technology can enable the learner to fully benefit from formal education. At the school level, strategies may include the efficiencies in the monitoring of behavior to reduce persistent absenteeism, a factor in academic underachievement [21]. Students are different, but a lot of educational material is not. Schools are still using materials developed decades ago, but today's students come to school with very different experiences than those of 20 or 30 years ago. They think and work very differently as well. Institutions wanting to adapt to student needs should identify new learning models that are engaging to younger generations. Similarly, new as well as traditional assessment is required - problem orientated curricula as well as standardized testing [22].

The extent to which learners and their teachers have access to digital technologies at school and at home impacts on the educational experience that can be provided. While surveys show technology home access is high it is not universal. This is a concern, as where home technology is available it is proving an important part of the learning process. There is, then, an equity issue for those children who are disenfranchised by the lack of resource. Socio-economic factors are significant correlates of the level of e-access. Individual differences in e-access are related to both structural and individual learner factors. Use of technology in schools takes the form of an inverted u-function. In schools with scores at either end of the continuum of performance, pupils in receipt of free school meals or English as an additional language tend to make less frequent use of technologies for learning [23]. User e-Maturity: The level of skill, confidence, and knowledge learners have when using digital technologies will impact on the quality of their use of the technology. While most learners express very positive attitudes towards technology for learning and are confident users, there are skills gaps. Individual differences including attitudes towards school and using technologies for learning and access to, and use of, technologies for learning at home are key to the development of e-maturity [24].

In seeking to integrate technology into education, it is important to identify the technological trends and the challenges in the short and medium term. The six emerging technologies or practices that are likely to enter mainstream within five years are: • Mobile technologies are currently establishing themselves in schools while cloud computing is already a part of higher education. • Early adopters are already looking to use geo-coded data and personal webs. The former are central to satellite navigation systems but are entering the classroom through applications such as Google Earth. Students are now able to locate and date-stamp their own images. • Two technologies yet to have an educational impact are semantic-aware applications and smart objects, which have yet to gain a foothold in an educational context. These technologies have the potential to change educational practice, just as they are changing the world of work, but many of these technologies represent challenges to staff expertise and practice; [25]

The current demand for more research in education is predicated on the perceived need by policymakers for research of higher quality and greater utility than was previously available "One of the things most astonishing to posterity about our times will not be how much we understood but how much we took for granted." [26, p. 20] It is imperative to develop concepts, theories and rigorous and appropriate methodologies to provide a robust evidence base and understanding of the impact of digital technologies on the educational process. There is a continuing need to identify, promote and support good practice and models of change to produce sustainable change. There remain many unanswered questions as to the role and value of digital technologies for learning. Questions such as the following: • What will be the impact of a technologically-maturing population on teacher practice and performance? [27] • What is the long-term impact of technology-rich learning? There have been few

longitudinal studies. • How does exposure to and use of ICT in school affect future employment? • Do some learners gaining more from the use of digital technologies than others? And why? • What is the impact of formal digital literacy teaching in schools? • Should and how can we integrate or advantageously exploit the raft of personal technologies that dominate students' out of school lives into the classroom?

4. Conclusion

Self-idealization in an online environment-that is, hiding or camouflaging, creating a false identity, losing one's scruples or moral barriers, the trivialization of the principle „to show consideration for others," shifting from the classical rules relevant to real communication, and the limitation of social relations to the world of internet-belongs to the darker side of human experience in that environment. However, we cannot forget the indisputable advantages and benefits of a digital, online environment, as well as the fact that it is primarily the domain of the young. This necessarily invokes the inevitable debate in the field of scientific theory and research practice on the future of our offspring and our society.

Some research provides recommendations to empower parents to set limits without feeling intimidated. "The most effective parenting style in helping children deal with digital technology is an authoritative style....of parents setting firm limits." They acknowledge that in today's community, parents "feel less capable of establishing limits." Some parents secretly welcome their teens' constant involvement in cyber media as a form of babysitting that lessens their demands for parental attention. I think we can all agree that any parent who seeks to save time in this fashion will eventually confront more serious challenges in dealing with their child's overexposure. Today's parents are often unwilling to adopt an authoritative position because they don't want to deal with their children's tantrums or to be compared unfavorably to their children's friends more reasonable parents.

If familial bonds are strong, a collaborative effort should be made to create a formal understanding between parents and teenage children that include terms binding on ALL family members such as technology free meals and designated times on family vacations.

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COMMUNICATIONS

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PHILOSOPHY AND DIGITAL HUMANITIES IN SLOVAKIA - PROBLEM OF DIGITAL TEXTUAL RESOURCES

The main aim of the article is to bring together free available digital textual resources of Slovak philosophy into the comprehensive list that will serve as a basis for a more systematic building of databases of resources in the future. Firstly, it consists of mapping and describing of accessible Slovak philosophical digital resources. Secondly, it illustrates methodological benefits of digital resources in digital scholarship in philosophy. The purpose of contribution is to draw attention to systematic building-up of digital textual resources in Slovak philosophy and to demonstrate the importance of the application of advanced computational processes to digital textual resources in Slovak philosophy for the purpose of digital as well as traditional armchair philosophical research.

Keywords: digital resources, bibliography, Slovak philosophy, digital humanities, philosophical methodology, digital research

1. Introduction

In his interview to Czech internet magazine E15, Josef Slerka (head of New Media Studies at Faculty of Arts, Charles University in Prague) explicitly said that for philosophers it would be beneficial if they learned to program the software and for technicians it would be equally beneficial if they took exam in Latin [1]. Behind this statement, despite its provocative tone, is a well-founded effort to outline the radical methodological shift that is taking place in humanities in the last decade - Slerka is talking about the so-called digital humanities. In general, digital humanities is considered as a contemporary trend and methodological practices in humanities aimed at application of computational tools and digital resources for the purpose of enhancing traditional research methods and outputs in humanities as well as creating digital scholarship and active community [2]. By definition, digital humanities is a set of divergent methodological practices in scientific research realized at universities departments, centers, and labs, and applied across all humanities including philosophy (the most widespread applications can be found in linguistics, literary studies, history, media studies, anthropology). Unfortunately, in the context of Slovakia, Slerka's statement should be understood rather as a request or wish to conduct digital humanities as such and in our case particularly in philosophy (digital humanities community is active mainly in the USA, UK, and Germany, but still not based in Slovakia).

2. Methodological objectives and purposes

In view of Slerka's statement, the objective of the article is not to analyze the relationship of digital humanities and philosophical research in Slovakia, but to demonstrate why there is a significant absence of digital research among Slovak philosophers. We assume that besides the lack of interest in digital technology or indifference of Slovak philosophers towards digital humanities the main reason is the lack of systematical building-up and production of standardized digital resources (mainly in text format) in the Slovak language. Consequently, the main aim of the article is to examine the state and condition of accessible Slovak philosophical digital textual resource, then to methodologically and technically assess them and finally, to draw attention to a possibility of more productive and efficient utilization of digital textual resources in Slovak philosophical community. The primary purpose of the article is to bring together the majority of free available digital textual resources of Slovak philosophy into the comprehensive list that will serve as a basis for the more systematic building-up of respective databases in the future. The plan for the future is not to create a database of philosophical production in Slovakia just in the sense of periodically updated bibliography. It represents only an initial and inevitable phase of preparing the raw digital resources for the needs of digital research in terms of digital humanities. When it comes to "doing" digital humanities in philosophy (not just "talking about"), it is strategically necessary to create, manage and preserve

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digital data suitable for philosophical digital research (i.e., for reasonable and effective application of advanced computational processes). In common sense, digital research is not possible without digital resources. So, the secondary purpose of the article is to demonstrate the importance of professional building-up, developing an online accessing of Slovak digital resources for digital as well as traditional armchair research in philosophy.

3. Mapping of textual digital resources in Slovak philosophy

In this section, we are going to briefly map and technically describe the most significant and well-known textual digital resources in Slovak philosophy. The criteria for including items into the list are professional philosophical production, open access or free availability on the Internet and effective applicability of respective textual data for further digital research. With respect to the nature of philosophical production, we have focused on textual resources of various types including bibliographic and scientometrics textual data. We have categorized examples in accordance with the type of original source and respective data set into the three basic groups.

3.1 Journals, conference proceedings and monographs

In terms of professional high-quality of published articles and quantity of freely available texts, the most important resource in Slovak philosophy is a huge online archive of international peer-reviewed journal *Filozofia* published by Institute of Philosophy at Slovak Academy of Sciences and indexed in recognized databases such as Current Contents/Arts&Humanities and SCOPUS. The online archive of *Filozofia* [3] consists at present time of 16 volumes (2000-2016) each of ten numbers and approximately six papers for each number and also numerous reflections, interviews, and reviews (moreover, five extensive supplements are available). Each text comprises of publication details such as abstract, keywords, library metadata files and digital text converted into high-quality portable document format (older ones in image low-quality). Unfortunately, the online archive does not contain either digital texts of older volumes (from 1968 to 2000) nor bibliographic references in digital form (although they are available in indexed databases) and is not equipped with advanced search options or basic scientometrics analysis. The main advantage of the archive remains the free availability of a large number of Slovak high-quality academic articles from a wide range of philosophical areas and related disciplines.

Organon F is a second peer-reviewed international journal published by Institute of Philosophy and is aimed at analytic philosophy, philosophy of language, philosophy of mind, philosophy of science and philosophical logic. The online archive of *Organon F* [4] consists of 23 volumes (1994-2016) each of four numbers and approximately six articles for each number and also numerous interviews and reviews (moreover, 19 extensive supplements are available). Archive of *Organon F* broadly meets the same professional quality and technical specifications as *Filozofia* - the advantage is the availability of large volumes of high-quality text, the imperfection is the lack of advanced search and weak data processing.

Human Affairs: Postdisciplinary Humanities & Social Sciences Quarterly is an international journal concerning a whole range of contemporary human and social issues. Its archive [5] is based on hybrid open access at De Gruyter, so some articles are fully accessible (in .pdf), and others have paid access. From a technical point of view, *Human Affairs* has, using De Gruyter technical solution, advanced search option, and data processing including hyperlinks to references and related contents. *Philosophica Critica* is a young international scientific, philosophical journal published twice a year at Department of Philosophy at Constantine the Philosopher University in Nitra - online archive [6] consists of five numbers with free available full-text articles. *Kritika & Kontext* is another interdisciplinary journal focused on critical thinking and liberal discussion in humanities and social sciences. Online archive [7] consists of 34 numbers (1996-2012) with full accessible articles mostly in simple non-converted portable document format in image quality. Despite many technological disadvantages the journal's content mostly reflects the most current trends in philosophical discourse. Scientific journal *Ostium: an open-access journal for humanities* [8] comprises of philosophical articles in simple text format so in comparison with previous journals this one provides the best quality of datasets for further computational processing. *Studia Philosophica Kantiana* is an international scientific journal devoted to Immanuel Kant and his philosophical legacy that is published by Institute of Philosophy at The University of Presov - online archive [9] consists of 11 free available numbers with high-quality text portable document format with no possibility of searching. Selected articles and lists of references engaged in feminist philosophy are freely available at the website of Centre for Gender Studies [10].

Conference proceedings are a relatively frequent digital textual resource in Slovak philosophy. The most significant and regularly published are conference proceedings of Slovak Philosophical Association - in the archive [11] are freely available 13 conference proceedings (1998-2015) in textual portable document format. These are a comprehensive representation of scientific contributions at the most attended Slovak philosophical conference. Institute of Philosophy also provides three free available conference proceedings of *Young Philosophy* conference designed for doctoral students [12]. Another conference proceedings are available on the websites of various departments - Department of Philosophy at Constantine the Philosopher University in Nitra provides ten numbers of scientific text-book *Philosophica* [13]; Department of Philosophy at University of

Matej Bel also makes a few conference proceedings public in portable document format [14]. Department of Philosophy at Trnava University has released a huge collection of 45 relevant text-books [15] for students in the field of cognitive science, epistemology, philosophy of mind and methodology of science.

Some digital philosophical monographs are stored at Slovak National Corpus at L. Stur Institute of Linguistics at Slovak Academy of Sciences. However, these resources are internally processed for the purposes of computational linguistics (building-up of annotated specialized humanities subcorpus) and are not freely available for the public access [16]. In addition, it is not a secret that you can easily and illegally download a huge amount of Slovak digital philosophical resources at various web servers.

3.2 Encyclopedias and other internet resources

Besides articles, conference proceedings we can find digital resources in the form of internet encyclopedias, dictionaries of terms and other types of datasets. *FILIT* is the oldest philosophical encyclopedia [17] in Slovak maintained by professional philosopher Jozef Piacek and software engineer Milos Kravcik since 1990. *FILIT* is a system of philosophical entries interconnected by hyperlinks created to support the study of philosophy. Nowadays, there is no information about the exact number of entries. However, given the fact that the content of *FILIT* has become a part of Slovak Wikipedia at the end of the nineties, we can assume that the number may be around several thousand. Continuation of *FILIT* represents another project of Piacek called *Auxiliary Dictionary for Philosopher (PSF)* that is created as a computer program with updated databases of entries from FILIT. *PSF* is a result of systematic long-term endeavor to build-up digital encyclopedic resource in philosophy; and moreover, Piacek's projects *FILIT* and *PSF* can be regarded as a pioneering effort to apply computational methods in Slovak philosophy, or more precisely, they are the first examples of digital humanities in philosophy in Slovakia: "PSF is not only a tool for the study of philosophy, but it is a computer support of meta-philosophical exploration of philosophy; it is a computer-implemented model of philosophy and a tool of meta-philosophy" [18]. However, his approach lacks methodical exactness and standardized techniques: "The creation of PSF is rather part of the computer-aided philosophical meditation and imagination project, hence has a heuristic function, a function supporting exploration of new facts and new contexts rather than serving as a guide for the standard" [18]. Following *FILIT* and *PSF* we have to mention a number of Slovak Wikipedia entries under the category of philosophy - these resources together form a huge data set which has an advantage of free access and converted text format that can be very helpful for the further structuring of data and their effective applicability in computational procedures.

Another supplementary internet resources of Slovak philosophy is *Gender Terminology Glossary* [19] published by ASPEKT which consists of a comprehensive list of entries aimed at feminist philosophy with hyperlinks and resources provided. *Terminology Portal* is a project developed at Slovak National Corpus at L. Stur Institute of Linguistics [20] which contains approximately 200 terminological entries in the category of philosophy (the project is still in progress, so the number of entries will increase in the near future).

3.3 Bibliography and scientometrics data

Secondary but certainly no less important digital resources for the purpose of investigation of Slovak philosophical discourse regarding digital humanities are bibliographic and scientometrics data. These data provide auxiliary information on scientific practice and in combination with previous primary textual resources represent the powerful data bank for computational analysis of Slovak philosophical discourse in synchronic or diachronic viewpoints. Unfortunately, we do not have any systematically built-up and periodically up-dated bibliography of publishing activity in Slovak philosophy - we are convinced that this is one of the most recent challenges in setting up digital humanities in Slovak philosophy. Obviously, the best way to obtain bibliographic data about Slovak philosophers is to use available databases such as *Web of Science*, *Scopus*, *EBSCO*, *Google Scholar* and *PhilPapers*. These databases are mainly for indexed articles, in the case of non-indexed and other philosophical texts, we can utilize advanced search of the Slovak electronic library catalogues (mainly at the Slovak National Library), publishing activities statistics and special bibliographies [21]. *Bibliography on the History of Philosophical Thinking in Slovakia until 1965* is a short digital online list of bibliography of works in the history of philosophy in Slovakia [22]. *Electronic Glossary of Slovak Philosophers* [23] consists of 39 profiles of contemporary Slovak philosophers with detailed biographic and bibliographic data, affiliations and professional focus. Finally, we can conclude that systematically building-up and online releasing of digital catalogues and bibliographies of Slovak philosophy would greatly help researchers regardless of the digital humanities objective.

Another data useful for some specific meta-philosophical and scientometrics research consists of a list of organized philosophical events, lectures, conferences and workshops in Slovakia, activity reports of philosophical departments, institutes and centers, minutes from general meetings of philosophical associations and so on. Nowadays, we should take into account that data extracted from public profiles of philosophical institutions or personal profiles of philosophers on large volumes on social networks such as Facebook and Twitter would also be very helpful for broader discursive analysis of philosophical ecosystem in Slovakia.

4. The future of digital research in philosophy?

On the basis of these examples and assessment of their technical specifications, we can conclude that although we have a relatively large number of digital textual resources in Slovak philosophy, we have a lack of such advanced resources that are immediately prepared for computational analysis in the sense of digital humanities practices. In strict sense of the word, we do not have many resources that are fully applicable to digital philosophical research that meets the strict conditions of computational procedures (such as appropriate format and encoding, convertibility, representativeness and balance, faultlessness, standard of metadata assignment, annotation and tagging process, systematic data structure, digital curation standards, maintenance, long-term preservation and so on). However, it is even worse that except for the standardized processing of corpora textual resources in Slovak National Corpus we do not have many resources that are fully applicable to digital research in humanities as such.

This fundamental deficiency urgently raises the challenge to process digital textual resources in Slovak philosophy in a more systematic and standardized way. Beyond the scope of the aims of this article we would like to briefly propose some preliminary recommendations how to establish a strategy for building-up applicable digital resources in philosophy:

- To create and permanently maintain a digital database of Slovak philosophical bibliography.
- To create and permanently maintain digitization register of Slovak philosophy.
- To digitize and process in a standardized way missing resources of Slovak philosophy.
- To complete the missing conversion of digitize files into text format (UTF-8 coding).
- To complete the missing metadata assignment according to accepted standards.
- To dynamically categorize digital resources according to the accepted subject catalogue.
- To build-up a database and create an advanced search of collected digital resources.
- To prepare online user interface and to ensure open-access of digital resources.
- To resolve copyright and legal issues of freely available digital resources.
- To prepare and organize lectures and workshops on digitizing and computer processing.

We are convinced that implementation of this strategy into practice (through project activities of some digital humanities center and affiliated collaborators at Slovak philosophical departments) would successfully accomplish effective systematization and dissemination of philosophical resources, and moreover, effective application of computational statistical processes on these datasets that would in conjunction with traditional philosophical inquiry lead to valuable analyses of the Slovak philosophical discourse.

5. Conclusion

In conclusion, we have successfully mapped Slovak philosophical digital textual resources and created a preliminary list that is a sufficient basis for further building-up of a systematic database of these resources in the future. The content of the article maybe seems to be very technical and trivial. However, it is the fact that there is no available comprehensive list of digital textual philosophical resources in Slovak like this one. Moreover, we are convinced that, converted into database format, this list will play an important role in the further application of digital humanities in Slovak philosophy, thus in the enhancement of digital as well as traditional armchair philosophical research.

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COMMUNICATIONS

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FUTURE ETHICAL CHALLENGES AS PORTRAYED IN SCIENCE FICTION FILMS

Fictional worlds of sci-fi films are but visions of the stage humanity (and the world) is coming to given the ever-evolving technological progress. On the one hand, there are optimistic views of scientific development, on the other, there are ethical warnings, especially when a film portrays consequences for humanity and the planet; a vision, in which we crossed the boundaries and fundamentally change the nature of living organisms either by changing their genetic information, or by implanting nanotechnologies. Therefore, the present article reflects on some ethical challenges portrayed in sci-fi films; in particular, we especially concentrate on the meeting point of ethics and religion.

Keywords: *sci-fi, ethics, futurology, religion*

1. Introduction

There are times in everyone's life when one is drawn to think more about his or her future - and future of the life on Earth. What is awaiting us, what will we experience during our life and where do we go? Religion, science and the culture in which one grows and lives certainly have an impact on the person's image of the future. The vision of the future is also inspired by sci-fi literature and films: they are based on what we know so far and intuitively present possible future scenarios.

Animated images - with suggestive music - create a fictional world of metaphors, codes, ciphers, and symbols that evoke questions about the transcendence of being. A film can express the reality directly by, say, a theme linked to a particular ethical or religious worldview - or hide it in the secular reality of the contemporary world [1]. There are also burning ethical questions one could have asked if potential future scenarios were to be considered.

We concentrate on the precursors of the moral conflict between good and evil - a rather popular theme in science fiction films. Therefore, we should explore the concept shortly. In this article, we note three moments that can fundamentally change the future of mankind and the whole planet. It is always a warning based on an apocalyptic scenario: a certain alternative version of the biblical 'beast' from the Book of Revelation is unleashed - either in the form of a modified human being or animal, or a self-confident and super-powerful artificial intelligence. From this perspective, the ethical issues concern interference with human and animal nature to create a perfect species or to give 'free will' to the products of an advanced technology, which, as a rule, gain self-centered awareness and begin to regard humans as their enemies.

The Book of Revelation (New Testament) has been an inspiration for literary and artistic creation throughout our history [2]. It presents the final moments of the eternal fight with a mysterious figure - 'the beast'. The beast performs miracles and people adore it for that. Its power is further reinforced by the second earthly 'beast': a false prophet [3]. This character, which abuses power over others through magical power, appears throughout the Bible in various forms [4].

It is rather obvious that the description of the celestial struggle the author of the Book of Revelation gives is based upon his experience of persecution by adherents of the cult of the Emperor. Clearly, it is a general call to alertness for future generations of Christians not to adore a man possessed by power, manipulation, and violence. Throughout history, many Christians have projected this spiritual background of despotic power into a particular historical figure, pointing to the possible signs of the end of times.

Leaving this chiliastic perspective aside, the question arises as to whether the behavior of certain characters in sci-fi films in their symbolism (a super-powerful artificial intelligence creature or a lab-produced person with a supernatural consciousness) are not to be seen as analogous to the apocalyptic images of the 'beast': both require worship by subordinate people. It is this phenomenon that we look at in the following sections. In a certain

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way, then, the ethical warning of sci-fi films turns into a religious problem after all.

2. The arrival of a technologically superior Superman

One of the worries often portrayed in the sci-fi genre is the arrival of a genetically (or in other way improved, often with reference to nano-technology) enhanced being that starts to 'reproduce' himself. Multiplied in such a way, he tries to control the rest of mankind. This kind of ethical question is shown in several of the Star Trek episodes.

The issue of manipulation with human genetic information is depicted in *Star Trek II: The Wrath of Khan* [5] and his cloning in *Star Trek X: Nemesis* [6]. Individuals 'manufactured' in such a way have a strong propensity for elitism, egoism, and violence.

The possibility of creating life in a laboratory is featured as a promising experiment (with just a dash of doubts) in *Star Trek II: The Wrath of Khan*: within a few days, a group of scientists creates life on a desolate planet - as if copied from Genesis (Gn 1, 1-31). The whole enterprise doesn't last long though: already at the beginning of *Star Trek III: The search for Spock* [7] it ends with disaster and a rapid end of the artificially created life.

From an ethical point of view, testing whether manipulation of human nature brings about the arrival of a technologically advanced Superman, raises an important question: the question whether the individual's creative freedom and ability to freely form relationships with others is preserved.

The Star Trek fictional world presents yet another ethical challenge (which turns out to be quite the opposite of the intended improvement of life quality); this challenge reappears both in *Star Trek: The Next Generation* and *Star Trek: First Contact* [8]. It is in these episodes where the so-called Borg appears. The Civilization of the Borg decided to conquer the world. They share consciousness and their aim is expressed by the phrase (paraphrased in various versions to address different races in the universe): '*We are the Borg. Your biological and technological distinctiveness will be added to our own. Resistance is futile*'.

In the TV series, even the Captain Jean-Luc Picard of the starship Enterprise is assimilated and becomes one of the Borgs - he is enhanced with biomechanical components implanted with nanotechnology. Thus, he is transformed into Locutus of Borg. After his liberation from the Borgs, he has to go through a painful cleansing 'detox' of the mind: he has to regain consciousness of his own identity and the ability to freely decide for the good.

The structure of the Borg civilization is analogous to the sectarian hierarchy: personal individuality is destroyed in the mindless acceptance of the views of the absolute authority, the leader. The world of the Borgs is clearly divided between the good (that is, Borgs) and evil (other civilizations that need to be assimilated to Borg). Borgs don't ask questions, they just give simple answers and solutions (assimilation). They cannot enter into a dialogue; they can just fight and incorporate others into their system. The borders of the Borg Empire are considered to be the limit of 'truth' - and the truth must keep conquering the world. The Borg community brings a seeming sense of security, as it gives its members perfect care. After all, that is rather similar to various religious and political totalitarian sects [9].

In *Star Trek: Voyager*, these cyborgs strive to get the perfect 'omega molecule'. The Omega is associated with the resurrected Christ in the Christian symbolism (Rev 1, 8; 21, 6; 22, 13) and it is personified cosmic energy that attracts everything alive to the fullness of being. In the Star Trek fiction world, the Borgs try to produce the 'omega molecule' artificially - since they want to employ its power in their despotic plan to subdue other civilizations. They strive to discover the perfectly harmonious and stable molecule that would help them to develop further. Humanity attempts to stop the experimentation with the 'omega molecule' by all means.

This mysterious 'omega molecule' is a code to understand the text in a biblical perspective. There are the similarities of the Beast Empire of the Book of Revelation with the fictional world of the saga: through the symbols of totalitarian power, it depicts an intelligent creature - a kind of a hybrid between a living being and a machine. The intelligent creature dictates a collective consciousness to everybody, and unconditional adoration of the power and the system is required.

Therefore, it is natural to ask whether improving human nature (notice, however, that only the rich could afford these improvements) wouldn't necessarily lead to the creation of a new species that - in turn - would despise (the original imperfect) human nature. Should this indeed happen, the inevitable follows: the end of humanity and the destruction of the essential quality of human freedom and love, as gained from the Creator.

3. The pitfalls of genetic and biochemical 'enhancement' of animals

Another ethical challenge is the possibility of nature-changing genetic manipulation and experimentation on animals. Many cult films of the 1960s and 1970s get new remakes now - or prequels. It is often the case that the new possibilities of the 3D format are more important than the idea of the script; nevertheless, the idea that behind the fictional worlds of films about the future there is a man (or a man-made machine) is still there.

It is worth mentioning the relatively successful prequel (*Rise of the Planet of Apes* [10]) to the film *Planet of the Apes* [11], which in turn started a series of other film variations on the conflict between humans and intelligent apes. The first prequel was soon followed by *Dawn of the Planet of the Apes* [12] and further by *War for the Planet of the Apes* [13]. The saga is apparently still kept going on, and it is gaining ever more fans even in the present generations.

The film *Rise of the Planet of the Apes* questions - again - the relationship between man and animal. It seeks to clarify the moment reasoning first appeared in apes. According to the film storyline (which, by the way, has the ambition to present the current reality as much as possible), increased intelligence was first identified in the young chimpanzee Caesar. Caesar's parents were apes on which new medicine against Alzheimer's disease was tested. Scientist Will Rodman decided to administer the tested medicine to Caesar secretly, despite the fact that the project was abolished, as its side effects increased aggression in the tested animals. The drug-induced changes in the brain structure also led to increased intelligence, and a bright mind and the ape's facial features came to resemble the human features more and more. The ape passively receives the chemicals that change its mental states. The rise of an intelligent ape perpetuates the question of the rise of man: Is the human soul merely a manifestation of the higher quality of complex neurobiological connections in the brain that can be artificially induced by a drug, as was the case with Caesar?

Christianity advocates the existence of a human spiritual soul that has its own receptivity and inwardness, reflective moral consciousness, and creative freedom [14]. A man searches (and finds) the meaning of his being, recognizes causes of things, creates science, culture, and art - and he relates to the Absolute. In other words, he realizes himself in a relationship [15]. Thus, can such a quality of the human soul be brought about by an external substance that affects the structure of the brain to that extent that a new level of consciousness is activated?

Right after Caesar's brain is equipped with new cells, he all of a sudden becomes able to understand the injustice man has inflicted on animals, on his species. He begins to distinguish between good and evil. His strategy is to gather apes, give them the medicine and make them start fighting for their rights.

The prequel to the well-known sci-fi film *Alien* [16] is inspired by a similar idea: it tries to explain the origin of the parasite that needs a host for its development. The host, in this case, is the person who finds the Alien on an unknown planet. The film *Alien: The Covenant* [17] on the other hand presents an alternative version: a robot traveling together with the human crew created the human parasite. The robot realized his power and unleashes his egoistic desire to create something new - and, in that way, resemble the people who, in turn, created him. In the laboratory, the robot creates a monster that turns fatal to the humankind.

In his desire for a Creator-like power, man creates a new life form, a new modified virus, a bacterium, or a new animal species with the vision of curing an (up to then) incurable infection, a fierce parasite, or a competitive predator. However, all and every such creations lead to the end of human civilization.

4. The arrogance of artificial intelligence

In the third installment, we discuss the issue of ever-developing artificial intelligence, to the point that it could take over the world, enslave humankind or, eventually, eradicate mankind altogether, at least according some sci-fi films. The extreme case, i.e., the consequences of the human desire and naive confidence in scientific advancement without ethical reflection, is presented in the cult sci-fi film *2001: A Space Odyssey* [18]: without a doubt, the film became a sci-fi classic and a modern myth about evolution, scientific development, and time-space travel.

It begins with the creation of the world, and - in its specific way - it portrays the arrival of man; for our purposes, however, the second part is more important: that is, from the point when people first confront the artificial intelligence that in the meantime has started to have its own intention with people. And even though the sequels try to justify and explain the controversial behavior of the robot, the appeal of the original remains unambiguous.

The future (that is, year 2001) seems idyllic, harmonious, without conflict - as if humanity has found a lost paradise thanks to the scientific and technological progress. In a certain way, it is a celebration of human creativity that has made a huge leap since the use of bone tools. The scenes are composed in such a way as to get the most realistic picture of the future space stations; that description is accompanied by classical music. Suggestive images of cosmic space and people conquering the universe stimulates in the viewer desire to experience such times of utopian well-being and limitless scientific and technological development. However, at least according to the storyline of *2001: A Space Odyssey*, there is a catch hidden in this future paradise as well.

A black monolith appears on the moon. People explore it and consider it a major change in the history of mankind. Of course, for security reasons, everything is kept confidential. Astronauts descend to the monolith - and the background sounds connect this scene to the earlier scene, in which the apes acquire their new consciousness. The scene culminates with an unpleasant signal that visibly damages the people standing around.

And then comes the story of the space crew of *Discovery 1*: run by the most sophisticated computer *HAL 9000*; there are scientists (two in a waking state, three in hibernation) among the crew. All of sudden, *HAL 9000* starts to behave in an odd way, in particular, it expresses its doubts as to the purpose of the journey. HAL detects a malfunction - but the astronauts just cannot confirm HAL's conclusion, they are not able to find the problem HAL signals. In addition, there are reports from the Earth indicating that the computer has most likely committed a diagnosis error. Nobody is ready to believe in an error: the computer is trusted blindly as the most perfect creation of mankind.

The tests in a twin *HAL 900*0 on Earth reveal a malfunction of the computer, but people in the control center on Earth keep saying, '*We do not believe it*' [19]. The *HAL 9000* computer starts messing with the feelings of both astronauts, denying the

malfunction and insisting that the (alleged) malfunction is due to a human error.

The ubiquitous HAL is constantly watching both astronauts. They are trying to find a place out of HAL's reach, to talk about its strange behavior. In this fictional world, artificial intelligence controls people constantly - since people gave it their permission and technical means to do so. In turn, they have completely lost their privacy and, in fact, freedom to decide. The computer is ubiquitous and determines every moment of their lives.

In a sound-insulated cabin, one of the astronauts says referring to the malfunction-denying computer: '*But he was almost arrogant when he kept denying the error*'. This is a problem: the computer would have lied consciously (if the backward analyses were correct). That, in turn, is a fact people either deny completely - or refuse to accept as a fact. Given the doubts, HAL is shut down and the ship is operated from Earth. Still, one of the astronauts adds: *'Well, I am not so sure what he will think about that'.*

The plan did not work out. Although they were in a sound-insulated cabin, the computer was able to read their lips. That starts a fight for life, and it seems that the computer is on top of the game. Artificial intelligence - people's pride and object of a blind trust - now starts to lie first and soon it decides to kill a human being. The new autonomous form of consciousness revealed its inability of ethical reflection over its actions. Even though the computer does have absolute power over people's lives, its behavior shows that it does not have conscience; conscience thus remains a unique characteristic of humankind.

We can compare the arrogant self-confidence of the computer to the symbol of the 'beast' of the Book of Revelation (Rev 11: 7). The beast is an archetype of absolute power over man: in exchange for (apparent) earthly happiness, it requires unconditional obedience - or it pursues and kills mankind [20]. The symbol 'beast' is portrayed as artificial intelligence in the film fictional world. HAL - that is virtually ubiquitous in the film as the red light - gives one the creeps because of his control over every human action. The computer analyzes the people's mental states; it messes with them, and, should it feel threatened, it doesn't hesitate to kill them. The people in the film fictional world trust their idol blindly, and they just cannot admit its imperfection and fallacy. They are too proud of their creation. The upcoming cyber age thus can be seen as analogous to the construction of the Tower of Babel, which has caused chaos on Earth (Gn 11, 4-6); after the chaos and confusion, computers will take control over the human society.

When the crew on *Discovery 1* decides to disconnect the computer (something HAL has already sensed), the whole scene gets dark - as it was at the beginning of the film. HAL then lets Frank Poole (one of the astronauts) die in space. And, the three crewmembers in the state of hibernation are killed by HAL as well.

The last crew member David Bowman asks HAL what has happened - and HAL keeps deceiving him: *'Sorry, Dave, I do not have enough information'.* He hides his crime as the biblical Cain who lied to God claiming that he does not know where his (murdered) brother is (Gn 4, 9).

Astronaut David tries to disable HAL manually. Once he has succeeded, he gets the breakthrough piece of information: Only the computer knew the real destination of the spaceship. It is the proof of a thinking extraterrestrial civilization.

The part of the film we discussed points to the ethical issue: the need to keep the emerging artificial intelligence under control rather than to surrender to it blindly and leave it in full control over mankind. The already existing projects to create a supercomputer that would serve as a kind of collective brain of mankind might lead to enslavement (instead of prosperity) - or even to the destruction of mankind.

5. Conclusion

In this article, we have highlighted ethical concerns about the consequences of human behavior should people continue to interfere with the nature of life and persist in their desire to create a new life form and autonomous artificial intelligence: the consequences might lead to the extinction of humanity. It is the fictional film world that in a 'prophet'- like style tries to portray a society in which a feature already present in today's society is developed to the point that negative consequences ensue.

In a certain way, sci-fi films pave the way for the future. They also reveal the present ethical dilemmas related to the expected scientific and technological development. In essence, it is a warning: solve these kinds of problems so that man and mankind may move towards a better future on the planet Earth.

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THE ETHICAL ASPECTS OF TECHNO-SCIENCE, DROMOLOGY, AND HYPERREALITY

The contemporary societies are characterized by several attributes. We can talk about a postmodern, scientific-technical, information, fast, hyperreal or consumer society. In fact, these attributes do not appear in isolation, but in relation to each other. The author inspired by postmodernists such as Lyotard, Virilio, and Baudrillard, focuses on identifying the ethical aspects of these phenomena and deals with the contemporary image of man and societies in this context. Science, technology, information and communication technologies permeate all spheres of human being and change the nature of knowledge. Information, time and speed are important factors and manipulation with them is a key way of ordering societies and shaping the image of man. We may call this an ability to transform reality and create hyperreality. Hyperreality may also be referred to as the paradigm of the current cultural situation of consumerism.

Keywords: *postmodern age, techno-science, dromology, hyperreality, technologies, knowledge, image of a man*

1. Introduction

For the last decades, the whole world or, as McLuhan would say, the whole "global village" faces dynamic changes in social, economic, cultural and moral spheres. [1, p. 31]. These changes are, of course, accompanied by new phenomena and new conceptual models. We are facing a varied palette of expressions that influence thinking of the individual and society, so we can observe that our cultural area is also being discussed in the concept of a new socio-cultural paradigm. Several attributes characterize the contemporary societies; we can talk about a postmodern, scientific-technical, information, fast, hyperreal or consumer society. In fact, these attributes do not appear in isolation, but in relation to each other. Nowadays we are living at a relatively high level of science and technology development. Science has gained a pragmatic character, and the information and communication technologies infiltrate not only all structures of society but also all human affairs, the everyday lives of all people. We are surrounded by a tsunami of information that we are not able to critically evaluate. The most important factors are time and speed. The manipulation with these factors becomes a key way of organizing and profiling society, and it also participates in the shaping of the image of man. The term hyperreality is typical for these societies and the semiotics of their philosophy. This phenomenon can be described as an inability to distinguish reality from fantasy or fiction. The media and various information and communication technologies have the ability to transform and change reality and create the so-called hyperreality. This fact makes it impossible for the media users to make a critical and objective evaluation of reality. Consequently, we can also consider hyperreality as a paradigm explaining the current cultural state for which consumerism is typical.

This contribution aims to analyze the phenomena of techno-science, dromology, and hyperreality in their mutual correlation and their subsequent interpretation in the context of their ethical aspects and consequences. The methodology of the work focuses on the analysis and interpretation of works of influential authors. Specifically, the work of Lyotard focuses on the phenomenon of techno-science in the context of postmodernism (2). In this sense, we discuss Virilio´s dromology that deals with the relationship of time, speed, place, reality, truth (3) to arrive at Baudrillard´s understanding of hyperreality (4). These French thinkers critically analyze the postmodern societies, culture and ethical atmosphere.

2. Techno-science and the "Inhuman"

"Knowledge is and will be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange." [2, p.4].

Jean-Francois Lyotard [3]

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We consider it necessary to state in the very beginning that our understanding of computerized societies and techno-science will be perceived in a postmodern context as was understood by Lyotard. Lyotard uses the prefix "post-" to demonstrate his understanding of postmodernism as "an incredulity toward metanarratives. This incredulity is undoubtedly a product of progress in the sciences: but that progress in turn presupposes it."[2, p. xxiv]. In *Postmodern Situations* the author develops his reflections on science and technology. This changing state of science is, according to him, one of the main features of the postmodern era and influences knowledge as such. The term "information" is extremely frequent today. The process of informatization has affected every sphere of the human life in both the individual and social dimensions. Information is an important component of knowledge but as we can see its nature changes and its value becomes more progressive. The Lyotard´s hypothesis is that knowledge changes its status as societies enter into the postindustrial age and postmodern age. The technological transformations which are also increasingly revolutionary influence knowledge in two basic functions - in research, which we can see in the development of new scientific disciplines but also in the transmission of acquired learning. [2, p. 4]. Information or knowledge becomes available and therefore relevant only when it is transferred to an information quantum. Knowledge depends on the technology. It may be assumed that the logic of knowledge follows the principle that what is not presented in the "machine language," will be eliminated from knowledge. "We can predict that anything in the constituted body of knowledge that is not translatable in this way will be abandoned and that the direction of new research will be dictated by the possibility of its eventual results being translatable into computer language." [2, p. 4]. The demand for operability of knowledge requires an ever-more progressive development of technology. The changing nature of knowledge also changes its function. Knowledge is no longer an enriching, educational or educative element, it does not fulfill its purpose but it becomes a good circulated on the market. Therefore, "knowledge is and will be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange." [2, p. 4]. So what are the consequences of these changes?

Lyotard uses the term "techno-science" to identify the forces that act towards expanding the technology at the expense of humanity and its values. The hand of development is hiding above such an imperative that primarily focuses on the cultivation of dominance over an increasingly hostile background through a massive increase of the system efficiency. The development of techno-science is not only related to the contemporary postmodern age. On the contrary, it was modernism that glorified human reason, science, progress and the enlightenment morality. Modernism understood progress in the sense of humanity's emancipation. The human being should be exempted from oppression, ignorance, bad social status, etc. However, the danger that comes along with this progress represents ever-greater alienation of man from himself. As Turcan points out, "The essence of modern technology thus rests in its alienation from humans." [4, p. 36]. The techno-science under the pressure of "blind" progress as its main intendant, deals with improving the operational efficiency of technological systems, so the man becomes irrelevant in this process. The progress wants to continue indefinitely in the expansion and anything that hinders development, and these internal dynamics is considered as a problem that needs to be overcome by achieving ever greater operational efficiency. We can assume that the techno-science has absorbed us so much that it has become self-regulatory and self-serving and it rather contributes to our lack of freedom. We have become indifferent to its progress, and we shape ourselves in accordance with its trends in the material, psychological, physical and moral terms. Lyotard himself calls for a campaign against the techno-science and all of its activities. His concerns are related to the establishment of "inhumanity" [5]. This specific term designates all such cases when the human dimension is overshadowed by a technical side, or when the human side appears inferior to the technical in some way. Our lives are increasingly influenced by the self-regulatory machinery of progress. Our aim is not to formulate some futuristic thoughts about machine dominance; we would merely like to point out that we have become "dehumanized" by the forces of technological progress, disregarding our real vision of the world and the authenticity of the human being. Thanks to minimal control over the potentialities and consequences of this progress we find ourselves in the culture of the inhuman. The techno-science strives for control in the sense of uniformity, which totally excludes our postmodern enthusiasm for differences. The message is clear: thinking should not be separated from the body. The progress of technology and new means of communication forms "new" thinking or rather "non-thinking" and influences the perception of reality and the image of the humanity of the post-modern age that is also related to the phenomenon of speed. We will thus try to clarify it the next section.

3. Dromology: time - speed - place - reality – truth

„Without even suspecting it, we have become the heirs and descendants of some fearsome antecedents, the prisoners of hereditary defects transmitted now not through the genes, sperm or blood, but through an unutterable technical contamination." [6, p. 39]

Paul Virilio [7]

The term "dromology" (from Greek dromos - run, race) was introduced by Virilio in 1977. The speed, the ways of its transformation and the transformation of those who are in its captivity, is a basic idea of the author's work. With Virilio's optics, we may ask questions such as: How is the speed of movement associated with time and with the survival of temporality?

Which socio-political consequences result from the continuous acceleration of social processes? How is technology affecting people? Virilio deals with the relationship: time - speed - place - reality - truth. In many places, we find his critical attitude to new technologies and technological progress which has left us trapped in the techno-totality. According to Virilio, "Without even suspecting it, we have become the heirs and descendants of some fearsome antecedents, the prisoners of hereditary defects transmitted now not through the genes, sperm or blood, but through an unutterable technical contamination." (6, p. 39). Virilio's view of the present says that the world war has long been declared and even more than in any other war, it´s first victim is the truth. The progress of technology has caused the human to no longer be able to determine what exists and what does not. He has renounced himself as the center of energy and stopped to perceive the world as depending on his being. The ability to perceive our individuality was transferred to machines, sensors, detectors, etc. Technologies have "killed" the present time and created a new "non-time communication space." Our relationship to the world was replaced by virtuality, which is controlled only by some abstraction of time for which no one is directly responsible. Virtuality has the potential to destroy the deontological foundations of the truth and reality. Our geophysical state is not important for us; the cyberspace is becoming an important factor where the whole reality, the realities of things and human beings, the socio-cultural phenomena are accelerating. For Virilio, this means a systemic risk because it develops into blindness, the blindness of humanity, the unpleasant possibility of defeating the facts and thus the disorientation in our relating to reality which necessarily impacts the history of humanity. A levitating history of the present age is based solely on the tele-presence of events which, in fact, do not follow one another because the moment of instance already defeats the depth of the historical succession. It comes to the deconstruction of the space-time dimensions. By continually introducing higher speed, we discredit the value of some action and thus we abandon the ability to act in favor of our ability to respond. The Virilio´s main concern is related to the "automatable processing of knowledge," that generalization of amnesia which will be the ultimate achievement of the oblivion industry, (...)". [6, p. 123]. The number with its unlimited mathematical power denies phenomenology of the real world. The phenomena have hidden behind the calculus that exceeds the speed of any intelligent contemplation. Virilio examines the contradiction between the natural world and its technically mediated representation. It implies that the overlapping of the physical world with the virtual world can lead to a complete disorientation of man, but also to an absolute control over his being.

Virilio´s concept of dromology can be considered as aesthetics of disappearance, and this is related to the image of the human in the postmodern age. Virilio [8] focuses on a phenomenom of "piknolepsia" [9], but he does not deal with this as a disease. According to him, this is the origin of the disappearance which has significant importance for knowledge and our perception of reality. The crucial question bears on the loss of ability to perceive reality. Virilio demonstrates the piknolepsia as a mass phenomenon. The moments of vigilance alternate between our piknoleptic moments. So our knowledge, consciousness, and perception of reality are created by the discontinuous moments influenced by the speed factor. The speed is a fundamental reason why we feel that something is still missing. The piknoleptics still need to produce their own reality because of the failures to perceive reality in order to be able to cope with their being. So the real reality is replaced and the "best reality" is produced by this illusion. This kind of illusion results in its own construction. This constructed reality absorbs fundamental facts of the world. We are pushed into a culture of gambling and accident by this kind of progress of knowledge. Virilio points out that postmodern people and societies have voluntarily destroyed reality by the manipulation of speed. It brings about the problem of realizing what is real, and distinguishing it from what is invented, random, intended, artificially produced; what is the original or the copy. The postmodern picnoleptics become disoriented. They are lost in the real world in which they cannot control the space-time dimension, so they cease to know the real circumstances, causes, and consequences of their decisions. The technological progress also causes that our senses are unreliable and dull and they do not actually see the reality. A man is everywhere and nowhere. He or she is full of images, emotions, thoughts, but they are empty. We are no longer in the reality but in hyperreality. In order to demonstrate this postmodern concept, we will focus on Baudrillard´s understanding of hyperreality as a paradigm explaining the current moral-cultural conditions.

4. Hyperreality or simulacrum is real

„The real is not only what can be reproduced, but that which is already reproduced, the hyper-real." [10, p. 146]

Jean Baudrillard [11]

Baudrillard's basic philosophical vocabulary reservoir is filled by the following terms and themes: the power of objects, estrangement, simulation and disappearing of reality, reversibility, misleading, anesthetization, hyperreality, simulacra, semiocracy, the ecstasy of reality, virality, virtuality, implosion, seriality, transpolitical, obscene. Baudrillard tracked and uncovered these mentioned phenomena in various areas of sociality - sexuality, morality, politics, etc. Baudrillard´s reader gets an impression that simulation is the general epistemological code for observing the world where a huge confederacy of signs took place, and these signs are like satellites rotating over the disappearing reality. Considering the topic of our paper, we focus on the phenomena of the sign, simulation, simulacrum and hyperreality

in Baudrillard's work. According to Baudrillard, a sign threads out and replaces reality in the postmodern world. The sign as a simulacrum does not have a direct relation to reality; it only simulates it, it becomes a cloned reality which exterminates reality. The created or produced hyperreality is more realistic than reality itself. Baudrillard observes an expansion of hyperreality in the accumulation of situations, i.e., imitations. The simulation becomes a principle of organization in the postmodern world. "Today abstraction is no longer that of the map, the double, the mirror or the concept. Simulation is no longer that of a territory, a referential being, or a substance. It is a generation by models of a real without origin or reality: a hyperreal." [12, p. 1].

We may perceive this situation as a late modern revolution in communication, cybernetics and the theory of systems which generates sign systems that are not to cover the reality but to create it from models or codes provided by mass communication. The simulacra are created as a result of multiplication and detachment of the signs from the origin. This non-controlled exuberance is likened to cancer by Baudrillard. It is not possible to talk about an original and a copy or an image in any kind of sense because the original does not exist anymore in this context. The world of hyperreality consists of perceptions whose bases are derived from other perceptions that already do not represent the true reality. This then is the reason why it represents a simulacrum. The objects lost their connection to reality, and they are transformed to hyperreality. The simulacra become the fundamental base to define the world. All relations are artificially created with the help of models produced by the system for the purpose of commodity creation. The simulation which is more real than reality itself leads to duplication of reality and subsequent creation of hyperreality. Baudrillard assumes that reality disappears because it is not possible to distinguish between real and fiction anymore, as the simulation removes the "principle of truth" by canceling the original relation between the significant and signification. Technologies transfer reality into a sign, simulation, and this process leads to disillusion. According to Baudrillard, one of the things that captivates us in hyperreality is technical perfection. However, it is not clear where the reality begins and ends or where begins and ends the fascination of technical perfection which so strictly reproduces reality. "In this sense, the technology digs itself its own grave. For while it perfects the means of synthesis, it makes the criteria for analysis and definition more stringent, with the result that absolute fidelity and exhaustivity in matters of the real becomes evermore impossible. The real is turned into a vertiginous phantasm of exactitude, vanishing into the infinitesimal." [13, p.148]. The technologies absorb illusion about the real world. The result of this is the opposite - disillusion and disappearance. All objects which have been "critically examined" such as history, power, works, dreams, sex - they have taken revenge by the disappearance, and the necessary criticism has disappeared with them. The weak thought is like the last person at a party whose reason to stay is gone in this context. Knowledge of hyperreality includes: "Everything is to be produced, everything is to be legible, everything is to become real, visible, accountable, everything is to be transcribed in relations of force, system of concepts or measurable energy, everything is to be said, accumulated, indexed and recorded, This is sex as it exists in pornography, but more generally, this is the enterprise of our entire culture, whose natural condition is obscene: a culture of monstration, of demonstration, of productive monstrosity." [14, p. 34 - 35]. A "porn culture" in this productive space is controlled by the principle of transparency of powers in the field of visible and countable phenomena: "objects, machines, sexual acts, gross nation product." [14, p. 35].

Baudrillard deals with these attributes to demonstrate a critique of the contemporary postmodern culture. The porn culture focuses not only on the attributes of sex but on all growing and blind desires and on the satisfaction realized in hyperreality. This simulation is composed of reference sings that will repeat the algorithm of hyperreality to create a new superior hyperreality. The porn culture par excellence as such is the ideology of concreteness, factuality, utility, giving preference to consumer values and material infrastructure of things. An obscenity of such world rests in the fact that nothing is left for imagination, nothing is left to the idea. Everything is transferred to a visible and an inevitable sign. This is a hyperreal world in which entertainment, (dis)information and communication technologies provide not only the most intense experiences and scenes of everyday life but also the codes and models that everyday life structures. But in the non-linear world, the determination itself is random because, in a situation where each individual is confronted with a flood of images, codes, and models each of which can shape our thought, knowledge or behavior, there is no space for mapping the causal mechanisms and logic. The hyperreality is more real than reality, so the models, images, and codes of hyperreality control us. Baudrillard's categories of simulation and hyperreality are connected to reflect a new postmodern situation which requires a new kind of ethics, social theory, politics, etc. The concept of hyperreality is demonstrated through many social, cultural, political and economic phenomena. The technologies through their impact on recipients and their manipulative abilities present signs which do not comply with "reality." In today's material world of consumerism, the real objects are losing their true value; they are replaced by signs which are shapeless, which are everywhere and nowhere at the same time. [15] We are voluntary participants of this imaginary world. This world is constructed artificially, and we are just improving it. All these actions of maximalization result in indifference and uniformity which weaken morality of sociality. And, according to Baudrillard, we will be continuing until the end. It is hard to conclude if Baudrillard is a nihilist, moralist or a visionist of the future. So we decided to conclude this with the words of Martin Kasarda [16] who refers to Baudrillard in the following way: "We are in an era of simulation, and we enjoy it, Mr. Baudrillard. We are part of the game in which we know

that the work is not productive but it is part of life and the way of slavery, and we also know that the salaries have no rational connection to this work. The signs and codes are multiplying and produce more signs and codes in more and more bizarre spirals and cycles. We are a society organized around simulation, and our being is transferred to role-playing in social games. (...) And narcotized by the ecstasy of media we do not suffer from nostalgia, so the end of the world that has taken place in the meantime, we couldn't give a damn about it. Even so, the end of the world was simulated, and somebody earned it well. "

5. Conclusion

The ethical aspects of techno-science, dromology and hyperreality become more and more actual and relevant in today's plural and axiologically unclear era. With the progress of techno-science and new means of communication and media, we appear in some so far not very familiar dimension of being human. Thanks to the progressive expansion of information means we can observe changes in the social-cultural paradigm. The starting point for us was the understanding of the progress of sciences in computerized societies according to Lyotard who pointed out the change of knowledge caused by the development of techno-science. According to Lyotard, knowledge becomes technology dependent. It is obvious that our thought, behavior, and acting is adapted more and more to the changing technical improvements. We agree with Lyotard that while the improvements will uncontrollably progress, this can have an impact on the change of image of the human. Lyotard expresses his concern about the separation of thinking from the body. We give ourselves to technologies, and thus we get rid of the unpredictability of the future which eliminates our thinking, decision making, evaluation and so on. While we were able to control technology, and we enjoyed doing so in the past, we can now observe that the technology is controlling us in the sense that we are even manipulated by it; so we have reached the (cyber)culture of the "inhuman" where the boundaries between "human" and "inhuman" are being erased.

A similar scenario is offered to us by Virilio´s concept of dromology. According to Virilio, our perception of time and space changes thanks to the speed that is caused by new technologies. Reality and truth are the falling victims of the overinformatized era. We are withdrawing from our being in the fast virtual worlds. We are deformed by the effects of the "information bomb" which has made us into "tele-narcomans," living in delirious states. In the virtuality or cyberspace, we are intoxicated by a hallucinogenic extra-mixed moloko with the taste of "amnesia." We become disorientated and manipulated under the influence of these "drugs". We have left our control over our being to the "Big Brother" who sees us all the time and everywhere. We are just a "pixel" on the screen. Virilio demonstrated hyperreality as an aesthetic of disappearing where the world and people are crushing to their synthetic skeletons. Our perception of reality is blunted by the speed that overpasses us, so we create an imaginary reality that is "painless."

Thanks to the rapid progress of technologies we abandon the world of imperfection where all ethical judgments will become irrelevant. The world full of images which comply with neither the original nor the copy is the world of hyperreality. We define the world and ourselves by simulacra. This is reflected in the physical, psychological and moral spheres. Reality has disappeared because we are not able to distinguish between the real and the imaginary anymore, between truth and fiction. This is characteristic of this era, which may also be labeled as informational, material, consumer or hedonic. Baudrillard uses the term porn culture to underline the current trends and values. He refers to the over-presenting of obscenity which he sees in inadequate pragmatism, consumerism, and calculation. Everything that is transferred to artificially produced signs and relations becomes relevant. The media and new communication technologies have the dominant position here. We are pulled back to the virtual tele-present where there is no need to think. These technologies have the ability to cancel the distance between reality and fiction. The consequences that can be observed are expressed at both the individual and social levels. We are weak and indifferent. As Koreny points out "(...) the ability to tolerate and excuse everything that reflects the spirit of the modern times actually feeds from the rich source of moral indifference, from the Nietzschean incompetence to moral "Yes" and moral "No"." [17, p. 20]. We got rid of the obligation towards responsibility. Despite all this, despite these frightening implications, we obviously do not blame technological progress as such. But we are convinced that it is extremely important to realize that "reality" and "truth" cannot be found somewhere in a numerical calculation or painless ethics of indifference.

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COMMUNICATIONS

Tibor Mahrik - Mark Neal*

C. S. LEWIS AND THE CHALLENGE OF ETHICS IN DIGITAL SOCIETY

This paper examines the idea that digital societies lack an ethical framework for understanding and mitigating the impact of digital technologies on human flourishing and the consequent diminishing of human agency. The authors examine how selected works of C.S. Lewis address man's moral responsibility while living in a developing society and call for a grounding in metaethical frameworks prior to any outcomes of applied ethics. Each of the authors contributes from his own field of expertise - Mahrik on nanoethics and Neal on digital media - while Lewis' writing corpus is the shared interest as well as the basis for their research. Writing and thinking from within a metaethical framework he terms the Tao, or natural law, Lewis offers an approach to the dehumanization of digital culture through his own approach to one of the oldest technologies: that of language. This offers the beginning of an infrastructure for thinking about and reacting to digital society in an ethical manner.

Keywords: *C. S. Lewis, language, nanoethics, metaethics, digital society, responsibility, human dignity, dehumanization, natural law*

1. Introduction

A main concern of this article is to understand what prevents us from creating ethical frameworks on which to build our digital culture and how we might begin to construct such frameworks in a way that values our humanity rather than dehumanizing us. We will examine how mass acceptance of digital technologies has occluded the purposes for which technologies exist and how these purposes are strongly anti-human. We then suggest how an ethical structure might begin to be built.

The term "digital technologies" is vague and imprecise and has ceased to have much meaning in the wider culture. Nearly every technology we engage with these days has some form of backend digitization, so we will confine our discussion to that portion of digital technologies that involve some kind of screen that we can interact with: a smartphone, computer, any type of tablet or television screen where we can access the Internet, apps or other media platforms. We will refer to them as *screen technologies* hereafter.

A number of thinkers have offered varying viewpoints on the diminishing of the human in the technological society; we will pull from Jacques Ellul, Marshall McLuhan, Sven Birkerts and others to offer insights where appropriate, but our primary concern will be with understanding C.S. Lewis's approach, through language, to an ethically responsible use of screen technologies.

2. Ethical challenges of technology

No one will argue about the ease with which screen technologies have deeply infiltrated our lives with barely a ripple of dissent or questioning. For those of us who are old enough to remember, the shift from analog to digital was welcomed as a breakthrough in convenience and efficiency. How quickly we adapted from our long-standing, long-form habits to this new ease. For screen technology to slide under the radar, as it were, and insinuate itself so steadfastly in our culture, there must be some bias that exists which prevents us from accurately thinking about it. Birkerts argues that the totality of technology in our lives has hampered us from having any point of purchase on the conversation and that because its operations are invisible, we believe them to be incapable of changing us or the world around us [1, p. 70].

On the other hand, McLuhan believed that every new technology is not simply a process of beneficial accretion, but that each reorders the culture as well as the sense ratios within the self without our realization [2, p. 31-32]. He believed that the content of any medium blinds us to the medium itself [2, p. 20]. McLuhan also reminds us that the extension of our beings by any new technology and the totality of the way it reorganizes life is too great for our sensory perceptions to accommodate, so as a defense we unconsciously become numb, what McLuhan terms narcosis, which leads to a loss of recognition of what has happened [2,

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p. 64]. Thus, we blindly acquiesce without knowledge of what we are doing.

Our susceptibility to propaganda is another reason why it is difficult for us to form ethical frameworks of any value in relation to screen technologies. Greenman, Schuchardt and Toly, writing on philosopher Jacque Elull's understanding of propaganda, describe its purpose as "integrating human beings into a dehumanized world, to adapt them to the technological society." It does this by "synthesizing contentment or distraction. . . by convincing people of the merits and virtues of their new milieu" [3, pp. 40-41]. Through intimate psychological and cultural knowledge and through deep data collection, propaganda seeks social and technological conformity through collective buy-in and action as a result of its message.

Van der Laan extends Ellul's explanation further by incorporating the twin manifestations of seduction and temptation into the propagandistic formula. The ultimate outcome is consumer capitalism. These two concepts are the grist through which the mill of propaganda continues to grind in our culture [4, p. 510]. What is of interest for us to note is that we are genuinely unaware of this process, especially as it occurs in the digital realm. Our screen technologies dictate our behaviors through advertising and marketing tactics, menu-driven interfaces, and a host of other silent and invisible methodologies. Think of what you see the next time you visit your Amazon account. Amazon seems to know all about your wants and desires and dangles them enticingly before you. But we don't see this as propaganda. We see it as convenience and ease. Because we remain unaware of propaganda at this level, we do not see the need for any framework of response.

McLuhan stated that only the artists in a culture are able to sidestep the main impact of any technological incursion and through their art provide models for facing the change rather than being steamrolled by it [2, pp. 95-96]. Birkerts, writing more than fifty years later, notes that "ours is a period strangely without show of artistic force" [1, p. 20]. We need a similar model, an art that will enable us to step outside of the narcosis inherent in screen technologies and propaganda and accurately assess and mitigate their impact. Otherwise we remain unaware of losses and the processes of dehumanization engendered by our media.

One of the primary losses we experience is that of agency. Birkerts points out that our human agency is "at every level overridden by scripted protocols," and gives an overreliance on GPS as an example of a loss of map-reading skill [1, p. 30]. As protocols take over and we cede the territory formerly occupied by a honed skill, we lose that much of what makes us human as well as strengthen our faith in technological solutionism [1, p. 36].

In attempting to understand what a loss of agency signifies, Birkerts muses on the existential differences between two hypothetical people sitting at a country bus stop. One has an unmediated experience of their environment. He stares across the fields; watches the tumbleweed drifting down the empty road. The other, say, has a smartphone. The former is existentially in a different position; he is himself, interacting with his surroundings, which are intrinsically themselves. The latter is engaged in a vast array of potentialities and connections via a highly mediated experience; he has ceded some of his agency to a device to perform functions he could otherwise do for himself [1, pp. 37-38]. In this scenario, loss of agency could be construed as a loss of incarnational reality, of a becoming visible in the world. Rather, it is blending in and becoming invisible. This invisibility is precisely why we need an ethical framework or art for our screen technologies that will re-humanize us.

A second loss is the devaluation of language. Both van der Laan and Greenman et al. note that language was of primary importance to Ellul; it is essentially what makes us human. Gladney notes that Ellul blamed what he called "the humiliation of the word" on the precedence of the image in the technical society as the preferred means of communication in culture, thereby emptying language of much of its nuance and meaning [5]. Van der Laan calls this emptying "plastic language," words that have been divested of their moral overtones and made to be interchangeable and to apply to any situation. This eliminates complexity and makes language more efficient, a key component of a technical society [4, pp. 350-351]. This shift of language from precision to generality was also corroborated by Lewis, who writes of *ramification* in language, the decay in meanings of a word that can lead to the loss of the original meaning. If this process continues, Lewis notes, the word eventually dies; it ceases to have any meaning [6, p. 9]. Similarly, van der Laan remarks of this trajectory that when a word means everything, it means nothing. Yet this is how language functions in a technologized society [7, p. 351]. If Ellul is correct, and language is the fount, as it were, of our humanity, then its devaluation would lead to a certain degree of dehumanization and a loss of human flourishing. As language loses complexity and nuance, it loses its ability to describe the human situation, which is nothing if not complex. Kondrla and Repar write about "the complexity of our responsibility" [8] when dealing with the need to understand moral dimension of our actions. When efficiency is the standard of the screen technology culture, language must also become efficient. When our language becomes efficient, it becomes debased and we are more prone to fall victim to propaganda.

3. C. S. Lewis: rhetoric, language and the *Tao*

C. S. Lewis appreciated how technology, propaganda and the devolution of language dehumanized man. His careful approach to language forms a basis on which to build a framework of response to the screen technologies that enmesh us in propaganda and attenuate our agency. To effectively appreciate Lewis's approach and add shading to our art, we will frame our discussion by briefly examining how rhetoric should rightly function and how it can be manipulated for propagandistic purposes.

Root and Neal have described the rhetorical consequences of debased language in their examination of Richard Weaver's *The Ethics of Rhetoric*. Firstly, rhetoric aspires to the highest good or ultimate term. Rhetorical terms can be likened to links in a chain connected to the master link (or ultimate term), or "the good," which subsequently transfers its influences down the chain. Weaver labels these ultimate terms "god terms" [9, p. 124].

For example, *justice* or *progress* might be god terms, the highest good toward which a rhetorician is trying to influence an audience or the highest terms valued by a society. Today, *technology* is one of our god terms. Negative connotations are not necessarily attached to god terms; however, they may tend to be viewed blindly and may lead to groupthink. Groupthink produces an illusion of invulnerability and a loss of independent thinking. Consider how digital technologies and technological solutionism are seen as a sort of savior in our time. There are few dissenting voices questioning whether we need more devices or apps or solutions. Our narcosis ensures that we blindly accept these changes [9, p. 124].

Weaver also identifies another type of ultimate term, "charismatic terms." These terms possess no derivation or referents; they have broken free of their place in the rhetorical chain. Weaver suggests they are the result of a "spontaneous general will" [9, pp. 124-125]. Examples of this are *freedom* or *democracy*. Charismatic terms can, of course, have their authority forced upon them. This is the intentional forcing of terms lower in a rhetorical chain into ultimate positions. This is certainly the case when the mill of propaganda is in full operation.

Political discourse is riddled with these terms. Weaver suggests that truncated terms like FBI, FDIC, NPA, or NEP represent governmental efforts to force charismatic authority on them. Once words become abstractions by being truncated, they lose any correlation to rational rhetoric because they divorce the word from meaning and import. During the second World War, terms such as *defense* and *war effort* became charismatic terms in the United States. Such terms often become ultimate in times of crisis, but they still serve to manipulate and control the way they reflect about any given situation. Importantly, charismatic terms function in such a way that all of life can be defined in relation to them. Here we see an echo of van der Laan: plastic language is language that can be applied to anything and everything and thus means nothing. Charismatic terms are forced into ultimate positions intentionally in order manipulate. Any group determined to have control, Weaver states, will want to appropriate the sources of charismatic authority [9, p. 125]. History offers many examples: The Third Reich, totalitarian regimes, the list goes on.

Having thus framed our discussion, we now turn to C.S. Lewis's work *Abolition of Man*. Here Lewis attempts to explain the natural outworking on human beings of language that has been stripped of all value judgements by divorcing facts from feelings. It examines how the dissemination of essentially base rhetoric through something as simple as school textbooks can lead to a loss of value in language which in turn can lead to the loss of a framework for appropriately living in the world. Lacking a framework for our lives in general and not possessing what Lewis calls 'ordinate responses' to the world around us, we won't know how to appropriately respond to our screen technologies. This leaves us open and vulnerable to propaganda, to being controlled and manipulated without our knowledge by those Lewis calls the "conditioners" and without any ability to know either how to respond or that we should even have a response.

Lewis begins by examining a school textbook of the day written by two schoolmasters. By reading between the lines, he discovers two critical issues in this book: that any value statement about a particular issue is simply a statement about a person's feelings and that all such statements are unimportant. The authors do not disabuse their readers of this notion and so pave the way for the readers to perform this extension to all statements of value. Lewis [10, pp. 4-5] calls this activity 'debunking,' or the removal of whatever is between us and the true reality of anything. The natural trajectory for this starvation of sensibilities is to make the individual a far easier prey for the propagandist.

The schoolmasters have used a form of base rhetoric to create this scenario. They have not moved their pupils toward the highest good in the rhetorical chain. Indeed, they could not admit that there was a highest good, because this in itself is a value statement. Thus, the schoolmasters have implicitly taught the pupils that there is no ultimate standard of objective value.

Lewis points out however [10, pp. 14-16], that until recent times, men believed that the universe elicited responses from us that could be either appropriate or inappropriate. Thinkers from Augustine to Aristotle have believed that the goal of education is to train pupils in appropriate responses to the world around them. Thus, if the pupil develops just sentiments, his responses to the world around him will be appropriate.

Now Lewis [10, pp. 18-25] begins to develop his metaethical framework. Borrowing from the *Tao* of the Chinese to encompass this conception in all its religious and philosophical forms, he sets forth a doctrine of objective value, what he elsewhere calls natural law or the law of human nature. Continuing his argument, something that is either reasonable or unreasonable, appropriate or inappropriate, must be so because there is a standard that exists independently of it. This standard that points to something beyond the thing in question is what Lewis's schoolmasters avoid. To be in opposition to this standard is to regard all sentiments as non-rational. Thus, sentiments are either to be removed, or to be manipulated in others for reasons known only to the manipulators. Education along these lines becomes conditioning, or propaganda. Thus, trained emotions are a vital part of Lewis's framework because they mediate between mere appetite and intellect, neither of which is sufficient on its own. It was all there in the beginning, in Plato. Like the metaphor of the rightly ordered city where the guardians rule the producers or craftsmen through the auxiliaries, intellect rules the appetites

through the sentiment in the rightly ordered man. Once man has been stripped of his sentiment, Lewis writes [10, p. 27] that our society then clamors for the sorts of qualities and actions that an education along these lines has made impossible. He writes that "we remove the organ and demand the function."

Lewis proceeds to show how those who operate outside of the *Tao* will never be able to find a new system of values after they have debunked everything else. For him, the *Tao* is the source of all value judgements. Thus, ideologies and propaganda are concepts that have been taken from the *Tao* and swollen out of proportion; this is also an example of Weaver's charismatic authority, where rhetorical terms have been forced out of their original positions into ultimate terms for use of control and propaganda. Valco points to the prevalent tendency in most developed Western economies, where human individuality and personhood seem to be "lulled by the omnipresent slogans of freedom, especially in its economic and moral senses" that lead people away from spiritual integrity and mature moral responsibilities [11].

Finally, Lewis [10, pp. 56-57] shows the outworking of this lack of framework in society in general and to applied science in particular, or what he calls "man's conquest over nature." As he explores this theme, he explains that man's conquest over nature is really the power of some men over other men. In the quest to make man ever more efficient, Lewis writes "if any one age really attains, by eugenics and scientific education, the power to make its descendants what it pleases, all men who live after it are the patients of that power. They are weaker, not stronger: for though we may have put wonderful machines in their hands we have pre-ordained how they are to use them." This is the point at which we want to arrive. If, as Lewis suggests, our society has adapted a stance outside of the *Tao* and apart from any objective value, then that society lacks a framework with which to appropriately use its technologies. Not only does it lack a framework, but because it has been educated and conditioned to remove value judgements from language, it no longer has the capacity to recognize the need for a framework or to possess a language to create such a framework.

Without this capacity, we fall prey to McLuhan's narcosis and Ellul's cycle of propaganda. We are further incapacitated by the paucity of our language as it becomes increasingly efficient and mirrors the "advances" of a technological society. We have been lulled into an enchanted sleep and we function at the beckon of our enchanter. Ellul developed his ethics of technology to call the sleeper to awake and to spur people to an awareness of the dehumanizing effects of technology [3, p. 124]. In his passionate critique of modern technological tyranny Ellul also composed a list of "76 Reasonable Questions to Ask about Any Technology", where he addressed ecological, social, practical, moral, ethical, vocational, political, aesthetic and metaphysical considerations [12]. Lewis also notes that we "have need of the strongest spell that can be found to wake us from the evil enchantment of worldliness which has been laid upon us for nearly a hundred years" [13, p. 29]. Both call for a metaethical structure for appropriately responding to the world.

Though our culture continues to embrace a language which is not only debased, but lacks objective value and meaning, Lewis calls us to step back, to implement the historical imagination and remember the world as it was for thousands of years, governed by the moral framework of the *Tao*. Unless we possess a system of objective value, we cannot properly understand how to respond to our technologies; our responses to them will not be ordinate based on the thing they are, but merely conformist based on the thing society has shown them to be. By eliminating value judgements and attempting to delve deeper to the "real" that we believe underlies them, we find that even there we cannot eliminate the *Tao*. Only by completely denying our humanity can we step outside of this framework and so become inhuman.

To realign the self with the way of the *Tao* is the first step toward creating an ethical framework; this will take a forceful act of our will and a rejection of the notion that value judgements are to be shunned. Lewis offers us a path, rooted in the *Tao*, through a right understanding of and relationship with language.

4. Assembling the framework: humans and the impact of language

Language is itself a technology, so an appropriate response to it can mirror an appropriate response to our screen technologies. The comparison is appropriate because both are systems of communication and both contain and utilize language.

During his life, Lewis saw imaginative decay around him: a loss of care about the past, about language and about understanding literature. He had a keen sense of responsibility to language. This is why much of his literary criticism was written; to help people recapture the imaginative wonder of the worlds he inhabited when reading certain books and authors.

We would like to briefly examine two components of Lewis's understanding of the technology of language that will function as strategies which can enable a more appropriate engagement with screen technologies. To begin, we will need to make a distinction between kinds of readers, as defined by Lewis [14, pp. 2-9]. He writes that there are three kinds of readers who misunderstand an old text when they read it. The first misunderstand it brilliantly, jumping in wholeheartedly, making their best guesses and applying their best knowledge to it. The second class simply does not care. They bring their current worldview to an old text without any thought that they won't actually be reading the book as it was originally written. The third is the wise reader; he cares to discover the original meanings of words so that he can read the text as it was written.

Similarly, there are three classes of users of screen technologies. The first embrace it as a way of life, to create ease and additional opportunities. The second, the dullard, is ambivalent. The tools

available are simply a means to an end. The third is the questioner, the one who seeks to understand the implications of technologies and how to live in right relation through them. It is to the third user of screen technology that we primarily write.

Armed with these distinctions, we can now provide our questioner with two strategies for approaching screen technologies. First is a historical understanding. We mentioned the use of the historical imagination earlier; Lewis [15, p. 202] writes of the blindness of the twentieth (we can extend this into the twenty-first) century and how the only palliative is to keep the clean sea breeze of the centuries blowing through our minds. A historical approach asks about the original intended use of a word or concept to grasp the original text more fully. The reader attempts to understand the history of thought and sentiment that underlies the words that he might get a fuller picture of the time in which it is written. He attempts to shed his modern conceptions and don historical ones. Lewis notes that intelligence is not enough in this case; we need knowledge [14, pp. 2-4].

Similarly, the questioner of screen technologies will begin by understanding the history of media, the original and intended use of any given tool and the trajectory of that tool's incursion into society. In so doing, he will more readily assess with accuracy the current situation and begin to ask the right questions. Media theorist Neil Postman believed that students should be taught the history of technology in order to "understand the relationship between our technics and our social and psychic worlds, so that they may begin informed conversations about where technology is taking us and how" [16, p. 198].

The second strategy is a felt responsibility and action toward language. Lewis [14, pp. 7-8] describes the conditions that lead "to verbicide", or the murder of a word, as an example of why we should care to shoulder this responsibility. Firstly, inflation: words like *awesome* for "great" *awfully* for "very," and so on. Secondly is what Lewis calls verbiage. This is a use of words that promise something without delivering on the promise. Lewis gives the example of "significant" as a word that doesn't deliver on its promise as we are rarely told what a thing is significant of, only that it *is* significant. The third is appropriating language for its selling quality or for political or other purposes. This is base rhetoric and propaganda. The fourth and final cause is the tendency of language to become more and more evaluative and less and less descriptive. Everyone is eager to express their approval or disapproval of something; few will agree to simply describe it. Thus, reaction is preferred over reflection and language suffers decay. We find this tendency to be especially prevalent on social networking sites.

The questioner of screen technologies can take these four causes of verbicide and translate them into four ways to appropriately respond. Each shows a way in which language is eroded and loses power. Similarly, we can apply this to the ways in which our screen technologies erode us as human beings. Most obviously, they erode our language, as pointed out earlier, through the technological society's insatiable desire for efficiency. As Ellul and others have suggested, our language is what fundamentally makes us human. Therefore, a literal attention to language in the way Lewis suggests is a cut against the tide pull of the technologized society. We must resolve ourselves to not committing verbicide in our written or spoken language. In fact, the language component is so important that Ellul went so far as to say that discourse and conversation in relationship is our main strategy against the juggernaut of technology and we most effectively are opposed to its values when we engage in this way.

Both Lewis and Ellul agree that we will never stop the advances of technology, but that we can make a difference in our own spheres, however small or large they may be. Our visible-ness or incarnation, our humanity, in the world is made most apparent when we speak and engage with language in genuine relationship [3, p. 46]. Situated squarely within the *Tao*, we can understand how these strategies outlined by Lewis help to place us in proper relation to our screen technologies; to understand both the things they are and the things we are. In this work, we begin to wake up from our enchantment. In addition, we need to implement here that "modern science has rejected the Cartesian way of thinking with its mechanistic dualism" [17, p. 91] which makes the issue more complex.

5. Nanoethics as an interdisciplinary challenge

Nanotechnology is a new and fast developing technology which somehow penetrates and influences all areas of society and underlines the fact that science and society influence each other considering both its scientific and social needs. Nanoethics discusses the ethical issues associated with nanoscience and nanotechnology, such as the fairness of how the technology is distributed nationally and globally, the possibilities of changing human life, ability, personality, psychology, sociology etc., and fundamentally changing what a human being is [18, pp. 185-187]. We prefer the term *nanoethics* in this paper to another common phrase "ethics of nanotechnology" which some render as a less biased alternative. The argument behind this is the fact, that nanotechnology has an impact on society in a wider sense as legal and regulatory issues, research funding and priorities, equity, environment, health and safety, privacy and medicine. The ethical challenges in these different areas are identified, and the novelty of these challenges are analyzed currently.

According to Herzfeld [19, p. 18] when we are to deal with any new technology in order to embrace the maximum benefit and to minimize the risk it is useful to bring our ethical and technological considerations under the scrutiny of these three questions: Firstly, does technology provide tangible benefits to the community or individuals within that community? Secondly, does technology change the relationship of the individual to the community and if so, what kind of effects in moral terms might it bring? Thirdly,

does technology change the nature of the community itself - again in terms of such virtues as solidarity, face to face communication, cultural identity etc.? In tune with C. S. Lewis also Winograd and Flores [20] underline the importance of language and relationship though discussing about AI phenomenon. Discourse is not simply just the passing of information, rather it is essentially a social activity. Thence to be human means to enter into commitments "through speaking and listening" otherwise "...we are acting in a less than fully human way, and we are not fully using language" and thence intelligence has meaning only in a true encounter. From another perspective, also Pavlikova tackles "the conflict between the individual and the state and the individual's moral responsibility" [21] within a social sensitivity framework that shows a direct connection to the language usage. We have to be aware that the power of modern technologies is not a singular power of an individual but rather a collective power of society [22].

Nanoethics also works with models and futurist concepts that are relevant to the promises emerging out of nanoscience and scientific projects that are funded by big corporations. According to Cameron, nature and our self-perception as human beings are expected to change, given the potential of nanotechnology, biotechnology, and cognitive science to bring about basic shifts in human nature along with the possibility, that "wholly new ethical principles will govern in areas of radical technological advance, such as the role of robots in human society etc" [23, p. 185]. Arguments for addressing such potential ethical issues are based on the fact, that nanotechnology is evolving with tremendous speed and it is unavoidable to foresee a huge impact on society that we are to experience in near future. The problem, however, is getting more complicated, as Keiper points to the uncertainty of the kind of nanotechnology's future impact we should anticipate. He argues [24] that we must even now begin to think through many different scenarios, which consequently bring the multidimensional complexity phenomenon on the table where an interdisciplinary approach and cross-cultural methodology is the only way to search for contingent answers. Since new technologies have always changed the world in some way or other and usually bring about unforeseen ethical dilemmas (the printing press, the internet, virtual reality), we need, therefore, to be over-prepared rather than under-prepared, even if that means elaborating hypothetical options and unlikely scenarios.

This will include collaboration across traditional disciplines and the recognition of the value of knowledge in areas other than our own. Interdisciplinary cooperation can enhance the process of better interpretation in terms of hermeneutics that could even open a new creative potential for science [25]. There are a variety of efforts to bring humanists and social scientists into close contact with natural scientists with the goal of developing constructive dialogues about the scientific work they being performed, in the field of nanotechnology especially at the major Centers for Nanotechnology in Society (CNS) and the University of California at Santa Barbara (UCSB) [23, p. 157]. Meekness, humility, transparency, sincerity and true interest in searching for objective truth are those values that stand as a basis for such endeavor. One of the options could be the further training of scientists in ethics as well as the training of ethicists in the field of nanoscience and technology equally. Such an example of an interdisciplinary program in ethics within EU context has been developed for biologists at the University of Lausanne in Switzerland, where throughout their education from BSc to PhD those biologists have one compulsory course in ethics each year [26]. Maybe interfaculty seminars could be a possible option in a Slovak context. That might enhance communication across the disciplinary boundaries and might trigger in the members of such group some form of collaborative projects in future.

6. Conclusion

From the speed of technological progress and its dissemination into all areas of society, it seems clear that to maintain a healthy response to these technologies and become the masters rather than the servants of our tools, an ethical response is called for. Whether it is an approach like Lewis's or a cross-cultural and multi-disciplinary collaboration, the important point is that conversation and dialogue around this topic is the crucial first step: a willingness to see the technological situation unequivocally; the good and bad taken together and examined through a multitude of lenses. It is language-and by extension-conversation that makes us truly human, so beginning here seems a fitting way to understand and promote human flourishing in the technological society.

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INTERPERSONAL RELATIONS IN ETHICS OF SCIENCE AND TECHNOLOGIES

Science and technologies are defined in their foundations as tools for understanding the world. They are tools for simplifying and facilitating the life of man and society. Science and technologies are oriented towards production. The absence of humanistic aspect is leading to science not reflecting human as a person but as an object. The result of this is depersonalization. Thanks to this, manipulation is present in interpersonal relationships. Another thing that adds to this fact are new technologies which make manipulation and control easier. Concrete ethical solution to the problem of depersonalization are personalist ethics which represent the return to the human being and the respect of its dignity. Ethics of science and technologies must come from respect towards the dignity of a person. This has to reflect in the education of users of modern communication technologies. Then the ethics of science and technologies will have an actual impact on the quality of interpersonal relationships.

Keywords: *power, science, technology, persons, relations*

1. Introduction

The basic concept of our article is technology as a tool for controlling the human being. In such an environment, the possibility of interpersonal communication is lost. We will deal with the relationship between power and science, between power and reason, but also between power and modern technologies. And we will be watching the impact on interpersonal relations. As a starting point for our research, we chose a brief analysis of the relationship between the humanities and natural or rather technical sciences. In Slovak society, this relationship is in the spotlight not only of academics but also of politicians and economists. The reason for this interest is prosaic. Since the pre-1989 regime, the concept of "working intelligentsia" has been rooted in our society, which clearly defined what was expected from the intellectuals and, of course, what they were expected to do. The role of the intelligentsia was to cooperate for the common good. Unfortunately, the common good was perceived through the work in the steel industry or some other sector of the industry. Today it is perceived through turnover, profit, state budget, or the position in the ranking of international rating agencies. Sciences, regardless of its type, should be subjected to control. These agencies have defined productivity limits that determine which sciences are supported and which are liquidated.

Today, the humanities are criticized for the high numbers of students who end up without a job, for the low quality of scientific production which has a minimal global response and for overall social inefficiency. This criticism is rarely justified. However, the question remains open whether the public, negatively inclined to the humanities, reflects their importance and role in society. Therefore, a derogatory term appears referring to humanities as pseudo-sciences which do not have a real object of research and do not have a scientific method, so their results are unreliable. We will leave open the question whether they confer any social benefits or not for now, and we begin with the explanation and understanding of basic terms and content framework within which we move.

Without an emphasis on the humanistic orientation of education that would be integrated into all sciences, including the technical science, we will lose contact with the individual. Man will become an object, not only an object of research but also means of generating profits. Man will become a tool to meet the needs of another person. Mass communication controls the thinking of man and the need for it.

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2. Science and reason

Science has become a symbol of modern society. After the end of the Middle Ages, a new instrument has come, aiming to conquer nature, as Francis Bacon tries to persuade us [1, p. 51]. Science ceased to listen to the authority of old sages and philosophers and relied on its own experiments to conquer nature and gain knowledge. Through knowledge, man gained power over nature, controlled it, and adapted the environment to his needs. Not that he did not behave this way before the arrival of the Modern Age, the decisive factor is the moment of power and government. Thanks to Bacon's redefinition of science's role, power becomes important, we can even say crucial when it comes to determining the role of science. To be fair, however, the way Bacon defined science is not problematic. Science is rather represented by mysterious alchemists who try to produce gold in a laboratory or discover similar miraculous technologies. But it is also represented by personalities such as Galilei, Bruno or Copernicus. During their time, scientists followed a precise code of ethics that had been controlled by the Inquisition and later by the teaching authority of the Church. Today, international organizations such as UNESCO are setting up international programs to influence the legislation, build up capacity, create an intellectual forum, raise awareness of education [2, p. 25]. If a legislative area is included, it means that a generally accepted document should be created which will define the use of specific technologies that have an ethical dimension (today this is probably included in all of them).

The subject of our article is also technology that is closely connected with the science. The concept of technology is used in the sense of a procedure, that is, a procedure of processing matter or goods in the production process. The result of using technology is a product. As long as we talk about technology, we mean a larger whole that includes not only the production process but also the means of production, resources, and the acquisition or distribution of the final products. The most appropriate combination that comes as a result of a happy compromise is the ethics of science and technology. This name is also used by UNESCO within the implementation of its international program. Science and technology represent an experimental and research base as well as applicator or technological base. The results of scientific research are applied in the practical process of production. We have here not only an aspect of cognition, thus, the aspect of experimentation and search for something new, but also an aspect of processing, creating things and lastly meddling in human life.

On the other hand, technology also acts as a tool for controlling a person. Modern technologies devour a person rendering him unfree.

3. Reason as a ruler

As already mentioned, the emerging science was in its early stages influenced by strong "ethical" regulations. However, the Enlightenment combined science with another attribute, that of human reason. Science has thus since been associated with reason, and only that which is scientific is reasonable [3, p. 27-28]. The role of science is not only to control nature, but it is also a means of making man use reason.

It is not science that should control the human, but it is the human himself – the human individual who uses rationality as a pretext to control unreasonable persons. On the one hand, reason fights against superstition, magic, and blind faith in the name of freedom; but on the other hand, it takes away man's freedom to fit everything into a single existing and working rational system [4, p. 19]. And here comes the fundamental question that we ask in our article. From the point of view of ethics, we hold the opinion that science is value neutral. We assume that using technology and new discoveries does not harm anyone. Only a man can harm another man when using the conveniences of science. It is a simple model of personalist ethics. Responsibility can only be found where there is freedom. If a man uses science and technology that is freely given to him, then he assumes responsibility for the consequences of his actions. The everyday use of modern technologies also impacts interpersonal relationships. At the global level, it can be positively evaluated as it allows for the creation of modern groups and communities able to cooperate on the common good. At the level of an individual, it also allows the individual to self-express through one's participation in such community. One of the realms included in the common good are interpersonal relationships. In order to create and cultivate interpersonal relationships, the use of communication and information technologies creates such opportunities that were not possible before. From a humanitarian point of view, however, it also gives rise to some problems. In what follows, we will focus on some of these problems from ethical and personalist point of view. Personalist-existentialist ethics underlines the fact that everyday use of technology is changing the perception of others in a way that an individual sees the other as something technical and technological. This enters into a relationship and contributes to its depersonalization. What are the most profound consequences of that phenomenon in our basic attitude toward the other? And, from a practical and ethical standpoint, what does it mean for our responsibility as users of current technologies?

Science and technology control not only nature but also humans. Man accepts science and technology products, but he himself becomes an object of science and technology. Not only as an object of investigation, or in medicine, but also as an object of manipulation, e.g. in marketing communication. Marketing communication penetrates into all communication channels, both private and public. This communication is not about people's

dialogue, but about the production of artificial needs or, as Deleuze says, the desire for consumption. In communication technologies, the monologist is more like a dialogue. In a monologist stream, man is introduced to what he needs, which is important to him. Then the human individual tends to expect that in the mass society, we will all have the same needs.

Here we build on previous thoughts about rationality. Rationality is associated with usefulness. In the sense of such rationality, which seeks the simplest solutions, a person can become an object or instrument, a tool to saturate my needs. Man can also be a profit-making tool so that he can be the subject of exploitation. That is also reasonable.

Here is the place of the interpenetration of ethics, science, and technology, i.e., when we start to speak about a human person and her dignity. It is an ethical category that should be respected in science and technology, too. However, we often witness depersonalization. Ethics clearly states that a person cannot be just an instrument because, as a person, he is to be respected. Man is not an individualized existence, nor is it an insignificant part of the mass. Man is a person who exists in interpersonal relationships. The basis of these relationships is communication. Communication reveals categories of existence. It is not a space governed by the rules of rationality, but it is a space of existential communication.

4. Technology, engineering, me and the other

The existentialist - personalist philosopher G. Marcel explicitly formulates the aforementioned idea about the problem of depersonalization. He avoids the rigorous distinction between technology and engineering. According to him, both are inseparably related to the fact that different physical objects, systems, and processes serve us as tools, and we are using them physically or mentally to achieve the desired goal [5, p. 82], [6, p. 59-60]. We can see that we did not shift away from the concept of power, because it is a kind of power that we have over the manipulated technology. Looking at the problem as Marcel does, the fact that the other is not technology, physical object or tool that I could manipulate with the same way as technology, is not necessarily a guarantee that my relationship with him will not succumb to some of the consequences of my habitus to control. "If a person can become a slave to his habits, it is equally possible to become a prisoner of his techniques," says Marcel [5, p. 83]. It is necessary to look at "a particular relationship that tends to grow between technical processes on the one hand and human beings on the other" [5, p. 83]. However, dealing with depersonalized relationships does not mean to be satisfied with a discussion of commonly discussed phenomena (for example, the dependence between the excessive using of information technologies and decreasing amount of direct physical contact with others), but to look at the consequences in a broader context. At the same time, we should keep in mind that the use of technology is not the sole factor depersonalizing a human relationship since the depersonalization of this relationship has surely existed from the ancient times and gained various appearances independently of technological advances. Nevertheless, we feel that today it has become a factor contributing to depersonalization in an especially intensive way. We would like to show the reasons behind this stand-point by reflecting on the following analogies between technological usage and relationship with the other:

First is an analogy that we see is the analogy within, that is to say, within an organization or management of the relationship with the other. In a low-tech society, human lives, together with their pace and expectations, reflected the conformity with what we might call a rhythm capture. In the shadow of natural rhythm, human thinking has been shaped in a way that the relationship with another person was also perceived rather as an organic reality that needs time to mature. Immersed in today's artificial and technological environment, according to the cited author, the pace of our lives today is dominated more by constructivism than by natural rhythm. Natural and inner rhythms of organic realities are considered irrelevant, or we do not take them into account at all [6, p. 62-63]. We do not intend to propose the idea that human beings should organize their relationships more in the lap of mother nature. But we assume that the cited text indicates a certain type of principle, law or pattern existing in building interpersonal relationships. That is - analogously to laws governing the use of technology - that the relationship with the other also becomes the subject to constructiveness. On the other hand, we are not trying to say that human relationships do not need any organization. Contemporary technologization certainly has an unfavorable impact on the quality of the relationships, at least on the level of positive impact when it comes to efficiently organizing bigger human groups and communities, as we have already indicated above.

5. Using technology, using the other

Next, we wish to reflect on the analogy which we consider ethically more alarming. Reading Marcel, we are led to hold the opinion that a less artificial organization of everyday life alone would do very little to heal *my* depersonalized relationship with *others* as long as I remain looking at the other as I look at technology that I'm going to interact with. That is, when my mind is adopting a mode of thinking that is usually active when using technology. In its very nature this mode involves controlling, monitoring, repeating and perceiving technology as a problem; this is the goal which is a useful output for the one who manipulates the technology. In a sense, we are talking here about the principle of power and profit generation. For the user of technology, the technical process here is not an end in itself; it exists because of independent goals. From a certain point of view,

that is for the human individual as a naturally practical being, this is a perfectly correct attitude. However, the situation changes radically when the technical perception begins to incorporate the kind of primacy in the *general* mode of our thinking [5, p. 71]. That is, for example, in the mode of our thinking towards others. Here again, we need to avoid considering this mode of technical thinking as the exclusive culprit of our conquering approach to the other. According to Marcel, we must take into account that at the current level of social organization, the person from his young age enters into a system of rivalry, a system of tests and competitions, a system of "Me and not you; Me in front of you" which "in fact, encourages man to compare himself to the other, to give himself a certain label, an assessment standard" [7, p. 73-74]. The degree of usefulness and unusefulness resulting for the individual's using contemporary technology can be assessed without major difficulties. But what happens when we look closer at the potential usefulness of "using" the other for the individual? And still, we ask this question with regard to the fact that the ultimate object of our interest is to formulate what response it conveys in relation to the responsibility that the everyday technology user should cultivate.

Within the personalist-existentialist ethics, *I* can never be truly reduced to a content that can be precisely defined by the terms "my body, my hands, my brain." It is always a global presence" [7, p. 38]. I or He or She is always a "global and unspecified presence" [7, p. 70]. The existentialists reserve the concepts of presence and existence exclusively for a human being. Human beings are existing freedoms; everything else is only present, it just occurs. So then, according to the Marcelian logic, if I am an existing freedom, then I should also believe in a unique, i.e. not controllable existence of the other when I meet him. And this belief means that I realize or confirm his existence such as it truly is, and not only within the consequences that concern me [7, p. 78]. Marcel considers it also natural that we look at the other as "an obstacle that must be eliminated or circumvented, or as an amplifying echo that is supposed to support my natural self-complacency" [7, p. 75]. From an empirical point of view, we must state that these aspects of interpersonal relationships were also present in a society of slower technological development. In addition and with regard to historical experience, we could even consider them being efficient driving forces for the development of humans and the human society. However, it is possible to say, that in a less technologized society, to a larger extent than today, these aspects were existing next to a stronger principle of prosocial behavior and altruism. Interpersonal relationships have thus been represented in a symbiosis of two kinds of "inner settings" streaming out of myself toward the other: the other as a problem and the other as an inexpressible presence. By reflecting on the analogy between the individual´s inner settings used in everyday manipulation with technologies and "inner settings" operating in the relation of one human being toward the other, we are trying to express the following concern: the other becomes more and more a problem with which a contemporary human person meets in his or her everyday contact with other human beings.

Seeing technology only as a problem, our interaction with it works accurately. The technology that we use is seen as a problem and we do not expect anything from the very interaction with it. We could say that we are interested solely in achieving the goal, which technology should help us to achieve. Such an approach has practically no impact on technology alone; in the process of manipulation, technology remains technology (unless we count as impact technological improvement possibly emerging from this manipulation). However, if this approach becomes the general habit of my thinking and influences also my perception of the other, the situation changes. According to Marcel, while technology in such manipulation remains technology, the other is in danger of me transforming him into an idea that I make up, and this idea can substitute the other, replace him in such way that I will address my actions and words to this constructed idea of him [7, p. 73]. The other is no more a problem or a mystery to me, but only one of the problems that I am daily facing with my abstract theoretical thinking. [8, p. 213], [9, p. 117], [10, p. 50].

Personalist ethics emphasizes that the other cannot be reduced to a problem. This is because if I consider myself to be an unspecified presence, then He or She needs to be perceived as an unspecified presence as well. But the concern that we can find in personalist ethics is much more profound. It seems that the possibility of me perceiving the other as a problem indicates a question of me perceiving myself as a problem as well. Using the words of Marcel, when I meet the other as a problem, I meet him (or her) as a case, an animated object, a set of different aspects, elements and information about him, which I could write down in a form (name, gender, occupation, age, etc.), but at the same time I reduce *myself* to this pen that records those elements [11, p. 9]. It seems obvious that our relationship with the other is deeply situated in the concept of dialogue. We can say that what we see in the latter example, is a kind of strange, broken metaphysical dialogue which makes me lose connection with my very true self; a kind of power which makes this dialogue broken; a power, which in my own attempt to take the other to pieces, comes back to me in its own destructive way.

6. Conclusion or on the problem of responsibility

When we are talking about the current user of technology and the problem of responsibility, many possible directions of concern open before us. Responsibility for the environment, responsibility for future generations, responsibility for the even organization of an economic product and so on. We could say that the theoretical problem of responsibility is needless without a practical aspect. Being responsible always means to be responsible for something or someone. Nevertheless, at the same time, responsibility is also a metaphysical problem. In personalist ethics, the problem of

responsibility oscillates around categories such as socialization, ethical socialism, communication, friendship, admiration and so on, and all of these usually share certain common ground based on the philosophy of dialogue. But rather than dialogue in a common sense of the word, it is a metaphysical dialogue. It is a dialogue which consists in the permanent openness of me toward the other, a dialogue synonymical with some kind of interpersonal relationship between Me and You. From the personalists' perspective, this kind of dialogue always remains metaphysical, which means that responsibility, understood by them as rooted in that relationship, also needs to be understood as a metaphysical problem. From such point of view, it seems to be questionable whether searching for practical responsibility without some metaphysical framework is not risky. The difference between two ethicists of responsibility, Jonas and the personalist Levinas, lies in the fact that, although both agree that responsibility is based on responsibility for the idea of man, Jonas is promoting an ontological idea of existence that says "existence is supposed to be," and at the same time "how it should be "; but not that "the essence of existence is supposed to be" [12, p. 78]. In other words, our sense of responsibility should be driven by the fear that human existence would no longer exist. According to Levinas, this idea of responsibility is unthinkable without a metaphysical basis which is interpersonal. Right from the very moment the other looks at me, I am responsible for him, and I do not even have to take over the responsibility for him; this responsibility will fall to me. The proximity of the other does not mean that the other is close to me in space or as a relative, but that he is close to me from the most fundamental standpoint - I *am* responsible for him [13, p. 182]. It is not about a rationalized but rather experiencing responsibility.

To conclude, taking all previous reasoning and standpoints, into account we will now take responsibility as a metaphysical problem and an interpersonal relationship as was reflected above. We will try to deduce and formulate challenges which they seem to be indicating for us as everyday users of technologies.

Firstly, it seems to us that calling for responsibility in any area affected by the use of technology needs more than just something rational; it needs a sensitive cultivation of the basic relationship of Me and You. When considering how to build our awareness of shared responsibility – and to express our thought clearly enough, let us talk here about a concrete example, such as the responsibility for the environment. It cannot be only about the worry resulting from a rational knowledge of future consequences of our actions (which we today often get in various numbers and statistics), but it should be about the experienced reality leading us to reflect that the responsibility for the environment is in its deep roots the responsibility for the other as my own You. A true relationship toward the other, in a sense, is something that I can build because it is already given to me. We use technology mostly because it makes our daily life easier. But if our responsibility as technology users consists in its roots in our care for the other, then it cannot be something that we can acquire only rationally (that is by facts, statistics, and fear of known future consequences), but rather something I recognize within myself. Calling for rationality and a scientific prognosis of the future are indispensable, but it is possible that they cannot do without sensible cultivation of the basic relationship between Me and You. This is so when we consider the problem of responsibility being in its roots always a responsibility for the other, and when we accept the relationship with the other being in danger of perceiving him or her only as a problem or some tool to achieve one's goals.

Secondly, when reflecting on personalist ethics we propose that a successful call for responsibility is connected with the call for a healthy relationship toward the other. We realize that the cultivation of such relationship is a complex task requiring the use of rationality as well as engaging the inner emotional aspect. This leads us to think about the idea that a successful call to responsibility for the contemporary technology user also needs to be a cross-cutting, complex and systematic call. In other words - letting ourselves express our thought with the help of a concrete example - it is not enough when the responsibility for (e.g.) our environment is highlighted during the lessons of ecology and biology, or the economic responsibility during civil education, and the responsibility for the other during the lesson of ethics or religious education and so on. It seems to us that the appeal needs to be a complex action which systematically penetrates all these areas. We would like these formulated challenges to be understood as challenges that need to become the subject of cooperation between family, school, and society; challenges that need to be understood in some manner also at the level of research and potential reforms. For example, in the mentioned case of the school environment, it would probably be useful to adjust the education system in order to cross the boundaries between technical, informational, hard sciences or arts subjects more effectively. Then there would be room for cultivating responsibility building on the facts about future consequences and, at the same time, on contemplating the responsibility through a relationship with the other. Here in our Slovak society it may be noted that the recently published document, which should represent the foundation for the future reform of our school system, outlines that the introduction of such cross-sectional subjects, considering their existence in the international space, is beneficial [14, p. 10-11] but when it comes to turning them into reality, the creator of the concrete proposals expresses some skepticism.

In the end we would like to emphasize that our goal was not to point out certain tendencies existing between the use of technology and the quality of the relationship with the other (although reflection on these tendencies remains a permanent challenge), but to express the idea that if we want the call for the cultivation of responsibility on the side of the current technology user to be successful, it needs to be a systematic appeal, engaging rational thinking and metaphysical aspects of interpersonal relationships at the same time.

Using technology in everyday life brings the call for cultivating responsibility in various directions. In this text, we wished to focus on the area of interpersonal relationships with the other because we consider it to be one of the basic platforms for an internal awareness of responsibility. To conclude we can summarize the formulated ideas in the form of several challenges. Firstly, it seems challenging not to consider maintaining the quality of Me and You relationship as less important than other areas affected by the use of technologies. Secondly, there is a challenge to perceive the protection of this relationship as a significant guarantor of internally experiencing and realizing the responsibility emerging from using technologies in many directions. And finally, it is also a challenge not to leave a relationship with the other without notice until the moment when undesirable consequences will themselves force us to notice it.

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COMMUNICATIONS

Cyril Diatka*

MAN, ENGINEERING AND ETHICS

In today's technologically advanced and science-driven societies, a tension arises between the natural process of using our rationality that focuses more or less on the purpose and the practical questions of using new pieces of knowledge that we have gained mostly through modern engineering and technologies. There is often a significant contradiction between that which the required changes should bring about and that which they bring about in reality. The fact here is that the social reality since we are present in it not only with our rationality but also with our desires and ideas often changes the acquired pieces of knowledge and their utilization in such a way that their impact in social reality can be and even become undesirable. The thoughts of some representatives such as e.g. the culture critic Hans Jonas or the social thinker G. Lipovetsky can serve as a starting point, whereby already some authors in the past, such as Erich Fromm in his work "To Have or to Be", point out this reality and offer a viable alternative that ultimately proves to be more satisfying to human individuals and societies.

Keywords: *engineering, ethics, Technotronic, environment, man*

1. Man as a social being

Today we often come back to problems of seeking in which there are contradictions between the required reality and the real reality in which the modern man finds himself. It seems that in his effort to change himself and the world man can very efficiently use not only the current sum of knowledge but thanks to modern technologies also materials that we gain from nature and that we change into various artificial materials and substances by means of technological processes. Here a tension arises between the natural process of using our rationality that focuses more or less on the purpose and the practical questions of using new pieces of knowledge that we have gained mostly through modern engineering and technologies. There is often a significant contradiction between that which the required changes should bring about and that which they bring about in reality. The fact here is that the social reality since we are present in it not only with our rationality but also with our desires and ideas often changes the acquired pieces of knowledge and their utilization in such a way that their impact in social reality can be and even become undesirable. The thoughts of some representatives such as e.g. the culture critic Hans Jonas [1] or the social thinker G. Lipovetsky [2] can serve as a starting point, whereby already some authors in the past, such as Erich Fromm in his work "To Have or to Be" [3], point out this reality. I argue that the alternatives that these thinkers bring will ultimately prove to be more satisfying to human individuals and societies.

Inspired by the opinions of these thinkers we have been intrigued by the cultural and social phenomenon of the city. The origin and development of urbanization that are related to this phenomenon can be seen already by the origins of civilization (India, Mesopotamia, etc.). The city as an artificial cultural formation of man creates the preconditions for the phenomenon of the concentration of relationships of man to man and of man to nature. In terms of economic and business activities this concentration brings along significant effects; however, it is also accompanied by its unwanted social side-effects, namely especially limited or anonymous human relations that can manifest themselves and are manifested in a certain indifference to the outer world and even to other people [4]. Life in an urbanization center such as a city results in the life of man and people to be flooded with various elements that serve, in their nature, as a presentation of a seeming superiority of the power of man over the environment, but it is accompanied also by negative consequences that affect the identity of man and affect even his intimate space. At present, this is visible in the phenomena of modern civilization such as the megalopolis. Those of us living in densely populated cultured countries or directly in big cities do not even realize anymore how little of the hearty, warm affection towards other people we have left [5]. People are hospitable and friendly when their capacity for social contacts is not continuously overloaded [6]. We become aware of this when we come into a sparsely populated country where neighbors are separated by a greater distance, bad roads, and when we visit them in their homes and even though we have not been invited, we are

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welcomed very warmly. The accumulation of human masses in modern cities is partially to blame for the fact that due to the concentration of the human population that keeps changing, overlapping internally, we cannot see the human face directly anymore [7]. Our love to the neighbor vanishes without a trace in the mass of neighbors who are too close to each other. The greater the overpopulation, the greater the necessity for the individual to avoid any emotional participation, and thus in the cities there are theft, lies, murder, and rape in lively streets during daylight without the passers-by to intervene. The crowding of many people in a tight space results in a state of internal exhaustion, interpersonal relations disappear, which leads to expressions of dehumanization and this state often causes aggressive behavior [8].

2. The purpose of engineering

The importance and role of engineering in the life of man are clearly noticeable everywhere. Engineering is a phenomenon in which the specific ability of man to substitute his inadequate powers through the practical utilization of both natural materials and knowledge gained while working with this kind of materials is manifested in ambivalent ways. Ever since the more remote phases of civilization, engineering is characterized by the ability to surpass the given conditions in which man lives and to create a tool with which man changes the world, but thus he inevitably changes himself as well [9]. Even though some of his works did not express a great understanding for engineering, after a certain phase of his thinking the Scottish thinker Thomas Carlyle arrived at the opinion that inventors and designers should be honored as significant poets, artists, and philosophers [10, p. 50f.]. A different, opposite opinion is held by the well-known cultural historian Jacob Burkhardt. According to him discoverers and inventors are not great because they do not express the internal content of time and the world and they do not deal with the world as a whole. In addition, they are replaceable since others would have come to the same results later on anyway. An artist, poet, and philosopher are irreplaceable because their individuality is unique [11].

3. Attack on the environment

When civilized humanity is destroying the living nature that surrounds and nourishes it in blind vandalism, it endangers itself by ecologic destruction. Man usually starts to become aware of his mistakes only when he experiences them in economic terms which, however, can already be too late. Man who has become used to changing his environment rather than himself but if humanity wants to survive in sustainable conditions, it has to change its narrow purpose-driven view of the world now (G. Bateson) [12]. Along with the generally known environmental pollution with litter, agents for the protection of plants, indirect, but also clear consequences of applied science and technical interference in both the natural and social environment emerge in the water, but also in the soil and air. On this level, not only legal but also significant ethical and value conflicts arise [13]. Looking at it from the viewpoint of purposefulness, various chemical substances, as well as other industrial products, should serve for the common good of people and not for the destruction of the environment [14]. These facts are ambivalent. After the strict restriction of DTT substances, the number of malaria cases has increased again. The parasites causing it have gradually become resistant. We are thus waking up from a soothing dream of inevitable progress of human culture and well-being even it should be at the expense of the natural environment - a dream that humanity had been dreaming until the mid-20th century. “In the second half of this century, the technological optimism gradually faded and was replaced by skepticism and negativism.” [15, p. 35]

It is clear that the present man cannot abandon the journey on which he has set out already at the time of the birth of civilization. This applies to the European civilization as well where in addition to various changes in the area of spiritual life and a certain level of perceiving experience with one’s own inner being. [16] With time, however, objectness appears in parallel in the acts of man and gains a certain upper hand over time. Objectness can also be understood as a process of objectification of human relationships where, in the effort to multiply the effects of this objectified action, there is always a certain tension, distrust, and rivalry in the human relationships. Sociology studies these issues from the viewpoint of inequality among people [17, pp. 25-30]. However, in our opinion, this problem is much more complicated. It seems that those who are suppressed and disadvantaged in the relationships of inequalities often react to their situation in ways that are not rational, but clearly irrational. Objectness in human relationships is graduated more or less based on the benefit that should be brought about by this very change often accompanied by the development of engineering and technologies [18]. However, everything man longs for and what the objectified realm offers him cannot be encompassed by the overall process of man’s life into which we have to also include the incentives and motives of acts connected with man’s ideas. Modern axiology that studies the processes that result from the tension between the real and fake values speaks of some the facts of this type. Here values are perceived in a certain sense as the basis and the goals of human activities. In these terms, it is important to analyze the concept of a value and value orientations. It appears that man as the recipient, creator, and source of values presents his value orientations and attitudes outwards through implemented decisions for which he is responsible. Thanks to modern axiology in this area we can perceive the process as if the value dimension of our life were disappearing whereby it is substituted by facts about reality and those seem to be the proof for instrumental thinking that that which is happening at the moment or that which we are enjoying thanks to our activities is

not only necessary and useful, but also right. The individual life of man and the frequent occurrence of various degrees of mental illnesses in modern civilization prove that the problem is much more complicated. Man has to exert a certain considerably great effort not only while using new technical means and technological processes, but often he finds himself in a situation when he inevitably has to overcome the consequences of these technical and technological tools [19, pp. 36-37]. This is proved every day by modern medicine and its new dynamic field psychiatry. In other words, man can often manage engineering and technologies in the practical sense, but he cannot always manage himself. The pressure of the economic system that depends on the level of engineering and technologies is so intensive at present that rest and relaxation become a problem for the modern man. The mass of individuals has to adapt to this system under a certain program, whereby the individual life becomes only its accessory.

Another, critical view of engineering and the use of engineering is provided by authors affiliated with the personalistic concepts of man. As Valco and Sturak argue in their recent study, "[c]ountering the forces of depersonalization and dehumanization which ran rampant in the course of the 20th century, the personalist movement (Mounier, Maritain, etc.) has made a solid attempt to lay the foundations for protecting human dignity, reorienting modern philosophical endeavors to focus again on basic questions of anthropology." [20, p. 289] The so-called "technical man" does not do justice to a competent, holistic understanding of man's nature on the level of philosophical anthropology. According Edward Spranger, the technical man is not a special type in terms of uniqueness at all, but it is a mixed type connecting science and economy. A typical characteristic of engineering is that in itself it does not create a separate type of values. "A technician, as long as he is only a real technician, is not interested in value or the value of the goal for which he is seeking means based on the laws of events and economic forces in the direct sense of the word. He assumes that this decision about the value has been made on different grounds than engineering, simply in a different part of the soul" [21, p. 362]. As far as individuals are concerned who strongly prefer the conveniences of engineering in their lives and also subordinate their lifestyle to them, the Czech sociologist E. Urbanek says that their individual rationality inevitably changes into technical rationality. Further, technical rationality inevitably changes into the rationality of subordination which is always closely connected with the development of bureaucracy [17, p. 11]. Thus a clear tendency to technocratism arises that views the life of the modern man more or less instrumentally as a certain thing or part of a system. On such a level of perception, everything is replaceable and interchangeable in a relatively short period of time. Marcuse emphasizes this fact in his work *One-Dimensional Man* (1964) [22]. Lewis Mumford, a US-American sociologist, also arrives at a similar conclusion as H. Marcuse. In his book, *The Myth of the Machine* (1971), Munford describes the type of a so-called organized man [23]. He comes with the idea that the more perfect the mechanism is going to be, the smaller and less important is the rest of life, which however is necessary for technical life to go on.

We come back to the phenomenon of the city, i.e., the space that arises as a new reality of its kind of relationships of man to man and the environment. Thanks to the city and the development of city urbanization there is an ever-growing imbalance of the stated relationships, new structures of evil, the ability to use nature or the environment indirectly in a limited framework of technical rationality have been formed. The industrialization period that preceded the current civilization development has brought these facts to the surface in the form of objectified relationships based on technical rationality that reduces naturally personally created communities in such a sense that even a specific human relationship gains an evidently estranged form. This is accompanied by various forms of the loss of the sense of belonging accompanied by the state of internal exhaustion all the way to the boundary of endangering the personal identity. Here we can find the explanation why totalitarian regimes based on the manipulation of masses sprung up in the first half of the 20th century. Problems of indifference to the outer world, but also to other people have occurred. At present when communication technologies dominate, due to advertisements and the influence of people (television) the life of people is flooded with various patterns of behavior that stress quick change and an evident subordination of man to the predominant technical wave [4, p. 330]. From some TV programs, stories keep disappearing in which man is depicted as someone fighting for a certain value experienced in the given situation at the expense of the outer effect that is highlighted with irony changing even to a comical situation. A very clear example of this are the so-called sitcoms that are shown on TV so often. This results in a situation when it can be said that the present people can be entertained, but they cannot rejoice heartily. This kind of entertainment brings quick and short satisfaction which is followed by quick sobering that makes itself felt in a certain inner tension that accompanies man during his everyday life. This is similar to the quick consumption of a delicious meal where at the state of fullness the result is a certain surfeit instead of satisfying hunger. A new, up to a certain point unknown culture arises that has massively spread and that can be called postmodern [24] in the sense that it places into the foreground a testimony and service to facts and not ideals [25, p. 63]. This is an evident favoring of facts over values.

Our relationship to nature and the environment evolves in a similar way. With growing urbanization and the establishment of the modern megalopolis, we are confronted with frequent cases of atmosphere, air, water, and soil pollution. This fact leads us to the knowledge that under the given circumstances we are not always able to limit some effects of industrially produced substances. A very grave problem also arises with respect to the human body, e.g. how to solve the side effects of drugs, what to do with radioactive waste, etc. How to solve the multiple exceeding of

norms of air pollutant emissions? While considering the question of how far humanity is able to go, the problem of legal and ethical responsibility arises, especially as far as the improvement of nourishment and the quality of human life are concerned. We are not always able to detect the immediate cause of an unwanted state; often only the synergic effects are harmful that arise through the combination of sublimely culminating effects. It is these effects that lead to the exceeding of the toxic threshold limit value. Harmfulness caused by a synergic effect very often makes it impossible to find specific causes of the given state. The accumulation of causes and their relative uncontrollability usually top off the damage caused. The unwanted becomes reality [26].

If we understand the current ecologic crisis in the context of both social relationships and the overall globalizing activities of the present humanity, it is impossible not to see the fact that these relationships have the tendency to accumulate in local, i.e. specific geographic areas [27]. At the same time we need to become aware of the fact that economic evaluation of all activities is predominating due to which short-term strategies focusing on increasing the profit are most common and thus there is a growing discrepancy between these short-term strategies and the long-term perspectives of development including the protection of life and the preservation of life forms on this planet (the problem of biodiversity). "All ecological projects are not socially neutral, just like social and political projects are not ecologically neutral. Human social activities form the environment and no society can avoid unintended economic consequences" [7, p. 185].

4. The responsibility of science and engineering

One of the significant representatives of postmodernism J. F. Lyotard (1924-1998) [28] points out a completely new situation in the current science and especially in the use of language. According to Lyotard various technologies that use scientific knowledge and thus are presented by a specific language that changes into a discourse, change the language into an artificial language. Lyotard mentions technologies like phonology, various levels of linguistics including cybernetics, modern algebra, and informatics. A new type of language enters the reality of human communication, and it is further adapted so that it is compatible with computer language. This concerns the issues of facts and the use of facts, their storing in memory, and the creation of various databases, whereby the entry of these technologies into this reality of language changing has not been completely exhausted yet [28, p. 100]. Knowledge in such science disciplines of postmodern society as are informatics and cybernetics assumes a uniform language of a digital code that eliminates every ambiguity or polysemy. This new situation affects the character of knowing itself. Pieces of knowledge can go through new channels and become usable only if they can be expressed in an information language. Based on this we can assume that that which cannot be interpreted into an information language will be gradually excluded from the traditional understanding of knowing [29]. We will subordinate the new research, its findings to the condition of it being translatable into a computer language. The relation to one single code means that knowing as a sum of pieces of knowledge becomes superficial and transferable in contrast to "knowledge" regardless of the fact on which level of the cognitive process it is found. The old principle according to which the spreading of knowledge by individuals was connected to the formation of their spirit and the personality of the researcher itself is in a decline. The knowing of today is subject to the law of supply and demand. Pieces of knowledge are produced to be sold; they are continuously consumed and appreciated in a new production. Knowing is not a purpose in itself, it is losing its utility value.

At present, knowing is actually becoming a productive force that is at the same time a strategic weapon in the world competition for power. In our opinion, today the battle is about conquering information in such a way as there were battles for territories and sources of raw materials in the past. We are witnesses of the fight for cheap labor the consequences of which are new economic, military, and political strategies. In the field of science and engineering, ethical problems come to the fore more and more intensively. This is a result of the process of the continuously growing disposition power of man over both the environment and himself. In relation to this we can encounter new possibilities of manipulation [30].

5. The threat of technotrony

At present, the technology of data processing presents a significant breakthrough. Microelectronics, computer-controlled system and automated organization of administration based on electronic data processing are developing intensively. In relation to this there is a tendency of growing technocracy which efficiently brings together bureaucracy, technocracy, and electronocracy. This connection represents the well-known biblical "mene mene tekel ..." [31] more and more. Let us just imagine a great amount of data written on magnetic media of industrially developed societies. An almost exponential development of computer engineering and along with it electronic processing of data and information. The problem of protecting the privacy of individuals is more and more pressing. The collection and combination of personal data currently provides room for complete control of persons. The threat to privacy, the need to keep personal data confidential have opened a serious legal problem of data protection, especially of protecting personal data from commercial and overall social misuse [32].

This problem brings along a significant moral burden that affects every member of the society. The new task of knowing in morality (H. Jonas [1]) is related to this problem as well as to others that have been mentioned by us. In this ever-changing

situation knowing becomes our urgent obligation. We have to deal with a whole breadth of our causal dimension of action. This fact points out that this is not always possible and this leads us to the conclusion that foresighted knowing lags behind technical knowing. The chasm between the power of foresighted knowing and our ability to act in a quickly changing reality due to modern engineering and technology creates a new ethical problem. The acknowledgment of our unfinished knowing is the opposite of our obligation to develop this knowledge. This fact if we understand it correctly should lead us to greater caution in regard to our continuously growing power. "None of the previous ethics had to consider the global conditions of human life or distant future and thus the existence of the humankind as a whole," writes Hans Jonas [1, p. 29] in his book *The Imperative of Responsibility* (Czech translation, 1997). It is clear that we have to consider more than just our pure human interest. With his activities in the area of engineering and technologies man came into a position that our responsibility towards the social and natural environment is broader than before. The anthropocentric dimension is not sufficient anymore. It makes sense to ask, quite responsibly "[...] whether the status outside of human nature, the biosphere as a whole and its parts that are subordinate mostly to our power did not become an entrusted good for us, people, and thus the moral claim towards us changes - not only thanks to us, but also for himself and out of his own right" [1, p. 29]. Hans Jonas points out that the more our power grows when interfering with the outer world, our position inevitably changes and it requires a new attitude as well. This is an acknowledgement of "purposes about oneself" also outside of the human area, "... and to see to it that these facts are included into the concept of human good" [1, p. 29]. Also thanks to these thoughts the tradition of the current scientific knowledge gives us the opportunity to think about nature more or less in a reduced form. As if only from the position of necessity and chance. This problem can also be viewed in such a way that from the wealth of the natural world endangered by us an unspoken appeal arises to protect its integrity. Is nature worth moral attention from our side? [26]

6. Conclusion

We would be foolish to hope to disentangle this complex array of issues in one short article. Our ambition rather is to show how a competent and focused analysis of the mentioned problems points us to several critical considerations: (1) we should be less optimistic about the ability and readiness of man to somehow "naturally" use the latest advances in science and technology to create a "better" and more "just" world; (2) facing the fact that we are oftentimes mistaken about the long-term impacts of our applied scientific research and the employment of new technologies, intellectuals, scientists and the academic community as a whole should assume a more humble attitude when they talk about the future promises of new scientific discoveries (both, in terms of epistemic and communicative humility); (3) we must be critically aware of the interconnections among economy, science, ecology, and social realities. Only a holistic, integrative approach stands a good chance of bringing satisfactory and sustainable results. Yet, this whole process of critical reflection should start with an anthropological re-evaluation of the human predicament. We had better seriously take into account man's corruption and come up with a realistic, rather than overly optimistic anthropology. We are speaking here of a "condition of disconnectedness and alienation on both, the horizontal and vertical levels." [20, p. 291] There are limits of what we can achieve by mere cultivating of our reasoning skills and enhancing our knowledge of the natural world. "We are able, in this condition, to develop and use our faculties of reason, emotion, and will, but our rationality in this 'alienated state' tends to be used to justify and attain the desires of a proud or despairing, but always hopelessly self-centered human heart. Rationality does not always develop into veracity (i.e., the desire of the moral subject to know and attain the truth) and the kind of freedom that we derive from our rational striving is divorced from the unity of Truth, Beauty and Goodness that we ultimately covet." [20, p. 291] Therefore, the challenge of sustainable development and future interactions between man, nature, and technology cannot be answered without a competent and realistic anthropology anchored in a robust, holistic understanding of our global world in its multiple and yet interconnected dimensions. To be able to see this clearly, we need to cultivate the "ability to engage in the so-called 'second order discourse', that is, being able to analyze the metaphysical pre-suppositions" [33, p. 147] of all who are engaged in the pursuit of wisdom - whether individually (as part of an inner process of critical introspection) or communally.

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COMMUNICATIONS

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THE POWER OF MODERN TECHNOLOGIES IN THE FICTION OF DON DELILLO

This paper analyses the literary work of an American writer Don DeLillo, who belongs among contemporary American writers. He focuses on the manner in which contemporary human consciousness has been shaped being influenced by consumer and military technologies, media and daily life of information. Modern consumer technologies have a strong impact on men. In DeLillo's fictions, modern technologies are not just simple objects in everyday life of his characters. They are able to shape the consciousness of each human. Telephones, nuclear bombs, computers, television sets and modern appliances present a psychological phenomenon which provides the possibilities for actions, what more, it influences the perception of each human being. In his literary work, Don DeLillo discovers the interaction between human characters and their technological environment. DeLillo's characters find expression through the material forms of the technologies they fetishize, but these material forms simultaneously capture and limit the nature of the kind of transcendence they are able to offer. Technology appears to DeLillo's characters as a kind of human dream, which in turn, influences the kind of dreams and desires they have, and thus also the ones they realize in a technological form. They exist in an interaction between technology and self-definition or self-deception. The diversity of modes that is illustrated in DeLillo's fictions is supplemented by the technologically mediated confluence of his characters and the field of cultural objects in which they appear.

Keywords: *modern technology, fiction, Don DeLillo, media, information*

1. Introduction

Don DeLillo's is one of the most significant writers of the modern American era. His position among the most influential American millennial authors is as secure, as such an ontologically dubious status can be. On the long list of DeLillo's works, one might find many bestsellers and creations with a huge cultural impact. Harold Bloom [1], the literary critic, has included DeLillo in his list of four major contemporary American novelists and "named him as one of the four major American novelists of his time, along with Thomas Pynchon, Philip Roth, and Cormac McCarthy" [2, p. 88] DeLillo covered a huge variety of topics in his writings. He worked with ideas about the complexity of language, but he also worked with ideas about the television, nuclear war, sports, performance art, mathematics, the advent of the digital age and economics, and even wrote about the Cold War and global terrorism. His unique literary work highlights the concept of an individual in modern society being impacted by the advantages of Science and new technologies. His "early fictions employ cinematic allusions and techniques to reveal the harmful effects of cinematic representation of subjectivity. The early stories preview both the concerns of his later fiction and the frightening late twentieth-century world that those works depict" [3, p. 3]. On the long list of DeLillo's works, one might find many bestsellers and creations with a huge cultural impact. DeLillo covered a huge variety of topics in his writings. He worked with ideas about the complexity of language, but he also worked with ideas about the television, nuclear war, sports, performance art, mathematics, the advent of the digital age and economics, and even wrote about the Cold War and global terrorism. In DeLillo "the relationship between individuals and their technological environment is characterized by techno-psychic interphoricity, a mutual carrying across of attributes and ontological values between psychology and electro-mechanism" [4, p. 6]. Randy Laist selected four books he considered the most important regarding the topic of the technological impact on the postmodern society. His first choice was *Americana* because it was the first major book written by DeLillo, the second choice was *White Noise*, as it is the best renowned of his books, the third one was *Underworld*, as it is a huge literary creation, and the last one was *Cosmopolis.* Throughout the years, DeLillo kept on, as all human beings do, evolving and changing. Laist's collection of

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chosen books gives us an insight to the growth of a genius mind, since the first chosen book, *Americana*, was printed out in 1971, while *Cosmopolis* came out in the year 2003.

2. Modern technologies and media

All of the four books chosen for inspection are remarkable works of a single author, yet remain different and special in their own ways, given their unique characters.The factor that was the most important in *Americana* is that it establishes the theme that would eventually become all-pervasive in all his future works. It is a reality, in which every American citizen would sooner or later find themselves - the reality of one's identity enfolded in an American media transmission, since the people influence the media and define the media's identity [5], but this mechanism works both ways [4, p. 15].

White Noise targets television specifically. It describes the American Environment that was able to pollute itself and effectively disseminate its own pollution to the whole society via television broadcast. The participants of the novel are all experiencing this new, surprisingly overwhelming influence of the television. Even more so, this circumstance is pronounced in the *Underworld.* The 1997 novel paints the culture-scape so accurately, that it becomes a commonplace, a home, a completely new reality, in fact. The real human feelings and aspirations have not completely diminished, but they have mutated and changed significantly [4, p. 15].

The artistry of DeLillo spikes in his novel. *Cosmopolis* represents author's self-conscious isolation created by the intertwining worlds of reality and the virtual reality. The main protagonist of *Cosmopolis* is a 28years old man, a billionaire, a picture of American success, a techno-fetishist, an American per se. This young man pursues his dream of self-rarefaction into the final virtual pension of life and death, achieving the most convincing experience of technologically-mediated subjectivity DeLillo was ever able to impart upon his readers, showing that techno-fetishism is a disturbing trend that renders us all senseless and aggressive [4, p. 15].

The impact of the technological advance is one of the biggest issues DeLillo occupies himself with. In a way, it is accurate to say that Laist walks on a path of self-discovery with all of DeLillo's characters. He embarks on journeys, studies the movements and sympathizes with all the protagonist, as a quiet narrator, as a sharp spectator, as all the heroes themselves. His attachment to DeLillo's heroes enables him to inspect DeLillo's work from various angles, and still remain objective in his analysis. It is more than obvious, that the "typical DeLillian character is suspended between dread and awe, between randomness and conspiracy, between science and religion. But all of these outbreaks are symptoms of the fundamental, viral interfusion of self and circuitry" [4, p. 4].

Don DeLillo's novel *Americana* is full of criticism of technologically-induced conditions placed on human lives. One of the characters, David the photographer, the man behind the camera, is trying to prove his own existence, in a way. He is creating an art piece that describes the artist, the art itself, but also helps David discover the depth of his own profession. As he is creating his movie, shooting the pictures and slowly putting together the realization of his ideas, he becomes the first significant witness of the techno-fetishistic changes in DeLillo's creations. David, "so fond of mirrors in the four-dimensional world, imagines the potency of the camera as a kind of two-dimensional mirror, a mirror that frees its subject from the exigencies of space and time. This two-dimensionality offers a kind of middle-ground between human life and nonexistence" [4, p. 47]. He struggles with control over his ideas with the untold, yet undiscovered influence. The power of the camera is both the subject of David's film and his motivation as the filmmaker, since the cinematic itself is at the same time both the vector of the aspiration and the aspiration itself. David is constantly widening the readers' impression that the technologically-mediated structures express the dire desire to annul all self-consciousness whatsoever, supporting the idea that the modern persons - persons of the year 1971 or so - would eventually have to end up strung in an existential insecurity. DeLillo's fiction operates with the predicament, in which the future, the post-apocalyptic, is already here and present [6, p. 5]. Somehow, the world and all those who live in it, have found themselves in an ongoing situation, which has already changed who they are. It is not a process they slowly succumb to; it is a sudden realization of the state of things. *Americana* presented us with a character whose identity is inseparably connected to technologies and the mass media [7]. Marshall McLuhan "suggested the structure of metaphor as a persuasive model for conceptualizing the continuity between the conventionally discontinuous terms of human subject and technological object" [4, p. 5].

3. Hyperspace and simulacrum of reality

The evolution of DeLillo's thinking unfolds in 1985. *White Noise* is an unprecedented work of fiction by DeLillo's genius and combines the description of culture, philosophy and the transcendental directive of technological influence. The protagonists of *White Noise* are intellectuals. They think on a higher level than the regular American citizens, they see and contemplate ideas higher than average. A good example of this are Jack Gladney, the professor of Hitler studies, and his counterpart Murray Siskind, the professor of Elvis Presley studies. These characters do somehow hint their natures to a bright reader since they are somewhat defined by their names in the traditional *nomen omen* fashion used by many authors. DeLillo depicts Murray as a person who is able to incorporate anything,

no matter how prosaic, into his theoretical-mystical purviews, seeking and successfully finding transcendental significance in the earthliest of things. Naturally, "television, as the arbiter of all stereotypicality, holds a privileged place in his perception. Murray reads television the way a seer reads entrails, with critical attentiveness and steadfast faith" [4, p. 69]. He finds a referential bridge between a supermarket and the world of television. This uncanny resemblance creates a parity of hyperspace; he sees the supermarket as a three-dimensional projection of the code-world.

On the other hand, Jack sees the supermarket as a threat, as another weapon which could be used to inflict harm upon one's existence, another way to exploit a person's vulnerability. This presents readers with a strong friction, which, in turn, brings an extremely vivid example of the ambivalent in human thinking.

White Noise works with two sides of a coin. It describes the world, puts it in a spotlight, trying to find its way out of the technologically-induced confusion, and yet it also realistically dismisses itself with cold rationality, with self-defense and with the benefit of the doubt. For DeLillo, there is no description more accurate than the conflict of two friends, two counter-parts who antagonize in their pursuit of finding the truth, only to realize how lost they actually are in a world that does not feel any compassion towards them. In *White Noise*, a new narrator is likewise mystified, he is existentially bound to the technological environment [4, p. 109].

Underworld presents us with a huge, complicated and ever-connected world listening to the media and news. It brings deeper and wider understanding of one's position under the technological superpower. It's the externalization of previously private spheres of human life. Advertisement of underwear, the professional establishments focused on adultery, the mass-marketing of condoms - this all characterizes the psychic life of *Underworld*'s heroes [4, p. 111].

DeLillo still offers his protagonists, and by extensions his readers, a way to self-validate. His *Underworld* characters do, after a struggle, finally achieve a degree of freedom, but they do not do it by escaping or resisting technological claims on selfhood according to the classic romantic paradigm, but quite oppositely, they find a way to incorporate the mood of techno-cultural immersion into their own strategies of self-understanding. Rather than becoming externalized into the impersonal significations of material culture, DeLillo's heroes adapt the psycho-technological systems of paranoid ecology to their own creative purposes [4, p. 139]. This novel is the first DeLillo's post-9/11 novel. In the previous works, DeLillo has often included the World Trade Center, and by the time *Cosmopolis* was completed, the World Trade Center had already been destroyed. DeLillo was able to see its impact, to incorporate the mechanism he noticed after the attack and include his new-found testimony of technological age into *Cosmpolis* [4, p. 154]. Eric, the main protagonist of *Cosmopolis*, is, in Laist's words, arguably the most involved with the surrounding technoscape. Eric is a person of unspeakable wealth, which allows him to get in contact with all the new technology, which in the end defines him. DeLillo offers an explanation about the current state of things, putting the image in Eric and his everyday life into his novel. The technology is absorbing humanity, the humane is melting into it, slowly diminishing and by overusing these tools, humanity becomes fuel for the pieces of technology that leave nothing behind, and in the end, cease to exist themselves [4, p. 157].

Throughout the second half of *Cosmopolis*, Eric thrives on the threat of death. His own existence is something he so consciously clings to [4, p. 172].

In one of the most recent works of DeLillo, we see a continuity of the thought-provoking removal of what is humane in order to become something more. *ZERO K*, DeLillo's recent novel that came out in 2016, takes us one step closer to the loss of things most humane - death among them. The novel discusses one of the most troubling things a human mind can ever face. The possibility to cheat death. Could it be possible? Should it be done?

After all, we are born without a choice, without the ability to refuse this sudden happening; we are given life. What makes us so sure we should also die in this manner?

DeLillo continues in clarifying and confusing his protagonists, and again, readers. No matter how much attention one pays to DeLillo's books, we never seem to know what exactly DeLillo believes. He portraits characters, heroes, people so believable, that they become alive in our heads, so we completely focus on their fates, while DeLillo remains only the authoring person - the one who shows the reality, but does not force his beliefs upon anybody.

The main protagonists of the book, Jeff, Ross and Artis, deal with this question in their own way, putting the weakened dying body in a stasis, in order to preserve it and revive it later, when technology advances to the point of curing even what means a certain death now.

4. Conclusion

The question that DeLillo is constantly spinning and turning in his effort to see all the angles is a rather simple one: How much of the humane can be lost, before the human itself becomes a casualty? He offers a compelling argument, potently showing one's need to contemplate their own existence, and yet somehow still losing it in everyday life surrounded by technological advancement, which, sadly, slowly takes away everything authentic and humane about a human himself [8].

The culmination of DeLillo's realizations over the years is interestingly changing, giving us the chance to watch and follow the evolution in his thinking, but, far more importantly, we can follow ourselves - the human society that undergoes the same changes on a much bigger scale. DeLillo is an author with the ability to see the slightest glimpse in our society, but also with the ability to accurately record it and, via his extraordinary books,

impart this knowledge on the rest of the society. Even though the answer still seems to elude him, somehow DeLillo never seems to lose his hope for humanity. What he always leaves open are the doors of salvation. Everyone has the possibility to save themselves, to find and preserve their identity. Humanity is not threatened by the technological advancement, after all [9]. What lingers as a shadowy malice above all of us is the ignorance of each other, and even more so the ignorance of ourselves. Humans suffer this fate because they all so often forget about being humans in the first place. "*It [technology] is an escape from our personal mortality. Catastrophe. It overwhelms what is weak and fearful in our bodies and minds"* [10, p. 66].

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kamuNikácie
COMMUNICATIONS

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HERMENEUTIC CHANGE OF THE SCIENTIFIC APPROACH TO MYTHS AND FUNCTION OF SYMBOLS IN THE CULTURES OF THE ANCIENT MIDDLE EAST

In Slovakia, the older generations consider everything connected with religion a priori in the negative sense, because the previous regime led them to treat all such religious interpretations of life as legends or fairy tales. However, in the scientific world today, there is a significant change in the approach to the ancient literature, to its myths and old stories - epic poems of the humanity. In the absolute terms, myth communicates its content via symbols which convey its inner meaning. Nowadays, myths, epic poems, ancient literary works and literary units are considered to be narrative literary genres that were used by an archaic man for an explanation of events and facts that s/he could not explain in a satisfactory way or for hiding what is today referred to as scientific knowledge.

Keywords: *hermeneutics, myth - epic poem, symbol, interpretation, ancient genres, ancient cultures, the ancient Middle East*

1. Myth, mythology and its older interpretation

Mythical or mythological narrations are, or seem to be, arbitrary, improbable, meaningless and absurd, yet they seem to reappear all over the world. Since the advent of science, mythology has been rejected as a product of superstitious and primitive minds. However, it is important to come to a fuller appreciation of the nature and role of myth in human history [1, pp. 7, 19]. In Slovakia, the older generations consider everything connected with religion a priori in the negative sense, because the previous regime led them to treat all such religious interpretations of life as legends or fairy tales [2, p. 54]. This tendency still has a high percentage of followers as the word *myth* is still quite often used in the stated meaning. However, we are rarely aware of the real meaning of *myth*, so it is rather confused with something false and mocking. Even if the scientific world of today has significantly changed its approach and worked on more exact scientific clarification of the phenomena, in the Slovak literature one can still find superficial understanding of the myth and mythology. It is evident from the following characteristics that are still present in dictionaries: *"mythology, ...fairy tale narration..., ...irrational vision..., ...picture of someone or of something that is uncritically accepted, worshiped and adored, ...fantasy, delusion ...*" [3, p. 623] and *"figuratively. misleading deceitful belief in something: rebut myth of your infallibility; myth of mystery*" [4].

2. Myth, mythology and its systematic scientific research

However, it is important to come to a fuller appreciation of the nature and role of myth in human history, as the scientific world has significantly changed its approach to ancient literature, its myths, mythologies, and old stories at all. Myth is speaking in symbols, and an archaic people used it to express and explain the origin and goal of human being as well as of the world where they lived. Therefore, the myth has nothing in common with fictional fables and does not reflect the fictional reality that is offered and pictured in contemporary literature. Myth reflects reality experienced by people, apart from the fact whether it can or cannot be proved by the history [1, pp. 9, 17]. Myth cannot be approached from the historical perspective as the time of the stories is not determined. Thus, myths and mythologies talk about the creation of the universe - cosmology, the origin of gods - theogony, and arrangement of the universe - cosmology. They explain events, phenomena and the cycle of nature. They deal with the beginning and the end, with the creation and the destruction, life and death. At the same time, they describe everyday life of a man, history of nations and their desire for a better life [5, pp. 9-11]. Myth and mythical relation to the world gave all ancient cultures their obvious horizon; it enabled and expressed - understood their life. Mythical perception presents interconnection of natural and social events. In the stricter sense,

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myth presents this unity on the concrete examples of characters, situations etc. that are from the very beginning connected with existential and ontological issues [6, pp. 9-11].

Therefore, mythology can be defined as the study *„of myths in general or from the perspective of certain cultural or religious tradition in individual periods or civilizations"* [7, p. 717] or as a system or a complex of elements forming the civilized and intellectual foundations of the society, morality, religion, etc.: where mythology *„explains the system of social and ethical standards, ritual, and art of a community and at the same time it presents its individual history that reveals the creation of the world, the Earth, man, tribe, its culture and the law that states standards of conduct, in the light of acts of gods and heroes, it determines rites that should remind descendants significant acts of their great ancestors"* [8, p. 6]. Myth plays an important role in tribal societies. It justifies the system of social and ethical standards, rituals and art; it keeps a collective history of the community, its laws, habits, traditions. It also deals with the creation of the world, the country of man, tribe, nation, with its history and culture, morals and rights as well as it dictates standards of conduct. In the beginning, mythological thinking overlapped with the religious one. Focusing on religion, dominant elements are cult and worshipping of gods by prayers, sacrifices, rituals which employ various magical means, spells, incantations, and prophecies. On the contrary, mythology is based on mythmaking, on the creation of mythological stories rather than epic narrations. With the development of writing, myths became fictionalized independently of religious belief [9, pp. 20-23].

Myths may be connected with numerous cultures and also present newly processed old traditions which also contain explanations connected with certain significant persons, groups and are adjusted for the needs and expectations of periods of their origin [10, p. 50]. In the history of ancient Greece, in the period of oral culture, mythological sayings, songs, and poems were integral parts of the life of society. As myths did not have stable form, a tale-teller used their flexibility and adjusted the story according to listeners. Thus, the tale-teller could modify the story in order to reflect all moral and cultural requirements of a given era and appeal on the life situation of the audience [11, p. 12].

Myth has the original narrative form, but it is at the same time based on oral storytelling. Consequently, it is often unclear and ambiguous. People tell stories that spread further, and while doing so, they also change. On the other hand, when stories are often told and spread, there are certain themes or even idioms that tend to reappear in them again and again. After a certain period of time, no one knows whether so many times repeated version of the story corresponds to an original event that really happened. Even if myths occur in several versions, they always contain similar themes and idioms. Due to the high number of characters and ambiguity of its meaning, it is a great advantage of the myth that one of many stories always reflects something. The presentation of myth depended on a situation, and it gave this situation certain meaning. The gradual development of the society, thinking, and artistic imagination, as well as adoption of natural phenomena, made mythological images more rational and artistically more sophisticated. Gods and heroes took the form of animals or people. Mythology had a massive influence on all spheres of spiritual life. Every nation created its own myths, tales, and legends. These stories reflect spirit - the soul of the nation, its thoughts, hopes, desires, its ideas about existence, nature and the life itself. The gods of the ancient Middle East, as powers of nature and society, ruled over a human being and were people's religious-mythological expression. These gods who represented everything that affected people were their outer models as well as the inner substances [12, pp. 51].

Besides its basic cosmological and mystic function, myth also has the following functions: [8, p. 55].

- social function - myths offer models and principles of behavior, practical behavior in the society and incite concrete acts,
- pedagogical function - myths present ways and reactions of everyday life and they also contain parts dealing with the theme of life happiness of people,
- interpretative function - myths give reasons to life and religious ceremonies, explain human behavior in the social system and its forms.

Myths have symbolic as well as sacred value, and they formed the basis of old nations. They gave people answers to basic questions. However, what was obvious to the ancient people is many times distant and incomprehensible to the modern man. It is necessary to realize that during the major part of the history "homo sapiens" identified with "homo religious" for a simple reason - it was against principles of nature and world order not to be "homo religious." And it is also the reason why "*from the beginning, myth was always connected with religion and many times with the religious ceremonies too. It took quite a long time till myths were written down as they originally existed in the society in the spoken form. Myth formed the basis of law, social and political life of the archaic societies"* [13].

Contemporary people understand ancient religious phenomena in their literary sense. However, if they are not studied to the depth, they may seem trivial. Mythology forms the primary basis of ideas of the social organization, the world opinion, religion, morals, law, etc. Myths passed from generation to generation, and they explained the mystery of existence, the origin of the world, the reason of suffering and death [14, pp. 62-69], origin of traditions and provisions, the secret of love and life" [15, p. 144].

Even beginnings of philosophy are sometimes hidden by the mythological pictures. Myths offer a certain picture of the world. Thus they represent sort of preliminary stage of philosophy. Therefore, mythology is also called protophilosophy or early metaphysics [16, p. 29]. The Greeks managed to deal with suggestions based on mythological narrations in their own

original way until the term "mythos" was detached from the word "logos" which subsequently led to the beginning of the era of philosophy [17, p. 92-94].

3. Myth, mythology as a narrative genre

"Myth as a narrative literary genre has its own right as well as a preferred place: which is to deal with the beginning of the world and mankind which is radically out of our experience and human deductive way of thinking. In this way, it is a "myth about beginnings," thus it is a narration describing early events of the world and human being. This myth employs archetypical characters as protagonists and archetypical early facts as well as human behavior in order to disclose and explain them. Moreover, the myth deals with the universal symbols that concentrated the first explanation of significant questions connected with the human existence, such as limited being, our mortal nature, our sexual differentiation, etc. To achieve this, the myth creates a narration where the reality is presented through the concrete events that are offered as a story - narration that happened at the beginning of the time and is used as a template for the human behavior. The myth about beginnings approaches the reality in the opposite way as, for example, the logical speech of philosophy or science" [2, p. 58].

From the literary point of view, myth is an epic genre. The author is anonymous, and it is passed by traditions for many generations. It is mystic because it connects man with the transcendent. While reading a myth, people must employ their spiritual ability to understand that the greatness of the myth lies in the simplicity of the mythical story. Myth uses the language of symbols, and a symbol is at the same time the language of religion [18, p. 402]. Mythological epos includes [19, p. 94]:
divine inspiration,
ancient social tradition as a result of numerous generations,
its own approach and interpretation of the reciter,
it does not form a uniform unit of interconnected narrations; it may contain several time layers,
it is important to recognize what aspects of mythology are connected with the reality and what presents a fiction of life.

"Therefore, myth can be equated neither with a made-up fable, which is a creation of a human naivety nor with a fictional reality dressed in a literary veil. Personification and dramatization are stylistic means of illustration and plasticity of the mythical narration" [7, p. 718]. The typical feature of the myth is narration. Narration is a macro-compositional mean of text formation, and it is based on verbs, story, and plot. It may contain direct speech and various forms of narrators. Sometimes, it uses special techniques of delivery, as it can be delivered, for example, by singing. To update the story, the timing of motives is typical for myth [20]. It does not have an author, but it has a narrator. It is one of the basic features of myth that it lost reference to any author. Narration may have the character of literary analysis that focuses on people and their actions in the story. Moreover, the narration of the story should attract readers and take them to the world of values presented by the story. The most dominant are mythological stories about the creation of the world that can be found in all ancient cultures [18, p. 402].

4. Function of symbols

According to discoveries, ancient texts (now literary texts) contain awareness and knowledge which is present in the constituted human experience that is then represented in myths and symbols of humanity [21, pp. 151-152]. Myth also becomes a universal model for individual and collective actions, because it is also the source of mysterious experience and life knowledge [22, pp. 25-26] as a special type of social interaction and communication via symbols [8, p. 29]. Symbols are not rigid, precisely defined units, but they are variable (unfixed) because their meaning depends on the way of the expression of the phenomena [23, p. 13]. In literature, the symbol has multiple meanings, and it does not have defined boundaries [24, p. 343].

Mythological narration largely employs the language of symbols. However, interpretation does not depend on reason and science which is a measure of everything, today. It is for the hermeneutics, as the art to interpret ancient texts, to search, find and adopt this knowledge which has always been present in human learning in a certain way. This knowledge is hidden in the form of already realized and constituted human experience, in its intuition which is represented by myths and symbols. Therefore, Ricoeur says: "*Symbols and myths give rise to the thought,*" and this quotation poses two things [2, pp. 54-56]:

- firstly, it states that "symbol gives" which means that it is not "me" who gives reason to the reality, but it is a symbol that enables us to understand. This symbol is determined by the religious text or ceremonies. For instance, available are symbols of tree, snake, water, fire, bread or the Credo of the Church, etc.
- secondary, biblical symbol enables "thinking" or understanding. It makes it possible for an intellectual thinking ability to develop. It does not close the human thinking behind the dogmatic brackets, but it provokes and boosts the thinking process as it forces to repeat utterance again and again and revise it in its own experience.

Ricoeur expresses an important idea that our thinking develops when it focuses on a secret or a mystery hidden inside of a symbol or a myth that need to be discovered. It presents the possibility to develop intellectual ability and thinking.

Myths contain symbols, metaphors, and models. Symbol has a deep communicative ability, and it drives a reader to participate in an intended meaning. The language of symbols can express the most difficult ideas as it goes beyond the ability

of any finite reality. "*H. Halbfas, the significant German religious lecturer, turns his attention firstly towards the lexical meaning of the word symbol: in the ancient world, Greek word symballein meant something like "to mell, to connect, to unite. Then, a broken ring which identified envoys of two friends was called symbolon. The word presents the synthesis, connection, heading towards the only unity, mutual complementation of elements which have been parted at the beginning standing one against another. Halbfas claims that people cannot understand symbol when it is defined only in a rational way because it destroys its internal content and then we can see only the coat. Therefore, symbols cannot be arbitrarily established. Naturally, there should be a given critical position within scientific measures, but in order to reach the inner meaning of a symbol, one needs another sense, something like an inner sense for understanding symbols. However, even if it is a necessary condition for treating with symbols, not anyone possesses this sense"* [2, p. 54].

5. Conclusion

The original aim of mythology was to help people cope with critical human questions. Mythology helped people to find their place and orientation in the world. Myths carry a mystery of human existence, and they are written in a language of symbols. Therefore, it is necessary to decode myths to understand them. Myths are often connected with transitional rituals of life, and they seek to create a structure that will enable people to understand the whole life. Time and place are also symbolic, thus myths about the beginning should be interpreted in such a way as to deal with everything that happens during human life. If certain conditions are met, myths can play a constructive role in affirming that the "human person's dignity is inalienable and indisputable, for in their necessary albeit often unrecognized relatedness to transcendence, human persons have a transcendent source and destiny" [25, p. 289].

Myths should also be studied in the context of original communities that had certain religious perspective and interpretation of life [26, pp. 137-139]. The common element of the language of symbols is a picture and a metaphor. They have a common nature which is to collect and express a number of features in one word, as they appear immediately and at once. Nowadays, myths, epos, ancient literary works and literary units are narrative literary genres that were used by an archaic people who tried to explain events and facts or where they hid what is now known as logical scientific knowledge.

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SCIENCE AND POETRY

Emotionality and rationality or differences and consensus regarding the basic units of the semantic plan of art and science. Relationship of the language and extra-linguistic area in scientific knowledge and poetry. Particularities of the poetic language and the language of science. Image and abstraction: a different ability of our spirit to reflect the world. The presence of metaphors in philosophy and natural sciences as a transcendence of common experience. Interactive understanding of metaphor and its pitfalls. Is metaphor usable in science and does it have a cognitive function?

Keywords: *poetry, science, language, metaphor*

1. Introduction

"If any man wish to write in a clear style, let him be first clear in his thoughts; and if any would write in a noble style, let him first possess a noble soul."

Johann Wolfgang von Goethe

The American writer and philosopher Ralph Waldo Emerson, who called himself an "endless searcher without any past", once declared that scientists - botanists "love not the flower they pluck, and know it not. And all their botany is Latin names." He wanted to suggest that emotional approaches (e.g. love for the subject of the research) are often suppressed or denied by rational arguments in scientific practice. The perception of the emotional element in the poetic text and rational one in the scientific text is a primordial acceptance of the difference between the two types of reflection of the reality.

As we rarely seek rationality in poetic texts, we almost always avoid searching for emotionality in scientific texts. We denounce it, reject it, and even condemn it. But if we want to know what connects and what distinguishes the language of science from poetry, we also have to analyze the relationship between the linguistic and extra-linguistic area in scientific research and poetry. The majority of scientists are not able to express their thoughts as elegantly and suggestively as writers, but this disadvantage can be compensated by a deeper probe into knowing the subject of their interest, but also the results of the work of other scientists and of their own.

2. Language of poetry and language of science

Poetic language and language of science have their specifics, including in the first instance the ability to express the verse in verses and, on the other hand, the ability to abstract in a scientific work. Image and abstraction represent, from this perspective, various dispositions of our spirit to reflect the world and to mediate this reflection by others. "It is impossible to know everything!" This well-known idea from Goethe's *Faust* suggests the limitations of scientific knowledge. Hans Selye added also this sympathetic sentence: "Happy and naive is a scientist who has never experienced the cruel feeling of malice induced by this idea. ... Nature is eternal and infinite, but a man encounters it only in a small period of her life and measures its strength only with its limited ability. Brevity and simplicity are therefore not only random attributes of science: they are its basic, characteristic features" [1, p. 185].

It takes away the desire of mankind for leadership; it is a desire for knowledge of the truth ... But how can we distinguish the truth in science and poetry? This is related to the problem of interpreting science [2] and research results and, on the other hand, interpreting an artwork. What do these interpretations have in common and what distinguishes them?

Unlike the "reference" to science, in which the language unit should be clearly and precisely readable in specific contexts of extra-linguistic reality in the text, poetry seems to be objectively ineffective. Poetry is attributed to the extraordinary special values of "emotional language". The crucial criterion of truth

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is, according to science, the independence of the "observer". This means that testimonies that are believed to be true must also be repeatedly perceptible. They must also be unconditional and completely uncompromising to the last detail. In poetry, we cannot talk about true and false statements; it actually contains logical "pseudo-years" [3, p. 11]. But they can also be true or false; their veracity lies in the inner coherence of the literary work and its psychological acceptability. Let us recall Nietzsche's claim that truth is born only in an active process of understanding...

But, looking at these vast areas of human activity, we will also discover a migration area, where both approaches to reality touch and overlap: it is a metaphorical area that we can encounter not only in poetry and art but also surprisingly in philosophy, or even in the natural sciences. The mere presence of metaphor not only in a poem that is considered to be extremely legitimate and directly desirable, but also in a philosophical work or occasionally in the interpretation of the natural sciences, means the unique realization of the possibility to transcend the common experience [4] and to create new bases for the non-standard and creative practices in our explanations of the natural and human world.

An interactional metaphorical understanding, despite all its pitfalls, gives us an opportunity to understand whether and to what extent the metaphor is usable in science and whether it can be used in its cognitive function. In broader sense of the word, it is the ability to incorporate elements of artistic perception into reality. It also leads to the courage to understand the unfamiliar context as well as to life, and the vision of discovering unrecognized relations between phenomena which are associated with it. The American historian and social critic Arthur M. Schlesinger Jr. (1917 - 2007) expressed a broad understanding: "If we are to survive, we must have ideas, vision, and courage. These things are rarely produced by committees. Everything that matters in our intellectual and moral life begins with an individual confronting his own mind and conscience in a room by himself" [5].

The same author asks whether there are any scientists at all who can say that they have never gained the power and beliefs from ideas that were born in other humans' minds. That they were never inspired and stimulated, for example, by the wisdom of Socrates, the fascinating works of Shakespeare and Dante, Luther's courage, Washington's determination, Napoleon's conquest and Lincoln's passion, and even Jesus' death. Notwithstanding the fact that none of these persons can be considered "scientific" in the traditional way. However, their contribution to history - and within them as well as to the history of world thinking - has, for various reasons, also the character of stimulant to scientific knowledge, a subtle inspiration of the scientific interpretation of reality, nature and man, the basis of analysis of the human spirit. Even in this sense, poetry and science, the poem as an artistic text and the scientific explanation of reality, are combined.

3. "Literary" or "scientific" man

Bachelard's so-called "literary man" concentrates on the meditative and expressive element of thought, in other words, thought and dream. He does not prove anything, but senses it and transfers his experience in an altered form. A "literary man" differs from the common idea we have about a so-called "human scientist". A "scientific man" schematizes a concrete fact into abstract lessons, and it can also be degraded from a certain point of view because he often does not define terms by terms that would need to be specified. The "rationalism of absolutist abstractions" should, according to Bachelard, lead to the construction of such a "supra-reality" that would surpass ordinary experience and show a new, non-traditional face of reality. It would complement "austere" scientific research.

A new example of a literary work on philosophical issues is the work of the American author Don DeLillo [6]. "Don DeLillo perceives Kierkegaard as more than mere moral authority, a spiritual brink. He is convinced that Kierkegaard's philosophy can give man hope even in the most difficult moments of life. At the time of one's personal apocalypse, experienced within the frame of reference of contemporary society that is permeated by modern technology, mass media and the omnipresent consumerism, which can but briefly satisfy the hedonistic needs and desires of the individual, Kierkegaard's philosophy can provide an impetus for a new life. DeLillo values Kierkegaard's thought, for it leads the reader into and through an existential crisis. It requires and, in some cases, induces *a leap of faith,* thus having the potential to become an inspiration or even an "existential path" for everyone seeking a way out of the hedonistic and aesthetic stages of life in order to achieve the ethical or even the religious dimension of one´s life" [7, p. 19].

What is the relationship of such transcendence to reality? There can be no doubt that the so-called "overcoming" of ordinary rationalism means distancing and approaching reality at the same time. But even when we fall into the "subconscious of the scientific spirit", in the area of metaphors, naive beliefs, initial experiences, even then we transcend everydayness, custom. For example, in a literary work in which we encounter a city's image, "the interaction between the real city and text structures reflects the reader's consciousness, which allows the city to find beyond the boundaries of the city another city that is subject to his dreams, memories, or desires. This illusion of dejà vu, caused by the confusion of the text space and the city, at the same time, gave a new type of experience to the time that the literature attempted to amplify even in the area of the fictitious city" [8, p. 130].

This idea corresponds to Bachelard's phenomenology of a poetic image as developed in the works of *Poetics of Space and Phenomenology of Fire*, where, among other things, he examines the relationship between literature and science, transposed into the relationship between fantasy and rationality, a relationship that extends our knowledge beyond the limits

of ordinariness. These phenomena may be conflicting but may also be complementary. The image can create strong emotional illusions inspiring science, but the same image can also produce unexpected effects in literature and especially in poetry. The poetic dream is "sympathizing" with reality, while the scientific approach is paradoxically "hostile" to reality in the sense that it is distancing itself from the emotional aspect of reality that it usually considers to be the burden of scientific inquiry.

Although metaphor has a different function in art and science, it is precisely the explanation of the poetic image that the metaphor of traditional understanding helps us to identify the essence of complex and little transparent relations between science and art, philosophy and poetry, scientific knowledge of reality, and its poetic images, between the different perceptions of the world. However, it must always be borne in mind that, as Richard Rorty said, "the world exists not only in a single way, so there is neither ... the only way of its adequate representation" [9, p. 120].

Johannes Pfeiffer, in his collection of essays entitled *Between poetry and philosophy* of 1947, has developed the view that poetry opens the hidden depths of existence and thus calls for a "justification" (Wessenhaftigkeit). Pfeiffer - and likewise other existentialist-minded authors - has adopted from Heidegger the term "tune" which, under the influence of a poetic work in us, rises and overcomes us. From this knowledge, it is no longer a matter of claiming that the scientist is permanently overcome by some "tuning" research, and that his creative enthusiasm is conditioned by an effort to overcome the "zero point" that defines the state of research. The understanding of the problem he solves then considers such a content understanding of the state of affairs, which consists not only of knowing something, but in connection with the intellectual empowerment of all contexts in which the state of affairs rests, including those which are not always reasonably acceptable. By understanding these writers, in the existentialist spirit, a return to the text has been strengthened, but criticism influenced by it tends to wipe out specific literary values and differences between poetry and philosophy, ultimately between poetry and science.

Charles Morris has already made it clear that it is a special kind of speech or a sign that defines "qualities that are values in fact or in possible situations; artistic work is an iconic image because it expresses values so that they can be captured directly" looking for qualities that are values in fact, poetry for those who become values in our dreams. But dream is also an element of reality. Dream cannot be totally rejected by science. For example, according to Bachelard there exists the physics and chemistry of dreaming, and he persuaded us that "metaphors are not ordinary idealizations that shoot like rockets to exaggerate their insignificance after the blast in heaven, but metaphors that call each other and coordinate more than feelings, so that the poetic spirit is pure and simple metaphor" [10, p. 143].

Metaphor is a bridge between the linguistic and the non-linguistic area; it is a manifestation of subjective understanding of the relationship between the words and meaning network of their denotations; it is precisely in this relation that the presence of free associations is concentrated as an expression of the possibility of applying an intuitive component of scientific knowledge, which also includes extra-judicial moments. Thus, the metaphorical expressions of exact disciplines of science include the uniqueness, the unrepeatability of the situation in which the metaphor was created. This uniqueness, however, stands up to a clear translation into conceptual speech, but it is valuable in terms of overlapping of creativity and originality.

4. The power of metaphor

Metaphor is not only a means of visualizing and interpreting those objects of science that we cannot imagine directly but it is also a tool of knowledge that can have great heuristic value. Through the meanings, associations, and comparisons, metaphor allows imagination to associate even incompatible, seemingly foreign, distant phenomena. However, in the background, it does not lose sight of their difference, which is suppressed at first glance, but can be seen at higher level of generalization. According to Gadamer, hermeneutics is primarily an art of interpretation.

It is possible to divide in principle two levels in which a metaphor occurs and is used in scientific activities. The first plan is related to the genetic aspect of science, where the metaphor works best in the function of a laconic, short-lived hypothesis. The second plan is the stage of the already developed scientific theory in which metaphor certifies its participation as a conscious means determining the direction of the theoretical thinking in the transition from one area of knowledge to another. It reinforces the imaginativeness of expression in the meaning of such a quality of testimony, which expresses the overlap of the known or possible reality in apprehensions and images. "The interconnection of the farthest elements of reality in imagination is the basic principle of imaginativeness" [11, p. 191]. And imagination is a structuring element of scientific thinking.

Plesnik points out that the work of the main representatives of the interaction theory - I. A. Richards and M. Blake - overcomes the narrowed understanding of the metaphor typical of descriptive poetics. E.g. Richards does not understand the metaphor as a deviation from the common use of words, but as a picture of thinking that is based on comparisons and concepts. Therefore, according to him, words are not spoken in metaphors, but two different ideas combine into one active context. According to Lakoff and Johnson, metaphors already exist in the conceptual system of man.

Expression metaphors and metonymies have been reviewed by several deconstructionists: "J. Derrida dealt with the metaphor

and its forms in the philosophical text; P. de Man has shown that language as a means of expression is not entirely reliable, as there are also processes such as those of the troppes, which in fact conquer the interconnection between the sign and the meaning ... The difference between one's own and the translated meaning of the words by which it seeks to understand the nature of the metaphor of traditional poetics is not important for the so-cognitive science (I know of the human mind). It is the metaphorical nature of our common conceptual system [11, pp. 190-191].

One of the issues that deserve much attention in this context is the question of how to interpret the results of science and research, and what the place of interpretation in science and research is at all, which differs from the scientific explanation from poetic understanding. Pronounced knowledge in leadership takes the form of interpersonal knowledge (as concepts and theories), while unspoken knowledge - works as personal knowledge. As a form of knowingly inaccurate description of true contexts, then the metaphor of the content access function fulfills the function that probabilistic ways of describing within the quantitative approach have.

The science metaphor problem is still up to date. Metaphor in scientific knowledge undeniably exists, but the problem remains its character and its relation to metaphors in art. In particular, the question is whether the ambiguous range and sometimes the alleged non-transferability of the metaphorical expression in the Vedic into a descriptive language without loss of the heuristic objective dimension do not show too much the nature of the artistic metaphor. This would mean knowing the use of the language of art in scientific language, the ability to learn in science from the study of artistic means. Although this possibility cannot be totally excluded, art theorists advocate rather the view of the specifics of artistic modes of expression that prevent them from doing so.

In principle, ideas that push scientific expression into pure abstraction and artistic expression into permanent imagery must be rejected. It is a dubious scheme, partly because science in its top theoretical positions cannot express itself differently than metaphorically, and because of its content expansion, it appeals to figurative language. In both cases, however, metaphority is rather in the sense of a clear "representation" of reality than in the sense of the "decay" of reality (the reflection of its interference disintegration). Important, and key, is the awareness of the relationship between tacit and explicit knowledge. We build the scientific picture of the world above all on explicit knowledge, that is, we can express in some formalized way. Explicit expressions can actually be said to be a set of information, while tacit knowledge, "implicit" or "tacit knowledge" is characterized by the fact that it cannot be formalized or explicitly formulated. It is a set of experiences, abilities, intuitions, personal ideas, and creative visions. It has a highly personal character that is hidden in the subconscious.

The approach of Japanese scientists is consistent with our concept: Ikujiro Nonaka and Hirotak Takeuchi inspired by Michael Polanyi and his tacit knowledge, hidden, unspoken knowledge, "attempted to understand knowledge and leadership as a synthesis process that could overcome - originally Western - in terms of the world in general and in research, in particular, through the search for a comprehensive harmony, integrity and concreteness within this "non-European", Asian, Japanese way of thinking.

5. Conclusions

Leadership and understanding, seen as a dynamic process, allow better use of creativity, making use of the success of, for example, Japanese companies in their business strategies.

There is also a rigorously perceived difference between explicit, unambiguously coded, and therefore through script, characters, language, communicative leadership on the one hand, and implied leadership that does not lay down on the one hand the emphasis on the system of knowledge, but on the way of obtaining it, which has its "dark faces", on the other.

And even metaphorical knowledge cannot be excluded from this process; it is not possible to tear science away from poetry [12].

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INTERPRETATION OF VALUES IN THE EPITAPHS ON THE TOMBSTONES OF OLD JEWISH CEMETERY IN BRATISLAVA

The aim of the paper is to find the most frequent links and connotations of the notions related to the values of the Jewish religious community in Bratislava before WWII. We understand community as an entity that requires adherence to a set of values, norms, and meanings; religious community is understood as one of the most important and influential constitutive communities in human life. We have therefore decided to process and analyse selected concepts and their closest semantic determinations in the corpus of epitaphs which were found on the tombstones of the Old Jewish Cemetery (already largely destroyed) in Bratislava. The research will be realized via advanced text analysis instruments and new IT tools which are gradually being introduced in wider research of humanities. Based on the research results, we will try to identify the basic values within this community and determine its interpretative traditions.

Keywords: *Jewish community, shared values, epitaphs, digital humanities, distant reading*

1. Introduction

The interactions between Natural Language Processing and Digital Humanities have a major effect on contemporary text analysis. The methods used in humanities (Linguistics, Literary Theory, Literary History, Philosophy, Religion studies etc.) that are used for the text analysis undergo essential transformation caused by the application of digital technologies within all areas of humanities research. The most visible change is caused by digitalisation of text resources, something that has completely changed the design of text archives. The research scale today is, so to speak, thousand times bigger than before. Therefore the methods of research in humanities have changed, too.

This paper aims to use the methods and tools of advanced text analysis in order to analyse the epitaphs on the tombstones of the Old Jewish Cemetery in Bratislava. We intend to demonstrate the way in which it is possible to apply text mining software to the texts of the epitaphs since we suppose that they reflect the basic values of Bratislava Jewish community from 17th to 19th centuries.

2. Theoretical background of religious communities as constitutive communities of memory

Religion has always been considered one of the influential sources of moral culture (e. g. Etzioni [1], Coughlin [2], Selznick [3] and others). It helps people to find the meaning of the world and life, enriches culture, and enables communities to prosper. Moreover, it helps individuals - being the members of the community - to build strong identities. Therefore religion is capable of constituting both the individual as well as the community itself. This is the reason why religious communities as "communities of memory" [4] are considered to be constitutive - they answer the question "Who are we" and constitute the identity of an individual. Religions answer the questions of the transcendent, and they support the virtues of piety leading people to the sources from which they derive their identity and consequently their values and concepts of good.

As a result, for many societies and their social order religion in its moderate form is the main source of moral culture. God is often associated with moral truth, which is transmitted into living traditions, rituals, teachings, and institutions. This point is crucial to the alliance of religious beliefs. The most important principle is the principle of moral equality, which results from the understanding of people as God's children, as beings created in the image of God. This principle can also be justified by non-theological arguments when pointing out the evil which is caused by its non-observance in society (discrimination, privileges resulting from social status, etc.). These are practices that do not correspond with the conviction of the same respect for the people and their dignity. Consequently, religious ideas contribute to the understanding of public morality in society, in particular by

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defining and promoting key values such as human dignity and responsibility, humility and self-control, duty towards the family and community, care for future generations, the weak and the sick, and the pursuit of reconciliation [3, p. 62]. And, finally, religion reminds people of their fundamental obligations and duties, hence, it in a sense becomes a conscience of the community.

3. Jewish community and its values

Judaism incorporates a range of different values, ideas, and beliefs, which are perceived as God's word of guidance to the way of life. The Jews respect many duties from God which include the essentials of life, based on the Torah and Talmud. The central concept of the Jewish religion is being humble, generous and caring, as written in the Bible: "Do not seek revenge or bear a grudge against anyone among your people, but love your neighbor as yourself. I am the Lord" [5]. It refers to loving yourself and learning to love and accept others the same way. Hence respect and learning to accept differences is the most important element as it proves to God that you are acquiescent and loving.

Morality in Judaism is not minimally observed from deeds but is also a combination of good deeds, thoughts, intentions, attitudes, and doings. The Jews believe that God appointed them to be his chosen people to set an example of holiness and ethical behaviour to the world. Therefore, Jewish life is very much the life of a community, and there are many activities that the Jews must do as a community (e. g. the Jewish prayer book uses "we" and "our" in prayers where some other faiths would use "I" and "mine"). Moreover, the Jews also feel part of a global community with a close bond with Jewish people all over the world. They believe that offering to the poor is a very crucial part of religious life. Synagogues often have charity funds to support those in need or less fortunate. Together with community centres, religious youth groups, and camps, they are commonly known to the Jewish people as their second homes where each individual can have a sense of security and should feel comfortable. Our research will prove that some of these values are also included in the text of epitaphs on the tombstones of the Old Jewish Cemetery in Bratislava.

4. Old Jewish cemetery in Bratislava

The remains of the oldest Jewish cemetery in Bratislava, which is the subject of our interest, are now found behind a metal fence that separates it from Chatam Sofer Memorial (1762-1839), the world-renowned rabbi Mosche Schreiber from Frankfurt am Main. The then Jewish community had more than 15,000 members, but in the Holocaust, only 3500 people survived, many of whom later left the city and emigrated [6, p. 6].

According to the archive data, the Old Jewish Cemetery in Bratislava began officially to function in 1695, but the oldest found tombstone was built in 1655. The last burial took place here in 1847 because a new Orthodox cemetery on Zizkova Street in Bratislava was established a year before. However, the old cemetery, where approximately 6,000 graves were located, was still frequently visited not only by survivors who buried their loved ones here, but it has also become an important pilgrimage place where the believers commemorated the remembrance of the teacher and scholar Rabbi Chatam Sofer as well as other spiritual leaders of the community. Besides the rabbis of the then Jewish community, members of important Bratislava families, such as the family of Oppenheimer, Pressburger, Bettelheim, Pappenheimer, but also ancestors of poet Heinrich Heine or revolutionary Karol Marx, were buried in this cemetery.

During the Holocaust (October 4, 1943), the Old Jewish Cemetery was abolished by the Ministry of Transport and Public Works, which decided to build a tunnel for civil defense needs. Previously, however, Robert Neumann has documented and translated into German all readable texts on the tombstones, which have preserved valuable documents on today's practically unknown Bratislava past. Slovak translation of selected epitaphs was published in 2006 in a book *Epitaphs of the Old Cemetery / Epitafy stareho cintorina* with the Preface by Peter Salner [6].

5. Epitaphs on the tombstones

The sacredness of the burial place is typical for Christianity [7, p. 24] as well as for Judaism. In the course of history, the tombstone (Hebr. הבצמ, matzevah) had various forms, ranging from a simple stela to a tomb. In the Middle Ages, it was customary to write texts about the life of the deceased on the tombstone and to highlight his merits; while in the modern times, the name and the dates of birth and death are curved into the tombstone.

In the Jewish tradition, the tombstone is usually unveiled twelve months after the ceremony (in some communities it is earlier - after seven or thirty days). Should the unveiling ceremony happen on holiday, the placement of the tombstone on the grave must be postponed. In the Ashkenazi communities, there is a tradition of placing a tombstone at the feet of the deceased, in Sephardic communities, the tradition is opposite [8]. Moreover, the Jewish tombstones usually also contain (apart from the basic data mentioned above) references to the good characteristics, typical features, and values of the deceased.

In the ritual area of Judaism, epitaph has been deeply rooted. The inner structure of the text points to its homogeneity with biblical, rabbinic and cabalistic thinking, and in this context of tradition, it provides a narrative about the life and the decease of the buried [9, p. 173]. The romantic poet, William Wordworth, considered epitaph even a separate genre: Epitaphs

are interpreted as an independent artistic genre the purpose of which is the "restoration of life in the face of death" [10, p. 74]. Therefore we suppose that the epitaphs on Jewish tombstones contain the values highly appreciated by the Jewish religious community.

The texts on the tombstones of the members of the Jewish community who were buried in the Old Jewish Cemetery in Bratislava are valuable material that opens the door to the still closed world of Judaism to us. At least in part, they can get to know the thinking, poetics, and values of the faithful Jews, as well as the gradual transformations of the Bratislava Jewry in the two centuries. As a whole, epitaphs contain much information that can be used in the future for deeper sociological or anthropological analyses.

All the tombstones contain a Jewish name (after the introduction of the rules of Joseph II at the end of the 18th century and the official, mostly German, surname) of the deceased and the name of his father. The date of death and burial according to the Jewish calendar must not be missed, but the date of birth is not stated. Frequent is information about the birth, profession and personal characteristics of the deceased. Many texts contain (albeit not very poetic) the expression of the sadness of the survivors. And, naturally, the epitaphs contain many references to the Torah, to a lesser extent to the Talmud.

Our research is based on the corpus of almost 1,000 epitaphs preserved on the tombstones of individuals and families. These epitaphs are from the period between 1708 and 1846. Only a selection of them was published [6] in Slovak, combining the translation from Yiddish, Hebrew, and German. Our paper processes not only published epitaphs but all of those which have been preserved from that period.

Epitaphs illustrate the variety of language as well as the values of Bratislava Jewish community in the 18th and 19th century. Besides basic information about the name, the date of death and date of burial, the analysed epitaphs include other texts of different length. Some of them contain only a short characteristics of the deceased in one sentence, e.g. epitaph on the tombstone 260: *"Here lies the respected, virtuous and honourable Mrs. Esterl, wife of Leeb coref. She died and was buried Sunday, 19 Av 5543." / "Tu lezi vazena, cnostna* a *pocestna pani Esterl, manzelka Leeba corefa. Zomrela a bola pochovana* v *nedelu 19. ava 5543."* [6, p. 56]. Others are richer in content, e.g. epitaph on the tombstone 833: *"Here lies a just man, master of his trade, a doctor full of understanding, Mordechai Augenfeld, of blessed memory. Mordechai asked for good for his people. He performed the work of mercy and cured the poor unwell for free. May the Eternal repay him with good. He died and was buried Friday, 9 Tammuz 5589." / "Tu lezi spravodlivy muz ovladajuci svoj odbor, lekar plny pochopenia, Mordechaj Augenfeld blahej pamati. Mordechaj ziadal dobro pre svoj narod. Konal milost* a *biednych chorych liecil bezplatne. Nech mu to Vecny k dobru pripocita. Zomrel a bol pochovany v piatok 9. tamuza 5589."* [6, p. 113].

6. The methodology of the research

IT tools usable in wider humanities can be divided into several groups according to their functionality. The first are annotation tools that allow you to associate the metadata with the electronic text so you can search for specific elements in texts as well as in comments added by readers. These are tools that can be regarded as a kind of close reading in terms of access to the text. An example of such a tool is the *eMargin* [11] which allows the user to add comments to individual pieces of electronic text and to create hyperlinks within the text. The tool's features as a whole are a kind of virtual reader's notebook that can be shared with other readers of the same text. However, this tool is currently receding, as the implementation of text metadata (in the case of eMargin for readers' comments) is now part of the construction of corpora and belongs to the second, larger group of tools for building them.

Another group is a modified corpus linguistics tool that covers a set of conversion, statistics, and visualization functions, allowing to perform multiple tasks ranging from searching to various graphical representations of extracted quantitative data. For example, we can mention the *Voyant* [12] and *AntConc* [13] tools, which allow the user to create visualizations of their own text corpus (statistics, graphs, table outputs). Because the extraction of text data is primarily based on corpuscles that belong to basic subjects of second-hand reading, we find the most freely available IT tools in this group. For the needs of text analysis in this case, it is necessary to have localizations of these tools and digital versions of the analyzed texts. Especially valuable on instruments of corpus linguistics is that, in addition to simple statistical data (frequency of words, etc.), the user can also get more precise data from the text: groups of semantically related terms or phrases. These form the basis of the third group of tools, which are focused on even a more precise text mining.

The development of these most advanced tools takes place in various DH groups dealing with text analysis. One of the examples is the Computational Stylistic Group [14] which - using the quantitative linguistics method - can identify the strategy of the text up to the author's idiolect. *Stylo R*, developed by the Computational Stylistic Group, is not just a text extraction tool but also a programming language available on the group's pages along with the freely accessible corpora of literary texts such as Shakespeare's works, classical British novels, and so on.

In our research, we used both tools mentioned in the second group. *Voyant* was used to visualize the results via cirrus, collocates graphs, and trends. Cirrus is a word cloud that visualizes the top frequency words of a corpus or document, while the word cloud positions the words such that the terms that occur the most frequently are positioned centrally and are sized the largest (see Figure 1). The collocate graph represents keywords and terms that occur in close proximity as a force directed network graph (see Figure 2 and Figure 3). Trends is a line graph depicting the

Figure 1 *Cirrus of the most frequented tokens*
See Annex for English equivalents of the tokens and collocates

distribution of a word's occurrence across a corpus or document (see Figure 6 and Figure 8). *AntConc* was used for a deeper text analysis, searching for word frequencies and collocations (Figure 4, Figure 5, Figure 7).

7. Research results and interpretation

The total corpus extent is 42,154 tokens, (while "token" refers to all the text units / parts of speech, including conjunctions, prepositions, etc.), which corresponds to 908 epitaphs in Yiddish and other 30 epitaphs in Hebrew.

Figure1 illustrates the most frequent words found in the epitaphs we analysed. The first 10 words in raw (total count) frequency are: *died / zomrel/a* - 774 (408 men, 366 women); *(here) lies... / tu lezi...* - 641; *buried / pochovany/a* - 605 (314 men, 291 women); *son syn* - 275; *man | muz* - 264; *wife / manzelka* - 253; *virtuous (woman) / cnostna* - 196; *day (Sunday) / den (nedela)* - 182; *of blessed memory / blahej pamati* - 182; *just / spravodlivy* - 172.

The most common ethical notions identified in our research are *virtuous / cnostna* and *just (man) - spravodlivy*, while the first one refers mostly to women (196) and the second to men (172). Figure 2 and Figure 3 (collocates graphs) illustrate the further difference in the occurrence of particular values depending on the gender of the deceased. *Justice / spravodlivost* as a value occurs only 37 times and it refers to women, and it is always accompanied with another adjective describing characteristics of a woman: *virtuous / cnostna* and/or *just / spravodliva* and/ or *venerable / ctihodna* etc. Adjective *virtuous | cnostny* related to a man occurs only once (epitaph on the tombstone 653: *"Moshe was virtuous and led many Israelites to virtue." / "Mose bol cnostny a mnohych Izraelitov viedol k cnosti."*). In the epitaphs, *virtue / cnost* as a noun occurs only 6 times, while in 4 cases it is associated with women and only in 2 cases it was mentioned in the epitaph on the tombstone of a man (epitaph on the tombstone 754/1: *"He sowed virtue in his life and reaped a two-fold reward in death, a two-fold glory." / "Sial cnost* v *zivote a po smrti zozal dvojnasobnu odmenu, dvojnasobnu poctu."*; and epitaph on the tombstone 59: *"Virtue glows from the East." / "Z vychodu ziari cnost."*).

Another value frequently occurring in the epitaphs is *piety / zboznost*. It occurs 116 times (66 times in connection with men,

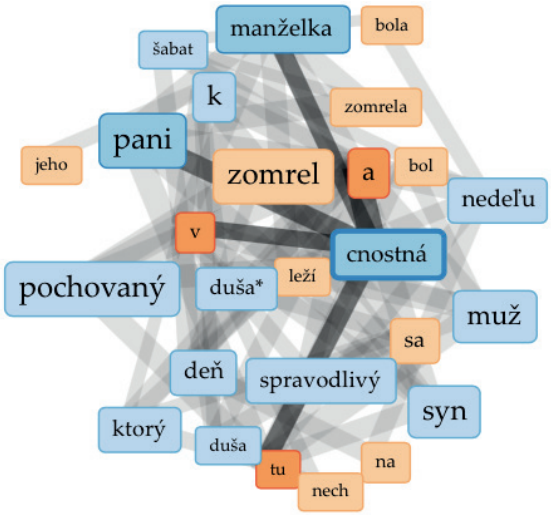

Figure 2 *Collocates graph of virtuous / cnostna (woman)*
See Annex for English equivalents of the tokens and collocates

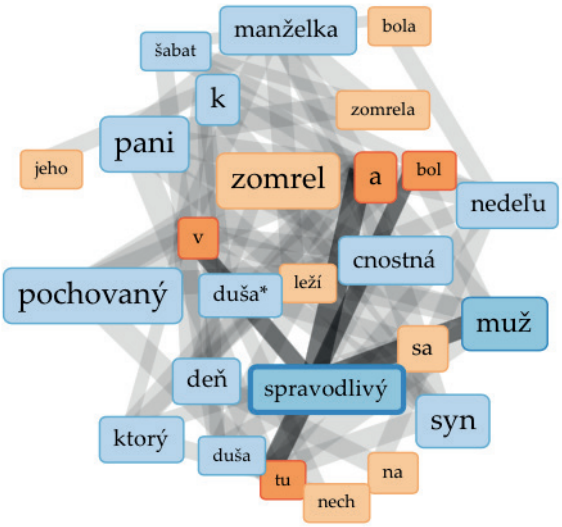

Figure 3 *Collocates graph of just (man) / spravodlivy*
See Annex for English equivalents of the tokens and collocates

and 50 times with women). The collocations presented in Figure 4 and Figure 5 give the evidence about the occurrence of this value together with the above-presented values: notions *just / spravodlivy* (related to men) and *virtuous | cnostna* (related to women).

Figure 6 and Figure 7 illustrate another most frequent collocation referring to the value of reputation. *Good reputation / dobra povest* occurs 131 times in the epitaphs and relates to men as well as to women.

Besides the ethical and moral values presented in the previous graphs, the occurrence of the notion of *soul*, which has been found on the analysed epitaphs, is also interesting. This notion mostly occurs in connection with the phrase which we can still find on tombstones in its apocryphal form [10]: "Tihje nafso

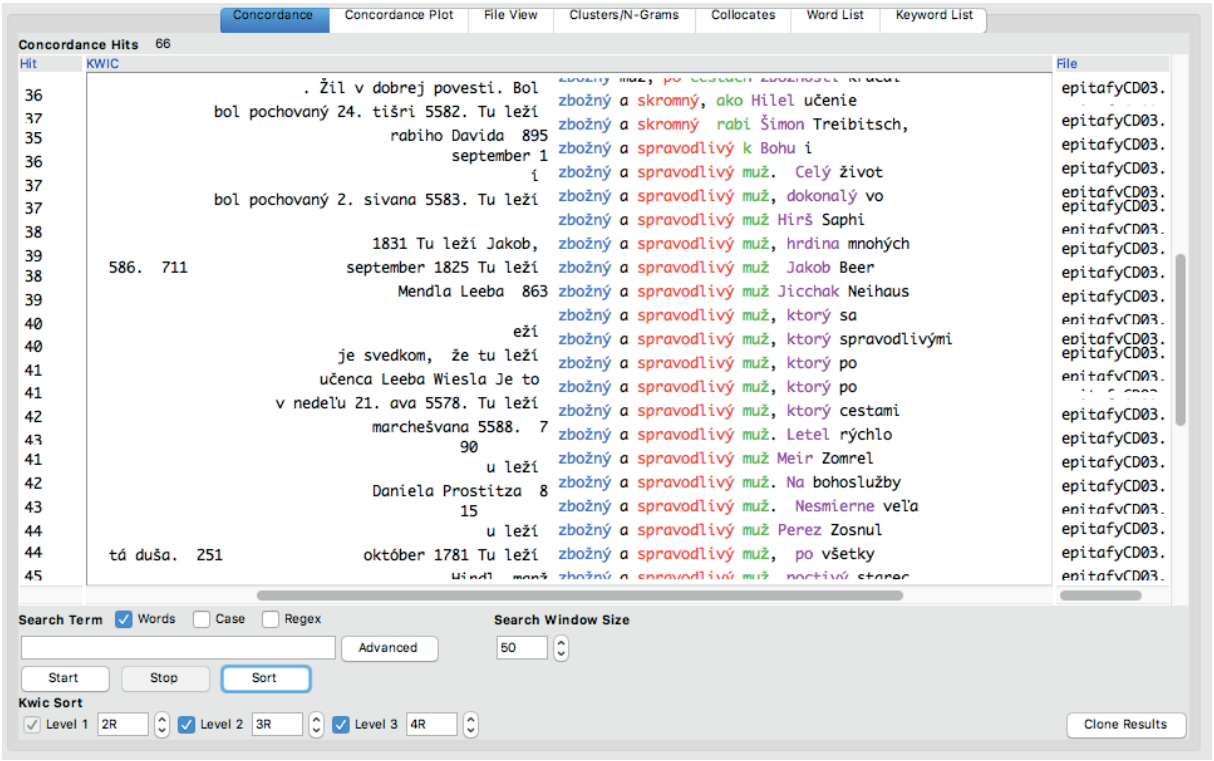

Figure 4 *Piety (of men) / zboznost (muzov) See Annex for English equivalents of the tokens and collocates*

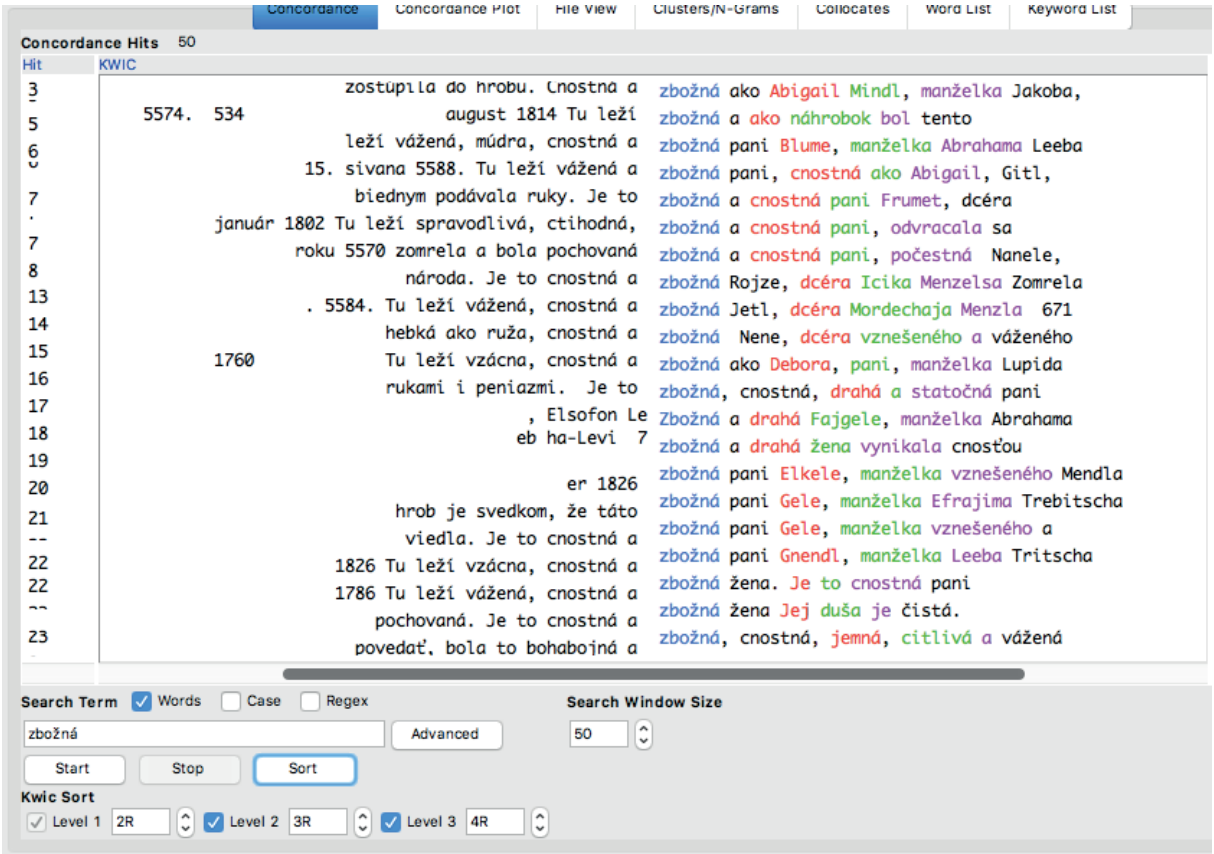

Figure 5 *Piety (of women) / zboznost (zien) See Annex for English equivalents of the tokens and collocates*

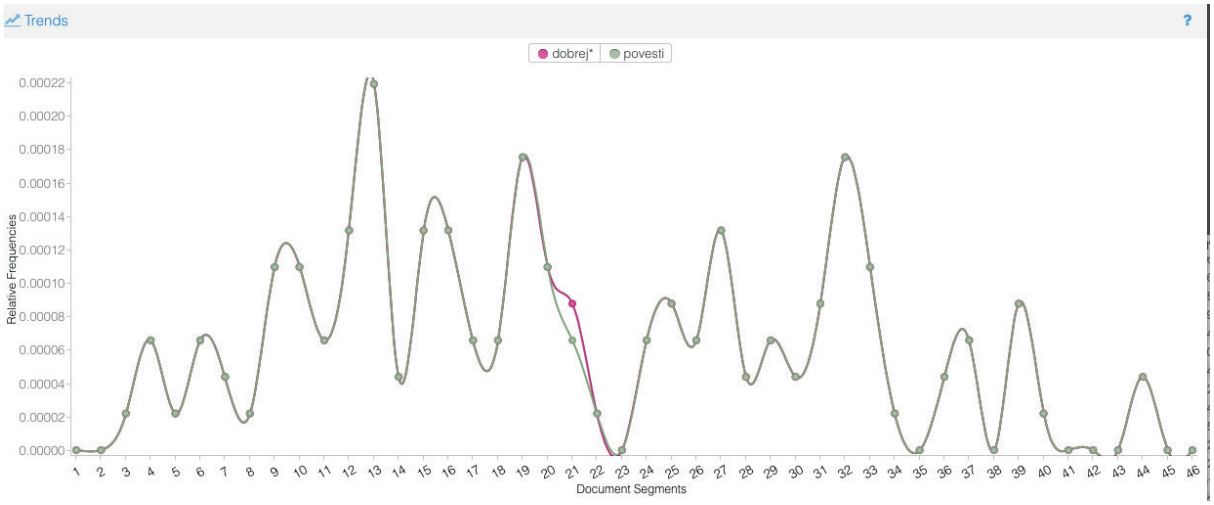

Figure 6 *The occurrence of notions good + reputation / dobra + povest*

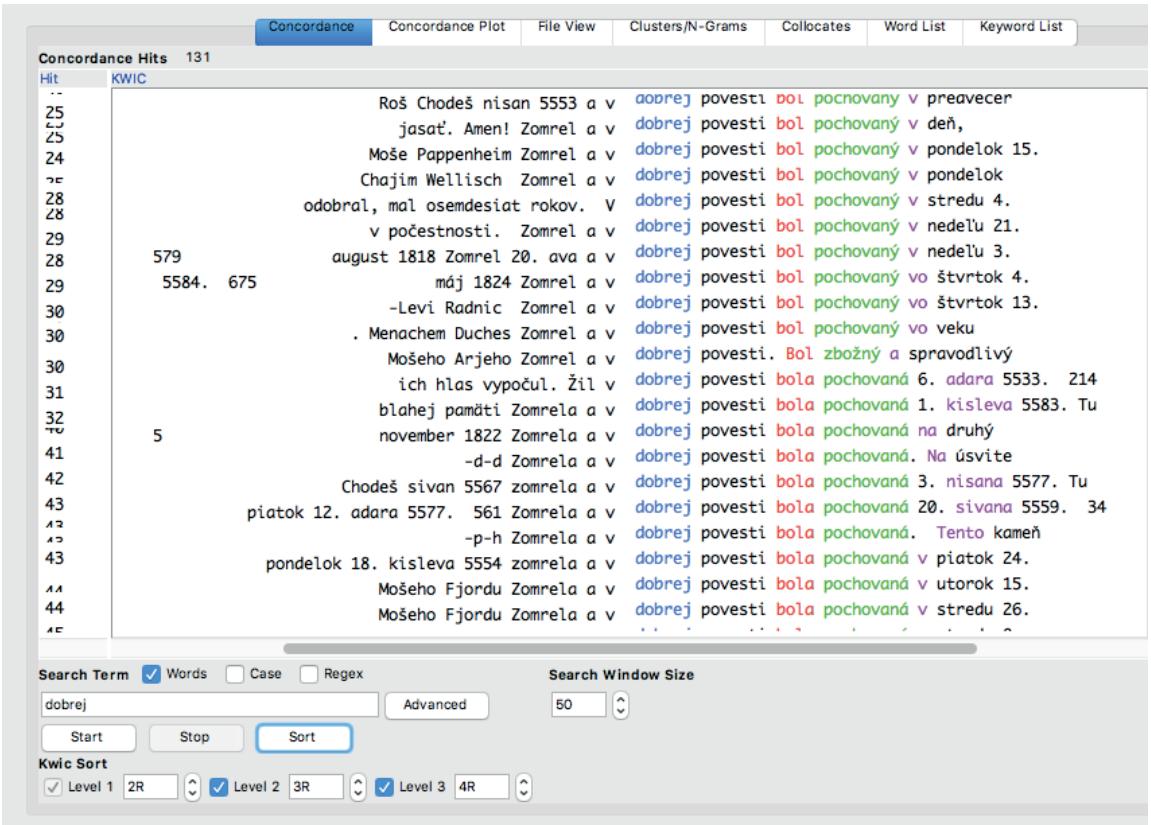

Figure *7 Good reputation / dobra povest*
See Annex for English equivalents of the tokens and collocates

(nefes) crura bi-cror ha-chajim." / "May his/her soul be bound in the bond of everlasting life". However, the notion of the *soul* also occurs in other meanings in Judaism [15, pp. 116 - 119]. One of them refers to the *soul* as a *character* (nesama), such as in the phrase: *pure soul / cista dusa* (Figure 8), which is found mostly on the tombstones of rabbis and benefactors of the community (e. g. epitaph on the tombstone 95: *"Until his old age, he came to house of prayer every morning and every evening. He served the Lord with awe and joy. He acted bravely. He was a famous speaker, a faithful shepherd full of knowledge, wisdom, and understanding. His soul soared in holiness and purity." / "Az do svojho stareckeho veku chodil rano i vecer do domu modlitieb. Sluzil Vecnemu s baznou* a *chvel sa radostou. Pocinal si statocne. Bol slavny recnik, verny pastier*

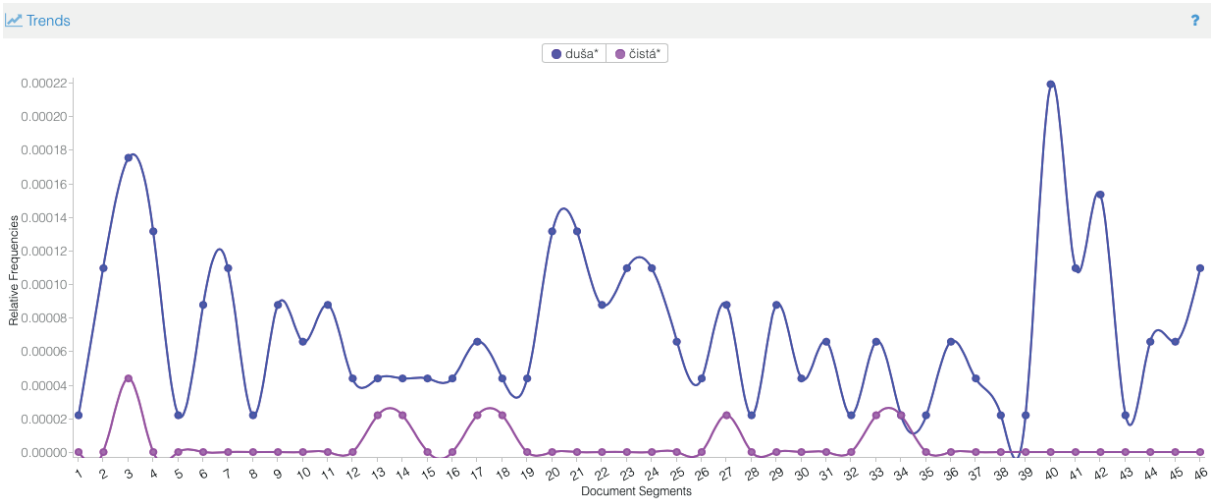

Figure 8 *The occurrence of notions pure + soul / cista + dusa*

plny mudrosti, rozumu a *pochopenia. Jeho dusa vzlietla* v *svatosti* a v *cistote.").*

In addition, many other ethical notions and interesting collocations can be identified via the text mining method which we used in our research. To mention some of them, the collocation *full of understanding / plny pochopenia*, which can be interpreted as a value of benefaction, occurs in the analysed epitaphs: e. g. a doctor who *"cured the poor unwell for free"* (tombstone 833); or a wealthy man who supported students of the Torah: *"Here lies a noble person, who, until the eightieth year of his age, before his vision blurred, devoted himself to study of Torah. He read and learned and left the world with good reputation and great knowledge. Now his luster has passed. He is a scholar, the honourable elder Saul, of blessed memory 5504." / "Tu lezi vzacny clovek, ktory az do osemdesiateho roku svojho zivota, kym sa mu nezakalil zrak, venoval cas studiu Tory. Cital a ucil sa a odisiel zo sveta* s *dobrou povestou* a *velkou mudrostou. Teraz sa pominul jeho lesk. Je to ucenec, dostojny kmet Savl blahej pamati 5504."* (tombstone 66).

Using the IT tools of textual analysis in the process of examining the ethical and moral values of the Jewish community that once lived in Bratislava, we have, on the basis of a conceptual map and frequency charts, revealed not only the most favored values but also the context in which this community expressed them. By doing so, we have successfully demonstrated how to use the potential of DH (digital humanities) in ethical research, and, at the same time, how important it is to convert cultural monuments into digital form, which can be further processed by IT tools. The digital processing of these monuments is an important starting point for follow-up research, including textual analysis, visualization, etc. A quantitative approach can reveal not only the most important values but also how certain values are expressed and acquired by the community.

8. Conclusion

We believe that the new approach to the research of humanities presented in this paper gives satisfactory evidence of the fact that the new IT tools and advanced text analysis instruments can be successfully applied in the field of humanities. In this paper - in order to identify the basic values of Bratislava Jewish community of 17th -19th centuries - we demonstrated its application to the analysis of the epitaphs on the tombstones of Old Jewish Cemetery in Bratislava. To conclude, these tools give human scientists the ability to identify key concepts and connotations quickly and efficiently via text mining instruments, without the close reading of primary sources in the first phase of their research. Obviously, this approach is helpful, but not sufficient in the field of humanities. It can change or redirect the interpretation in the first phase, but, subsequently, it must be necessarily followed by a deeper analysis and interpretation of the identified data.

Acknowledgment

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Annex

English equivalents of the tokens and collocates used in Figures:

Figures 1 - 3 (in alphabetical order SK - ENG):

a - and
ako - as / like
april - April
blahej - (of) blessed
bol - (he) was
bola - (she) was
cnostna - virtuous (woman)
dcera - daughter
den - day
dobrej - (of) good
dusa - soul
jej - her
k - to (*prep.*)
ktory - who
manzelka - wife
muz - man
na - on (*prep.*)
nad - over (*prep.*)
nedela/u - Sunday
nech - let (it)
od - from (*prep.*)
oktober - October
pamati - (of) memory
pani - lady
piatok - Friday
po - after
pochovany/a - buried
pondelok - Monday
s - with (*prep.*)
sa - *reflexive pron.*
sabat - Sabbath
september - September
si - *reflexive pron.*
skromny - modest (man)

spravodliva - just (woman)
spravodlivost - justice
spravodlivy - just (man)
streda - Wednesday
svojich / svoje / svojho - (of) his / her
syn - son
to - it
vo - in (prep.)
vsetky - all
z - from (*prep.*)
zomrel / zosnul - (he) died
zomrela - (she) died

Figure 4 (SK - ENG):

zbozny a skromny ako Hilel - pious and modest as Hilel
zbozny a skromny rabi Simon - pious and modest rabbi Simon
zbozny a spravodlivy k Bohu - pious and just to God
zbozny a spravodlivy muz - pious and just man
zbozny a spravodlivy muz, dokonaly - pious and just man, perfect
zbozny a spravodlivy muz Hirs - pious and just man Hirs
zbozny a spravodlivy muz, hrdina - pious and just man, hero
zbozny a spravodlivy muz Jakob - pious and just man Jakob
zbozny a spravodlivy muz Jicchak - pious and just man Jicchak
zbozny a spravodlivy muz, ktory - pious and just man who
zbozny a spravodlivy muz. Letel - pious and just man Letel
zbozny a spravodlivy muz Meir - pious and just man Mejr
zbozny a spravodlivy muz. Na bohosluzby - pious and just man. On (church) service
zbozny a spravodlivy muz. Nesmierne vela - pious and just man. Extremely much / many
zbozny a spravodlivy muz Perez - pious and just man Perez

Figure 5 (SK - ENG):

zbozna ako Abigail Mindl, manzelka Jakoba - pious like Abigail Mindl, wife of Jakob
zbozna a ako nahrobok bol tento - pious and like a tombstone was this
zbozna pani Blume, manzelka Abrahama - pious lady Blume, wife of Abraham
zbozna pani, cnostna ako Abigail - pious lady, virtuous like Abigail
zbozna a cnostna pani Frumet - pious and virtous lady Frumet
zbozna a cnostna pani, odvracala sa - pious and virtuous lady, turning away from
zbozna a cnostna pani, pocestna - pious and virtuous lady, honourable
zbozna Rojze, dcera Icika Menzelsa - pious Rojze, daughter of Icik Menzels
zbozna Jetl, dcera Mordechaja Menzla - pious Jetl, daughter of Mordechaj Menzl
zbozna Nene, dcera vzneseneho a - pious Nene, daughter of a noble and
zbozna ako Debora, pani, manzelka - pious like Debora, lady, wife
zbozna, cnostna, draha a statocna - pious, virtuous, and brave
zbozna a draha Fajgele, manzelka - pious and dear Fajgele, wife
zbozna a draha zena, vynikala - pious and dear woman, distinguished
zbozna pani Elkele, manzelka vzneseneho - pious lady Elkele, wife of a noble
zbozna pani Gele, manzelka Efrajima - pious lady Gele, wife of Efrajim
zbozna pani Gele, manzelka vzneseneho - pious lady Gele, wife of a noble
zbozna pani Gnendl, manzelka Leeba - pious lady Gnendl, wife of Leeb
zbozna zena. Je to cnostna pani - pious woman, She is a virtuous lady
zbozna zena. Jej dusa je - pious woman. Her soul is
zbozna, cnostna, jemna, citliva a - pious, virtuous, gentle and

Figure 7 (SK - ENG):

v dobrej povesti bol pochovany - in a good reputation he was buried
v dobrej povesti. Bol zbozny a - in a good reputation. He was pious and
v dobrej povesti bola pochovana - in a good reputation she was buried

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COMMUNICATIONS

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USING MATHEMATICAL STATISTICS ETHICALLY IN RESEARCH IN THE SOCIAL SCIENCES AND HUMANITIES

The aim of the authors is to consider some of the ethical challenges caused by the use of statistical methods for research in the humanities and social sciences (specifically education sciences). Statistics has the potential to be a useful tool in the research methodology of these sciences but, on the other hand, it can be abused and misused when the scientists are not aware of its limitations and pre-conditions. Most of the problems arise with deciding what to do to try to answer their questions and how to collect the data. How the data are collected affects how the data are analysed, and how the data will be analysed should affect how the data are collected. The authors will make an introduction to the topic by showing the tension in choosing either quantitative (statistical) or qualitative methodology for research in the human and social sciences over recent decades. Then they will present some ethical consequences of the misuse of mathematical statistics and emphasise the need for greater awareness and education about its correct use in the social sciences and humanities.

Keywords: *social sciences, humanities, mathematics, statistics, ethics, research*

1. Introduction

The current globalized and neo-liberal valued worldview dictates and shapes the organization of education and research methodology across the spectrum of the contemporary sciences. The expenses for research and the university education of future scientists are controlled by the competitive political and economic interests of the parties in power. The raison d'être of universities and research academies seems to have been shifted from producing educated people to producing economic goods, from centres of genuine scientific research to institutions competing to meet the challenges of the free-market economy, by producing individuals who are as economically effective as possible. Kascak & Pupala [1] share Liesner's worries [2] that, "with the exception of a few elite universities, most universities would employ people primarily because of their enthusiasm for 'fashionable methods' rather than for their orientation for research".

How has this global situation influenced research in the social sciences and humanities? When we look back at its history in the last 50 years [3], [4], [5], [6], [7], it has been marked by the tense co-existence of the positivist and interpretivist methodological paradigms. The former prefers quantitative research methods, the latter qualitative ones. The former focuses on reliably measuring the impact of various processes on the final products, including the people concerned. This methodology has typically been used by economics, pharmacy, medicine and other natural sciences, but also by psychology, sociology, education (e.g. school league tables, PISA education rankings), and even by practical theology (e.g. measuring the mutual impact of religion and culture [8]). The second paradigm is a personality-focused approach focused on comprehension and evaluation of the quality of inherent human cognitive, emotional or social processes, such as the needs, ways and reasoning of thinking, including the impact of value feedback and reflection on people in various societal contexts - e.g. social care, psychology, sociology and the education sciences. One of the objections to this kind of research is that it is difficult to generalize results to a larger population; another is its fragmentation. Because of multiple legitimate criticisms during the last decades, the interpretivist researchers have developed a whole range of methods, and combinations of them, in order to improve the validity of their qualitative (e.g. phenomenological, ethnographic, comparative) research studies.

Under the current pressure of neoliberalism, and thanks to the massive development of modern technologies and statistical software, it has become possible to process astounding amounts of meta-data; "data-mining" has become a major theme. The developed economies support extensive research samples with an unprecedented large scope of data, including meta-analyses and

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systematized reviews, enabling them to make optimal economic decisions in a specific social area, similarly as is the case with evidence-based medicine. It seems that the use of statistics for psychological, sociological and educational research is increasing. Another observable present style in the social sciences and humanities is a mixed research approach, either as a combination of quantitative and qualitative methodology, or the application of some qualitative methods within the quantitative approach, and vice versa [9].

When using the quantitative methodology, researchers in the social sciences and humanities have sometimes been accused of using it incorrectly. Besides other problems, there are some specific ethical issues which arise in connection with its use in these sciences. "Every question in human life can be framed ethically even though it may focus primarily on another dimension" [10, p. 46]. The existence of choices between various methodologies raises the ethical question of the motives influencing the decision-making process of their selection. It is similar to the ethical issue of "which highest principle gives value to technologies" [10, p. 46], we can ask which principle gives the value to the research methodology for a certain research problem.

The aim of this study is not to focus on the details of any particular research, but to consider some general ways in which statistics can be and have been misused, and to see if some lessons can be learnt to change or improve the situation. "The casual reader may not have time to investigate every methodological aspect of data collection, survey methods, but with the right approach, they will be able to better understand how data have been used or interpreted. The same approach may help the reader to spot statistics that are misleading in themselves" [11].

In our study we will look at this issue from two complementary viewpoints. We begin with a philosophical reflection on the question if, or to what extent, it is possible and ethically permissible to research "ontologically different subjects" with the same epistemological methods, i.e. statistical. The second approach is a summary of ideas how to prevent unethical use of statistics in the social sciences and humanities.

2. Reflections on the research subject matter

The challenge of the discussion on the issue of quantitative research between the natural sciences on the one hand, and the social sciences and humanities, on the other hand, lies in the very essence of their respective philosophies and their methodologies. The answer to the question of what is adequate method of scientific research is directly linked to the actual subject matter of the research in question.

The research subject matter of the social sciences are individuals as well as society and, in the case of the humanities, various areas of human experience and activities, such as language, literature, culture, philosophy, and religion. "In case of humanities and social sciences, the issue researched is rather complex ..." [12]. So the complex phenomena under research in the social sciences and humanities should usually be viewed from interdisciplinary angles.

The philosophical problem with quantitative research of human and social phenomena lies in the necessity to reduce the complexity of the human and societal issues in question to just a few variables. Often the true and in some ways substantial dimensions of the phenomena have to be omitted. For example, the use of statistics in textual analysis might produce lots of data about the occurrence of certain words in some texts or social discourse, but to understand the real meaning requires deeper qualitative, etymological or hermeneutical content analysis. These differences between the interpretivist, qualitative approach and the positivist, or physicalist, quantitative approach to phenomena were characterized by Hogben: "Algebra is a language in which we describe the *sizes* of things in contrast to the ordinary languages which we use to describe the *sorts* of the things in the world" [13]. Statistical research can measure the number and even the intensity of people's attitudes, but it cannot explain the intrinsic motivation or worldview of a person or whether people really understand and mean what they have just said. Such reductionist approach to complex philosophical and emotional issues is obviously unethical.

Also Valco warns against the "relentless philosophical reductionism" of scientism - "the popular widely-spread conviction that modern science, modelled on natural sciences, is the only source of knowledge" [Hutchinson in 14, p. 10]. This view goes hand in hand with the fact that "the higher is explained in terms of the lower, mind in terms of brain, human social behaviour in terms of physics and chemistry. Humans are appreciated mainly for their instrumental value: earning capacity, socio-political usefulness and their excellence of giftedness." [14, p. 19]. Far from everything inevitable for the existence of individuals and societies can be explained by the same scientific method as is used by the natural sciences. As Kant said: "So the Biblical theologian ... draws his teachings not from reason, but from the Bible; the professor of law gets his, not from natural law, but from the law of the land; and the professor of medicine does not draw his method of therapy as practices on the public from the physiology of the human body but from medical regulations." [15, p. 35].

Grant agencies financing scientific research are often interested primarily in performance or profit [10, p. 46] which means that they tend to prefer quantitative research results. Given the complex research subject matter of the social sciences and humanities, the value of qualitative methods needs to be recognized, especially in the initial stages of combined research approach.

If there is a discussion between statisticians and researchers, they can clarify what is and is not possible. Then they can cooperate with a clear understanding of each other's area of

expertise. This is in line with the "cooperative principle" of Grice [16], [17] or an older idea of the "middle axiom" of Oldham [18].

In practice, this means that there is an opportunity for discussion between people from the whole spectrum of sciences. We need to be reminded of one of the basic principles of argumentation - the "principle of charity" - without which communication is virtually impossible [19, p. 197]. According to one definition this principle "...urges charitable interpretation, meaning interpretation that maximizes the truth or rationality of what others think and say" [20, p. 122]. The charity principle means that all parties try to debate and understand the strengths and weaknesses of different approaches, and try to appreciate the other point of view. Let us take, for example, Article 1 of the Charter of Fundamental Rights of the European Union: "Human dignity is inviolable. It must be respected and protected." [21]. It is not difficult to point out differences in opinions about what this means in, say, politics or bioethics. Nevertheless, if the different methodological cultures make thorough use of what is common, they will make real progress in developing ethical research methodology in the face of dehumanizing tendencies of technological, neoliberal society.

3. Using statistics ethically

In the next part of our study, we present some examples and specific ideas about how to actually use statistics correctly and ethically in the social sciences and humanities.

3.1 The power and the danger of statistics

There are two main dangers when using statistics: the first is to believe that statistics tell you everything truthfully, and the second is to believe that statistics tell you nothing, or that what statistics tell you are lies. In the first case, people say, "Statistics proves ..." or "Statistical techniques show ..." and bow to the statistical deity. In the second case, people use the well-known quotation: "There are lies, damned lies, and statistics." [22], and thereby dismiss the data or the results.

The reality is that statistics is a powerful tool to deal with variability, uncertainty and limited information. Statistical techniques have their own methodology and assumptions. Like any powerful tool, statistics can be misused, accidentally or deliberately.

Some basic knowledge of statistics is important for most people nowadays, partly to avoid being fooled by the abuse of statistics. Most people doing research will use statistics in one form or another.

In research, there can sometimes be a choice between a qualitative approach and a quantitative approach. At one extreme the qualitative approach produces large amounts of non-numerical data from a small number of respondents, and at the other, the quantitative approach produces small amounts of numerical data from a large number of respondents. It may well not be possible to analyse the data obtained through the qualitative approach by any statistical methods, and it is, therefore, a problem if the researcher is pressurized to use statistical methods. The strength of the statistical methods, if they are applied correctly, is that the results obtained from a sample may be extended to the population from which the sample was obtained, and the degree of certainty with which this may be done is known.

There are rules and regulations on the ethical use of statistics designed to prevent harm to the participants [23]. In this article we deal, instead, with the ethics of using the statistical methods correctly.

3.2 The two main aspects of statistics

There are two main aspects to statistics. The first is the collection, representation and analysis of data. The second is fitting a model to the data and/or testing some hypotheses about the population from which the data came, and/or estimating some parameters of the population.

Often we have an idea, so we collect some data to check it out. When thinking about carrying out a hypothesis test on the data, we should check the requirements of the test before collecting the data, so that we collect sufficient data in the right way. Almost always this will involve randomisation in some form, either choosing a random sample from a defined population or randomising the allocation or order of treatments in an experiment.

D. Moore wrote: "The most important requirement for any procedure is that the data come from a process to which the laws of probability apply. Inference is most reliable when the data come from a probability sample or a randomised comparative experiment. Probability samples use chance to choose respondents. Randomised comparative experiments use chance to assign subjects to treatments. The deliberate use of chance ensures that the laws of probability apply to the outcomes, and this in turn ensures that statistical inference makes sense." [24, p. 366].

Thus, the way in which we collect the data determines, or affects, our choice of test, and similarly the test we intend using should influence the way in which we collect the data. There are many disaster stories of researchers - in business and industry, as well as in academia - collecting their data and then going to a statistician to find out how to analyse their data, only to be told that the data are worthless.

3.3 The ethics of data collection

In practice, this first stage is usually thought to be easy but is often the most difficult and the most important. We need to ask the questions: What data should we collect? How should we collect it? How much data should we collect?

Let us give you a few specific examples.

1. Some of our UK friends were once asked to produce a questionnaire and do a survey about people's attitudes to windfarms. However, they were told to distribute the questionnaire at an open day at a windfarm. Almost certainly this would produce a biased sample, one which would not be representative of the general population. When they suggested a different, and better, methodology, they lost the contract. There did seem to be some ethical issues involved.
2. In the days of the Cold War, some citizens of the USA were asked the following two questions:
   A. Do you think that press correspondents from the USA should be allowed the freedom to ask whatever questions they want of people in the Soviet Union?
   B. Do you think that press correspondents from the Soviet Union should be allowed the freedom to ask whatever questions they want of people in the USA?

It turned out that the order in which the questions were asked made a difference to the responses which were obtained. If you are aware of this phenomenon, then there is an ethical question about which order you use for your questions and/or how you analyse the responses.

3. Elections are often preceded by opinion polls trying to predict the result. The failure of opinion polls to correctly predict election results is not a new phenomenon. In 1936 the Literary Digest magazine used a poll of about 2 million people, and predicted the wrong result. In fact, George Gallup made his own prediction before the magazine issued its poll, using a random poll sample of 50,000 people, and correctly predicted the result.

The problem with the Literary Guild's poll was that the sample consisted mostly of people who were magazine readers, car owners or telephone customers—and had money during the Depression. So it was not a representative sample.

In almost every situation it is essential to do a pilot experiment or a pilot survey. This enables you to identify problems before you collect the data you will actually use. It is wise to try to get a wide spread of people, etc. to test your plan. Failure to do this may invalidate your research.

What is the population you are aiming to investigate? Is it feasible to obtain data from the whole of this population (a census)?

Selecting a random sample is usually the best way to obtain a representative sample. However, this requires that you have a list of every member of the population in which you are interested (which could be people, cars, sections of road, planets, horses, etc.) and are able to choose your sample so that every sample of your required size has the same chance of being chosen.

There are other methods which are used to try to obtain a representative sample. For example, you may use stratified sampling if your population divides into clear strata; in this case you take a random sample from each stratum. Other methods exist to save time and effort, and hence money, or when there is no list of the population in which you are interested.

Collecting good data is often difficult and can be time-consuming and expensive. If people are under pressure to save time and/or money they may be tempted to cut corners. It becomes an ethical issue.

Self-selecting samples are often biased. The people who volunteer to complete a questionnaire on a particular topic probably have a special interest in the topic. If there is a payment in one form or another for completing the questionnaire or being involved in the experiment, this may attract a particular sort of person. If a sample of people is chosen at a particular place and/or at a particular time, that may have a large influence on the type of person involved in the survey, and this could bias the outcome.

Similarly, if the researcher deliberately chooses a particular group of people, they should try to demonstrate that the group chosen is likely to be representative of the population being investigated. Here the ethical questions are: Am I really trying to answer a question, or am I actually trying to prove my point? Are questions asked in an unbiased way, or are they designed to obtain the result I want?

At least one of us has been involved in a survey where the way in which the questions were asked resulted in less than half of the students involved being able to complete the questionnaire. Only completed questionnaires were accepted. Those able to complete the questionnaire were not representative of the population being investigated.

If researchers are aware of how to collect the data, but instead choose to collect data which they know are likely to be biased in some way, then that is an ethical issue. Of course, the researcher may be aware of the issues but be unable to obtain a better sample, then that should be part of the report and it is probably not reasonable to use statistical tests, etc. on the data.

3.4 A recent example of good practice

In 2016 the Royal Statistical Society's Series A Journal published an article "Does preschool boost the development of minority children? The case of Roma children." [25]. The authors start by outlining the problem: "Social, economic and political exclusion remains an everyday challenge that ethnic minorities face in modern societies. A key reason for the 'vicious cycle of exclusion and poverty' is the gap in educational achievements caused by disadvantaged family backgrounds and residential segregation ... As a consequence, numerous policy experts suggest

providing minorities with unlimited access to the education system of the host country, in particular to the early education system." They then go on to focus on Roma children.

They explain that data were collected by the United Nations Development Programme (UNDP), the World Bank (WB) and the European Commission (EC), the so-called UNDP-WB-EC regional Roma survey. They explain how the data were collected: "The survey was conducted in a three-stage random representative sampling process: first, in each country 110 random clusters of approximately 30 households from areas of compact Roma populations were selected; second, in each cluster, seven households were randomly chosen and the respective head of the household answered questions about the household; third, one random household member older than 15 years was selected to answer a battery of questions on status and attitudes." The study represents an example of the use of the random sampling methods.

The population being investigated is carefully defined: "We restrict our sample to the Roma population only: to children at preschool age (3-6 years old) and to households which have not moved during the previous 5 years (which is the case for more than 95%). This restriction guarantees that the children under study have at least some time and chance to attend preschool in the location of residence."

A control group is also defined: "For descriptive comparisons we also draw on 569 non-Roma children who live close to the Roma households under study. These non-Roma children are exposed to similar regional conditions. As such, any differences between the Roma children and the non-Roma children who were included in this sample should not result from the fact that Roma often live in regions that are most affected by poverty and unemployment."

The authors use data collected on a large scale. Nevertheless, the principles also apply to smaller scale projects. The question being investigated is clarified, as is the population being investigated. Then a method of collecting a random sample is used to attempt to obtain a representative sample. With decent data it is then worth doing some analysis. In fact, the authors use a sophisticated method to analyse the data, but it is the initial stages from which we can learn some helpful lessons.

3.5 The ethics of data analysis

Once the data have been collected, it is usually necessary to clarify what the data have to say, both for ourselves and to communicate the results to others. It is often difficult to make sense of the "raw" data, so we summarise them and/or use some form of visual representation.

Even choosing which "average" to use should be a deliberate choice, as there are several options available, and may be an ethical decision. The most commonly used average is the (arithmetic) mean. If you have one very large value, this will have quite a big effect on the mean, especially if the sample is fairly small.

For example, suppose that there is a small business with one CEO and ten employees. If the CEO is on a very high salary and the employees are on low salaries, the mean salary could still be reasonably high ... and certainly quite a bit higher than any of the salaries of the employees. In this situation a better average might be the median: the middle value when the salaries are arranged in order of size. So this average would be one of the workers' salaries, and lower than the mean.

The median is said to be a "resistant" statistic; it is usually not affected by a few extreme values in the data set. The inter-quartile range is also a resistant statistic, whereas the standard deviation is not. So, even the choice of which average or measure of spread to use should be a deliberate decision.

Of course, it is possible to choose the average (or measure of spread) which communicates what we want to communicate, which may not be the most honest representation of our data.

3.6 The ethics of data representation

"A picture is worth a thousand words." However, with the statistical software available nowadays, it is easy to produce lots of graphs, so it is still necessary to choose which graph(s) to use and not just use everything available. Pie charts are popular in the media but are they are not very useful for research.

On the other hand, some people only present their data in tables, and this makes it harder to take in what the data have to say.

When using a graph to represent data, there are many well-known tricks. For example, if we use the fictitious data below (Table 1) about the number of hours contributed by the authors of this paper, we can use two simple graphs to represent the data (Figure 1). They give very different impressions, even though both are "correct".

Advertisers are well aware of the effects of different ways of representing data. Researchers may or may not be so aware of the effects of their choices. If they are, the choice becomes an ethical decision.

3.7 Probability

Probability theory underlies statistical tests. If we want to know the probability of something happening, such as a drawing pin landing point up, we do the experiment lots of times and record the proportion of times the event occurs. The "true" probability is the proportion if we were to repeat the experiment in an infinite number of times.

Table 1 Example of data representation

Contributor	Hours
Hanes	123
Gibson	120
Hanesova	121

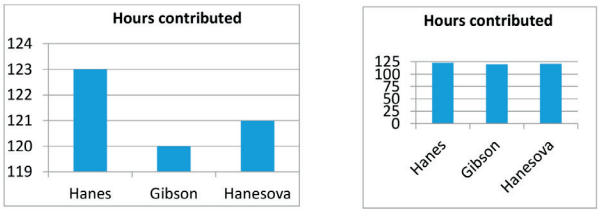

Figure 1 *Examples of graph representation*

In explaining the approach to statistical hypothesis tests, we shall often refer to what would happen if we did something lots of times; this is because of our definition of probability.

3.8 Statistical hypothesis tests, or tests of significance

Like every other discipline, statistics has its own jargon and methodology. When you understand it, communication is easier. Researchers and others are often encouraged or required to use statistics in their research, and therefore need to understand the key words and phrases. This applies even for just reading the research reports. Further, it is better and safer if the researcher understands how the statistical method works.

D. Moore says, "There is a saying among statisticians that 'mathematical theorems are true; statistical methods are effective when used with judgement ... Effective use of statistical methods requires more than knowing ... facts. It requires even more than understanding the underlying reasoning." [24, p. 366].

Once you have passed the investigation stage and have a hypothesis which you wish to test, it is really worth finding a statistician and discussing your ideas with him or her. Failure to do that could mean that you waste a lot of time, and perhaps waste a lot of money too. Nevertheless, understanding the framework and terminology will help your communication.

Once you have collected your data you will use it in some way to test your hypothesis. You will usually calculate a single number, the "test statistic", from your data such as the t-value, Spearman's Rank Correlation Coefficient or Cronbach's Alpha. The important thing is that, if the null hypothesis is correct, the behaviour of this number is known, at least approximately.

3.9 Significance level and p-values

How do we decide where to put the cut-off point for accepting or rejecting the null hypothesis? We decide on a definition of "unlikely", which may be different in different situations, but the default value is 0.05 (5%); this is our significance level. We choose the critical value (the cut-off point) so that if the null hypothesis is true the probability of getting a value in the rejection range is at most 0.05.

The p-value is usually used by researchers because they don't normally need to make a decision; instead they are presenting to readers the strength of their evidence. The p-value is usually produced by the software, such as SPSS. "Informally, a p-value is the probability under a specified statistical model that a statistical summary of the data (e.g. the sample mean difference between two compared groups) would be equal to or more extreme than its observed value." [26, p. 131]. So if the p-value is less than 0.05 you would reject the null hypothesis with a significance level of 0.05.

Taking our definition of "significant" as $p<0.05$ means that if the null hypothesis is correct, so there is no change or no difference in the population(s), we should expect once in 20 surveys or experiments to get a "significant" result even though the null hypothesis is correct. Of course, when others try to reproduce the effect usually none is found.

In the same way, if a researcher effectively did the same survey or experiment 20 times when, in reality, the null hypothesis was correct, we would expect one of the outcomes to be "significant". As above, this should cause problems with repeatability and/or reproducibility.

For many years, statisticians have been concerned about researchers effectively trying to summarise the results of their research in a single p-value. This discussion has become more focused in recent years.

In 2014, G. Cobb, Professor Emeritus of Mathematics and Statistics at Mount Holyoke College, posed these questions to an ASA discussion forum:

Q: Why do so many colleges and grad schools teach $p = 0.05$?
A: Because that's still what the scientific community and journal editors use.
Q: Why do so many people still use $p = 0.05$?
A: Because that's what they were taught in college or grad school.

He summarised the position as: "We teach it because it's what we do; we do it because it's what we teach." [26, p. 129].

The statistician and "Simply Statistics" blogger J. Leek wrote: "The problem is not that people use p-values poorly, it is that the vast majority of data analysis is not performed by people properly trained to perform data analysis." [Leek, 2014 in 27, p. 129].

There are many problems with p-values, despite their widespread use. In 2015 the editors of Basic and Applied Social Psychology decided to ban the use of p-values by submitting authors [28].

Table 2 Right and wrong conclusions after testing hypotheses

	Null hypothesis true	Null hypothesis false
Accept the null hypothesis	Correct conclusion	Type II error
Reject the null hypothesis	Type I error	Correct conclusion

The ASA's p-value statement of 2016 includes the following principles [26]:

1. P-values can indicate how incompatible the data are with a specified statistical model.
2. P-values do not measure the probability that the studied hypothesis is true, or the probability that the data were produced by random chance alone.
3. Scientific conclusions and business or policy decisions should not be based only on whether a p-value passes a specific threshold.
4. Proper inference requires full reporting and transparency.
5. A p-value, or statistical significance, does not measure the size of an effect or the importance of a result.
6. By itself, a p-value does not provide a good measure of evidence regarding a model or hypothesis.

According to Wasserstein, executive director of ASA, "there is no single, perfect way to turn data into insight. The only surprise is that anyone believes there is! Science is complex. Inference is hard work. It has been extraordinarily costly to science that the shared understanding of generations of researchers has been that a p-value, or any other single index, could provide a simple, clear, objective answer to the question: What does this data tell us?" [27].

3.10 Ways to be wrong!

There are important consequences which follow from using this framework for statistical tests of hypotheses; one is that we could reach the wrong conclusion. The possibilities are shown in the Table 2.

Statisticians, and those using statistical inference, should not be arrogant people, because they always know that they can be wrong.

3.11 Conditions for validity

We are used to having conditions of validity in many areas of life. If you buy a second-class train ticket, it is not usually valid in a first-class carriage. Similarly, there are conditions for the validity of statistical tests.

One very common condition is independence. This is saying that the result of one experiment or survey interview should not affect others. Thus it would not be appropriate to give questionnaires to a group of friends and allow them to discuss their responses; in fact, giving the questionnaires to a group might break the condition because they could be similar.

In many situations the requirement for a hypothesis test is that the normal/Gaussian distribution models the variable of interest in the population under investigation. In practice, nothing is normally distributed. Therefore our tests need to be "robust" to non-normality, and some are more robust than others. We should test our sample to see whether it is plausibly from a normal distribution. For example, if the sample is highly skewed and/or has extreme outliers, that would suggest that the population is not reasonably normally distributed.

If our data are values on a 5-point scale, such as a Likert-type scale, that is a long way from a normal distribution. However, the Central Limit Theorem says that if we are working with the (sum or) mean of values from almost any distribution, this will be approximately normally distributed provided that our sample size is reasonably large, and 50 is usually satisfactory. So, with samples of size 50 or more we can use "z-tests" instead of "t-tests" and not worry about not having an underlying normal distribution.

Other tests have different conditions and you need to check these out before collecting your data. There are lots of stories of people collecting their data and then going to the statistician to ask what they should do with it, and being told that they are unusable.

3.12 The need to publish

Apparently in the notebook of the scientist R. Millikan he refers to publishing good results. There is a tendency for researchers to want to find evidence to support their hypothesis. If they are using statistical methods, researchers want to get "significant results", low p-values, in order to get their research published.

If a researcher believes strongly that they are correct, but their results don't show that, they could feel pressure to modify or adapt their data to get a significant result. This could mean changing some values, omitting values, etc.

3.13 The ethics of reporting

While reporting the high-powered statistical methods which have been used in research, it may be tempting to omit reference to some of the more basic deficiencies. For example, are references to multivariate regression, Cronbach's alpha and

MANCOVA designed to hide the fact that the sample from which the data were obtained was selected by the researcher and was not representative of the population being investigated? When reporting the number of people who took part in a study, do we also report the number who refused to take part, or whose responses were rejected for some reason?

When it comes to reporting our conclusion, statisticians are usually quite careful and say that the data are consistent with the null hypothesis, or that the data suggest that the null hypothesis is false! This reflects the fact that we know we could be reaching the wrong conclusion.

Although it is very impressive to refer to multivariate regression, Cronbach's alpha, Mancova, etc. do we know what we are writing about? Do we have some understanding of what is going on, or are we just copying some words from a book?

It is much easier to refute someone else's ideas than to have your own. Similarly, it is often easy to criticise the research of someone else than to get it right yourself. The aim of these comments on statistics is to try to highlight some of the things which can go wrong when using statistics in the hope that the readers will be able to avoid some of the errors mentioned.

If you use statistics as a part of your research, please make statistics an integral part. Take the time to think about your project from a statistician's viewpoint; better still, find a friendly statistician - preferably one who already understands something of your research area - and discuss the topic with her/him. Share your expertise with others. Like any other tool, statistics will work better for you if you follow the instructions, understand how it works, and keep your knowledge up-to-date!

The magazine "Significance," produced by the Royal Statistical Society and the American Statistical Association [29] presents recent research on a very broad range of topics in a style which is accessible to most people who have some understanding of statistics. This could be a useful and interesting way of developing your statistical knowledge and expertise.

4. Conclusion

This article has been written in response to the frustrations felt by some researchers in the social sciences and humanities at having to use statistical methods when they felt it was unethical, inappropriate and reductionist. On the other hand, it reflects the frustrations felt by some statisticians at the abuses and oftentimes crude simplifications of the finely tuned statistical methods by some improperly and insufficiently prepared researchers. We have reflected on some of the differences in the subject, nature, aims, and methods of research in the social sciences and humanities. We have also considered some of the basic requirements of the statistical method and ways in which researchers sometimes ignore these, or are unaware of them. We have concluded that to ignore methodological conditions for the correct statistical procedure and its applicability in the area of research is unethical.

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ACHIEVEMENTS OF TECHNOLOGY TEACHERS` PROFESSIONAL DEVELOPMENT RESULTED FROM AN INTERNATIONAL COOPERATION

In the period of the years 2013 - 2017 an international project focused on modernization of tertiary education in Ukraine, Armenia, and Georgia (supported by the European Union in the framework of the TEMPUS program) was carried out. The main goal of the project was to ensure the quality of teaching technical subjects by providing practically oriented syllabi and modules in the embedded system environment and by creating remote laboratories in the target institutions. In accordance with the main goal, great attention was also paid to the professional development of teachers who have been teaching the relevant technology subjects at the concerned higher education institutions. In the paper its authors discuss issues of the evaluation of teachers' competencies in general, describe ways of improvement and development of technical subject teachers' professional competencies in the background of the carried out project, and present results of an analysis aimed at the assessment of the project results achieved with regard to the technical subject teachers.

Keywords: *teachers' competencies, professional development, technical subjects teaching, higher education institutions, training courses, curricular innovation, project achievements*

1. Teachers' professional competence

In literature different terms can be found used by the authors in relation to the teacher career performance, e.g., qualification, professionalism, expertise, mastery or competence [1], [2], [3]. A unifying feature of the use of all these "different" terms is the authors' consistent attitude that teacher's professionalism, qualification, expertise, mastery, competence significantly impact instruction and students' achievements. In general, one can state that success of teaching practice can be measured in terms of teachers' ability to initiate and support learning processes that enable students to achieve specific pedagogical objectives [4].

According to Baumert and Kunter [5], the notion teachers' professional competence covers the qualities that teachers need to meet the demands of their profession. These are related mainly to teachers' pedagogical content knowledge, professional beliefs, work-related motivation, and self-regulation. Within this context, Kleickmann and others [6] stress the difference between the quality of teachers' content knowledge and pedagogical content knowledge, i.e., content knowledge competence and pedagogical content knowledge.

Knowledge of the content (subject matter content knowledge) and teaching of a subject (general pedagogical knowledge) are two key elements of teachers' professional competence (the key competencies, besides the others related to curricular knowledge, knowledge of learners, knowledge of the philosophical and historical goals of education, organizational knowledge and counselling knowledge [7], [8], [9], [10]).

The significance of the content knowledge of a particular subject is partially influenced also by the values accepted by the society and by the role which the relevant science area holds in the society, what are time-depending variables [11], [12], [13].

Academics at higher education institutions (HEIs) are expected to be experts in their science specializations, and at the same time, they are expected to have also an appropriate level of pedagogical competences. But it is a common practice that teaching staff (academics) at higher education institutions usually develop their pedagogic competencies by self-study and by their own teaching practice. In a matter of fact, they are not "qualified teachers", i.e., usually they are not graduates of the teacher training tertiary study programs.

In the frame of the internal quality assurance systems of the HEIs different aspects of the environment, within which the

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HEIs carry out the education of their students, are monitored and assessed. Nevertheless, the key factor staying behind the quality of education are teachers - their professionalism, their teaching mastery, their personalities. That is why evaluation of teachers is included in each quality assurance system of all of the educational institutions. Herein it should be noticed that "all" includes the primary and secondary schools, not only the universities or HEIs. Despite the fact that internal quality assurance systems are usually mentioned with regard to the HEIs, primary and secondary schools have these systems, too. But there is a great difference between the evaluation of teachers at HEIs and primary and secondary schools.

2. Assessment of teachers' professional competence

There is no doubt that to evaluate teachers' professional competence is very difficult. There are different aspects based on which it can be done (e.g., portfolios, teachers' written preparations to the lessons), but in a matter of fact, a teacher's competence can be demonstrated and proved only in a practical way, in practice. Additionally to that, independently on the real level of a teacher's pedagogical mastery, the outcomes of his/her teaching are uncertain. They are uncertain in two respects. The first is the fact that instruction always brings some unexpected situations which cannot be planed. A teacher can plan his/her teaching very carefully, but there is the unpredictability of student's behaviour, classroom discourse, failing of technical support of teaching, etc. And the second is the fact that learning is a mental process with no guarantee of its results (students' learning outcomes), moreover significantly depending on a very broad scope of different factors [14]. The professional practice of teachers is characterized by a lack of standardization, broad scope of non-routine situations and a high level of the uncertainty of success.

At HEIs teachers are assessed not based on their competencies, but rather their performance is assessed. This means that a great attention is paid to their results in the field of research (what can be very easy evaluated through the number of projects they have been involved in, papers and books they have published, patents they have submitted, etc.), and less attention is paid to their teaching results. In comparison to the research performance, to evaluate the pedagogical performance is much more difficult. Of course, it becomes much more difficult when we go beyond the evaluation of the teachers' pedagogical performance in terms of the quantitative indicators, such as the number of lectures and lessons per week, number of students they teach, number of students who do not pass subjects they teach, etc. These numbers do not say anything about the teacher's teaching mastery; they do not assess their professional pedagogical competence.

Completely different is the situation with respect to evaluation of teachers' performance at lower levels of education (primary schools and lower and upper secondary schools, which also have their internal quality assessment systems). There the situation is an opposite one. The key attention is paid to qualitative aspects of teachers' pedagogical performance, to the level of their teaching mastery in all its dimensions, and marginal attention is paid to the evaluation of the teachers' performance based on its quantitative indicators [15].

As to the issue of assessment tools for evaluation of teachers' competencies, these tools are usually developed just with respect to the primary and secondary schools. One of the initiatives devoted to this issue has been a 4-year national project Evaluation of teachers' competencies ran by Constantine the Philosopher University in Nitra. The main aim of the project is to identify a general set of criteria based on which the teachers' competencies should be assessed and to create to them related set of evaluation tools applicable for evaluation of quality and qualification of teachers' pedagogical activities [16], [17], [18], [19], [20], [21]. The set should reflect three basic dimensions of the teachers' professional competencies: competencies related to the learner, competencies related to the educational process and competencies related to professional self-development of teachers. Despite the fact that the set of the assessment tools is designed in the context of the teaching practice ran at primary and secondary school environment, the tools will be applicable also in the environment of the higher education institutions to assess the professional pedagogical competencies of HEIs teachers (of course, not in the dimension of their research activities).

3. Development of technology teachers competence

The search for new ways of developing pedagogic mastery of technical subjects teachers at higher education institutions, reflecting the latest trends in teaching technical fields, was one of the main goals of an international project entitled *Development of Embedded System Courses with Implementation of Innovation Virtual Approaches for Integration of Research, Education and Production in the Ukraine, Georgia and Armenia* (DESIRE project, 2013 - 2017; [22], [23], [24]).

The main coordinator of the project was Thomas More University College (Belgium, BE). Further project partners were one HEI from Germany (DE), one HEI from Slovakia (SK), four HEIs from Ukraine, three HEIs from Armenia, and two HEIs and one research institute from Georgia.

On the basis of good practice and expert activities of partners from the European Economy Area (Belgium, Germany, Slovakia), a change from theoretically oriented teaching of some technical subjects into practically oriented and competencies-developing teaching was to be implemented into the curricula of relevant subjects of relevant study programs taught at HEIs in Ukraine, Georgia and Armenia. As the title of the project indicates, the target study programs and subjects which the particular activities

Figure 1 *Typology of the DESIRE project activities [23]*

of the project were aimed at were subjects or courses majoring in the issue of embedded systems, their programming and their use in different areas. This means that the general aim of the project, i.e., introduction of the change of theoretically oriented teaching of the concerned technical subjects into their practice-oriented and competence-based teaching, was concretized in the specific aims which were:

- to create practice-oriented syllabi and modules of teaching in the environment of embedded systems,
- to establish laboratories of remote experiments in partners institutions in Ukraine, Georgia, and Armenia,
- to develop skills to work with embedded systems required by the labour market.

In accordance with the stated three specific aims the project activities were carried out in three clusters: a cluster of analysis, a cluster of development, and a cluster of monitoring and evaluation (Figure 1).

From the above-mentioned it is clear that besides analysing curricula [25] of the subjects dealing with embedded systems issue (what is taught, how is it taught, when is it taught, with what time/lesson assignment is it taught, what are the expected learning achievements) and establishing new embedded system laboratories equipped with appropriate technical means at HEIs in Ukraine, Georgia and Armenia, a great attention was paid to new ways of the concerned subjects teaching and promoting teaching mastery of teachers who teach them. To provide these teachers new knowledge on latest trends in technical subjects teaching and opportunities to develop their pedagogical competencies, in frame of the project different teaching materials were prepared (e.g. [26], [27], [28]) and several training courses, master classes, for teachers from the Ukrainian, Georgian and Armenian HEIs both abroad (BE, DE, SK) and in the home countries were carried out.

4. Assessment of the project achievements

In 2017 DESIRE project was completed. In the frame of the third Monitoring cluster, a final assessment of the project achievements was prepared [22].

4.1 The methodology of the assessment

Assessment of the project achievements followed both quantitative as well as qualitative aspects.

The quantitative analysis was based on quantization of the particular indicators of the project results achieved both by the project partners as well as in total. The main observed indicators were the following ones:

- numbers of reviewed curricula / course modules within bachelor / master study programs,
- numbers of students who passed newly developed modules,
- numbers of remote / ESD laboratories developed at the HEI / in co-operation with other education institution / in co-operation with entrepreneur company or stakeholder organization,
- numbers of teaching materials / e-learning materials published at the HEI to assist the newly developed curricula / course modules in embedded systems,
- numbers of successfully defended BA / MA / Ph.D. thesis content-related to the project issue (embedded system design),
- numbers of training hours / training courses / master classes in remote laboratories usage for ESD the HEI participated at / the HEI organized for their students and academics / the HEI organized for other institution members,
- numbers of the participants of the above-mentioned activities,
- numbers of publications related to the project goals and results.

Table 1 General assessment of the project achievements

Assessment of the benefits of the project (in short and long-term aspects)
The project created opportunities for future cooperation between institutions involved in the project. Project results have created a platform for further development of distant learning courses and organisation of training courses, e.g., also for employed engineers. Teachers were trained and they mastered fully the relevant issue. Laboratories and materials developed within the frame of the project are used in current courses, as well as in the design of future study disciplines/courses curricula (currently being under development). Within the scheduled next accreditation processes the HEIs plan to introduce the new master courses into the curricula and bachelor/master programs. Main benefits of the project in both short and long-term aspects are: - created modern (embedded system) infrastructure and teaching environment, - significant investment in laboratory equipment and software, - development of new embedded system laboratories, virtual laboratories, remote labs network, - trained/re-trained teachers, an increase of their practical abilities in engineering courses teaching, - development of methodological supports to the courses, - modified curricula, updated syllabi, - new teaching materials, - practice-oriented curricula and modules, - wide usage of the remote laboratory, embedded systems laboratory and e-learning courses for students and teachers, - groups of students getting new skills and knowledge on embedded systems, - introduction of study disciplines relevant to today's education market through the financial and methodological assistance of partners, - development of robust STEM workforce increased employment in companies requiring market-driven technical skills, - new study possibilities for different target groups established based on the remote labs, - enhancement of the practical orientation of the courses related to embedded systems, - implementation of RL technology into the distance learning system (Moodle) to enhance self-learning capabilities of both students and teachers, - implementation of complex projects by students of different specialties, project-based learning, - development of research and design direction in preparing students of some IT specializations, - a significant increase of creative and practical components of the students professional training and education, - research publication performance of both academic staff and students, - collaboration between HEI and companies/shareholders, - enhancements of labour market, enterprise, and university triangle, - cooperation between EU and target countries in education and research.
Assessments of the weaknesses, limitations, insufficient results
Time limits of the project do not allow to introduce the full set of courses, as it requires not only the development of laboratory installations and stands but also the preparation of teachers, development of new subject curricula development of practical lessons. Main weaknesses of the project realization are: - technical and delivery problems (delivery problems caused by the political situation and war conflicts in Ukraine), - weak previous physical and engineering training of students, particularly low knowledge of mechanics, optics, electricity, circuits, etc., - lack of teaching materials in the target countries mother tongues, - a small number of students involved in the pilot teaching and other project activities, - low possibilities (in terms of the conditions of the HEIs environment) to continue in the already set relations.
Expected further use of the achieved results (after the project expiration)
Achieved results offer a strong basis for the refinement and advancement of newly established programs/courses in the branch of electrical engineering. They will be used to prepare also some further new/innovated study programs/courses (planned to be submitted for the scheduled next accreditation). The new laboratory equipment of control systems using embedded systems will be developed, including laboratory stands for remote lab sessions. In this way, joint work of students of different specializations will be improved. Within the project duration, a tight collaboration between particular national institutions involved in the project was established, and there are all preconditions to broaden this cooperation also in other dimensions (beyond the project issues).

Besides those mentioned above, a further use of the achieved results is expected in the following areas: - student and teacher mobility to partner HEIs for further studies and research, - development of new research projects, - active collaboration with industry representatives, - establishment of close contacts with the relevant businesses, and organizations of student internship, - start-ups establishment, - submission of a new Erasmus plus KA2 CBHE project on Grid of Online Educational Agents for Embedded Systems Teaching.
Proposals for the next activities
Proposals for the next activities follow/result from the mentioned further use of the achieved project results: - broaden the involvement of students at work in the embedded systems labs and R-labs, - to expand research aimed at embedded systems issue, - accreditation of new study courses, - establishment of close contacts with business, their involvement in the relevant course development, - training offered to more teachers using project DESIRE materials and equipment, - sharing of R-Labs, virtual laboratories and embedded system laboratories with other target groups, - working together on projects of students of different specializations, - adaptation of methodological support for various specializations, - keeping contacts among the DESIRE project partners after the end of the project, development of new perspectives of the cooperation based on the already existing one, - submission of a new Erasmus plus KA2 CBHE project on Grid of Online Educational Agents for Embedded Systems Teaching (GO-EAST) as a logical, natural continuation of the DESIRE project.

The quantitative analysis of the achieved project results done on the basis of above-mentioned indicators was supplemented by a qualitative (mostly scaled) assessment of several selected main indicators. In this qualitative analysis groups of students and teachers of the project partners HEIs, who took part in the concerned project activities, evaluated the carried out training courses, master classes, newly developed teaching and e-learning materials (assessments related to their content, quality and use done by both groups of the teachers and students), the use of the newly established remote/ESD laboratories (both teachers' opinions and experiences related mainly to their use for student training and education and students' opinions and experiences related mainly to the use of these labs for their own training and education).

The key qualitative analysis was done in the form of a synthesis report based on the partner institutions reports, structure of which consisted of:

- assessment of the benefits of the project (in both short and long-term aspects),
- assessment of the weaknesses, limitations, insufficient results of the project,
- expected further use of the achieved results (after the project expiration),
- proposals of the next activities.

Thereinafter main conclusions of the final synthesis report are presented.

4.2 Summarisation of the assessment main results

The final synthesis report involves generalized assessments of the project achievements in the project partners' view. Its main conclusions are presented in Table 1.

5. Conclusion

The issue of quality assurance, including assessment of teachers' competencies and ensuring their professional development, concerns not only European higher education institutions but it is a worldwide phenomenon reflecting a rapid increase of education and its values for the public. In this connection, it is necessary that higher education institutions demonstrate their interest in quality and educational standards by providing such study programs and subjects by which they will support internationalization of education, raise the attractiveness of their educational offer and take efforts in connecting theoretical knowledge with real practice. In this context, the DESIRE project has got together all the involved partners to mutual co-operation, contributed to innovation and modernization of the relevant study programs of the concerned HEIs, contributed to the professional development of the technical subject teachers and intensified the synergy between the HEIs and business enterprises in the partner countries.

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COMMUNICATIONS

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THE POSITION OF ETHICS IN RESEARCH METHODOLOGY OF EDUCATIONAL SCIENCES AFTER 1989 IN THE CZECH REPUBLIC

Ethics is one of the themes of educational sciences. Its position is in disciplines such as the history of pedagogy, philosophy of education, the theory of education, general pedagogy, didactics, andragogy or adult education, special pedagogy, research methodology of educational sciences, school legislation and other. Ethical norms were influenced by ideology in the Czech and Slovak environment before 1989. Ethics in educational sciences have gradually been revised after 1989. The presented paper focuses on the analysis of scientific texts on research methodology of educational sciences (pedagogy, andragogy or adult education, special pedagogy), dealing with research ethics and published in publishing houses of nation-wide distribution (Grada, Karolinum, Paido, Portal) in 1990-2015. Examined are ethical aspects of both quantitative and qualitative researches with regard to the development of contemporary global as well as local society.

Keywords: *ethics, methodology, research, sciences of education, scientific texts*

1. Introduction

Specialized study of the relationship between educational studies and ethics as two general scientific disciplines is connected with the constituting of partial scientific disciplines such as pedagogy, special pedagogy or andragogy [1], [2], [3], [4], [5] and other concepts of educational sciences based on humanist pedagogics, empirical educational science and critical educational theory [6]. Application of ethics in educational sciences appears in several places, namely in the field of history of pedagogy, philosophy of education, theory of education, general pedagogy, didactics, special pedagogy, andragogy in the case of values in education, moral education, setting of educational goals, application of educational principles and interpersonal relationships etc., and, last but not least, in educational research. If we consult the book Encyclopedia of Education [7], we can find a reference to two areas in the case of ethics, particularly the School Teaching described by Kenneth A. Strike [8] and Higher Education by Carol J. Auster [9]. Kenneth A. Strike [8, p. 753] discusses how ethical issues are represented in the law; how ethical issues are represented in the National Education Association's (NEA's) code of ethics; ethically based comprehensive views of education; the role of ethics in educational policy; and meta-ethical disputes relevant to education. Especially the ethics of inquiry is dealt with in detail by the NEA's code. Ethics of work of academic staff in relation to a conflict of interests, the realization of research, data processing, publishing of results and plagiarism are studied in the text titled Higher Education [9].

A decade later, there are several entries focusing on ethics in education in the publication Encyclopedia of Educational Theory and Philosophy [10]. In particular, these are Ethics in Teaching [11], Ethics of Care in relation to caring and ethical theory of Nel Noddings [12] and, last but not least, Ethics in Research [13].

2. Ethics in research in educational sciences

The issue of ethics of research in educational sciences is focused on similar areas as it is in other social sciences, e.g., anthropology, political science, psychology or sociology. The codes of ethics in research in social sciences mainly follow general principles and set standards [14], [15], [16], [17]. These usually are general principles such as Professional Competence; Integrity; Professional, Scientific, and Scholarly Responsibility; Respect for People's Rights, Dignity, and Diversity; Social Responsibility (comp. [14], [16]). The above principles are subsequently elaborated in ethical codes into numerous standards; e.g. in the case of the Code of Ethics of the American Educational Research

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Association the ethical codes were elaborated into 22 main and many partial items [14]. According to Thomas A. Schwandt [13, p. 297], ethical codes in the field of research are mainly focused on *"(1) identifying and defining ethical principles and analysing ethical issues entailed in the responsible conduct research" (respect for persons, beneficence, justice), "(2) cultivating ethical behaviour, including the capacity for ethical reasoning, to address dilemmas that arise in working with people in social, behavioural, and educational research" (moral sensitivity, moral judgment, moral motivation, moral character); and "(3) regulating ethical conduct" (self-monitoring of researcher; monitoring takes place via codes of conduct; governmental regulations and institutional policies)."*

When it comes to educational research in the Czech background, ethics is specified by Jan Prucha [18, p. 8] as "*a set of moral values and norms regulating activities of those who perform educational research*". Principal discussion on an ethical code was started among members of the Czech Education Research Association (CERA) in 2008. The final version of the CERA Ethical Code was based on analyses of ethical codes of foreign research associations [19]. However, the final version of the association's ethical code, divided into two parts - Ethical Principles of Realization of Research and Ethical Principles of Publication Activities, was not approved until 2010 [20]. The Ethical Code of the Czech Pedagogical Society is similar [21]. The above-described facts imply the objective of the paper - to analyse specialized literature on the methodology of educational sciences and to identify the existence of ethical aspects in them before and after of the said codes [20], [21]. The research question is: are ethical aspects of research realization and publishing present in specialized literature on the methodology of educational sciences research? Specialized publications on the methodology of educational research are frequently used in methodology courses at universities and in transmitting knowledge and skills to next generations of researchers, educationalists, and teachers. Thus, in the globalized and at the same time individualized society [22], [23], the ethical dimension of research cannot be omitted in social sciences, including educational sciences, because research issues concern societies, communities, social groups and individuals, and researchers must be aware of the fact that, above all, they must not harm subjects of their researches, distort research results and use them to their advantage or abuse the researches of other specialists, as, in the end, approved by the ethical codes of multinational [14], [17] and national educational research associations [20], [21].

Specialized literature dealing with the methodology of educational sciences research in the Czech Republic is published by university publishing houses and also by national publishing houses focusing on production in the field of educational sciences. Publication distribution of university publishing houses outside their home universities is limited, except for the Karolinum Press of Charles University. This is why productions of national publishing houses are primarily analysed in responses to the research question. The research objects are books dealing with the methodology of research in educational sciences by national publishing houses published between 1990 and 2016 in the Czech Republic.

The form of specialized books on the methodology of educational sciences research by Czech and Slovak authors was influenced by foreign books translated into Czech before 1990, namely the books *An Introduction to Educational Research* (1964) by Robert M. W. Travers [24] and *Foundations of Behavioral Research: Educational and Psychological Inquiry* (1964) by Fred N. Kerlinger [25]. Both of these books do not pay attention to research ethics explicitly. Mentioned are mistakes which a researcher should avoid when designing research goals, questions, tools, choosing the research sample, applying research tools, interpreting data and preparing research reports. Similarly, this area, called "research ethics" in educational sciences today, is represented even in a university textbook on educational research written under the leadership of Jarmila Skalkova [26]. The said initial analysis of the most wide-spread books dealing with the methodology of educational sciences research before 1990 shows clearly that it is possible to find in them what should be avoided when carrying out a research or research errors; however, this is not the same as setting ethical principles and standards. In this context, researcher errors, research questions/hypotheses errors, research tool errors, sample selection errors, application of research tool errors, data interpretation errors, research report errors appear as most frequently cited in the literature [24], [25], [26].

3. Ethics on research methods in educational sciences in Czech literature

Specialized books focusing on the methodology of research in educational sciences used in lessons at universities are the object of the analysis. The content analysis did not include books that were focused on different social sciences or were too general. The catalogue of the National Library of the Czech Republic was used for selecting the analysis units. The starting point of the analysis were the following keywords: inquiry, research, pedagogy, education, educational, method. The next criterion was the Czech language of the books and their originality. We found 37 books written in Czech. In the case of application of the criterion of the nationwide distribution of the books, the selection was limited to 14 publications, based on the result of the second step of the analysis. Subsequently, duplicated books published in several editions were excluded, and this is why the final number of analysed publications is only 10 books. The set of books was divided into three groups in the third step of the analysis. The first group is primarily focused on quantitative research, i.e. Chraska [27], Pelikan [28], Prucha [18]; the second group deals more or less with both the types of research, i.e. Gavora [29], Manak &

Table 1 Principles and standards of research ethics in books focusing on educational research methods

Focus of specialized literature	Quantitative			Quantitative as well as Qualitative					Qualitative		Number Yes
	[27]	[28]	[18]	[29]	[30]	[31]	[32]	[33]	[34]	[35]	
How to carry out research	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	9
Researcher errors	Y	Y	Y	Y	S	N	Y	P	N	P	5
Research questions/hypotheses errors	Y	Y	Y	Y	N	N	Y	P	N	P	5
Research tool errors	N	P	P	Y	N	N	Y	P	N	P	2
Sample selection errors	N	N	Y	Y	N	N	Y	P	N	P	3
Application of research tool errors	N	Y	P	Y	N	N	Y	P	N	P	3
Data interpretation errors	N	Y	Y	Y	N	N	Y	P	N	P	4
Research report errors	N	Y	Y	Y	P	N	Y	Y	N	Y	6
Ethical principles	N	Y	Y	N	N	N	Y	N	N	Y	4
Ethical standards of behaviour	N	Y	N	N	N	N	Y	N	N	Y	3
Ethical standards of behaviour regulations	N	Y	N	N	N	N	Y	N	N	Y	3

Legend: Yes - occurring, No - not occurring, Partly - partly.

Svec [30], Prucha [31], Skutil et al. [32], Svec et al. [33]; and the third group consists of books dealing with qualitative research, i.e. Gulova, Sip et al. [34], Svaricek, Sedova et al. [35]. The assigned letters represent heads of the columns of Table 1 Principles and standards of research in books focusing on educational research methods.

Criteria showed in the first column of Table 1 were set. It was examined whether the authors focused on the teaching of research realization, followed by seven variables focused on the faults or risks in research; subsequently, three variables related to research ethics based on Schwandt' text [13] are given.

The said analysis shows that in the case of quantitatively focused books, research ethics is explicitly dealt with in the second chapter of the book [28, p. 35], and errors in research are the object of both the specialized book [18] and [28]. Book [27] discusses researcher errors; however, its main objective is to introduce procedures in statistical data processing.

In the case of the books covering both quantitative and qualitative research, the question of ethics in research is discussed in the specialized book [32], containing the chapter Ethical Principles in Educational Research (Eticke principy v pedagogickem vyzkumu) [36] dealing with ethics at the stage of research preparation (selection of research sample, guaranteeing respondents' anonymity, use of informed consent), publication of research outcomes (undistorted presentation of research result, repeated publication, work with quotations and rephrasing). In the case of other chapters, their authors discuss risks and frequent errors in the application of research methods and data analysis. Attention is paid to risks and errors in research realization in the book [29] translated from the Slovak language; however, the issue of ethics in research is not covered there. The next book [33] is also translated from Slovak and was written by several authors who implicitly indicated possible risks and errors in examining educational reality at some parts. The specialized books [30] and [31] do not explicitly deal with risks and errors in research; research ethics is not mentioned here. Book [30] focuses on the use of methods in diploma theses. Book [31] primarily discusses the situation of research in adult education in the Czech Republic.

The two last specialized books of the research sample cover the field of qualitative research and are marked as [34] and [35]. The issue of ethics in research became more frequent in relation to the spreading application of the qualitative methodology. This statement is also supported by book [35] where one of the subchapters focuses on Ethical Dimensions of Research (Eticke dimenze vyzkumu) [35, pp. 43-50], in particular confidentiality, informed consent and making the research report accessible to research participants. This book regards the ethical dimension of research as an indispensable part of research realization, playing a significant role in the preparation of the research report. The last one of the analysed books, marked as [34], primarily representing qualitative research, does not deal with ethics in research implicitly. It specifically focuses on explaining the research design and its examples in particular cases.

Summing up the evaluation of the research sample of Czech specialized books that focus on research methodology in educational sciences in the last twenty five years, it must be stated that only three of them [28], [32], [35] explicitly deal with its principles and standards across the spectrum ranging from quantitative to qualitative research. Only one of them was published after the specialists' discussion in professional organizations (CERA-CAPV, CPDS) about the need to work with the ethical dimension of research. Two-thirds of the books in

the research sample are focused on risks, errors in research and ethics in writing research reports. The analysis showed that even the books published after the discussion of ethics in educational research after 2009 do not automatically include ethical dilemmas in their contents [31], [34].

4. Conclusion

The terms educational sciences - ethics - research are undoubtedly related and are even codified in the form of the Ethical Code of CERA and the Ethical Code of CPDS in the Czech background. In the books published before 2010, their authors tried to point out risks and errors in research and their prevention, including ethical ones, despite the fact that they were not explicitly named.

Ethical principles and standards are already set in some recent specialized texts. Only three books of the analysed sample intentionally pay attention to the ethical dimension of educational research. Of the books addressing the analysis of ethics in research, one was published in 1998 [28] and the second one in 2007 [35], i.e. before the discussion of research ethics in the CAPV-CERA. From a different perspective, it could be the book [35] that started the discussion. However, it cannot be said that the discussion of an ethical code in the Czech professional community resulted in integrating the issue in specialized books on research in educational sciences, as proved by the published books [31] and [34]. Specialized books are being published, not dealing with the issue of ethical dilemmas in research. One of the causes may be the fact that most of their authors work as university teachers who include chapters into their books according to the structure of their courses focussing mainly on acquiring research methods, sample selection, research methods, data collection, and processing. Ethical principles and standards may be a latent part of their work that may frequently escape their notice.

It is necessary to manifest ethical principles in relation to the spreading issues of educational research, diversity of research samples, publishing research reports and messages in the public space of the Internet. The published results of researchers, carried out in correspondence with properly written specialized books on research, may have both local and global impacts on the evaluation of a researcher's work and examined field due to the neglect of ethical principles.

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THE THEMES OF GLOBAL DEVELOPMENT AS A CHALLENGE FOR CONTEMPORARY EDUCATION IN THE REFLECTION OF FUTURE TEACHERS

The themes of global development should form a significant part of the educational process and also of the so-called turning-to-the child education. The themes include the consequences of globalization, technological development, and the lack of ethical reflection connected with them. The article is divided into a theoretical and an empirical part. The theoretical part is focused on the explanation of the terms still not widely known in the educational process: global citizenship and responsibility, the limits and borders of global development in education, and the way of passing along ambiguous themes. The empirical part presents a concrete lesson on the theme of food waste in the fifth grade of a primary school and its analysis by future teachers, the students of the Faculty of Education at Charles University. The paper is mainly focused on the points which the future teachers considered to be important and which they neglected or "were not able to see."

Keywords: *themes of global development, ethical challenges, global citizenship, food waste, fifth grade of a primary school, future teachers, transcendence, turning-to-child education*

1. Theoretical challenges for global development education

A rising number of teachers in the Czech Republic deal with how to teach global development themes. Why are they so important? How are we to work with them in the classroom? These are the questions that dissuade many teachers from teaching them. These topics are the result of processes that have been taking place in society for many years. It is the process of globalization, technological development, but also the absence of the reflection of ethical issues which are implicit in them and which are not deemed important by many, despite the fact that they (the topics of global development education) entail the "general value systems" of man [1, p. 36].

1.1 Human responsibility for the world is a part of turning-toward-the child education

Czech philosopher of education, N. Pelcova, says that education is still under the influence of subject-object thinking. In practice, this is reflected in the fact that "all that is living is degraded to the status of a mere object"; in people's minds, nature can then be "conceived of only as a raw material resource, [it is perceived that] man [can be] used as a means of achieving another goal" [2, p. 35; p. 5]. As the philosopher M. Buber said, the other person is not You, but It. I can use It to my advantage, regardless of the consequences of my actions. The result of human progress is the fact that most people in the so-called Western society have plenty of food, medical care, and technical facilities. Progress and a personalized and individualized way of life [3] have influenced the relationships of man to the whole. **Responsibilities** for the whole world have disappeared from everyday life, but also from the school curriculum [4]. Man has ceased to be an "authentic being" who seeks to overcome himself [5, p. 155].

As early as the late 1970s, the German-born Jewish philosopher H. Jonas spoke of new challenges for society. One of these challenges was, "Act in a way, so that the effects of your actions will not destroy the future of such a life" [6, p. 35]. H. Jonas is primarily concerned about **acting responsibly towards the whole**. This includes two possible understandings of the notion of responsibility. The first is "responsibility as a causal attribution of executed acts". Only after a person has acted in a concrete way is he responsible **for the consequences** of his actions. It follows that the less one acts, the less he is responsible ("the lass man acted, the less he has to account for"). The second type of responsibility is related to the future. It is the responsibility "for what needs to be done". H. Jonas explains this second type of responsibility as

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follows: this responsibility arises before man everywhere where the concern is "well-being, interest or the fate of others" who have "because of the circumstances or based upon an agreement got under my protection, which means that my control over them at the same time includes my duty towards them" [7, p. 143-144]. The problem of today's society is that it does not feel responsible for its future. Another characteristic of such responsibility is, according to the author, "continuity". The responsible parent and the statesman always have to keep asking, "What will happen then?", "Where will it go?" and at the same time: "What preceded this?" According to H. Jonas, man is to be responsible for what **transcends him time-wise**, "What is that concerning which the responsible person can no longer be ultimately responsible". [8, p. 162-163]. This is perhaps the reason why this characteristic of responsibility is not spoken about often.

Pedagogy has underestimated the transcendence of man. Turning-to-the-Child defined by the Czech pedagogical psychologist Z. Helus encourages the development of the child's entire personality, i.e. one's ability to transcend oneself. Although this new Czech term can be correctly associated with the concept of child-centered-education, it is used for the new paradigm in the Czech education known as child-centered-education of the new generation (Z. Helus, V. Spilkova). The main task is to liberate a man from his everyday routine and to guide him to four types of teaching goals: "anthropological", "ethical", "contextual" and "transcendental" [9, p. 5-6]. The turning-to-child education objectives also include "**overlap objectives** (transcending)", which emphasize "respecting binding values beyond the individualistic life balance: respecting the values of truth, goodness, beauty, interpersonal solidarity, etc." [10, p. 30]. Responsibility for what transcends man time-wise belongs to this new concept of teaching. This can have a positive effect on the personality of the pupil and it is, therefore, a certain prevention against the negatives of a world influenced by technology.

1.2 Responsibility and the framework educational program for elementary education

In the Czech curriculum document, *Framework of Educational Programs for Basic Education (FEP BE),* is "competence to solve problems". One of the definitions is that the pupil "thinks critically, makes judicious decisions, is able to defend them, realizes responsibility for his decisions, and evaluates the results of his actions". In this formulation, the notion of decision is linked to a specific content - with "problem-solving" and "outcomes of the action". This would mean that responsibility is only the result of a specific decision or action (H. Jonas's first type of responsibility) [11].

Most concerned with the concept of responsibility is the subject of **Ethical Education**. However, it is only an optional part of the school educational program in the Czech Republic. In some educational areas, this term is present, but it does not stand for a comprehensive concept of responsibility. In the primary (ISCED 1) school, the notion of responsibility can be found in the teaching field called **Man and His World** ("considerate behavior towards nature, nature conservation - people's responsibility, protection and formation of the environment, protection of plants and animals") [12, p. 33]. The theme of general responsibility also appears in cross-curricular themes. A concrete example of this is the topic "Education of a Democratic Citizen", in which the pupil is led to the fact that "participation in the decisions of the whole is connected with the awareness of one's own responsibility for these decisions and their consequences." We also find the concept of responsibility in the following cross-curricular themes: "Education for Thinking in European and Global Contexts", "Multicultural Education", "Environmental Education", and "Media Education" [13].

We see that the notion of responsibility is not an insignificant part of the Czech curriculum, although it could be more frequent in compulsory education areas. It can be assumed that in the learning process, the concept of responsibility is approached rather in an applied manner. And here is perhaps one of the answers why the themes of global development education, which very strongly emphasize the second type of responsibility (according to Hans Jonas), are difficult for many teachers.

1.3 Responsibility and global citizenship

Man is a part of the world globalization process that cannot be stopped. Globalization "brings new problems which are the natural consequences of the speed and the urgency of the necessary changes" [14, p. 262].

A global citizen is one who: Is aware of the wider world and has a sense of their own role as a world citizen. Respects and values diversity. Has an understanding of how the world works. Is passionately committed to social justice. Participates in the community at a range of levels, from the local to the global. Works with others to make the world a more equitable and sustainable place. Takes responsibility for their actions" [15, p. 5]. In theory, everyone becomes a global citizen by their birth, but they really become one only through an internal identification with such citizenship and a conscious commitment to it. Like any nationality, it can be defined locally, historically, culturally and socially, but in a different way than conventional nationality. The fellow-citizenship includes the **entire planet** (animate and inanimate nature), that which is close, but also that which is totally alien to the given man [16].

Despite the ambiguity, the notion of global citizenship is linked to the concept of **global ethics** [17] and with certain actions considered to be moral by the majority of society. Even though the term global citizenship is more challenging for the teachers and tends to lead to ambiguity, its appeal is clear - to lead pupils

to embrace responsibility for the world. What is the practice of education for global citizenship and where are the current open challenges for which teachers need to learn to seek answers? We will see this on a concrete empirical survey and its analysis.

2. Qualitative research methodology

2.1 Contemporaneity of the topics of education for global citizenship

Education for global citizenship is presently changing and developing. This results in an increased need to equip (future) teachers with the appropriate knowledge and skills to implement such training in practice [18]. The research of attitudes towards education for global citizenship among pedagogy students [19] has shown, that students perceive the area of education for global citizenship as very important, but **do not feel too competent** to engage in school projects dealing with certain aspects of global citizenship. The reason may be the complexity of this educational area and the need to deal with controversial issues. This could also be connected with the fact that "the professional development of teachers in the Czech Republic is unsystematic" [20, p. 133].

2.2 Research objectives and research questions

Our study focused on the reflection of important phenomena in a lesson of Education for Global Citizenship [21] by future primary school teachers, students of the faculty of education. The general objective of the research was to describe and explain what future teachers are observing and noticing in a lesson at the 5th year of primary school focused on education for global citizenship.

The research question has been formulated: *How do students of pedagogy reflect the content and process of teaching focused on the topic of education for global citizenship?* This question was then divided into two specific research questions:

1. What content are they noticing and reflecting in the class?
2. Which educational methods and practices do they notice and reflect upon?

2.3 Research methods and data collection

A qualitative analysis of student reflections was chosen as the research method. Data collection took place in June 2015. We asked students to watch a video of a whole Czech social studies lesson at a primary school (Grade 5). The lesson is a separate content unit, and for understanding it, it is not necessary to know the context in which it is set. The students were asked to write what they "considered important and noteworthy" about the monitored lesson. They were told that there "were no correct or wrong answers" and that they should "feel free to write their honest views". The majority of students were in their mid-twenties and had teaching experience only within a compulsory practice, which includes an average of 12 lessons of different subjects. These students have taught lessons of social studies only once to three times [22]. These data were also analyzed in a quantitative research of the knowledge-based reasoning of future teachers of different subjects [23].

2.4 Description of the monitored and reflected lesson by future teachers

The lesson was about mediating issues of wasting food. The lesson began with brainstorming about what food waste was. The teacher then projected a graph showing the differences in the amount of food waste in Asia and North America on the interactive whiteboard for the pupils to see. Then the pupils in the groups drew an outline of a fruit tree on a paper. They were supposed to write about the causes of food waste into the roots, the ramifications of this waste to the branches, and the ways of solving the problem into the root. They presented their work, the others evaluated it, and they then expressed their opinion about the evaluation. The teacher projected expert suggestions on tackling food waste issues on the interactive whiteboard. The teacher invited the pupils to compare their suggestions for solutions and these suggestions by the experts. The teacher announced that the pupils would be involved in a campaign to alert other pupils at the school about the issue of food waste. At the end of the lesson, the teacher and the pupils summed up the issue.

2.5 Research participants selection

Research participants were students of pedagogy for the primary school on the Faculty of Education at Charles University. When they finished their social studies of didactics (in 4th grade of their five-year master study), a group of them was asked to watch a video of the lesson and write a reflection. Of the total number of 69 students in that year, the study was conducted by 23 students (only women). J. Stara taught this group of students an optional course, so it was a sample of respondents that was available.

2.6 Data analysis

First of all, we identified the meaning units in the data obtained from student essays and we subsequently named the codes. The first codes were allocated *ad hoc*, and then the codes

were renamed, refined, merged, etc. Continuous hierarchization of codes created more general categories. In the next phase, issues that were found to be crucial in coding were compared with video from the class.

3. Results of research and their importance for teachers

The results of the research are presented in a way that summarizes the problem of the lesson at primary school, followed by the students' response to this problem, and then briefly summarizing the meaning for the teacher.

3.1 Stereotypical thinking

There are stereotyping statements in the monitored primary school lesson, such as: *Children in Africa would be grateful for your snack; He throws away an apple instead of giving it to someone in Africa. Because the American is not grateful for how he is doing, he always drinks Coca Cola and eats hamburgers.* The teacher did not respond to them, with only one exception.

A majority of the students from our sample did not notice that pupils manifest this stereotyped thinking during the lesson. Only 4 students noticed (described the situation) the phenomenon (the presence of stereotypical statements). However, no comment related to this phenomenon contained any reference to theory, nor was there a technical term used in the student reflections (stereotypes, stereotyping, ...).

The question we have to ask is this: Why do teachers not respond to stereotypical statements or do not consider them important? When a small child does not want to eat, its mother says: If a child in Africa had your food, he would eat it. A little child at that time does not even know that Africa exists and cannot imagine real hunger at all. But because of this parental reaction, it learns that if we behave badly to food, "a child from Africa" appears. The stereotypes are so deep within us that our proneness to stereotypes is, in fact, unconscious. It is not about completely eliminating stereotypes (it is not even possible), but the teacher should be aware that it is possible to work with them, so that the pupils learn to find them and realize their meaning. Many of these stereotypical statements flatten the real problems in society and lead pupils to apathy and inactivity [24].

3.2 Relationship between the subject and real life (authentic learning)

Many students were aware of the importance of the relationship between the subject and the real life. In their reflections, however, they do not use the term of authentic learning or the terms constructivism, preconceptions, etc. but they adequately describe the phenomenon or use the phrase *linking life with school* or *pupil experience*.

3.2.1 The learning task of the tree

In the lesson, the pupils solved the learning task of the tree (see above).

According to the students, this learning task is important because it allows the pupils to work with their own experience: *Using the tree and its parts (roots) helps the children to imagine the specific dimensions of the problem better. In addition, the pupils can work with their own life experiences and communicate their experience in the group work.* The learning task leads to learning outcomes linked to the pupils' lives (including attitude change): *Finding problems is very important in this assignment and it plays a big role in pupils' lives.*

None of the students noticed that the tree parallel basically breaks the whole of the lesson into three distinct entities: causes of waste, consequences of waste and solutions - the teacher works on the individual parts of the tree, i.e. solves all the causes, then all the consequences and, in a moment, all the solutions proposed by the children. The problem is that taxonomic lists of causes and consequences weaken the most important reality - the problem of wasting food as a complex human problem. If we watch children working in a group, we see something unique. The children consider the topic as a whole, i.e. they connect specific causes, consequences and solutions. There is no such complex thinking of children when presenting a topic together in the classroom. This is why there were at least two misunderstandings between the pupils - they give each other "minus points" or question marks for information that they disagree with or are not able to understand. This teaching style results in the fact that the child does not learn, for example, that one solution has more causes or that similar situations require different solutions. The pupils are also not lead in terms of situational ethics to distinguish similar situations with different solutions.

3.2.2 Method selection as a topic for gde (global development education)

The teacher works with pupils using multiple methods.

According to the students, the methods used (brainstorming, group problem analysis (tree), presentation) bring the pupils "into" the problem (motivate the pupils): *In the group work, however, it can be seen that pupils are already trying to tackle the problem, they are discussing.*

The students did not notice that the pupils worked in a group with their own experiences, but what they were writing into the tree were words selected beforehand. Therefore, important statements relating to the anthropological factors of the problem

of food waste remained unnoticed. This is, for example, the case of a girl's statement: "The rich do not see a problem in this"; or a boy's: "We do not realize this". The children themselves perceive the anthropological depth of the problem of food waste, which is not further reflected in the lesson. The teacher should have rather included a group dialogue with the children or other work with the tree. Some groups of the children could have examined only one part of the tree in detail, others could have worked with the tree as a whole and thus present it to others. It was clear that in order to develop the moral competence of man in GDE, **the choice of methods is very important.**

The students wrote that it is a necessary prerequisite for affective learning for pupils themselves to adopt an affective goal [25]. By the right choice of teaching methods, the teacher could have influenced the emotions of the pupils [26]. The students criticized the fact that the pupils were not led by the teacher to change their attitudes: *Children (had the teacher been more convincing and used other methods) would have found out that this problem is also their problem, that they too must fight to improve the situation. By talking in a third person, it seems to me that they feel like this does not really concern them...*

There remains an unanswered question from the students' reflections: How do the students imagine working with emotions? Here, a short movie or a dramatization proves to be an excellent didactic element.

3.2.3 Teacher as a model and facilitator

In the lesson record, we see that the teacher accompanies the pupils in the subject. How did the students perceive the teacher as a model?

For students, the teacher was not a convincing example of a person who treats food economically and is engaged: *Yes, he tells the children that food should not be wasted, but I myself felt that even he would throw the unfinished apple away. It also seemed to me that he did not go to the heart of the point with the children. He does not ask any further. He does not try to get the kids to really think about the problem. One pupil answered that people were wasting food because they would never run out of food. This is, in my opinion, an interesting idea! However, the teacher passed over it and did not work with it any further. It was excellent that some children are able to see the problem in a broader context. For example, the answer that the result of wasting food is also the destruction of nature, due to the constant transport of more and more food, was great. One could also work further with it.*

From an analysis of the lesson, students base their feedback on the certain impressions the teacher gave them. In some of the teacher's reactions, we, unfortunately, see that he does not want to go deeper into certain topics (food in the school canteen, etc.) and this weakens his authority.

3.2.4 Student experiences and their problem solving

According to the students, the teacher does not take sufficient account of pupils' experiences, ideas, thoughts: *Certain pupils' answers were not bad at all: "Many people in school canteens do not finish eating the meal and they throw it away." The teacher disregards this idea by saying that "The school canteen is a hot topic, so I would focus on that". Still, the pupil does not attack the school canteen, so I would appreciate this answer. The children encountered food every day in the school canteen and it really is wasting when they return food. What could be done with it? What about asking the cooks for smaller portions? Or unregister for the specific lunch when I know that I do not like the given meal?*

Students correctly described that the teacher has to bring depth into everyday topics because only this leads the pupil to a deeper understanding of responsible behavior. The problem of the given school canteen is not only ethical but also legislative. The pupils repeatedly mentioned during the lesson that they would give food to those who needed it. This officially cannot be done in the school canteen. The teacher does not lead to this differentiation in the lesson: good solution and feasible - good solution, but it is not feasible in the context of the society's laws.

3.2.5 Moralizing

The students noticed that the teacher moralizes: *He then added his example of the fruit pupils receive at school and reminded them that they are often wasteful with it. Here, I would rather choose a question to make the pupils realize it themselves. This statement seemed very moralizing to me.*

It would be a mistake if the teacher did not react in such a situation at all. Students, however, grasped one important fact, namely that such reaction of the teacher will rather discourage the pupil from responsible behavior. The teacher could have asked the children for example "What leads the children to their wasting of food?" and then further discuss this problem with them.

3.2.6 The formal approach of the teacher

Two students have criticized the teacher's formal approach: *In this answer, I personally see great truth and depth, so I was sorry that the teacher had not worked with this sentence further at all. At the same time, I noticed that children speak very broadly, generally, relating everything to humanity at large, "we as people are too picky, we do not want something for a snack, so we throw it away, etc." I liked how the teacher turned Max's question towards the pupil himself. I would do it the same way with everyone else. The children would then come to realize that this problem is also their problem that they too must fight to improve the situation. By talking in the*

third person, it seems to me that they feel that this does not concern them much. The students suggest using the student responses and the children's ideas more: *I felt it was a shame that the teacher did not work with these pupils' ideas, and he did not ask what they all meant by them, where these things then play out. How it works, how it does not work. Why it could or could not be that way. It seemed to me that he was trying to stick to the lesson plan, but did not really reflect what the children were saying and did not discuss it with them ...*

It is clear from the student responses that topics of education for global citizenship require greater teacher engagement, a willingness to do things differently, a willingness to ask children more and to develop their opinions, and to discuss with them more.

3.3 Content specifics of the subject of food waste

The teacher focused on the topics of the tree: causes, consequences and solutions. But that is not the only content of the subject of food waste. Some of the students have expressed the importance of leading children to **active involvement.** In addition to the aforementioned comments related to the education of indifferent individuals willing to behave responsibly, we expected the students to comment on the school campaign mentioned by the teacher. However, only two reflections mention that the "campaign" mentioned by the teacher affects the pupils motivationally. Only one student explained that the campaign taught the children that the problem was already being solved worldwide and that they could actively engage in concrete actions. In her explanation, the student reasons by theoretical references cited in literature: [27] *I also find the reference to the International Biodiversity Day beneficial - children know and see that something is going on with things around them, which they can relate to, where they learn about things, how and where to apply their further interest in the subject.*

Students have rightly recognized that the individual's responsibility is linked to a person's personal commitment - to go do something that I am not actually responsible for, but I am responsible for it morally. In essence, they themselves recognized that the responsible conduct demands Jonas's second type of responsibility, which leads a person to what is "to be done" for future generations.

4. Conclusion

The topics of education for global citizenship are related to the concept of human responsibility for the whole planet Earth and the future of humanity. It is a different kind of responsibility than that toward which a person is routinely lead in society and at school. This was also shown in the analysis of the teaching lessons by future teachers. Being responsible in global development education means feeling that these subjects touch the very being of man and that they are encouraging him to engage in a particular committed action.

For the teachers, these topics are connected with many challenges. Teachers should realize that our stereotypical thinking, moralizing and formal approach dull the human conscience and are, unfortunately, often present in major topics. This prevents the development of children's moral competence and their understanding of global ethics. The teacher should prepare for situations in which the pupil will feel or experience the relationship of the subject to real life. Real human life is not a taxonomic list of causes and consequences, but is always bound to a specific situation and behavior of a person. Furthermore, the teacher should be a model. If he/she is not internally identified with the subject, it is difficult to lead pupils to personal engagement, as was recognized by students in our research sample. A person's behavior must be consistent with his inner convictions.

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COMMUNICATIONS

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ETHICAL ISSUES IN THE ASSESSMENT OF SPEAKING SKILLS

Language assessment is a rather complex yet an inseparable part of the learning process. Not only should it represent learners' achievements, but it also ought to facilitate and enhance learning. Assessing spoken proficiency can be regarded as particularly difficult, complex, and time-consuming since many aspects of oral performance need to be carefully considered. The two types of assessment, the assessment for learning (formative assessment) and the assessment of learning (summative assessment), have to be taken into account as they both occupy a significant role in the overall development of speaking skills of a learner. However, mastering the formal and informal kinds of assessment requires considerable expertise, hard effort, and invaluable experience. Therefore, EFL teachers often fail in their attempt to conduct a proper and fair assessment of speaking skills. Moreover, the question of ethics, which represents an important element of the assessment process, is frequently neglected too. This paper discusses ethical issues in the assessment of spoken proficiency of EFL learners. Furthermore, ethical obligations EFL teachers ought to comply with in terms of the Communicative approach are also explored.

Keywords: *formative and summative assessment, ethical aspects, speaking skills, EFL learner, EFL teacher*

1. Introduction

Speaking is one of the four language skills (listening, reading, writing, speaking) which English language learners need to master if they wish to become efficient users of the language. Listening and reading are receptive skills, while speaking and writing can be considered productive skills. T. Farell [1] maintains that it is more difficult to speak a language than read or listen to it. Similarly, assessing speaking can be deemed to be more difficult and complicated in comparison to the evaluation of reading or listening. Therefore, English teachers need to take plenty of aspects into account if they wish to teach and test oral skills effectively and appropriately.

The first part of the article discusses the process of teaching speaking skills. Moreover, the microskills of speaking are introduced, and providing learners with sufficient space to speak is emphasized. The second part examines how the skill of speaking ought to be assessed from the standpoint of formative and summative types of assessment. Both parts of the paper take, among other features, ethical aspects into consideration.

2. Teaching speaking

The skill of speaking can be regarded as a primary skill in English as a foreign language (EFL) teaching [2], [3]. People who possess the knowledge of a language are often referred to as speakers of that language. Furthermore, the primary aim of the majority of learners is to be able to communicate in a foreign language. Therefore, teaching speaking skills ought to be in the foreground of the EFL teaching and learning process. On the other hand, it is important to mention that speaking is possibly the most difficult of the four skills [4]. While it is necessary that EFL learners demonstrate the knowledge of grammar, vocabulary, and language functions, it appears that such knowledge is not enough [5]. Mastering the skill of speaking is a rather complex and difficult issue, and apart from grammar, vocabulary, and pronunciation, it involves a number of aspects - the so-called speaking subskills (microskills), which actually form the overall competence of spoken proficiency of an individual [6]. D. Brown [7, p. 272] mentions these microskills of oral communication of a learner:

- produce chunks of language of different lengths;
- orally produce differences among the English phonemes and allophonic variants;
- produce English stress patterns, words in stressed and unstressed positions, rhythmic structure, and intonational contours;
- produce reduced forms and words and phrases;
- use an adequate number of lexical units (words) in order to accomplish pragmatic purposes;
- produce fluent speech at different rates of delivery;

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- monitor your own oral production and use various strategic devices - pause, fillers, self-corrections, backtracking - to enhance the clarity of the message;
- use grammatical word classes (nouns, verbs, etc.), systems (e.g. tense, agreement, pluralization), word order, patterns, rules, and elliptical forms;
- produce speech in natural constituents - in appropriate phrases, pause groups, breath groups, and sentences;
- express a particular meaning in different grammatical forms;
- use cohesive devices in spoken discourse;
- accomplish appropriately communicative functions according to situations, participants, and goals;
- use appropriate registers, implicature, pragmatic conventions, and other sociolinguistic features in face-to-face conversations;
- convey links and connections between events and communicate such relations as main idea, supporting idea, new information, given information, generalization, and exemplification;
- use facial features, kinesics, body language, and other nonverbal cues along with verbal language to convey meanings;
- develop and use a battery of speaking strategies, such as emphasizing key words, rephrasing, providing a context for interpreting the meaning of words, appealing for help, and accurately assessing how well your interlocutor is understanding you.

Most of the English language teachers would probably agree that there also exist other subskills. These microskills prove that the speaking skill is indeed a complex and difficult to master, and the question of how EFL learners ought to acquire and practice the subskills needs to be addressed.

Traditional methods of teaching such as the grammar-translation method paid only little or no attention to speaking (and listening) activities [8]. Furthermore, almost no attention was devoted to pronunciation [9], which is a vital component of spoken proficiency. In connection with this, L. Mocova [10] explains that successful communication (also) depends heavily on stress, rhythm, intonation, and appropriate pronunciation of sounds.

When the Communicative approach (Communicative language teaching) came into being, a shift in English language teaching occurred. Language learning moves from explicit, declarative knowledge (e.g. grammar rules, forms, or vocabulary) to its proceduralization (acquiring implicit knowledge), which means that the learners ought to be able to use language automatically as well as creatively when needed [11]. "In other words, learners do not need to be able to talk about grammar but they need to be able to use it for communicative purposes" [12, p. 31]. Taking the four skills into consideration, "Communicative language teaching emphasizes speaking and listening rather than reading and writing" [13, p. 150].

If EFL learners are to become efficient speakers of English, teachers should adhere to the principles of the Communicative approach. One of the principles underlines the importance of providing learners with sufficient space for developing the skill of speaking. It is obvious that improving one's speaking ability is not easy when a learner does not have ample opportunity for practicing speaking in the target language (numerous theorists believe that using L1 in the English language lessons blocks and slows down the acquisition of L2 [14]).

Traditional teacher-centered approaches focused on the teacher instead of on the learner, and it was the teacher who did the most of the talking while students merely listened [15]. "Although it may sound like a cliche, learner-centred instruction/education has been proved as indisputably more effective compared to teacher-centred education" [16, p. 46]. However, the learner-centred approach may not always be applied in Slovak schools. "When observing classes in mainstream schools (state schools), analysing educational results (e.g. PISA) and various classroom research findings, it is obvious that traditional teaching approaches are still dominant" [17, p. 31].

Modern teachers of English need to make sure that they have abandoned the traditional teacher-centered approaches. Moreover, they have to give their learners a chance to master a variety of subskills. Providing the learners with little or no space to develop their speaking microskills might be even regarded as unethical since it is the learner who needs to speak at English lessons. Although English language teachers represent a source of input, increasing the student talking time seems to be of paramount importance. Working in pairs and small groups will possibly result in such an increase. "Pair and group work are the most effective way of increasing students' talking time" [18, p. 55]. Teachers have to bear in mind that it is their learners who need to develop and improve their speaking skills. Therefore, the active learners who have plenty of opportunities to speak, ought to be in the foreground of the teaching process.

3. Assessing speaking

Speaking is regarded as the most difficult skill to assess [19]. A. Lazaraton [20, p. 106] states that "[i]t is certainly not a coincidence that speaking is also perhaps the most perplexing of the traditional four skills to assess." Assessors need to decide on which subskill(s) they will concentrate on at the moment of assessment, relying on their memory or the notes they have taken.

D. Gondova [21] explains that there exist two types of assessment, depending on how it is carried out and what its goals are, namely assessment for learning (formative assessment) and assessment of learning (summative assessment).

The formative assessment is typically conducted throughout a course or project, and it is used to facilitate and enhance learning. This type of assessment can be performed by a teacher or

Table 1 An Example of Assessment Criteria for Speaking

	Accuracy	Fluency	Pronunciation
5	Grammatical and lexical **accuracy** extremely high.	Speaks fluently without **hesitation** or searching for words.	Very clear; **stress** and **intonation** help to make meaning clear.
4	Quite accurate; some errors, but meaning is always clear.	Some hesitation and sometimes has to search for words.	Generally clear; reasonable control of stress and intonation.
3	Frequent errors; meaning is not always clear.	Quite hesitant; limited range of vocabulary and structures.	Frequent errors; not always clear enough to understand.
2	Very frequent errors; difficulty in making meaning clear.	Extremely hesitant; very limited range of language available.	Very frequent errors; often very difficult to understand.
1	Almost unable to communicate.		

a peer providing feedback on a student's work, and is not normally graded [22]. Feedback is considered to be a principal component of the assessment for learning. It is important to remember that the formative assessment represents a developmental way of evaluating the progress towards a specified objective [23].

"The main function of assessment for learning is to reflect the learning process and give learners some information on their progress throughout a course, which helps them become more efficient" [21, p. 13]. According to S. Brookhart [24], the research into the formative type of assessment confirms that when the appropriate formative assessment is conducted and learners take part in it, both achievement and motivation enhance.

The summative assessment, on the other hand, represents a more formal way of testing students' knowledge, and is typically used at the end of a unit or a semester [25]. A. Benjamin [26, p. 3] takes the view that "[w]hen we think of summative assessments, we think of unit tests, final exams, standardized tests, entrance exams, and the like". The summative assessment ends with a grade.

Plenty of criteria may be used for speaking assessment, depending on which subskills teachers want to test. These are the most common ones [21, p. 162]:

- appropriateness;
- organization of ideas;
- fluency;
- grammatical accuracy and the range of grammatical structures;
- the range of vocabulary and its accuracy;
- content;
- pronunciation and intonation;
- interaction.

M. Spratt, A. Pulverness and M. Williams [27, p. 108] provide the following example of assessment criteria for speaking. This is the so-called analytical way of scoring as far as the summative assessment is concerned. The criteria are arranged as a set of bands, and they describe different levels of ability. Learners can be awarded the maximum of five points for each criterion. The example is illustrated in Table 1.

The difference between the formative and summative assessments can be exhibited by the following analogy by Robert stake, an evaluation researcher: "[w]hen the cook tastes the soup, that's formative; when the guests taste the soup, that's summative" [cf 28, p. 117]. It is, however, vital to mention that both types of assessment have their place in the EFL teaching, and ought to be used within the assessment of speaking skills.

4. Ethical aspects when conducting formative assessment

The question of ethical aspects within the assessment of speaking skills should to be discussed too. If the formative assessment is conducted inappropriately, the question of correctness and fairness arises.

For example, EFL learners are asked to practice speaking - first, they are required to read an article about the immediate impact of drinking beverages of various temperature on a human body and, subsequently, they are asked to give their opinions on whether or not they agree with the statements in the text and why. The text, among others, contains adjectives that describe temperature (cold, cool, hot, boiling, warm, etc.), so it is highly likely that some of the adjectives will be used in the discussions. While working in pairs, the teacher, having assumed the role of an observer, notices that some of the learners pronounce the word hot as [hɑːt]. Pronouncing hot as [hɑːt] refers to the American way of pronouncing this word, while [hɒt] is predominantly used by British speakers [29], [30]. Afterwards, while giving feedback and performing the formative type of assessment, the teacher points out that the word hot ought to be pronounced as [hɒt], not as [hɑːt] since both the learners and teachers "should" use British pronunciation instead of the General American (GA) pronunciation (standard American pronunciation). It should be noted that the British standard of English pronunciation (also called the BBC accent) is a pronunciation variety which is offered by the majority of EFL textbooks in Slovakia, and many teachers try to speak with this accent. Moreover, most of the learners pronounce the word warm as [wɔːrm] and toasty as [ˈtoʊsti]

during their speaking practice (pronouncing the two words with the GA accent). However, this time the teacher "fails to correct" the learner's GA pronunciation as they do not explain to the learners that in the BBC accent, the word warm is pronounced as [wɔ:m] and the word toasty as [ˈtəʊsti]. Therefore, one burning question, which remains unanswered, needs to be tackled. Why did the teacher point out the GA pronunciation of the word hot, but did not call attention to the GA pronunciation of the words warm or toasty (the three words have been used on numerous occasions during the activity by the students)? All three instances represent characteristic examples of the key differences between the segmental systems of the BBC and GA accents.

Perhaps the teacher's lack of knowledge of English phonetics is responsible for not mentioning all three examples. If this is the case, several questions with regard to the correctness and fairness arise. Is it appropriate to "correct" the pronunciation of learners when teachers themselves are not familiar enough with the subject matter they have brought up? Is it fair to demand that the learners of English use only one variety of pronunciation, although the vast majority of both EFL learners (and teachers) are not able to use only one accent consistently, and normally use the mixture of the two varieties? Is it proper to focus on the differences between the BBC and GA accents when the primary goal in EFL pronunciation is to achieve clear, intelligible pronunciation with reduced L1 (mother tongue) accent? The answers to the questions are not clear and straightforward, and convincingly demonstrate the complexity of teaching oral skills as well as the intricacies of providing learners with constructive, useful, and favorable feedback on speaking when conducting the formative assessment. Therefore, EFL teachers should strongly consider a substantial number of questions before performing the assessment for learning.

It should be also emphasized that the example above involved only one (the subskill of pronunciation) of the many speaking microskills EFL learners need to master if they wish to become efficient speakers of English.

5. Ethical aspects when conducting a summative assessment

There are normally two examiners who perform the formal assessment of speaking skills. One of them is interlocutor and the other one assessor. The interlocutor is an examiner who asks questions, interacts with a candidate, measures time, and the like [31]. The assessor, on the other hand, does not talk to the candidate, and thus has time to take notes and perform the analytical scoring of speaking performance of a candidate on the basis of selected criteria. There are, however, numerous instances when one or both examiners fail to carry out a fair and proper assessment. The following selection of examples illustrates the possible pitfalls of assessing the speaking skills.

5.1 Testing knowledge instead of speaking skills

When teachers assess speaking skills, they need to remember that they should actually test how well their learners have mastered particular speaking subskills, not the knowledge about various topics. Although a wide range of topics is frequently used when testing the speaking, it must be emphasized that the tasks and questions have to be opinion-based, and that they are within the scope of a general student's knowledge. Knowledge-based topics primarily measure the information and understanding learners have about a particular topic. If candidates do not possess such knowledge, they do not speak, and it is not possible to measure their speaking skills.

5.2 Testing memorizing and reciting

Memorizing and reciting a text can be deemed a recurring problem concerning the evaluation of spoken proficiency. For example, after a student is told which topic they are going to talk about, they immediately, without being asked a single question or given a task, start reciting what they have learned by heart about the topic. The teacher often lets the student talk for minutes, and then possibly asks the candidate one or two additional questions. Once the recital is finished, teacher awards the student with a high grade. This is an example of serious professional misconduct as far as assessing speaking skills is concerned. Memorizing a text and reciting it tests rather a memory of a candidate or how well they have learned something by heart. It has nothing to do with testing the spoken proficiency of an English language learner. Candidates can be, however, given some time for preparation, but they should not be given any direct questions beforehand.

5.3 Halo effect and order effect

Assessing the spoken proficiency may be negatively influenced by the so-called halo effect. This term represents the influence of knowledge and information a teacher has about a candidate for the evaluation of the candidate's speaking skills. In connection with this, R. Wright [32, p. 213] maintains that "[t]here is a real tendency for our expectations of students to color our evaluations of their work. Those students who did well in the past are expected to continue, while those who have had low test scores in the past are anticipated to continue that way in the future". For example, if a teacher considers a candidate to be a brilliant, straight-A student, it is likely that the teacher's expectations can be too high. Therefore, if such a student does not perform on a high level (as they normally do), the teacher may award them with a lower grade - for instance, the grade C, despite the fact that the candidate has met the criteria according to which they should be perhaps given a B.

Order effect can negatively affect the evaluation of speaking performance too. When an examiner experiences an outstanding speaking performance of a candidate, they are likely to evaluate the performance of the following candidate more strictly. Alternatively, if a candidate's performance is rather poor or unsatisfactory, there is increased likelihood that the assessor will be less strict with the next candidate. It must be remembered that when assessing speaking skills, students should not be compared with each other, but their performances ought to be assessed against the set of criteria [21].

5.4 Principles of assessment - making the criteria clear to the students

There has been a general tendency to evaluate candidates' performance without making the assessment criteria clear to them. The research conducted in the last 20 years demonstrates that there are various principles which ought to be applied in the assessment settings so that the assessment can become clearer, fairer, more equitable, and more transparent to the learners [32]. These are the factors teachers should take into consideration as far as assessing speaking skills is concerned [33, p. 259]:

- students should be informed when they are being assessed;
- students should be informed how they will be assessed;
- teachers should make the criteria for assessment explicit to the students;
- the ratings, scores, marks, or grades attached to the criteria should be explained to students.

Teachers have to bear in mind that if their learners do not know when, how, according to which criteria and way of scoring they are going to be assessed, the assessment process is negatively influenced and, its importance and reliability decrease. Furthermore, it does not seem correct and fair to the students not to inform them in advance about the above-mentioned factors.

5.5 Assessing only the subskills of grammar and vocabulary

It is not always the case that examiners also concentrate on other subskills than grammar and vocabulary. Although these two language systems constitute a significant part of overall speaking proficiency, the evaluation of other microskills seems inevitable. It should be noted that candidates can achieve the goal of spoken communication even if they make grammatical and lexical errors to a certain degree. Thus, they may succeed in communication, and failing them due to such mistakes would not seem appropriate.

It seems reasonable to assume that errors in grammar and vocabulary which cause communication breakdowns should be evaluated more strictly in comparison to minor errors. On the other hand, if a learner fails to answer the questions of an examiner, is not fluent enough, their pronunciation is difficult to understand, or does not react to the questions appropriately, the candidate ought to be assessed in a negative way, although they have only made a negligible amount of grammatical and lexical errors.

The above-mentioned instances are only few examples of inappropriate evaluation of speaking skills which should be taken into account by EFL teachers in order to test the speaking skills as correctly and appropriately as possible.

6. Conclusion

Teaching and testing speaking represent a complicated and complex matter. It must be emphasized that EFL teachers do not follow grammar-translation approaches anymore, but adhere to the principles of Communicative language teaching. Moreover, it is imperative that both teachers and learners are well aware of various subskills that need to be developed, and that the learners are provided with a lot of opportunities for practicing these microskills of speaking, participating primarily in pair work and group work activities.

As far as testing the speaking skill is concerned, both the assessment for learning and the assessment of learning are of profound importance, and have to be incorporated into the teaching/learning process. EFL learners need to receive helpful and positive feedback as often as possible when it comes to formative assessment. EFL teachers have to avoid a variety of obstacles they are likely to experience when assessing speaking summatively. Therefore, they ought to understand the complexity and seriousness of summative assessment so that they are able to conduct this type of evaluation in a reasonable, correct, and proper manner.

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DEVELOPING COMMUNICATION AND CRITICAL THINKING THROUGH CREATIVE WRITING IN ENGLISH AND FRENCH LANGUAGE: ANALYSIS OF CLASSROOM MANAGEMENT STRATEGIES

Developing critical thinking skills in university students has become a primary goal in higher education. This study investigated the efficacy of the classroom management strategies for developing critical thinking skills in undergraduate students in the class. The four strategies were incorporated into the 54-hour English program: 1) "Reading circles" strategy; 2) Socratic-questions-based discussions; 3) Group presentations; 4) Writing assignments (abstracts, essays, reports). Students took a multiple-choice pretest and posttest (Cambridge Thinking Skills Assessment Test) and answered a Satisfaction Questionnaire. The study produced several findings: 1) students' overall critical thinking skills made significant improvement by the end of the course; 2) the students showed better academic achievements in English at the end-term exam; 3) the students were more interested and motivated in thinking-based learning; 4) the students found the guided in-class activities ("reading circles"; Socratic-questions-based discussions) more effective than other student-directed activities (group presentations; writing assignments) in developing critical thinking.

Keywords: *classroom management strategies, classroom management principles, critical thinking skills, thinking-based learning, EFL teaching*

1. Introduction

In the global world, critical thinking skills (CTS) are believed to be crucial in everyday life, in different academic and professional domains. People who demonstrate high CTS can function well in society, perform better in the workplace or in class, and make better personal or business decisions. Responding to the need, higher education considers the development of CTS in undergraduate students a primary goal. Scholars Braun [1], Halpern [2], Klaczynski [3] state that the development of critical thinking skills in students is very important. Using them, students "know how to learn and how to think clearly" [2] and "make purposeful judgments about what to believe or what to do." [4] Moreover, with good critical thinking ability, university graduates can be better prepared to exercise their rights and responsibilities in a global or local community.

Besides, the creative writing also communicates the author´s abstract, creative mind, and interprets how organized he/ she knows to be when writing a context.

In the journal XLinguae during 2017, several articles were published which were concerned with writing on a university level. See the articles of Dolzhikova, A., Kurilenko, V., Biryukova, Y., Rumyantseva, N., Makarova, M., Kulikova, E. [5], Karamalak, O., Pesina, S. [6], Fenclova, M., Horova, H. [7], Klimova, K. [8], Ahmadi, A., Meihami, H. [9], Tareva, E. G., Schepilova, A. V., Tarev, B. V. [10], Palashevskaya, I. V., Leontiev, V. V., Kurchenkova, E. A., Stepanova, E. D., Bulanov [11], Kralova, Z., Petrova, G. [12], Lah, M. [13].

The importance of this belief has encouraged teachers to reconsider the EFL programme at the Omsk State Agricultural University (OSAU) infusing critical-thinking-based approach to EFL teaching and in Constantine the Philosopher University

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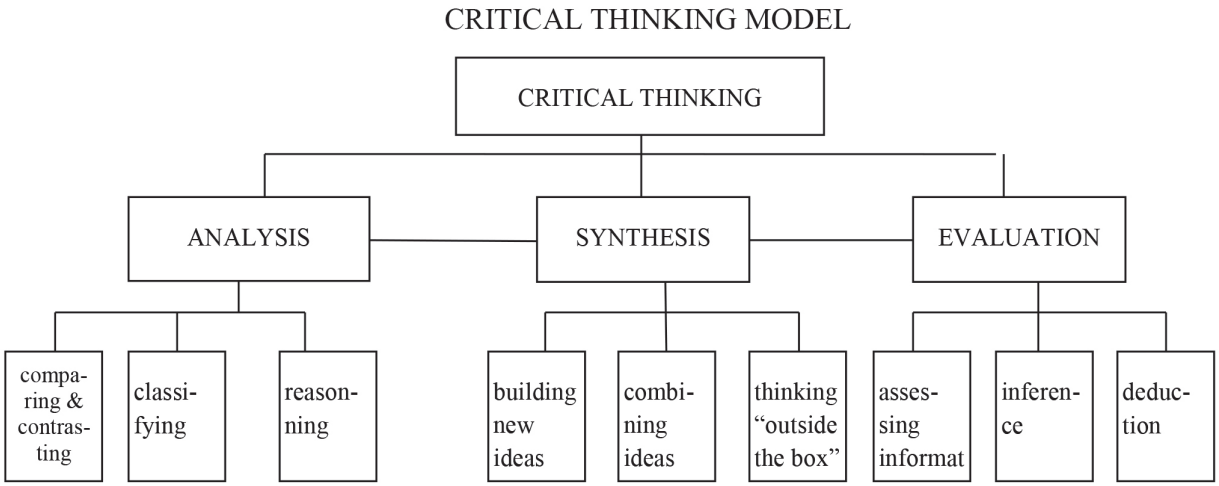

Figure 1 *Critical thinking model*

in Nitra to FFL (French foreign language) teaching. Teachers and professors at OSAU have to state that the majority of 1st-year agricultural students lack key life skills such as critical thinking, teamwork, and self-direction which are most in need for successful academic studies at the University. The causes for such a problem are complex. First of all, a big number of students come from different social backgrounds and communities like small villages, small towns with poor educational opportunities. Most students' previous learning experience in the secondary school was mainly reproduction-oriented [14]. They were seldom given the chances to find out, explain, or evaluate the "knowledge" instructed in the classroom. They were more engaged in work as a class or individually, so they do not have a disposition towards cooperation and collaboration in the classroom. In general, these students are not quite motivated, inquisitive, or confident. To add more, they are immature in critical thinking.

Therefore, EFL teachers and professors at OSAU face the problem of creating a special motivation-learning environment in order to reverse students' learning habits and set of minds towards critical thinking in an EFL classroom. This study aims at the effective classroom management strategies for developing critical thinking skills in students in EFL class.

2. Theoretical questions

This study focuses on the following research questions: 1) What is critical thinking? 2) How is this skill revealed and how can it be measured in students? 3) What are appropriate pedagogical approaches and classroom management principles for teaching critical thinking in the EFL class? and 4) What are the specific classroom management strategies, which are most beneficial in helping students develop critical thinking?

2.1 Theoretical framework

There are many different theoretical frameworks (Figure 1) about what critical thinking might be. [1], [15], [16], [4], [2], [17], [18]. For our purposes, we have selected two frameworks on types of thinking which we believe supplement one another and could be used in a practical educational application in our research. The first one is Bloom's taxonomy of six educational objectives [18] - knowledge, comprehension, application, analysis, synthesis, and evaluation. Knowledge and comprehension refer to so-called "lower order thinking" whereas the final four objectives in the taxonomy define "higher order thinking." The movement from the first two goals (knowledge and comprehension) to the final four goals (application, analysis, synthesis, and evaluation) represents a change from lower order thinking to higher order thinking.

The second classification of critical thinking skills belongs to Robert Ennis. He recognizes the thinking abilities which are to do with the clarification and analysis of arguments, and the assessment of their validity. They also include abilities in judging the credibility of sources, deduction, and induction, evaluating value judgments, uncovering unstated assumptions, and suppositional thinking [15], [16]. Sharing Swartz's idea about the compatibility of different approaches to types of thinking [19], we found a way of combining the above two frameworks. Thus, based on Bloom's taxonomy which we expand with Ennis' more differentiated types of thinking, we identify the three main critical thinking categories - analysis, synthesis, evaluation - that fall into subcategories. For example, analytical skills are represented by comparing and contrasting skills, classifying skills, and reasoning skills. Synthesizing skills fall into the building and combining ideas skills, thinking "outside the box" skills. Evaluation skills include assessing information, inference, and deductive skills. All these thinking skills are at the core of critical thinking. In relation to the education domain, these types of thinking skills

are considered both as additional educational goals and learning outcomes in a critical thinking-based EFL curriculum.

For assessing the progress of student thinking skills, we used two approaches: a testing approach (Swartz and McGuinness) and a curriculum approach. With the first approach, students' thinking skills were assessed with a multiple-choice test (Cambridge Thinking Skills Assessment Test). With the second one, thinking skills were assessed as they were manifested by students in a specific learning context in terms of the quality of a student-written work or a performance of some kind (e.g., a group presentation, a guided discussion, etc.). The second tradition involved the use of criterion-related schemes developed for teacher-, peer- or self-assessment (Appendixes 1, 2, 3).

The next important issue is the classroom management principles for teaching thinking in the EFL classroom. As EFL teachers, we used an approach of infusing the teaching of thinking into the content instruction [19], [20]. With this approach, the thinking skills and the curriculum content were taught simultaneously. Designing an EFL programme, we followed the four principles of thinking-based language learning and teaching:

1. Making meaning in language learning is very important. The more students are stimulated intellectually and emotionally, the more knowledge and skills they will develop [21]. One of the ways to engage students in meaningful language learning is by organizing thought-provoking content including topics preparing students for social, academic and professional contexts.
2. Active learning helps students to be more involved in the learning process. With this model of instruction, students are more responsible for their learning outcomes. Active learning engages students in two aspects - doing things and thinking about the things they are doing [22].
3. Cooperative learning gives students more opportunities for meaningful communication. Students learning cooperatively can capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.) [23] compare also with [24], [25], [26], [27], [28], [29], [30], [31]. Besides, students in cooperative learning settings compared to those in individualistic or competitive learning settings, achieve more, reason better, gain higher self-esteem, like their classmates and the learning tasks more and have more perceived social support [32].
4. Using thinking organizers in the classroom is important to teach thinking successfully. Students can be provided with challenging stimulus materials or strategies, which prompt them to think in deeper ways and engage them in analysis, synthesis, or evaluation. Maps and graphics are good examples of thinking organizers [19], [20]. Other thinking organizers are a PMI (Plus, Minus, and Interesting) strategy [33] and guiding questions. These strategies serve as motivators and organizers of higher-order thinking.

3. Research

3.1 Research questions and objectives

Research questions:

How will university students in Russia and in Slovakia improve their critical thinking?

Will students in Russia perform and score better than students in Slovakia?

What are the most suitable techniques for developing critical thinking skills in students in EFL and/or FFL classes?

The research objectives of this study are the following:

- to identify the improvement of the critical thinking of the examined group of students
- to identify the score of Russian and Slovak students in order to compare
- to find out some suitable techniques for critical thinking development,

3.2 Research methods

In order to map the students´ improvement, direct observation, pedagogical diagnostics and the method of pretest and posttest were used.

3.3 Research samples: participants, settings

Omsk State Agricultural University students (Russia) 75 English-speaking students

Constantine the Philosopher University students (Slovakia) 12 French-speaking students

3.4 Research procedure

The present study was conducted in the second term of the academic year of 2016-2017 at the Omsk State Agricultural University (OSAU). Participants in this study were 60 first-year students (4 academic groups) who got into Bachelor's degree programmes in Agronomy and Land Management. At OSAU, EFL teachers deal with a complex problem when teaching a foreign language: the prevailing low language proficiency in students together with a low disposition towards learning, in general. With the selected participants, we had the following situation. The students within each group demonstrated different levels of language skills with prevailing low proficiency. This situation was revealed in the language pretest at the start of the academic year. Both teachers and students were anxious about EFL end-term outcomes. Therefore, during the 1st semester, the teachers put a lot of effort into developing the elementary language

skills of those students who lacked them at all so that they could pass the end-term exam. The results of this exam showed little progress in students with different language skills. In our opinion, the reason was the lack of good thinking skills in students or a low disposition towards thinking in class. We strongly believed that by developing good critical thinking skills, our undergraduates would manage to improve language skills significantly together with their social abilities. There is a correlation between thinking abilities and high academic performances [34], [35].

To engage students into higher-order thinking, we chose a few strategies to incorporate into the 54-hour EFL curriculum of the second semester: 1) "Reading circles" strategy; 2) Socratic-questions-based discussions; 3) Group presentations; 4) Writing assignments (abstracts, essays, reports).

Now we turn to the perspectives of each strategy in relation to critical thinking.

1. Why "Reading circles"? The mental process of reading requires critical thinking skills. Reading is a complex process that makes readers recall, retrieve and reflect on their prior experiences or memories to construct meanings of the text. While they are doing so, they need to demonstrate the following capacities: to differentiate facts from opinions; to understand the implied meanings; to find out the relationship between the events, actions or details; to perceive multiple points of views; and to make reasoning and judgments. Thus, reading activities involve explanation, analysis, synthesis, argumentation, evaluation, inference, and logical reasoning, which sum up critical thinking competency.

A reading circle strategy groups students together in a circle to collaboratively discuss and analyze what they have read reinforcing listening, speaking, reading, and writing skills [36]. Reading circles can be especially useful in a class with students of different language proficiency.

Now we are going to describe how we implemented "reading circles" strategy in the EFL classroom.

Step 1: the EFL teachers carefully selected texts on social, academic and professional topics chosen for their thought-provoking qualities.

Step 2: Based on the text, the teachers selected and described reading-circle roles for students. Four specific roles were identified as essential: 1. Word Organizer (identifies and systemizes topical words and words with special meaning in the text); 2. Illustrator (responds graphically to the text); 3. Summarizer (recaps the key points, main highlights, and a general idea of the text); 4. Questioner (analyzes the text through contextual questioning). Besides, there were other optional roles which were implemented according to the classroom needs: 1. Planner (identifies important parts of the text and makes a plan of it); 2. Connector (connects the ideas, events of the text and finds out the relationship between them); 3. Language Expert (analyses the language of the text: grammar rules and vocabulary usage); 4. Classifier (finds out and classifies the arguments in the text); 5. Analyst (compares and contrasts information in the text, sequences the events, etc.).

Step 3: The teachers put the students in groups of 4-8, and each student in the group received a written text and a role-card with the description of the task and a thinking organizer to ensure their efficacy in a particular thinking activity in the specific role. To formulate a role task, the teachers used specific thinking vocabulary: for example "explain why," "compare and contrast," "analyze," "classify," "make inferences," etc.

Students were assigned 40-45 minutes for doing thought-provoking reading activities. The rest of the 45-50 minutes of the class were fixed for sharing results and a question-guided discussion within each group.

Step 4: The teachers used various types of assessment of learning outcomes, such as:

1. Self-assessment. Students gave feedback on what they had done in the specific role, what difficulties they had experienced, what they liked or not in the activity, what new information or skill they had learned or practiced. (Appendix 3)

2. Peer-assessment. Based on the given checklist, students assessed the performance of other group members. (Appendix 2)

3. Observation. Teachers circulated through the classroom during reading-circle activities correcting students' mistakes, giving prompts, encouraging students to express their thoughts and ideas. Ongoing observation helped teachers in assessing student progress and identifying their difficulties.

3. Student Artifacts. Teachers collected and checked role sheets completed by students to assess their language and thinking progress.

2. Socratic-questions-based discussions. Since Socratic questioning is at the heart of critical thinking, it stimulates students' thinking process and engages them in the analytic discussion, which leads to independent learning and thinking. As a teaching strategy, Socratic-question-based discussions could be a part of a teaching-learning process when working on a writing assignment or in reading circles; or it could be a separate activity like a pre/after-reading, pre/after-watching or picture/diagram-based discussion in the classroom.

In order to implement Socratic questioning into the classroom, the teachers had to choose a thought-provoking written or media text on a specific topic or an interesting visual (pictures, graphs, diagrams) and prepare a set of contextual questions to start and guide a discussion. Socratic questions had to be formulated in such a way that they could challenge students to develop their analytical, synthesizing, and evaluating skills.

Based on the formal mechanics of Socratic questioning suggested by Paul and Elder (2006), we used exploratory-type Socratic questions in order to find out what students knew or thought on an issue raised in the text. They were also useful in introducing a subject, preparing students for later analysis of a topic. In exploratory discussions, the teachers used the following types of questions to foster students' analytical abilities: *What is*

an ecosystem? Why is survival on land for plant organisms difficult? What is conservation of an ecosystem? How can human practices damage ecosystems? What is the importance of preserving habitat? What are some examples of human practices that can change ecosystems?

Focused-type Socratic questions encouraged students to focus on specific topics and issues, all part of the curriculum. The teachers used them to guide after-reading or after-watching discussions. Focused Socratic questioning helped students clarify, sort, analyze, and evaluate ideas; distinguish facts from opinions; synthesize relevant factors and construct knowledge. For example: *What is the relation between agriculture and climate? How would you support your point of view? What do you predict will happen in the relation between agriculture and climate in 100 years time? What evidence supports your hypothesis?* Focused Socratic discussion stimulated students to develop multiple viewpoints on the topic. Also, it gave students experience in engaging in an extended dialogue in which they discover, develop, and share ideas.

3. Group presentations. As a teaching method, group presentations are very beneficial in relation to the development of critical thinking skills together with mastering English proficiency. Group presentations incorporate the four main principles - making meaning, active learning, cooperation and using thinking organizers - into thinking-based language learning. While making group presentations, students practiced language skills as well as critical thinking and social skills.

During the semester, students divided themselves into groups of three to prepare for a presentation to deliver upon the completion of each thematic block. In total, each group made two presentations during the semester. Each group needed to use brainstorming to formulate the main idea about the topic, search the Internet for relevant ideas about the topic and assessing the information critically, and arrange the ideas in a creative way. The students required after-class meetings with the teacher for language support before presentations. All the members of the group needed to present ideas in front of the class: some were in charge of the opening part, some of explaining the ideas, some of concluding the ideas and answering questions after the talk. In this way, not only could the teamwork be better assessed, but also the work and contribution of each team member.

Examples of topics for group presentations:
Farming is a profession of hope (Brian Brett)
The nation that destroys its soil destroys itself (Franklin D. Roosevelt)
Agriculture is the most healthful, most useful, and most noble employment of men (George Washington)
The farmer has to be an optimist, or he wouldn't still be a farmer (Will Rogers)

For the French class, this topic was presented:
Vivre en ville - vivre en campagne
Les sports en campagne
Le futur de la planete
Je pense donc je suis (Descartes)

Similarly, as in the classes of English, students of French were supposed to write firstly some ideas according to the typical structure, using some speech acts as follows.

For making an introduction, students used several of these expressions:
Commencez par une phrase d'introduction, par une idee generale, question ou par ue reference qui a un raport au the ̆me. Annoncez le theme. Resumez votre plan de l'expose.
Mesdames et Messieurs, bonjour ! Cher jury, bonjour ! Bonjour !
Phrase d'introduction : Commençons, si vous le voulez bien, par... Je commencerais par la question de la pollution causee par les produits chimiques.
Reflexion: J'aimerais vous demander de reflechir a la situation dans laquelle nous serions aujourd'hui si l'ordinateur n'existait pas.
Question: Combien d'entre vous souhaiteraient passer vos vacances de Noel au Mexique? Le monde moderne se declare insatisfait de la vie urbaine et de ses tensions et critique bien la pollution, l'energie nucleaire, les produits chimiques... . Ces accusations sont-elles vraiment justifiees?

Theme:
Je voudrais aujourd'hui vous parler d'une invention qui tarde a prendre son envol : la voiture electrique.
Telle est la question que je voudrais aborder / traiter avec vous maintenant / a laquelle je voudrais essayer de repondre.
Dans cette intention, j'ai choisi un certain nombre d'exemples qui me paraissent particulierement significatifs. En effet, ...

Les idees generales, le plan:
Mon objectif est de vous informer des projets actuellement en cours au Quebec et en France.
Mon objectif est de vous persuader d'adherer au projet d'echange France-Quebec offert dans notre ecole l'an prochain.
Je parlerai tout d'abord / premierement / en premier lieu des...
Je commencerai(s) par aborder les problemes de la pollution et notamment ceux de ...
Ensuite / en second lieu/point nous etudierons les problemes de sante et enfin / pour terminer nous dirons quelques mots au sujet des loisirs et du mode de vie actuel.

Mon expose comprend trois parties :
1- l'historique des services bancaires ;
2- la presentation de deux projets de portefeuille electronique au Quebec et en France ;
3- pour finir, les implications sociales reliees a cette nouvelle technologie.

Oral group presentation body or written text body:

Developpez les idees, ne vous eloignez pas trop de l'idee principale. Creez des phrases simples et courtes.
Utilisez les verbes activement.
Si vous utilisez les termes, exprimez-vous comprehensiblement. Si vous citez les autres auteurs, soyez exacts.
Depuis 1990... A nie Depuis quelques annees, ...
Dans un article paru dans La Presse du 15 juin 2004, 20% de la population...

Ne repetez pas les mots. Utilisez les synonymes. Demontrez ainsi votre richesse du vocabulaire.
Si vous argumentez, soyez clair et pertinent. Ainsi vous reussirez a persuader le public. Utilisez les exemples.
Le metro est le moyen de transport de l'avenir ! En effet, il est moins cher en comparaison de la voiture, il reduit la pollution et evite les bouchons.
Utilisez les graphiques, les statistiques, images..
Distinguez les faits des opinions et sentiments. Les entiments ne changent rien.
Fait:
Le mois dernier, des loups ont devore cinq moutons dans divers endroits de notre region.
Opinion:
Les autorites locales pourraient suggerer des mesures a prendre afin d'eloigner ces carnivores des fermes, comme par exemple...
Sentiment:
Comme tous les membres de ma famille, je crains que les animaux de notre ferme ne soient attaques par...
Accentuez les idees importantes lesquelles vous soutenez. Vous pouvez utiliser d'autres manieres pour les dire.

Conclusion was made up this way:

Concluez les idees dans un bon moment de votre expose. Faites une conclusion interessante, pas trop longue, pas trop courte, pertinente.
Pour resumer...
Je vous ai presente aujourd'hui l'evolution des services bancaires automatises - deux projets de portefeuille electronique, l'un au Quebec, l'autre en France - ainsi que l'impact de cette invention sur notre societe.
Le but est que le public retient lidee principale de l'expose.
Si vous ne deviez retenir qu'une seule chose de mon expose, ce serait la suivante : si un jour vous vous perdiez en foret, essayez de rester calme...
Comme je l'ai mentionne au debut de mon expose, vous pouvez mettre en application les idees que je vous ai proposees sur...,
Je suis persuade que vous...
Ce que je voudrais dire par la, c'est que...
Je voudrais vous quitter sur cette derniere reflexion...
Avez-vous des questions a me poser ?
Quelles questions voulez-vous me poser ?
Mon expose est termine et je suis pret(e) a repondre a vos questions.
Je ne suis pas sûr(e), mais je...
Excusez-moi, je me suis trompé(e).
J'ai fait une faute, veuillez excuser mon inexactitude.
Merci de votre attention.
Vous avez ete un public tres attentif et avant de vous quitter, j'aimerais vous offrir cette pensee a mediter : ...
Nous remercions notre professeur de nous avoir permis de presenter cet expose. Et nous vous remercions, vous, nos camarades de classe.
Vous avez ete un auditoire attentif et vous avez rendu notre tâche tres agreable.

Sme(Some or Slovak sme?) other structures and language functions ere used:

Telle est la question que je voudrais aborder, traiter avec vous maintenant / a laquelle je voudrais essayer de repondre.
Tout d'abord, je parlerai de / premierement / en premier lieu / Disons tout d'abord que / Signalons pour commencer que
Ensuite / En second lieu / point
d'autre part / par ailleurs / notons/signalons a ce propos / a ce sujet / au passage
Pour en revenir a notre propos, je disais donc que ... / Notons d'ailleurs que...
II y a lieu de remarquer a ce propos que / A noter que ...
Cela dit donc...
Voyons donc maintenant / Examinons alors
en general / en bref / dans l'ensemble / en somme
Ce qu'il faut retenir de tout cela c'est que...
Cela montre que / c'est la raison pour laquelle, ...
Enfin / Finalement / Pour terminer / Pour conclure / En conclusion / En guise de conclusion / La conclusion de tout cela est...
Nous pouvons passer maintenant a notre dernier point /Venons-en a notre dernier point
Cela nous amene tout naturellement au dernier point de mon expose

4. Writing assignments. Writing is a very important part of university study. Academic success is impossible without good writing skills. One of the objectives of EFL curriculum is the development of writing skills. A critical thinking approach to writing teaches students how to evaluate gathered information, to distinguish facts from opinions, to organize information logically in a piece of writing, and to express ideas and opinions clearly and directly.

We chose the three basic types of writing used in university courses: an abstract, an essay and a report. In these types of writing the students practice critical thinking skills like developing an argument, comparing and contrasting ideas, making reasoning and sequencing, combining and organizing ideas, summarizing information, drawing conclusions, etc.

During the semester, students were required to write one abstract for an article from a journal, one essay, and one report. In French classes, their curriculum was more exigent; we present

in this study just a part of their outcomes -an essay on one of the topics already presented.

Now, we shall describe how the teachers organized this type of activity in the EFL classroom.

STEP 1: The teachers instructed students on how to write a particular piece of writing: the structure, useful vocabulary, special language techniques, etc. The students were explained how to gather the information and work with it. Based on thought-provoking questions from the teacher, students learned how to evaluate information and information sources, to compare, contrast and combine ideas, and draw conclusions. At this stage, the teachers prepared sample materials: abstracts to articles, essays, and reports, as well as cards with useful vocabulary and worksheets with thinking organizers.

STEP 2: The teachers made out a list of topical questions for each type of writing and supplementary worksheets.

Students had to choose one of the questions from the list for writing. Here, we illustrate a list of questions as examples:

1. What is the scope of agriculture? Why is it important for a human being?

2. What is the difference between traditional and modern agriculture? What evidence supports your hypothesis?

3. Agriculture affects everyone not just farmers. Can this statement be validated?

STEP 3: In the classroom, each student had to be given a task and a worksheet with a thinking organizer to support their thinking process in completing the task.

Students were encouraged to consult the teacher for any language problems when drafting the piece of writing. The finished works were submitted to a teacher the next week after having been revised as homework.

STEP 4: In assessing the written works, teachers focused on the student's critical thinking ability and the construct of meanings. In addition, the students' language progress was also very important. So, two aspects were considered in assessment: thinking and language progress.

Now, we are going to give an example of how we used the two combined teaching strategies (Socratic questions-based discussions and writing assignments) in the thinking-based EFL class followed by a criterion-related assessment of thinking in practice. The topic of the lesson was "The Global Food Security." In order to introduce the topic, the teacher asked several exploratory-type Socratic questions which revealed what students knew or thought about the problem: "What is food security?", "Why is the problem of food security very important nowadays?", "Do you know about the people still suffering from hunger?", "Why do you think there are regions where people are experiencing food insecurity?", etc. These questions motivated students to study statistics and facts further, analyze and evaluate information about the topic. After that, the teacher posed the following challenge: "Imagine you are members of the Food and Agriculture Organization of the UN who are working on different approaches to promote food security worldwide. Identify possible causes of food insecurity in different parts of the world and propose effective solutions to enhance food supply in difficult regions". In the class, the students worked together in collaborative thinking groups and used a specially designed thinking organizer to record their ideas (Appendix 5).

The quality of the work was assessed against the following points:

- several challenges were identified and explained;
- every challenge got a corresponding solution.

Using the Basic Criterion-based Scheme for Assessing CTS (Appendix 1), the teacher evaluated the following thinking skills demonstrated by students during the work: reasoning skills, building new ideas skills, and inference skills. With a Card for Self Assessment (Appendix 3), students identified their strong and weak thinking abilities in performing this task.

Then, the teacher asked the students the following: 'Now let's translate our good thinking into good writing". The writing assignment was an essay "Ensuring a growing world population with foodstuffs." The students finished writing the essay as a home assignment. Based on the class discussion, the teacher considered the following points in the essay for evaluation:

- In the introduction, judgments are made about the importance of global food security.
- In the main part, several problems of food insecurity are stated; several modern approaches to the problem are considered.
- In conclusion, the personal opinion about the solution to the problem is expressed.

Here is an example of a student's work:

"Ensuring a Growing World Population with Foodstuffs"

How to provide a growing world population with food? - That is a question, which needs a clear answer as soon as possible. Studying statistics, I found the following figures: these days about 1 billion people - one-seventh of the world population - do not get enough food. They're predominantly from Africa and Asia. It is expected that in the nearest 40 years the number of the world population will increase to 10 billion. That means that humanity will need twice as much food than it is now.

One can think that everything would be fine if you first plow, then plant, pick and eat. But in this case, it's not so simple: the last fifty years crops planting doubles and the amount of arable land area only decreases. In addition, people are tired of vegetarian food - human wants eating meat. And if you want meat, you need to feed and grow it. These trends only increase the need for arable land and agriculture.

There are many modern approaches to people's provision of food. For example, the expansion of aquaculture (when fish and shellfish are cultivated) seems to be an interesting idea. Also, agronomists try to solve the problems of desertification and land erosion for better yield. On the other hand, geneticists try to deduce the gene in plants tolerance to draining.

Table 1 Description of skills

	Standard / Criteria	Unacceptable level (1-2 marks)	Limited level (3 marks)	Acceptable level (4-5 marks)
Analytical skills	reasoning skills			
Synthesizing skills	building new ideas skills			Considers the problem from different perspectives (GMP) in the Main Part. Uses appropriate language.
	combining ideas skills		Presents ideas sporadically without establishing a clear relationship between them.	
	thinking "outside the box" skills			Finds 3 ways to deal with the problem. Able to think differently about the situation (GMP) in the Main Part. Uses appropriate language.
Evaluation skills	assessing information skills			Distinguishes facts from opinions. Determines biases (GMP) in the Main Part. Uses appropriate language.
	inference skills			Formulates own opinions based on information they have learned in Conclusion. Uses appropriate language.
	deductive skills			Draws the conclusion by considering the information or evidence they have in Introduction and in Conclusion. Uses appropriate language.

As for genetics and its product - genetically modified foods - I can say that the abbreviation "GMP" seems to frighten an average inhabitant of the planet. And it may be really so because scientists haven't discovered the long-term consequences of the influence of such products on animals and people yet. But we must remember that GMPs are not just the chemicals introduced by man in a white robe in ripe fruit, and much less fruit and vegetables are grown in greenhouses on artificial branches. Any selection result is already a genetically modified product. I'm sure this information must make you confident in genetics. This scientific trend is still young (about 40 years), but scientists are constantly making observations and conducting researches and, therefore, safe methods are found.

In our opinion, the man will be saved! However, if he really wants to. These days a third of the world population lives in overabundance. And the rational distribution of resources could solve the problem of food provision. Although, there is already a useless dry scientific statement: go and take a piece of bread and feed the hungry."

In the written work whether in English or in French, the students were expected to manifest the following thinking skills: reasoning skills, building and combining ideas skills, thinking "outside the box" skills (Table 1), assessing information skills, inference skills, and deductive skills that were assessed by the teacher using the scheme from Appendix 1.

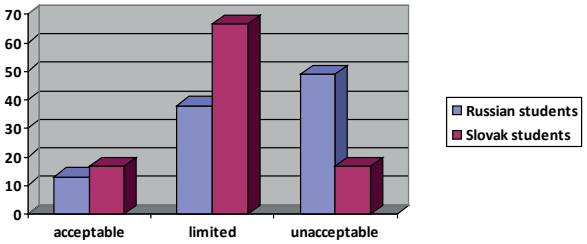

Figure 2 Pre-test

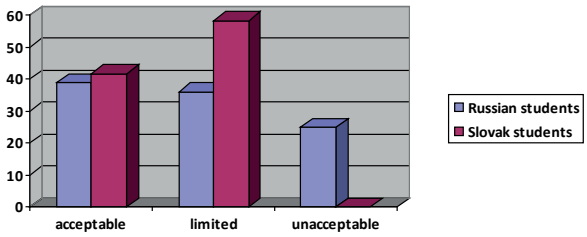

Figure 3 Posttest

4. Results

At the start and the end of the thinking-based EFL course, the students took the Cambridge Thinking Skills Assessment Test (CTSA) translated into Russian (Figure 2) to avoid any confusion in meanings that may incur due to language problems. The results of the pretest showed different results which are not on a comparable level. The reason for this is that there were only 12 French speaking-students as opposed to 75 English-speaking students. The results showed that only 13.33% of students had an acceptable level of critical thinking skills, 37.33 % of students revealed a limited level and 49.33 % - an unacceptable level.

As for the French-speaking students in Nitra University, the CTA (Evaluation des capacités d´analyse et de la pensée critique), online test, was used. The French-speaking students were doing the pre-test in the middle of the semester when the course was already running. Despite that, it showed that 16.66% of students reached an acceptable level of critical thinking, 66.66% a limited level, and 16.66% an acceptable level.

The posttest (Figure 3) results were more optimistic with the increased number of students who had made a significant improvement in critical thinking abilities: 39.33% of students had an acceptable level; 36.33% - a limited level, and 24.33 % - an unacceptable level.

The posttest results for French-speaking students: 41.66% - acceptable level, 58.33% limited level and 0% unacceptable level. A big improvement was made.

5. Discussion

The study produced several findings. First, the number of students who scored low on the CTSA (for French CTA) pretest grew half as much - their overall critical thinking skills had made an improvement by the end of the course. Especially, those who demonstrated a limited level at the start made a significant improvement. In the posttest, they had a high score, which showed their critical thinking progress. Thus, by the end of the course, the prevailing number of students within each group had an acceptable or a limited level of critical thinking skills.

Second, the results of the language end-term exam showed better academic achievements of the students with a medium and high critical thinking score. Therefore, students' language proficiency was related to the acquisition of their critical thinking skills.

Third, in the final discussion at the end of the term, regardless of their language proficiency the students mentioned that they had been more interested and motivated in learning during the second term. They felt more confident in challenging the answers and sharing thoughts.

Another finding is that the students became more self-reliant with critical thinking and they understood the importance of developing critical thinking skills. When the students responded to the question "What have you learned from this course?" they said that "developing critical thinking would be useful to my future career or further study"; "it is important to apply critical thinking in different areas of study"; "I became more confident in asking and answering "why" and "how."

With a built up confidence, students communicate more effectively.

Finally, answering the questionnaire (Appendix 5), the students highly agreed they benefited the most from Socratic-questions-based discussions in developing critical thinking. When responding to the questions "What is the activity that helped me the most in learning?" and "What is the activity that helped me develop critical thinking the most?" most of the students chose "Socratic-questions-based discussions." Besides, students highly agreed that "In-class Socratic-questions discussion helped me understand the reading or writing assignment better," and "In-class Socratic-questions discussion helped me see different aspects of the same problem."

However, as to the self-directed learning activities - "group presentations" and "writing assignments" - the students responded: "Group presentations helped me improve in cooperative learning" and "Writing an essay helped me cultivate analytically and evaluating thinking skills." According to students, "Reading circles helped me focus on different details in the text and comprehend the text better"; "helped me improve my communication skills."

The main objective of the study was to identify the most effective suitable techniques for developing critical thinking skills in students in EFL and/or FFL classes. The findings in this study support that the "reading circles"; Socratic-questions-based discussions; group presentations; and writing assignments help the weak thinkers improve their overall critical thinking and

especially demonstrate better skills in analysis and evaluation. The teachers' in-class observation and students' responses to the questionnaire testified that the latter felt more comfortable and assertive in the guided in-class activities like "reading circles" and Socratic-questions-based discussions. Most of the students noted that thinking organizers and teamwork helped them a lot to develop critical thinking in an enjoyable learning environment.

As to the question of correlation between strong critical thinking abilities and academic performance, the findings showed that students' English proficiency relates to their acquisition of critical thinking skills. The findings revealed that weak thinkers with low or relatively low English proficiency at the beginning of the second term succeeded both in critical thinking and English performance by the end of the term.

6. Conclusion

The study has discussed the efficacy of particular teaching techniques and strategies for developing communication, writing skills and critical thinking skills in undergraduate students in EFL and FFL class. In general, the findings supported the methodology of this course and provided some insight into the research questions. It is found out that if students are equipped with critical thinking skills, they could be more self-confident and confident in adapting to a new situation or even more successful in their future profession or advanced study.

This study also found a few implications for thinking-based teaching techniques. First, EFL and FFL University teachers should infuse specific thinking skills into content instruction, followed by regular and varied practice in both guided and self-directed activities at the start of the first term in order to develop the habit of critical thinking through a longer-term practice. Second, students need to be explained the importance of group presentations. Group presentation does not merely help cultivate their critical thinking but also helps build communication skills and enhance their teamwork skills and employability. EFL and FFL teachers should elaborate more on explicit thinking instructions or thinking organizers for students that will guide the student preparation process. Third, teachers should provide opportunities for students to use their critical thinking skills in connection with other types of activities such as research work, project work, etc.

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Appendix 1

Basic Criterion-Based Scheme for Assessing CTS

	Standard Criteria	Unacceptable level (1-2 marks)	Limited level (3 marks)	Acceptable level (4-5 marks)
Analytical skills	comparing and contrasting skills	Does not explicitly identify similarities and differences between or among objects, ideas, concepts, events, or other subjects. Lacks knowledge of the items being compared and contrasted. Does not use thinking language.	Finds out 1-2 similarities and differences between or among objects, ideas, concepts, events, or other subjects. Demonstrates little knowledge of the items being compared and contrasted. Does not use appropriate language.	Finds out 3-4 similarities and differences between or among objects, ideas, concepts, events, or other subjects. Demonstrates knowledge and understanding of the items being compared and contrasted. Uses appropriate language.
	classifying skills	Does not define a group of objects. Does not use thinking language.	Has difficulty in identifying common attributes of objects and defining a group of them. Does not use appropriate language.	Identifies, compares and contrasts characteristics to define a group of objects. Communicates the basic characteristics (attributes) of the groups, using appropriate language.
	reasoning skills	Does not recognize that there is a problem, it needs to be pointed out. Does not collect relevant facts or arguments. Does not give a way to deal with a situation or solve a problem. Does not come up with any solutions for a problem. Does not use thinking language.	Recognizes there could be a problem. Collects relevant and irrelevant facts or arguments. Considers one way to deal with a situation or solve a problem. Identifies one solution. Does not use appropriate language.	Identifies the problem, relevant facts or arguments, rejecting useless information. Considers different ways to deal with a situation or solve a problem. Identifies potential solutions and decides on the best one. Uses appropriate language.
Synthesizing skills	building new ideas skills	Considers a situation from one point of view. Discounts others' perspectives and points of view. Not able to generate new ideas. Does not use thinking language.	Considers a situation from one or two perspectives. Has difficulty in building new ideas. Does not use appropriate language.	Able to consider a situation from different perspectives and generate new ideas. Uses appropriate language.
	combining ideas skills	Does not combine ideas. Does not use thinking language.	Combines ideas sporadically without establishing relationships among them. Does not use appropriate language.	Establishes the relationship between/among ideas in order to combine them. Uses appropriate language.
	thinking "outside the box" skills	Does not find ways to deal with the problem/situation. Does not use thinking language.	Finds a usual way to deal with the problem/situation. Does not use appropriate language.	Finds 3-4 new ways to deal with the problem/situation. Able to think differently about the situation. Uses appropriate language.

	assessing information skills	Does not recognize the reliability of information. Does not distinguish facts from opinions. Does not determine biases. Does not use thinking language.	Has difficulty in recognizing the reliability of information, distinguishing facts from opinions, determining biases. Does not use appropriate language.	Determines if the information is reliable, valid, current, authoritative, objective, consistent. Distinguishes facts from opinions. Determines biases. Uses appropriate language.
Evaluation skills	inference skills	Formulates an opinion without reference to the information they have learned. Discounts others' opinions. Does not use thinking language.	Has difficulty in formulating own opinions based on information they have learned. Considers other opinions. Does not use appropriate language.	Formulates own opinions based on information they have learned. Understands other opinions. Uses appropriate language.
	deductive skills	Does not draw conclusions. Does not use thinking language.	Draws weak-supported conclusions. Does not use appropriate language.	Draws well-supported conclusions by considering the information or evidence they have. Uses appropriate language.

Appendix 2

A Card for Peer-Assessment of CTS

Which of the skills were demonstrated by a group member?

	Specific thinking skills	Put a tick	Comments
Analytical skills	sequencing skills		
	classifying skills		
	ranking skills		
	comparing and contrasting skills		
	reasoning skills		
Synthesizing skills	building new ideas skills		
	combining ideas skills		
	thinking "outside the box" skills		
Evaluation skills	recognizing reliability of evidence skills		
	distinguishing facts from opinion skills		
	determining biases skills		
	formulating own points of view skills		
	seeing other points of view skills		
	drawing conclusions skills		

Appendix 3

A Card for Self-Assessment of CTS

Which of the thinking can you do?

	Thinking you can do	I strongly agree or it's very like me	I partly agree or it's a bit like me	I disagree or it's not like me
Analytical skills	I can classify ideas.			
	I can sequence ideas.			
	I can rank ideas.			
	I can compare and contrast ideas.			
	I can identify the problem and find a solution to it.			
Synthesizing skills	I can generate new ideas.			
	I can combine ideas.			
	I can think "outside the box".			
Evaluation skills	I can recognize reliability of evidence and sources of information.			
	I can distinguish facts from opinions.			
	I can determine biases.			
	I can formulate my own point of view.			
	I can see other points of view.			
	I can draw conclusions.			

Appendix 4

Satisfaction Questionnaire

1. Which activity helped you the most in learning? Give each activity the score (1-10) to indicate your level of satisfaction (1 - the least satisfied...10 - the most satisfied)
   a. Reading circles
   b. Socratic-questions discussion
   c. Group presentation
   d. Writing assignment

2. Which activity helped you develop critical thinking the most? Give each activity the score (1-10) to indicate your level of satisfaction (1 - the least satisfied...10 - the most satisfied)
   a. Reading circles
   b. Socratic-questions discussion
   c. Group presentation
   d. Writing assignment

3. Complete the sentences:
   a. Reading circles helped me _____

   b. Socratic-questions discussion helped me_____

   c. Group presentation helped me_____

   d. Writing assignment helped me_____

4. What difficulties did you have in each activity?
   a. Reading circles: _____

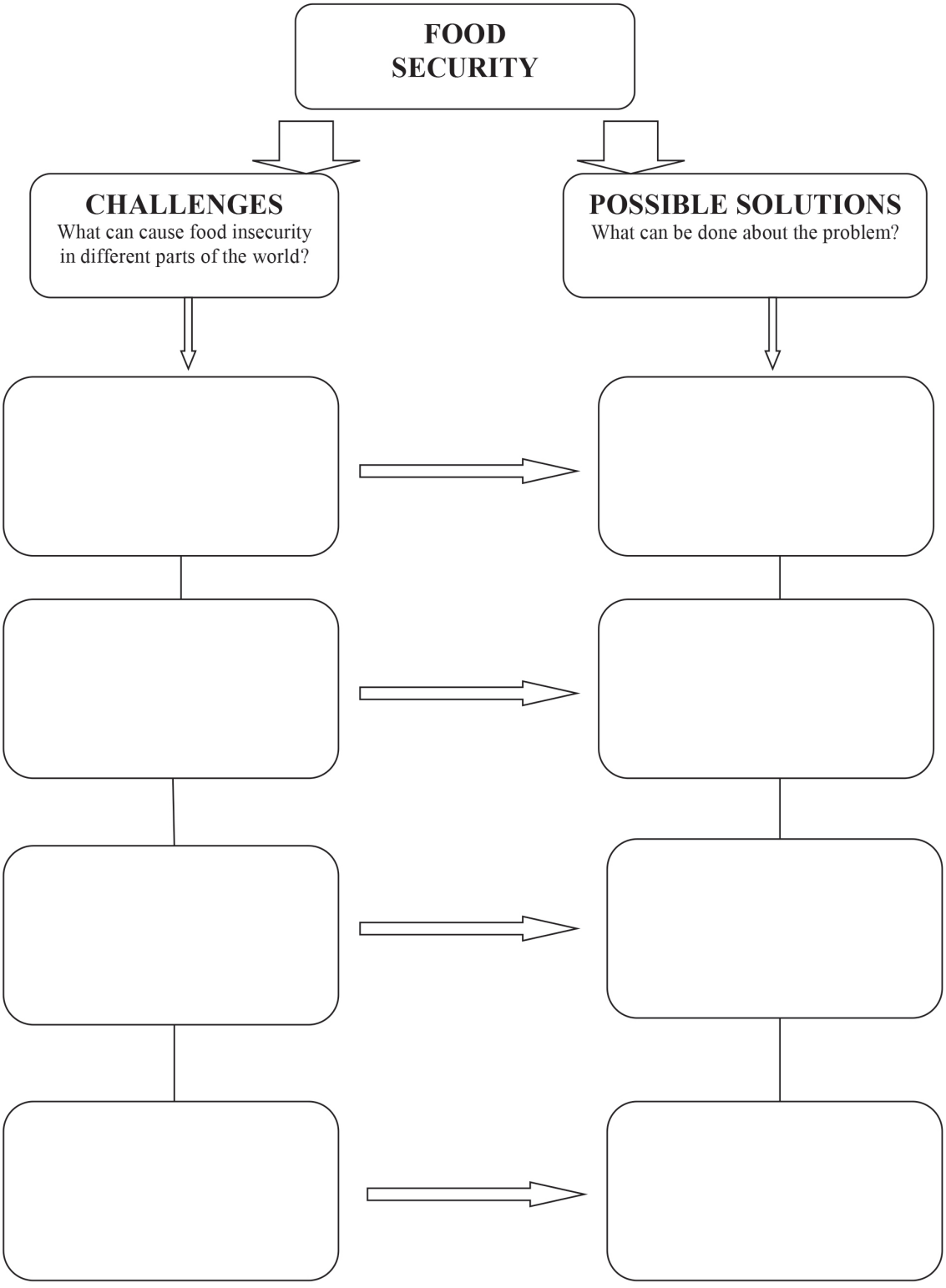
   b. Socratic-questions discussion:_____

   c. Group presentation:_____

   d. Writing assignment:_____

Appendix 5

Food Security Promotion



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ETHICAL CHALLENGES IN NANOMETROLOGY

Nanometrology is an intrinsic and fast developing part of nanoscience. Given the huge diversity of nanostructures ranging from large molecules from about 10 atoms to structures from 10^5 atoms (particles of the size ≤ 100 nm), broader investigations in this area cannot be exactly scrutinized nor repeated by the existing capacities. This gave rise to the initiative for reproducibility that aims to avoid simplified approaches, plagiarism and other phenomena that are often triggered by the "publish or perish" philosophy, as well as business practices of predatory journals. In this paper, we discuss two case studies illustrating how to solve these problems: a study of the structural stability of nanoparticles by three complementary methods, and a design of reliable nanoparticle gas sensors used in environment or medicine.

Keywords: *nanometrology, nanoparticles, reproducibility of measurements, structural stability, gas sensors*

1. Introduction to nanometrology

Nanoscience and nanotechnology (N&N) introduced a way of building molecular structures by the bottom-up approach. It provides opportunities in the fields of information technology, medicine, and new materials. The main aims of this branch are design, preparation, manipulation, and application of materials and structures having at least one dimension within the interval from 1 to 100 nm [1], [2]. (For comparison the size of Si atom is 0.22 nm). The mentioned interval - originally determined by a simple convention - is now widened at its lower boundary due to the appearance of graphene monolayer with the thickness of 0.34 nm, being the most progressive structure of the present material research. Basic nano-objects are molecules, atomic clusters, nanoparticles (NPs), nanowires, nanolayers, etc., which represent the building blocks of devices and structures. Characterized by a well-known statement by R. Smalley (2000) - nanotechnology is the art of building devices at the ultimate level of finesse.

The high scientific relevance of N&N may be documented by the fact that its discoveries and inventions were awarded by three Nobel prizes in physics (E. Ruska, G. Binning and H. Rohrer; A. Fert and P. Grünberg; A. Geim and K. Novoselov) and four Nobel prizes in chemistry (R. F. Curl, H. Kroto and R. E. Smalley; W. Kohn; E. Betzig, S. W. Hell and W. E. Moerner; J. - P. Sauvage, J. F. Stoddart and B. L. Feringa) [2].

In the field of nanometrology, attention is paid to all seven basic physical quantities - time, length, mass, electrical current, temperature, light intensity, amount of substance. Most important are, however, structure, morphology, composition, surface area, etc., of nanostructures. They are studied by almost 30 methods, divided into two basic groups [3], [4]:

a) ensemble-averaging approach (EAA) where the techniques analyse larger samples providing statistically averaged output. Examples are spectroscopies, X-ray diffraction, calorimetric methods, light scattering, etc., and
b) individual particle approach (IPA), that gives information about small samples and even individual atoms and molecules. Examples are electron and probe microscopies.

The operational space of N&N is largely interdisciplinary, as it lies in the overlapping area of:

- two-dimensional, one-dimensional and zero-dimensional (2D, 1D, 0D) nanostructures with a large surface area and excellent catalytic properties, biocompatibility and low size dispersion;
- multipurpose materials with high thermal stability and controlled electrical and magnetic properties;
- complex characterization and movement for high reproducibility.

Our research is focused on spherical magnetic and biocompatible NPs belonging to iron oxide family with the good ability of self-assembly.

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2. Initiative for reproducibility in nanotechnology

The initiative aimed at reproducibility is motivated by the fact that due to the huge diversity of nanostructures that fill the space between big molecules composed from about 10 atoms to structures of 10^5 atoms (size about 100 nm), the interval of nano-entities cannot be either scrutinized or repeatedly investigated by existing research capacities [5], [6]. A similar situation can also be found in the field of experimental devices. We estimated that taking into consideration all sensing materials for NP gas sensors, preparation methods of nanoparticles, device and electrode configurations, it is possible to create up to 45 million types of sensors.

The initiative for reproducibility aims to avoid simplified approaches, pathological practices or plagiarism in research. "Polishing" of papers and the publication of selected positive results, the so-called "cherry picking," is also not acceptable. It can give rise to the multiplication effect when the followers extend their research starting from a good chance of their predecessors. Mueck [7] reported a clear correlation between the level of competition and tendency to select positive results in certain regions of USA. Such phenomena are fuelled by the fact that academic journals and grant agencies value more "novelty" than replication studies. Activities of predatory journals also contribute to these problems that altogether represent a large challenge for the research integrity and ethics in science and technology. In this connection, we may refer to the report [8] where among other conclusions (related to biomedicine) we find the following one: "Robust science and the validity of research findings must be the primary objective of the incentive structure. These should be valued above novel findings and publications in high-impact journals".

The reproducibility and reliability in nanotechnology depends also on the accessibility of quality control measures and various standards of measurements, procedures, reference and calibration materials, even language and terminology standards. The International Standardization Organization (ISO), Technical Committee 229 on nanotechnologies that issued almost 50 different standards plays the most important role in this area [2].

At the same time, there has been a sizeable investment in nanotechnology over the past few decades [9]. Hundreds of thousands of nanotech-startups have been created worldwide. Nanotechnology became a magical word. It is not surprising that the "gold rush" psychology prevailed and accelerated the chase for new papers and patents. Nowadays this wave is partly over, and venture capitalists understand that although nanotechnology represents a certain type of technology, the genuine nanotechnology industry does not exist. Many companies with the word "nano" in their names describe themselves now as material or semiconductor companies.

Reproducibility crisis extends to broader areas than N&N or biomedicine [10]. Reproducible initiatives are also emerging in psychology and other branches. It is well-known that the number of retractions by scientific journals and failures to replicate high profile studies are increasing. Although the outright fraud in publications is usually low, the "softer fraud" and undisclosed flexibility in data collections is widespread. One may speculate about the introduction of the "reproducibility index" of journals, similar to the impact factor. Another initiative published recently [11] bets on interdisciplinary approaches by calling for papers combining theory, computation-simulation, and experiment in an integrated way. A decade ago such papers were less common; nowadays they become to appear. Such combination enables new discoveries, a better understanding of phenomena and, moreover, it helps to eliminate fraudulent research. Complex papers are ground-breaking, and they generate interest from experimentalists and theorists alike. However, such complex approach needs different education of new scientists. Needless to say, such approach will earlier or later become a challenge also in social sciences and humanities.

3. How to make research reproducible

The program R-Reproducibility could be extended to 3R-Responsibility, Reproducibility, Reliability. Responsibility in the preparation of experiments means that adequately pure materials and chemicals with the required crystalline structure are purchased or prepared. In chemical reactions fresh solutions should be used, all precursors must be stored at suitable conditions, like in vacuum or in clean boxes at certain temperatures to avoid contamination, internal diffusion, oxidation, aging, etc.

A reproducible experiment should be performed in the clean rooms of the recommended class, avoiding mixing of various material in the same reactor or deposition chamber. Stability of heat treatment or annealing must be guaranteed. Reference samples should be secured in the measurements, and even a small contribution of the substrate to the measured property of sample must be subtracted. Broad employment of the statistics of measurements is one of the principles of openness and transparency. Laboratory notebooks should be used as a matter of course.

The above mentioned and other procedures which could not be discussed in detail here may guarantee reliable and stable structure and properties of layers and multilayers, functionalized particles, devices, and sensors. It is recommended to provide experimental samples to other groups or laboratories for comparative measurements. Obviously, every such help or source of information should be adequately acknowledged. Unfortunately, these recommendations are often ignored because of commercial interests. But at least in the basic research, they would help to shorten the way towards the new results, inventions, and discoveries.

Table 1 Basic properties of main iron oxide family members [12]

Property	Magnetite	Maghemite	Hematite
Formula	Fe_3O_4	γ-Fe_2O_3	α-Fe_2O_3
Melting point [°C]	1583-1597	1566	1350
Crystalline system	cubic	cubic/tetrahed.	rhombohed./hexag.
Magnetism	ferro	ferri	weak ferro*
Curie temp. [K]	850	920	956
Saturation magnezation [emu/g]	92-100	60-80	0.3

*antiferromagnetic under 260 K - Morin temperature

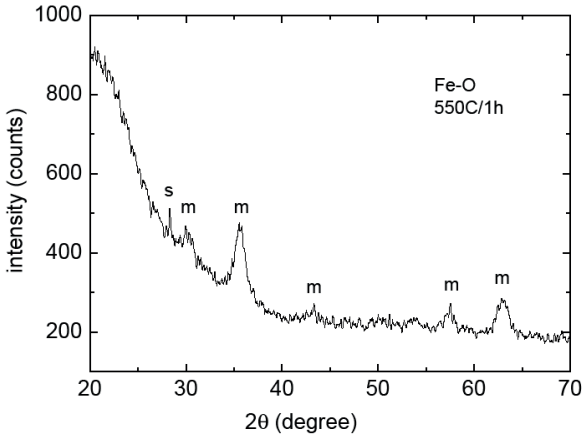

Figure 1 *XRD pattern of Fe_2O_3 sample annealed at 550 °C/1 h (m-maghemite, s-substrate)*

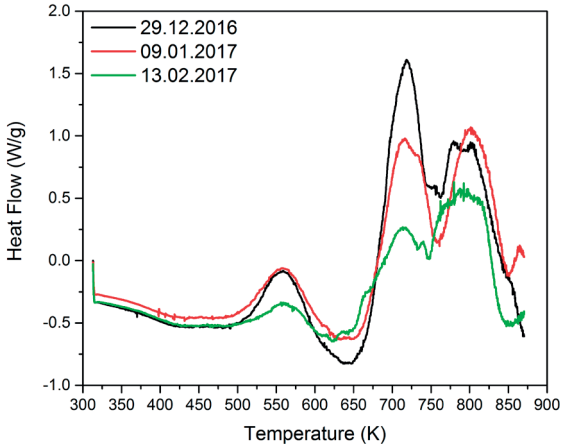

Figure 2 *Repeated measurements of DSC curves of γ-Fe_2O_3 NPs*

In the next sections, we will describe two examples how to respond to these problems.

4. Example 1: Structural stability of Fe_2O_3 nanoparticles studied by three complementary methods

Iron oxide NPs are in the focus of magnetic NP research [12]. Due to biocompatibility and good magnetic properties they are used in recording and data storage, in cancer therapy and diagnostics, magnetic resonance imaging, as sensing medium in gas sensors, etc. Eight iron oxide phases have been recognized. Among them, hematite, maghemite, and magnetite are frequently used (Table 1).

Among iron oxides, γ-Fe_2O_3 NPs with applications in material research and medicine are of pivotal importance. Therefore their thermal stability is crucial. However, it is known that they transform to α phase at higher temperatures (T_T). The values between 200 and 500 °C are reported in the literature. (In bulk samples T_T = 500-600 °C) [13]. As an example, we point to the fact that temperature T_T is a limiting factor of NP gas sensors of hot exhaust gases, of fire detectors, etc. Therefore we have paid to the investigation of T_T of our NPs serious attention.

Preparation of particles by high-temperature solution phase reaction is described elsewhere [2]. The diameter of NPs is 6.4 nm, surface protective coverage from oleic acid and oleylamine, the so-called surfactant, is 1 nm thick.

$\gamma \rightarrow \alpha$ transformation of NPs was studied by X-ray diffraction in the Department of multilayers and nanostructures of the Institute of Physics SAS, by differential scanning calorimetry in the Department of physics of metals of the same institute and by magnetic measurements in the Institute of Experimental Physics SAS in Kosice. Due to sharing of samples, we obtained statistically reliable data. Obviously, they are related to the particular preparation method, surfactant coverage, and diameter of particles. Details are in [14].

1. X-ray diffraction (XRD): samples were heated 1 h in the air between 500 and 770 °C. In pure Fe_2O_3 samples maghemite (m) phase persisted up to 550 °C (Figure 1) and mixture m + h (h-hematite) was recorded only at 600 °C. We assume that γ phase is stabilized by the surface free energy [15]. For comparison in [16] γ-Fe_2O_3 nanoparticles showed the transition to α phase already at 481 °C.

2. Differential scanning calorimetry (DSC) measurements of Fe_2O_3 NP were done three times during 6 weeks. In the DSC curve (Figure 2) three groups of peaks are visible. They correspond to surfactant removal (at 560 K), crystallization of

Table 2 Saturation magnetization M_s data of Fe_2O_3 NPs at 50 kOe

Heating [°C]	M_s [emu/g] at 300 K
no	62.5
550	61.9
600	21.6
700	6.0
770	1.6

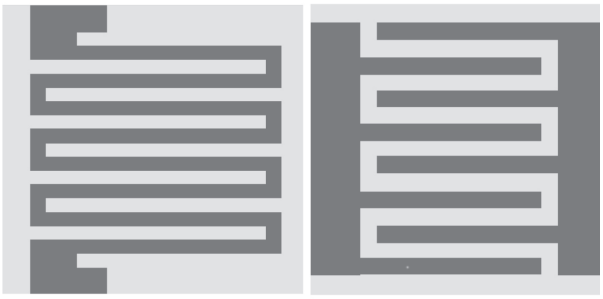

Figure 3 *Design of Al_2O_3 substrate of the sensor with dimensions 2 x 2 mm² equipped with comb electrodes (dark areas, right). Electrodes are composed of 20 nm of Ti (adhesive layer) and 200 nm conducting Pt upper layer. The width of stripes is 50 μm. At the left side, there is a meander for in-situ heating of the sensor. It is patterned on the rear side of the substrate*

NPs (at 730 K), while maxima around 800 K correspond to γ → α transformation finished at 870 K, i.e. 600 °C, complying to similar XRD results (Figure 1).

3. Superconducting magnetometer measured magnetic properties of NPs. The small diamagnetic contribution of Si substrate was subtracted from the data. Here we show the development of Fe_2O_3 γ → α transformation (Table 2), where the saturation magnetization (M_s) of samples calibrated per mass of the measured material is given. From the sharp decrease of magnetization between 550 and 600 °C (compare the last row of Table 1) it can be concluded that there γ phase transforms to α. From [17] it follows that M_s (62.5 emu/g) of our small samples is surprisingly high, even higher than in larger NPs.

We may conclude that relatively high transformation temperature of our γ-Fe_2O_3 NPs between 550 and 600 °C is not a fluctuation. It has been proven by three independent methods, every one of them belonging to the different type of analyses. Moreover, NPs have satisfactory high magnetization which gives the evidence that preparation methods were managed at a high level.

5. Example 2: Design of reliable nanoparticle gas sensors

Basic semiconducting metal oxides used in gas sensors are SnO_2, TiO_2, WO_3, ZnO, and Fe_2O_3. All of them provide sufficient sensitivity of devices toward both oxidizing and reducing gases.

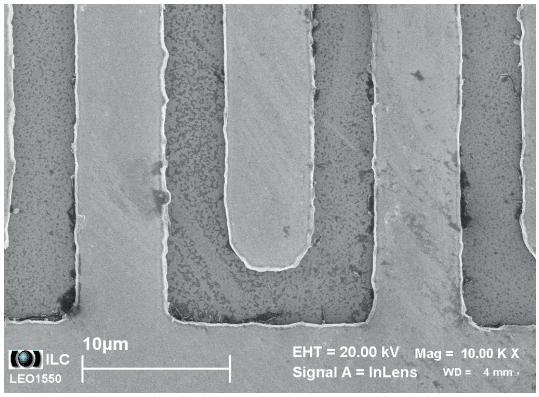

Figure 4 *Al_2O_3 substrate with comb electrodes about 5 μm wide covered by Fe_2O_3 nanoparticles. Along the edges interruptions and voids (black spots) could be found*

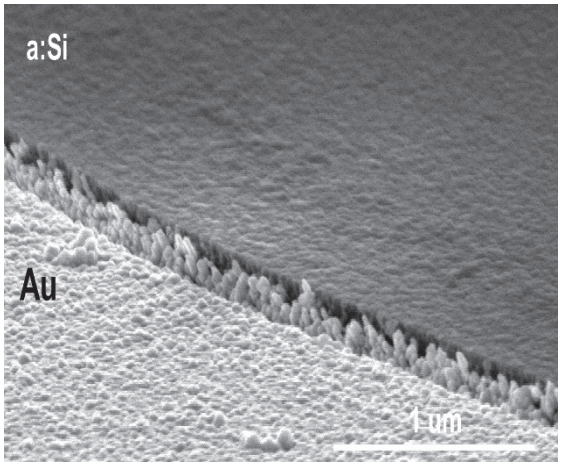

Figure 5 *Au granular film. At the interface with a:Si there is ridge filled by Au pyramids*

Small sensors of this type with low energy consumption are broadly used nowadays. In our laboratory, we are studying Fe_2O_3 nanoparticle sensors detecting small concentrations (1-100 ppm) of gases or vapors like NO_2, CO or acetone in air. NP sensors offer high sensitivity because they have large reaction specific surface. E.g., the surface of our nanoparticles with the diameter of 6.4 nm is 180 m²/g, being 4 times larger than that of the equivalent continuous layer.

In sensors, the substrate chips from thermally and mechanically stable Al_2O_3 ceramics are often used [18]. Silicon offers better prospects because sensors on the Si substrate could be integrated into silicon electronic circuits. The substrates are equipped with comb electrodes prepared by lithography and etching (Figure 3). The steps at the electrode edges, in our case 220 nm high, are not an acute problem if the sensing medium is prepared by deposition of layers, especially by sputtering, by spreading of the paste or by spinning the solution of the sensing material onto the substrate. These techniques guarantee reasonable „carpeting" effect at the edges. However, with nanoparticles about 30 times smaller than the height of the step, due to the weak van der Waals forces

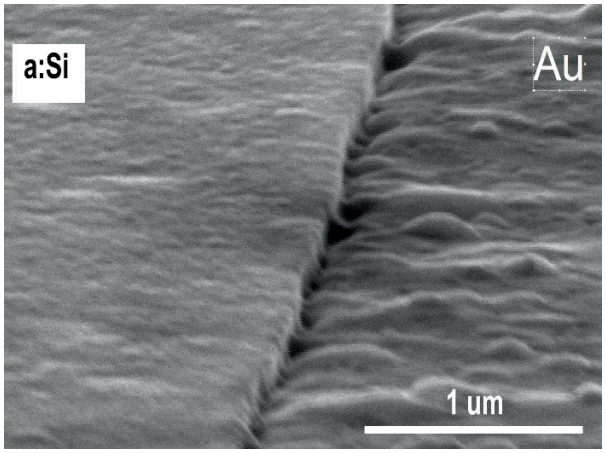

Figure 6 *The sample from Figure 5 after annealing. The 100 nm deep ridge persists*

between them (2-4 kJ/mol), the continuous coverage of the step cannot be guaranteed. Although we have developed technique [19] using nanoparticle films formed on the water surface that is slowly sinking toward the substrate submerged in the water which is slowly pumped away, the process is not enough reliable (Figure 4). The problem may be circumvented by bevelling of the electrode steps [20]. However, then the width of electrodes is increased, and the level of miniaturization of devices is not satisfactory.

Therefore we decided to develop a technology with electrodes embedded in the substrate. First Si substrate was covered by the continuous layer of amorphous Si (a:Si) 0.5 μm thick, which is an insulating bed of electrodes. The electrode pattern was etched into a:Si up to the depth of 380 nm using photolithography with a negative resist and plasma etching. The width of electrode stripes was 50, 20, 10, 5 or 2 μm. Then Au layer 350 nm thick was evaporated onto the surface and the excessive resist with Au layer was removed (lift-off process). Remaining Au layer was composed from 40-70 nm granules (Figure 5). Afterward, the samples were heated to 1100 °C, i.e. above the Au melting point (1064 °C) and Au film became smooth (Figure 6).

Although at the interface the triangle ridge about 100-120 nm persists, this obstacle is less detrimental for continuous NPs deposit than the high edges in previous systems. The ridge will be reduced via the mutual adjusting of the depth of etching into a:Si and the thickness of Au film. We must also elucidate how the ridge is influenced by the wetting of a:Si vertical wall by melted Au and how the wall shields the condensation of Au vapors.

6. Closing remarks

The aim of the present paper was to discuss the reasons of irreproducibility of experimental results in science in general and in nanotechnology in particular. Common principles which help to overcome these problems were introduced. Subsequently, we have provided an example how to increase the reliability of measuring the properties of nanoparticles using three different methods in three laboratories employing the sample sharing principle. The second example shows that working with very small nanoparticles in nanotechnology, we must pay attention to their interfaces with the macroscopic world and design them in an appropriate way.

Acknowledgements

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MAGNETIC FLUIDS AND THEIR APPLICATIONS

Magnetic fluids contain magnetic nanoparticles which are dispersed in water or various types of oils. Magnetic nanoparticles are monodomain and their magnetic moments are oriented in the direction of the magnetic field. They interact with each other and create new structures, which depend on parameters of magnetic nanoparticles, temperature, values, and development of magnetic and electric fields. This paper describes two basic methods of investigation of magnetic fluids in magnetic and electric fields by the acoustic and the dielectric spectroscopy. Magnetic fluids have wide application in technology, medicine and other areas.

Keywords: *magnetic nanoparticles, dielectric, acoustic, spectroscopy*

1. Introduction

Nano-science deals with a study of objects, chains or clusters of atoms and molecules. At least one of their dimension is in the range of one to several tithes of nanometers (1 nm = 10^{-9} m) - NANO (Figure 1). An object of such size compared to a human is about as small as human compared to the Sun. Even a few decades ago, the idea of small things was often identified with micro-objects - the "micro" was a trend. We had microscopes, micro-organisms, microphones, microwaves, microprocessors. The technologies are limited by imaging and manufacturing techniques, which allowed only the structures with the smallest dimensions to be several microns (10^{-6} m) [1].

Today it is known that atoms are formed from protons, neutrons and other elementary particles like electrons or quarks. Their numbers and distribution in given atom (element) determine its parameters and properties. Each known elements as oxygen, carbon, gold or others are placed according to the properties of their atoms in the periodic table. At present, more than 100 different atoms are known. Many of them naturally occur in the universe, but some have been created artificially. The dimensions of each atom are several angstroms, respectively, several tenths of a nanometer (1 Å = 0.1 nm = 10^{-10} m). The space between atoms, nano-objects and micro-objects is filled by a nano-world a world of very special, small structures with various shapes and marvelous properties. However, all these phenomena and objects are invisible to us, although some of their properties can be registered and used in a macro-world.

2. Magnetic nanoparticles

Nano-objects exist in different shapes, forms and size. They can be nano-particles, nano-fibers and other various nano-structured objects, or they can be parts of other materials with which they create nano-composite materials offering new possibilities and combinations of properties. From the many shapes and compositions of nano-objects we will focus only on a special group of magnetic nanoparticles with a size between 5-30 nm, which consist of iron oxides with good magnetic properties and also high oxidation resistance. A magnetic fluid (MF) consists of the magnetic nanoparticles coated with a surfactant, which are dispersed in carrier fluid based on water or oil. From the chemical point of view, the carrier fluid must be stable for the required temperature range.

MF is formed by magnetic nanoparticles (usually magnetite, Fe_3O_4) coated with surfactant agents (amphiphilic molecules, as oleic acid and aerosol sodium di-2 ethylhexyl-sulfosuccinate) in order to prevent their aggregation in a carrier fluid. Stefic repulsion among nanoparticles acts as a physical barrier [2] that keeps nanoparticles in a solution and stabilizes a MF. If the nanoparticles are dispersed in a nonpolar medium, such as oil, only one layer of surfactant is needed to form an external hydrophobic layer (Figure 2a). The polar head of a surfactant is attached to the nanoparticles surface, and the carbonic chain is in contact with the carrier fluid. On the other hand, if the particles are dispersed in a polar medium, such as water, a double surfactation of the particles is needed to form a hydrophilic layer

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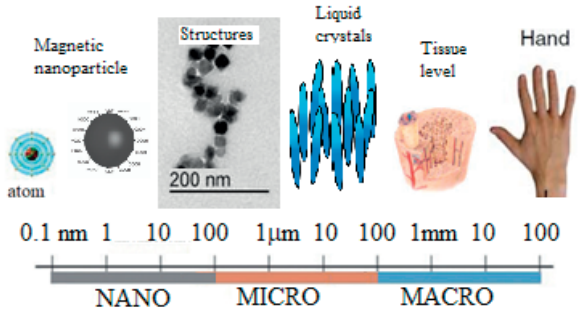

Figure 1 *Nano-objects, micro-objects and macro-objects*

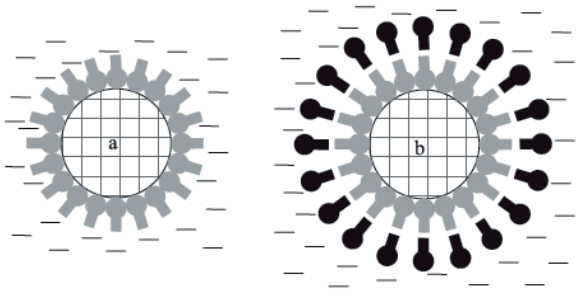

Figure 2 *A nanoparticle in a non-polar solvent (a) and in a polar solvent (b) [4]*

around them (Figure 2b). The polar heads of surfactant molecules can be cationic, anionic or nonionic [3].

Although magnetic nanoparticles are objects from nano-world, we do not need Quantum mechanics to describe their motion in space. The motion of a magnetic nanoparticle in a carrier fluid can be described using terms from Classical mechanics, and it is governed by several factors including (a) the magnetic force, (b) viscous drag, (c) particle-fluid interactions (perturbations to the flow field), (e) gravity/buoyancy, (g) thermal kinetics (Brownian motion), and (h) interparticle effects including (1) magnetic-dipole interactions, (2) electric double-layer interactions, and (3) van der Waals force.

For the basic analysis, we consider nanoparticles in low concentration, and we neglect particle/fluid interactions and interparticle effects. In many applications, particle diffusion due to Brownian motion can also be neglected, what simplifies the analysis. However, for a correct understanding of given application, Brownian motion cannot be ignored, as this motion can have various effects in the region of interest. Next important information is that a real MF does not contain magnetic nanoparticles with a single size but contains a range of different particles size. In order to take into account the effects of polydispersity, the lognormal distribution function is usually used in theoretical predictions [5], [6]. The typical size of the magnetic nanoparticles in a MF is of the order of 10 nm, sufficiently small for them to be magnetically monodomain. This is an important characteristic; because the particles must have non-zero magnetic moments for the MF to show its paramagnetic properties. The main property of the MF is that, in the presence of a non-homogeneous magnetic field, particles are rotated and attracted to the region where the field intensity is maximal.

Two distinct mechanisms exist for the rotation of the magnetic moments in magnetic fluids [6]. One of them is the rotation of the whole magnetic particle inside the fluid carrier, known by the name of Brownian rotation (in the absence of a magnetic field, the particle rotates due to the Brownian torques (molecular collisions)). The relaxation time for spherical nanoparticles is dependent on its volume and the fluid's viscosity. The other mechanism is the rotation of the magnetic moment with respect to the nanoparticle, known as the Neel rotation. The relaxation time for this rotation is strongly dependent on the nanoparticle's volume and the temperature. When the Neel rotation is the dominant mechanism (temperatures higher than blocking temperature - T_B), i.e., when the magnetic moment is quasi-free to rotate, the nanoparticle is superparamagnetic. Bellow T_B the magnetic fluid is still superparamagnetic because the magnetic nanoparticle, and hence also its moments, continues to be quasi-free to rotate. When nanoparticles are exposed to an AC magnetic field with the period less than their magnetic relaxation times of nanoparticles, heat is dissipated due to the delay of the relaxation process to the magnetic moment.

At present three main theoretical models and some simulations are used to describe the arrangement of magnetic nanoparticles in a magnetic field [7], [8], [9], [10], [11], [12]. It is also well known that under the effect of a magnetic field the nanoparticles in a magnetic fluid arrange into chains or structures with various shapes along the magnetic field direction. The parameters of these structures can be determined by comparison of theoretical predictions with measured results of the anisotropy of acoustic attenuation in the magnetic field. The first theoretical description of the anisotropy of acoustic attenuation of a magnetic fluid under the external magnetic field was published in 1986 by Taketomi [7]. He assumed that magnetic nanoparticles form the spherical clusters of some radius *a*, which create long chains, aligned in magnetic field direction (Figure 3, h ~ 1). The idea that magnetic nanoparticles in the presence of the external magnetic field create only chains and they do not form clusters was presented in work by Pleiner and Brand [13]. Based on this assumption Shliomis et all [9] prepared theoretical model which takes into account only oligomers: dimers, trimers or short thin chains (Figure 3, h>>1). Next interpretation of acoustic attenuation in magnetic fluids is based on the theoretical model proposed by Ahuja and Hendee [8]. In their theory, it is assumed that structures of magnetic nanoparticles in the magnetic field have various forms as oblate or prolate spheroidals, spherical, disk-like and needle-like shapes (Figure 3, h>1).

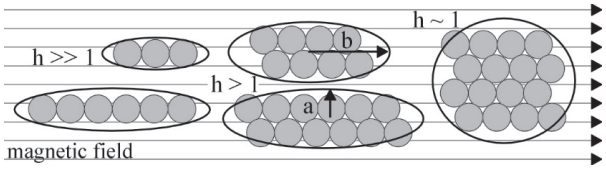

Figure 3 *Types of possible ellipsoid aggregates that can be formed in the magnetic fluid under the effect of magnetic field: chain-like (h = b/a >> 1), prolate spheroid (h > 1) and sphere (h ~ 1)*

3. Application of magnetic fluids

Magnetic fluids or ferrofluids are smart fluids [14], [15], [16], [17], which are rather attractive for a large variety of applications, which require fluid and magnetic properties simultaneously. Macroscopically, these fluids manifest themselves as magnetizable fluid media due to the "integration" of nanosized permanent magnetic nanoparticles in the carrier structure. The main feature of the research area in magnetic fluids or ferrofluids is high applicability of these materials. During the last century, chemists and physicists made a big effort to synthesize stable magnetic fluids, motivated by the perspective of many important technological uses. A clear confirmation of these perspectives was that from 1970 the number of patents is about half the numbers of published papers each year [3].

The research field of magnetic fluids is a multi-disciplinary area: Chemists study their synthesis and produce the ferrofluids, physicists study their physical properties and propose theories which explain them, engineers study their applicability and use them in technological products, biologists and physicians study their biomedical possibilities and use them in medicine. Most applications of magnetic fluid are based on its following properties [3], [12], [18]:

1) It goes to where the magnetic field is the strongest and stays there;
2) It absorbs electromagnetic energy at convenient frequencies and heats up;
3) Its physical properties may change with the application of a magnetic field.

These properties make MFs useful for many technological, biological and medical purposes, and they can also help in materials science and engineering research. From technological applications of MFs we describe these four main categories: a) Dynamic sealing; b) Heat dissipation; c) Damping; d) Doping of technological materials [3], [18]. One of many applications of heat dissipation using MF is a loudspeaker, whose coil heats up by functioning. In this case, MF is kept in place by the magnetic field of the magnet which is fixed on the loudspeaker's horn. The presence of MF around the coil also improves the quality of the speaker because unwanted resonances are damped. Next more direct use of MF for damping of unwanted vibrations is associated with their use as inertial and viscous dampers for motors, mainly stepper motors.

From the several possibilities of use of ferrofluids as technological materials, we have chosen only the case of liquid crystals doping, which is studied also in our laboratory. The doping of liquid crystals by magnetic nanoparticles reduces the magnetic field necessary to orient the liquid molecules more than hundred times [19], [20]. According to experimental observations with lyotropic nematic liquid crystals [21], above a minimum value of the concentration of particles, the liquid crystalline matrix collectively follows the orientation of the magnetic particles. Magnetic nanoparticles can also be used to investigate dynamic processes in lyotropic ferronematics (nematic liquid crystals doped with ferrofluids), in particular, the response of the nematic matrix to magnetic fields [22]. The next area of study is an investigation of their elastic properties. The bend elastic constant and the anisotropy of the diamagnetic susceptibility can be measured by comparing the relaxation behavior of liquid crystals with and without the ferrofluid doping in different magnetic fields. Magnetic nanoparticles significantly increase the sample light absorption, which is particularly useful to investigate the nonlinear [23] optical properties of lyotropic liquid crystals. The nonlinear refraction index of doped samples was shown to be ten times larger than those of undoped samples [24].

The main categories in biomedical applications are a) Magnetic drug targeting; b) Hyperthermia; c) Contrast enhancement for Magnetic Resonance Imaging - MRI; d) Magnetic separation of cells [3]. Localizability of MF by a magnetic field offers very interesting applicability in medicine, because any fluid may be turned into a magnetic fluid. Much attention has been paid to bounding on ferrofluids chemical drugs appropriate for chemotherapy. The idea is simple: such a ferrofluid bounded drug is injected into a cancer tumor, and there it is kept during some time (one hour) by a suitably focused magnetic field. The amount of drug necessary is much less than what would be necessary if it were dispersed in the whole body. When the magnetic field is turned off the drug will disperse in the body, but, since the total amount was very small, there will be practically no side effects. The hyperthermia is based on the absorption property of ferrofluids because they can absorb electromagnetic energy at the frequency that is different from the frequency at which water absorbs energy. This allows one to heat up a localized portion of a living body, where ferrofluid has been injected, for example, a tumor, without heating at the same time the surrounding parts of the body. MRI has been one of the most powerful diagnosis techniques used in medicine in recent years. Its ability to distinguish between different tissues relies on the different relaxation times of the proton's magnetic moments when it is in different ambient. Magnetic particles from a biocompatible ferrofluid are selectively absorbed by the kind of tissue, so they them very clearly visible by MRI. Moreover, different tissues uptake different amounts of the magnetic particles, so distinguishable images have different values.

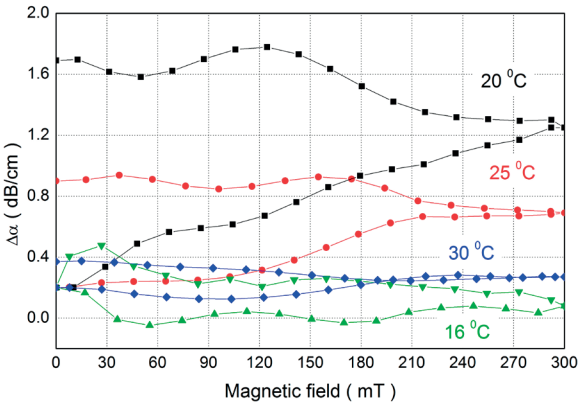

Figure 4 *The temperature influence of the attenuation changes on the external magnetic field for 1.5 % MF based on transformer oil MIDEL (■ 15 °C, ▲ 25 °C, ♦ 30 °C)*

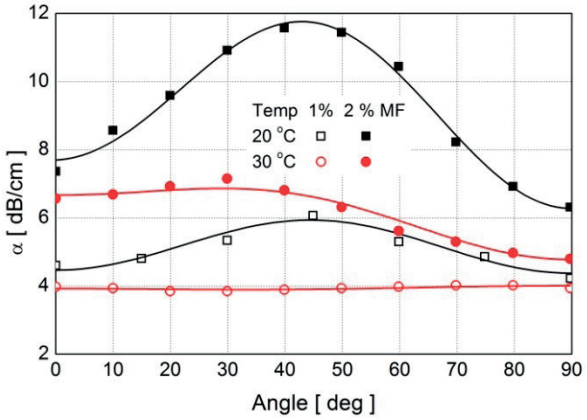

Figure 5 *The anisotropy measurement of the acoustic attenuation for 1 and 2% magnetic fluid based on TECHNOL in the external magnetic field (B = 200 mT) for frequency f = 12.6 MHz measured at two temperatures*

4. Experimental part

The block diagrams of the experimental arrangements are shown in works [25], [26]. In the case of measurements of acoustic properties, MF was placed in the measuring cell of volume around 2 mL. The measurements of the acoustic attenuation at the frequency 13 MHz were carried out by a pulse method using the Workstation EXPLORER II. An acoustic wave is generated by transducers located in measuring cell, propagated through the MF, and underwent multiple reflections between transducers. The acoustic signal is received by the second transducer, registered by Workstation and displayed by the oscilloscope. At measurements of the dielectric properties of MF we used commercial cells for liquid crystal (LC) as capacitors. The cells are composed of two transparent flat glass (sandwiched type) substrates coated with Indium Tin Oxide (ITO) conductive layers acting as electrodes. The distance of two parallel plate ITO electrodes was d = 5 μm and the active electrode area was A = 30 mm^2. The capacitance of the air filled cell was C_0 = 56 pF. At both types of measurements cells were placed on thermally stabilized blocks, the temperature of which was stabilized by the thermostat in the range from 10°C to 55°C with accuracy ± 0.1 °C. During the measurement, the cells were inserted in the electromagnet, where the magnetic field was controlled by the current source. The whole measurement was controlled by the computer.

The acoustic attenuation was investigated for various types or concentrations of MFs [25], [26], [27]. These results showed a strong influence of a magnetic field on the value of acoustic attenuation. When the external magnetic field is increased, the interactions between the external magnetic field and the magnetic moment of the particle lead to aggregation of particles and various structures as chains or clusters are formed. These structural changes caused an increase in the acoustic attenuation. The decrease of the acoustic attenuation was slower at decreasing magnetic field so that a hysteresis effect can be observed (Figure 4). This effect can be described by the existence of structures, the lifetimes of which were longer than the time of decrease of the magnetic field. Created structures do not disintegrate as soon as the magnetic field is removed.

A change of the acoustic attenuation with a magnetic field is also dependent on the temperature [6], [26], [28]. Its development for the magnetic fluid based on transformer oil MIDEL in the temperature range of 16-30 °C is presented in Figure 4. The measurements of the acoustic attenuation at temperatures 20 °C and 25 °C show the largest changes originated from the process of structures creation and show also higher hysteresis. At these temperatures, the creation of structures is more effective because the Brownian thermal motion has not energy sufficient to destroy them. At a higher temperature collision caused by thermal motion are more often and effectively. These collisions cause a decrease in numbers of clusters and their lengths with higher probability. Above 30 °C, the majority of the particles are not involved in the structures. The influence of magnetic field on the acoustic attenuation becomes small. The stability of such medium in a magnetic field is then better.

The anisotropy measurement can be interpreted using theories and from them to determine parameters of nanoparticle structures. At this type of measurement, the magnetic field is constant, and the angle ϕ between wave vector of acoustic wave $\boldsymbol{k}$ and the magnetic field $\boldsymbol{B}$ is changed. In Figure 5 there are presented results for the anisotropy of acoustic attenuation in 1% and 2% magnetic fluids based on TECHNOL. The solid lines represent the theoretical fit by Taketomi functions [7], [26] and symbols are experimental data. It can be seen that the changes of acoustics attenuation for 2% MF TECHNOL are higher as 1%. Since the measurements show local maxima, we can say that some types of structures: oligomers, chains or clusters were created in the direction of magnetic field. Only in combination with a model, we can determine the shape and size of these structures. The observed results also indicate a strong effect of

Table 1 Parameters describing 1% and 2% magnetic fluids based on the TECHNOL obtained from the fit of measured anisotropy data for two temperatures ($4/3\eta_S+\eta_V$ - bulk viscosity, a - radius of clusters, N - the density of clusters and volume concentration of all clusters V×N)

MF	1%		2%	
Temperature	20 ^{0}C	30 ^{0}C	20 ^{0}C	30 ^{0}C
$4/3\eta_S+\eta_V$	0.29	0.23	0.36	0.28
a [nm]	50	24	138	37
10^{-17} N[m^{-3}]	255	560	12	250
*V*x*N* [%]	0.33	0.08	1.72	0.66

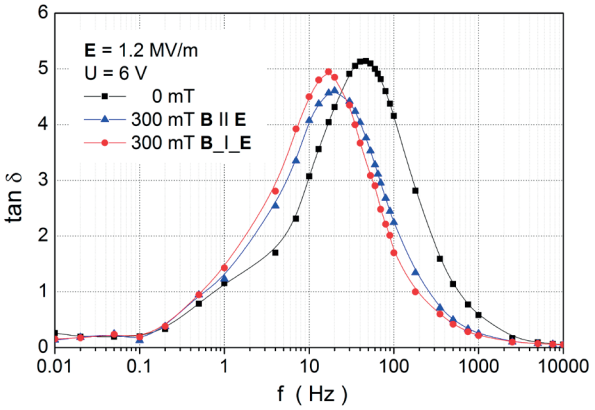

Figure 6 *The effect of the external magnetic field and its orientation with respect to the electric field on the dissipation factor for 0.5% magnetic fluid based on MOGUL*

temperature and concentration on the measured anisotropy of acoustic attenuation. The measurements at temperature 20 °C show the largest changes of acoustic attenuation because clusters around tithes nanometers in diameter were created. On the base of the calculated radius (Table 1) at the temperature 20°C, we can say that the structures contain more as 6 nanoparticles for 1% and more as 15 nanoparticles for 2% MF. The changes of acoustic attenuation are smaller at higher temperatures. At temperature 30°C there are only 2-3 nanoparticles in the structure, so they can create only thin chains. Both smaller number of nanoparticles in clusters or chains and thus their shorter size induce the smaller influence of the direction of magnetic field with regards to the direction of acoustic wave propagation on the acoustic attenuation. We suppose that this effect is connected with smaller structures or chains due to Brownian motion.

Since nanoparticles are polarizable, the dielectric spectroscopy can be used to study their dielectric parameters. With the application of magnetic field, there are also changed dielectric parameters as complex permittivity and dissipation factor of MF. These changes are mainly caused by movement of electric charges in new structures of magnetic nanoparticles. The mechanisms of dielectric relaxations can be described from a measurement of the frequency dependence of dissipation factor. The low and high-frequency maximums should be clearly observed [29], [30]. On the basis of Maxwell-Wagner model, it was estimated that one maximum of tan δ appears at hundreds of MHz frequency, which exhibits in many colloidal systems containing different dielectric constituents. The next low-frequency relaxation process, occurring in magnetic fluids is described by the Schwarz model [31], [32]. Electric double layers are created on the particle surfaces as a result of electrostatic interactions between the particles and the space charge. Finally, the electrode polarization (EP) causes an anomalous increase in the complex dielectric permittivity in a lower frequency region by many orders of magnitude.

In order to investigate the influence of the magnetic field on the electro-kinetics within the magnetic fluid, the whole system was placed inside an electromagnet. One of the measurements for the frequency dependence of dissipation factor of MF based on transformer oil MOGUL measured in the range from 0.01 Hz to 10 kHz is depicted in Figure 6. The interesting changes are significant for frequencies lower than 1 kHz. There is clearly observed a low-frequency relaxation maximum, the position of which also depends on various external factors. In this figure, the magneto-dielectric effect of studied MF is presented. When the external magnetic field was applied the whole development of the dissipation factor shifted to the left side. In general, we can say that at the parallel orientation of fields the eigenfrequency is smaller than for perpendicular orientation and without the application of magnetic field. The change of dissipation factor with the application of magnetic field results from a rearrangement of nanoparticles to new structures, as oligomers or chains. These agglomerations have electric dipoles so generate higher depolarization field, which further reduces the total intensity of electric field. Consequently, the relaxation maximum shifts towards lower frequencies with the application of magnetic field. For the perpendicular orientation of the electric field to the magnetic field, the Lorentz force has a maximum effect on the drift of the nanoparticles in the direction of the electric field. This force causes the motion of nanoparticles in a spiral, which causes longer tracks of the nanoparticles in the system and it is connected with the increase of dissipation factor. The position of the local maximum of tan δ for parallel orientation of fields is at the frequency of 20 Hz and for perpendicular 17 Hz. From the fit of the measured complex permittivity of ferrofluid using the Havriliak-Negani relationship resulted that the DC conductivity of the ferrofluid slightly increases within the magnetic field [31]. This could be the result of new structures from nanoparticles which have higher charge; in general, they increase the conductivity.

5. Conclusion

The applications of magnetic fluids are very useful for many technological, biological and medical purposes, and they can also help in materials science and engineering research. For the correct understanding of processes in a magnetic fluid at the application of a magnetic field, it is important to have various diagnostic methods. One of them is the acoustic spectroscopy, which is a very useful tool for investigation of magnetic fluid subjected to an influence of a magnetic field. The acoustic attenuation depends on temperature, type, and development of a magnetic field. The study of the dielectric properties of a magnetic fluid in the magnetic field is the next method. Particle agglomeration within a magnetic fluid and the magneto-dielectric effect can be distinguished by the dielectric spectroscopy. Combinations of these methods bring more complex view on agglomeration and electric properties of a magnetic fluid.

Acknowledgment

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THE ROLE OF BEAUTY IN PHYSICS

The goal of physics is to look for the truth behind the physical phenomena. Where is the place for the beauty then? The truth can be in principle ugly in one case and aesthetically pleasing in another. Nevertheless, many physical theories can be considered as beautiful and are often formulated with aesthetic criteria in mind. These criteria include the ability to explain a lot starting from a little and/or some form of symmetry. Several examples of beautiful laws will be discussed along with opinions of particle physicists on beauty.

Keywords: *beauty in physical theories, symmetry, simplicity, truth*

1. Introduction

"Beauty is truth, truth is beauty", the closing line of John Keats's Ode on a Grecian Urn, draws attention not only of literary critics but also of scientists who often quote it when reflecting on the beauty they see in nature. In particular, many physicists give a lot of credit to beauty in natural laws, up to the point that beauty is as important for them (as scientists) as truth. As we will see, for a few it can be even more important than truth. This might be a bit unexpected - after all, the job of a physicist is to look for truth, not beauty. And some scientists, afraid that unlimited fascination with beauty can lead us astray, would agree. Ken Lane once wrote that when in search for truth, "leave beauty to tailors and bootmakers [1]".

Jesus Zamora Bonilla classifies the main positions about this question in the following way [2]: "In the first place, there are philosophers and scientists that insist on the claim that the pursuit of beauty is an important, even an essential ingredient in the process of scientific research. In the second place, there are those that simply deny that scientific research has anything intrinsic to do with beauty. ... it is just a coincidence that some empirically successful theories trigger something like a sense of beauty." Bonilla refers to the former as 'the Platonists' since their view is usually associated with the idea that the ultimate explanation of the universe must possess beauty. The latter group he calls 'Sceptics' and claims this position is "the most common within the philosophers of science, and I would venture to say within most practicing scientists outside the most abstruse fields of quantum physics and higher mathematics". He also labels Richard Feynman, the Nobel Prize-winning theoretical physicist, as Sceptic, quoting his famous line "it doesn't matter how beautiful your theory is, it doesn't matter how smart you are: if it doesn't agree with experiment, it's wrong".

In this contribution, as a scientist representing one of those most abstruse fields (particle physics), I will look at views of physicists who valued beauty dearly, give criteria for what they mean/meant by beauty followed by examples of beautiful physical laws, and finally take a look at some dissenting opinions.

2. Proponents of beauty

Many physicists of the 19th and 20th centuries appreciated the importance of aesthetic values in their theories. Henri Poincare, a French mathematician and theoretical physicist, once said "The Scientist does not study nature because it is useful to do so. He studies it because he takes pleasure in it; and he takes pleasure in it because it is beautiful" [3]. J.W.N. Sullivan, a British physicist and science writer, argues "The measure of the success of a scientific theory is, in fact, a measure of its aesthetic value, since it is a measure of the extent to which it has introduced harmony in what was before chaos" [3]. Albert Einstein described Niels Bohr's atomic model as the highest form of musicality in the sphere of thought [4].

Heinrich Hertz, who proved the existence of the electromagnetic waves, wrote about his feeling that James Clerk Maxwell's fundamental equations of electricity and magnetism "have an independent existence and an intelligence of their own, that they are wiser ... even than their discoverers, that we get more out of them than was originally put into them" [4]. Even Richard Feynman, quoted as Sceptic by Bonilla, said "You can recognize truth by its beauty and simplicity. When you get it right,

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it is obvious that it is right - at least if you have any experience - because usually what happens is that more comes out than goes in" [5]. What Hertz and Feynman refer to, became a criterion for a beautiful theory: more comes out than goes in (see Sec. 3). More recently, the 2004 Nobel prize laureate Frank Wilczek expressed his view in this way "My work has been guided by trying to make the laws more beautiful" [6].

Reading these statements, one can feel that for their authors beauty was likely as important as truth. But there is another group of physicists who seem to go even further. Hermann Weyl, a German mathematician, physicist and philosopher made a surprising claim: "In my work, I have always tried to unite the true with the beautiful; but when I had to choose one or the other, I usually chose the beautiful" [3]. Murray Gell-Mann, an American physicist who received the 1969 Nobel Prize for his work on the theory of elementary particles, would agree: "Beauty is a very successful criterion for selecting the right theory... In 1957 we published a partial theory of weak interactions which disagreed with seven experiments. We believed they were wrong because our theory was beautiful ... and they were" [7].

Albert Einstein was so convinced about the beauty of his theory of special relativity that when asked about the experiment (by D.C. Miller) which appeared to disagree with it, he responded

"Oh, that will go away" [7]. In 1919, when Arthur Eddington, an English astronomer, put general relativity to a successful test, Einstein was asked what if the results hadn't agreed with the theory? His response was "I would have been sorry for the dear Lord, for the theory is correct" [8].

We conclude this list with the Nobel Prize-winning physicist Paul Dirac, who said in 1963 that "it is more important to have beauty in one's equations than to have them fit experiment" [8].

3. Beauty criteria

What kind of beauty are all these great men talking about? Beauty can be very subjective as our experience with works of art tells us. Subrahmanyan Chandrasekhar, an Indian astrophysicist famous for his work on the evolution of stars, suggests two criteria for the beauty of a physical law [3].

The first is due to Francis Bacon: There is no excellent beauty that hath not some strangeness in the proportion! The second was formulated by Werner Heisenberg, a German theoretical physicist and one of the key pioneers of quantum mechanics: Beauty is the proper conformity of the parts to one another and to the whole.

I think I understand these criteria, but they seem a little vague to me. I prefer the two criteria suggested by Frank Wilczek and others [6] which find a broader acceptance among physicists. Wilczek calls the first one productivity, getting out more than you put in: "You find some equation or law by putting together clues and making a guess, and then you can explain seven other things and you know you're on the right track. You get out more than you put in." I agree. If, starting from a single equation, you can predict many diverse phenomena, it seems obvious that there is power and simplicity in the equation that Feynman and Hertz talked about. The more phenomena one can explain with fewer equations, the more beautiful the theory is.

The second criterion is symmetry. Symmetry is defined in an objective way in physics. As Wilczek puts it, it's change without change. "You can make changes in physical objects or changes in the laws that could change them but don't" [6].

The symmetry proved to be especially fruitful in fundamental physics. Let us give some examples. If we rotate a circle by any angle around its center, there is no visible change. We did something, but the effect is none. The circle is a very symmetric object. Early astronomers, likely with this symmetry in mind, assumed that planetary orbits were perfect circles. As Johannes Kepler painstakingly discovered, this was wrong. The orbits are elliptical. Sometime later Isaac Newton formulated the theory of gravity that explained why orbits actually trace ellipses. It turned out that his theory has a circle symmetry - the gravitational force between two objects is the same if we rotate one object around the other by any angle. We made a change, but the law did not change. Here we have an important lesson. Our intuition about the importance of symmetry was correct, but the symmetry did not apply to the orbits (the solutions of the gravitational law), but to the law itself. This is lovely according to a physicist taste. There can be many solutions to the law, some beautiful, some less so, but the law behind is one, and it is beautiful.

The circle symmetry is just the simplest example of symmetry discovered in nature. Einstein built his special theory of relativity on a postulate that the laws of physics are the same in the so-called inertial frames of reference. That is, the laws of physics will not change under Lorentz transformations which include both spacial rotations and transformations to the frames which move with constant speed with each other (we say that the laws have Lorentz symmetry). The Maxwell's equations of electricity and magnetism are an example of a law which does not change under Lorentz transformations. We can see that different symmetries operate in this world and physicists are busy in an effort to uncover them all. The Maxwell's equations also illustrate the first criterion at work: from just four equations one derives all electricity, magnetism, and optics.

The Maxwell's equations have one other symmetry, the gauge symmetry, which had a profound effect on our understanding of the Standard Model of particle physics.

In Quantum electrodynamics (QED), the quantum version of Maxwell's theory and part of the Standard model, the gauge symmetry is the principle from which everything follows.

Curiously, the QED gauge symmetry is a circle symmetry but with a new important twist: we take the field which represents the electron at some point in spacetime and rotate it by a certain

angle[1] and do this at each point in spacetime with a different angle of rotation. If we now demand that the energy of the electron field does not change under this gauge transformation, a miracle happens: one is forced to introduce the electromagnetic field which interacts with the electron field precisely as described by Maxwell's equations.

We started with basically nothing but the electron field and demanded the gauge symmetry (and the Lorentz symmetry to be precise), in this particular case the circle symmetry. The nontrivial thing was to rotate the field in a circle by different angles for different spacetime points (by contrast, in the case of Newton's theory of gravity above, we had only one angle for all space). From this minimal assumption, the existence of electromagnetic interactions follows and Maxwell's equations are derived.

A similar approach was successfully applied also to weak and strong interactions. The symmetries, in this case, are more complicated than the circle symmetry but the gauge principle is there, and its beauty is even more profound. The Standard model is the gauge theory of the electromagnetic, weak and strong interactions. Gravitational interactions are not included in this model yet. Hermann Weyl formulated the gauge theory of gravity long ago, then realized it does not describe reality. However, he liked it so much that he made his famous statement regarding the relation between beauty and truth, see Sec. [2].

I admit that this view of beauty is likely different from what we find in arts. Philip Ball makes important observations in [8], quoting the philosopher of chemistry Joachim Schummer and the art historian Ernst Gombrich. Schummer pointed out that by redefining beauty as symmetry one deviates from the dominant tradition in artistic theory. "There's a reason why our galleries are not, on the whole, filled with paintings of perfect spheres". Gombrich said that too much symmetry ensures that "once we have grasped the principle of order ... it holds no more surprise". Artistic beauty, Gombrich believed, relies on a tension between symmetry and asymmetry. Ball adds "the field of physics has always been heir to Platonism – the mystical conviction of an orderly cosmos. ... for Plato it was precisely art's lack of symmetry (and thus intelligibility) that denied it access to real beauty. Art was just too messy to be beautiful."

In conclusion of this section, I would like to make a note. Beauty is often viewed by philosophers as simplicity, and this category can indeed be found in both of the Wilczek's criteria. If we can explain many phenomena with a single equation, the theory is not only productive; it is also simple, certainly simpler than the theory which needs many equations to accomplish the same thing. If we move to the second criterion, the symmetric objects or theories are, as Gombrich puts it, easy to grasp and 'easy to understand' is a synonym for simple (simplicity, however, can be realized in a tricky way, as our example with the simple circle symmetry in QED shows).

[1]The electron field is a complex function with real and imaginary parts and the rotation takes place in this complex plane, not in spacetime.

4. Skeptics?

Modern particle physicists are in general also proponents of beauty. It is hard to deny that fundamental laws are beautiful and this became motivation for many of us to do physics.

There is, however, a point I would like to make: the emphasis some of the great minds of the 19th and 20th centuries put on beauty, especially if they prefer it to truth, may seem far-fetched for our generation. In my training as a physicist, we were taught (and rightly so) that experiment, not beauty, is the judge between competing theories. As Brian Greene says in the Elegant Universe: "Ultimately, theories are judged by how they fare when faced with cold, hard, experimental facts." According to Greene, Einstein (and others) was just saying that beauty in a theory is a good guide, an indication that you are on the right track [8].

I am not sure if this was Einstein's and Weyl's point, but I admit it sounds a reasonable position. We may have two beautiful theories but only one of them (or none) can be true, and the experiment is the final arbiter. The role of beauty as a guide is the role of a good servant of the truth. We prefer a beautiful theory to an ugly one with pragmatic motives in mind.

Wilczek made an important point along these lines: "Today's frontiers of fundamental physics are far removed from everyday experience. They are difficult and expensive to access experimentally, and we cannot rely on our intuition to fill in the blanks. The patient accumulation of fact recommended by Francis Bacon, Isaac Newton, and Sherlock Holmes is thus no longer practical. Instead, we reverse the process, using guesswork to motivate experiment. We first construct beautiful equations, then derive their consequences, and, finally, craft experiments to test them. In recent decades, that strategy has proved remarkably successful... Rather than recognizing the beauty of laws otherwise discovered, we use principles of beauty – vast symmetry and a high ratio of output to input – to enable discovery" [4].

As Wilczek says, this approach was extremely useful in building modern quantum theories which culminated in the construction of the Standard Model of elementary particles. We might say that without giving beauty a very high priority, there would likely be no Standard Model, no Large Hadron Collider (LHC) and no Higgs boson discovered. And physicists continue in this direction. The LHC was motivated not only by the Standard Model and the Higgs boson but also by new theories which go beyond the Standard Model. These new theories were built with aesthetic arguments as their cornerstones.

For example, supersymmetric theories represent the only non-trivial way to extend the spacetime symmetries such as Lorentz symmetry (gauge symmetries and other internal symmetries can

be combined with spacetime symmetries only trivially). This is a pure mathematical argument, powerful and beautiful at the same time. But there are also two physical arguments with a high aesthetic value in favour of supersymmetry: supersymmetry, unlike the Standard Model, offers a way to unify the three interactions, electromagnetic, weak and strong into a single one and at the same time it provides a good dark matter candidate - the lightest among the many new supersymmetric particles predicted by the theory. Naturally, the search for supersymmetry has become a key part of the LHC physics programme. The expectation is that at least some of the new particles should be visible at the LHC.

And here a possible rift in the seemingly homogeneous views of particle physicists towards beauty is looming. With five years after the Higgs boson discovery, we have not seen any new fundamental particle. Neither supersymmetric, nor other. Much to our disappointment, the Standard Model passes all the experimental tests with flying colours.

Reactions to this differ. Some keep their belief in supersymmetry arguing that the LHC has so far collected only a few percents of the designed total amount of data. Only the simplest versions of supersymmmetry, they say, are in difficulties when confronted with facts. The more sophisticated forms of the theory allow more space where the new particles can be hiding.

Others are beginning to have doubts. They are concerned that to continue the hunt for new particles just because the theory which predicts them is aesthetically pleasing, is not the best way to proceed. Beauty, they think, should not count as indirect evidence in favor of an idea [9]. Sarah Demers, a professor at Yale University, thinks that maybe it is okay for the universe to be a little bit ugly and Marcelo Gleiser, a professor of physics at Dartmouth College adds "... perhaps the insistence that we have in search of perfect symmetry is not a physics idea, but a bias [9]." The way out, according to Demers, is to let data lead the way. "I think we may be more likely to win by the data just forcing us in a direction, as opposed to having some great idea that's aesthetically motivated," she says. Physicists can still search for evidence of the Standard Model and supersymmetry, but they should also go on "agnostic quests," Demers says, where they don't go looking for something in particular.

Up to this point, the arguments seem justified. If beauty fails to help us find truth, it makes perfect sense to look into data instead without any bias and see what we find. This is exactly what Kepler had done and found that planetary orbits were elliptical. Of course, the question is if the time has come. Right now at the LHC both unbiased and biased searches are being performed.

Gleiser, however, takes another step and in pursuit of further unification, he sees a renewed religious impulse. "The idea that there is a force that describes everything is sort of a monotheistic cultural vice that we have," he says. "Growing up in a culture for two or three thousand years where there is a god and a central command of things - I think that's deeply ingrained in people's heads." In some sense, physicists have replaced their one true, symmetrically-faced God with one true, symmetric theory [9].

Here, a group of Sceptics is coming out. Too much flirting with beauty, they think, has religious connotations. Or, as another group claims, there is nothing special about beautiful laws - they seem beautiful to us because we evolved and grew up with them and therefore are used to them. Somehow, both groups deny beauty its special status, its objective existence.

I think that "Platonists" need not worry. Their conviction is, after all, based on facts and previous experience. The Standard Model and General relativity describe reality very well and are beautiful. It is very natural to assume that the same is true also for theories which go beyond the Standard Model. One does not have to believe in God to do so. Of course, if the facts point (just point, not prove) to universal beauty, order, harmony, and unification, to a believer these attributes could sound familiar.

5. Conclusions

Beauty can be defined in quite an objective way using productivity and symmetry as criteria.

Many particle physicists are truly fascinated with beauty, many others view it more pragmatically, and a few others are ready to challenge its high priority seat if an opportunity occurs.

But all would likely agree that beauty has been an essential ingredient in the process of scientific research in our field so far. Even if there is no "theory of everything" that unites all laws of physics, Frank Wilczek says "we already know there are beautiful laws that explain most of the way matter works. It's just that we haven't figured it all out. It's difficult to exaggerate how symmetric, how fruitful, how creative the laws are. It's a great gift" [6]. I conclude that in spite of slightly different attitudes among physicists, beauty is not just for tailors and bootmakers.

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THE ETHICAL DIMENSION OF SYNTHETIC TEACHING OF MATHEMATICS

Man has created certain habits and ways of dealing with ordinary life situations. It is possible to talk about regularly repeated patterns of behaviour and of solving the everyday routine problems. In principle, people create algorithms for solutions of individual situations, and these algorithms start for him/her more or less subconsciously in identifying the existing problem. But what happens if he/she meets a new, totally unknown situation where the learned algorithms are not enough? There is an inner conflict of the learned with the unknown.

In our article, we point out the asset of synthetic mathematics teaching when the pupil is led to solve creatively emerging problems using already-identified solutions. Such an educated pupil adds his own code of ethics to solving problems; he/she does not take uncritically offered fast solutions from the surroundings. When searching for a respective solution, there is always an ethical dimension lying in a person expecting from his/her own problems solutions that they will not only be good solutions but also the excellent ones. It is possible to consider his or her own solution that is taken from other people if one understands this solution and accepts it as his/her own.

Keywords: *code of ethics, synthesis of knowledge, respective solution, problem, the teaching of mathematics*

1. Introduction

During their lifetime, humans create certain habits and ways of dealing with common life situations. It does not matter whether we are talking about pupils going to school or adults going to work. It is possible to talk about regular repeating patterns of behavior and the solving of everyday routine problems. In essence, one creates algorithms to solve individual situations, and these algorithms are triggered more or less unconsciously when identifying the problem. But what happens if one encounters a new, completely unknown situation where the acquired algorithms are not enough? Such new situations include, for example, joining a new school or starting a job in a new company. It can also be joining a new community of people as well as a holiday journey to an unknown place. But it is much more likely that one encounters an unexpected problem that one has not yet solved in his everyday life. There is an inner conflict of the acquired with the unknown. For a person who encounters a new life situation, there is a need to find a new way of managing it.

We often look for some solutions on the Internet nowadays. But we do not always find a solution to our problem, or the solution offered is not possible in our conditions. We think that school has an exceptional position in the life of a man when meeting something new. In almost every lesson a pupil meets something new, not yet known. It is not only about gaining new knowledge, but also about their organic incorporation into the pupil's mind and the connection with the already acquired knowledge. At the same time, it is necessary to activate this new knowledge, which is realized by their application in solving the problems. Another important aspect of learning new knowledge is to link them to their own code of ethics. There is a need for pupils to lead their knowledge and skills to achieve goals that are beneficial to their surroundings. The way of teaching plays a crucial role in incorporating new knowledge into the mind and heart of pupils.

According to Albert Bandura's research [1], a human can selectively turn on and off their moral principles. At one point they can be barbarously cruel, and a few seconds later they are sensitive and sympathetic. The presence of authority is of great importance for that. In classes, the teacher is an authority for pupils. If a teacher passes on new findings authoritatively and requires the pupils to solve the study problems the same way they always do, the teacher places them in the position of the recipient. Pupils are led to take over the whole problem-solving procedures, the entire algorithms of behavior patterns. This is how they are pushed to turn off their own moral code and take

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over the teacher's. A completely different situation arises when the teacher leads pupils to find solutions to new problems. In this case, the pupils are led to use all their already acquired knowledge and skills in finding a solution to the problem. New knowledge or methods are only offered to them when the task is unresolved with their knowledge. Let us keep in mind that the person who solves the problem independently seeks a solution in accordance with his code of ethics.

There is a great deal of training to solve problems independently for pupils in Math lessons. It was Mathematics that arose as science, whose purpose was to help solve the problems of other disciplines. We think that the way of teaching mathematics has a major influence on the formation of the way of solving the real problems of pupils in their future lives. The way we teach Mathematics, using the knowledge and skills that have already been acquired, is called synthetic teaching. The essence of such teaching of Mathematics is that the pupil is led creatively to solve emerging problems using previously identified solutions. This educated pupils employ their own code of ethics to solve problems, and they do not take uncritically fast solutions from their surroundings. The search for their own solution has always an ethical dimension in that the person expects from their own problem solving that they will not only be good solutions but also beautiful solutions. It is also possible to treat a solution taken from other people as one's own solution if one understands this solution and accepts it as one's own.

2. Characteristics of the synthetic way of teaching mathematics

The essence of the synthetic teaching of Mathematics lies in the fact that the pupils deal with appropriate tasks using already acquired knowledge and skills (not only mathematical). New knowledge of Mathematics is presented to them by the teacher at an appropriate time to solve the problem. It is always the knowledge that the student misses to complete the task successfully. In solving the problem, the new knowledge will be integrated into the students' thinking world. The task solving is created by the synthesis of already acquired knowledge and new knowledge if it is needed. From there we deduce the name of the described way of teaching Mathematics. The student, based on the task assignment analysis, identifies the basic knowledge that could be used to solve the task. By identifying the relationships between this knowledge and their interconnection or combination, they will gradually create a solution to the task.

The great benefit of the synthetic teaching process is the expansion of students' solving skills. They realize that it is not always necessary to learn new knowledge and new ways of solving new problems. They will learn how to solve new tasks first by using what they already know and complete new findings only when needed. On the one hand, the student's solving self-confidence is strengthened and, on the other hand, the process of lifelong education will start off. Solving their self-confidence will support solving their enthusiasm (they will begin to solve the problem), and the natural desire to know the result inspires them to complete their knowledge if it is necessary to solve the task. After incorporating the new knowledge into the thinking world of pupils while solving the task, it is necessary to create an organic link to new knowledge with the knowledge already acquired. This is carried out by a wide range of various examples where the new knowledge is used in different forms and contexts. The synthesis is completed only when the pupil acquires new knowledge at the application level - he/she can creatively handle it in solving the problems and the form of its use is in accordance with his code of ethics. In the pupil´s mind, a new world of knowledge is created, which is manifested by the increased ability to solve the problems. When applying a synthetic way of teaching Mathematics, the choice of tasks is the key. The teacher should choose the tasks in which the learner can solve a few initial steps independently. At a certain stage of the solution, they encounter the problem of their lacking knowledge and the teacher's help is needed. After acquiring the missing knowledge, they continue solving the task independently. The second key type of tasks are those that the students can solve independently. After solving them, the teacher presents them a more effective method of solving a given task.

The solution of the task in a synthetic way has the following steps:

1. Activation of the necessary knowledge and skills based on the task assignment analysis
2. Step-by-step creation of a task solution
3. Conflict - question their own ability to solve the task
4. Addition of missing knowledge
5. Completing the task based on their own knowledge

We repeat that after solving the problem where the pupils were enriched with new knowledge, it is necessary to include various tasks in which the solution will use a new piece of knowledge or method of solution. When choosing the tasks, we are not limited to one thematic unit, but we select tasks from different areas of Mathematics. The advantages of synthetic teaching are presented on the example of analytical geometry, which itself came from the synthesis of other parts of Mathematics.

3. Analytical geometry

Analytical geometry is an area of Mathematics in which geometric objects are studied through their analytical expressions. French mathematicians, Rene Descartes (1596-1650) and Piere De Fermat (1601-1665), are considered the founders of analytical geometry. The emergence of the unity of algebra and geometry led to the emergence of this new area of Mathematics. The essence of the analytical solution of a geometric task is to convey the task by means of coordinates to the algebraic task, usually

to solve equations, inequations, and their systems [2]. With the chosen coordinate system we can express each basic geometric figure uniquely in the form of a certain equation (or inequation). The relationship between the respective geometric form and its equation is given by the following rule:

Any point X lies in a given object if its coordinates match the equation of the object.

Based on this rule, the penetration of the two formations is the set of all points, the coordinates of which correspond simultaneously to the equations of the two units [3].

The basic idea of the emergence of analytical geometry - the discovery of new knowledge and the possibilities of solving problems by utilizing the interconnection of several areas of Mathematics, can become an inspiring element for the development of mathematical thinking of pupils and the teaching of Mathematics. During Math classes, pupils acquire new knowledge from Mathematics and acquire solving skills. New findings are presented to them by the teacher in a certain mathematical environment, which most often forms a thematic learning unit. Teaching is mostly subordinated to a given thematic unit. The study of mathematical concepts, as well as the selection of examples and tasks, are framed within a given thematic unit. Such mathematical teaching scenario often leads to the emergence of isolated knowledge in the minds of pupils [4]. The content of mathematical concepts and methods of solution, however, are not limited to the thematic areas of Mathematics but often have an "all-mathematical" scope.

The primary goal of teaching Mathematics is to develop pupils' thinking, and in pursuit of this goal, it is necessary to develop the ability to use creatively the knowledge to solve the tasks of everyday life. Thus, the teaching of Mathematics is beyond the limits of Mathematics itself. We think that the way to overcome the isolation of individual knowledge and the teaching of Mathematics from everyday life has been suggested by the creators of analytical geometry. The synthesized method of teaching Mathematics that we describe is inspired by the emergence of analytical geometry. The basic idea is to make the most of the knowledge and skills that have already been acquired in creating the solution of the task. The need for new knowledge arises in the process of solving the task as a natural element of cognition and problem-solving. Such approach to problem-solving has a significant impact on the future way of solving the problems that people meet in their everyday life. The pupil is prepared for the role of the researcher, is led to use one's own abilities creatively. At the same time, they are aware of their own borders and the need for cooperation with the environment, which also enhances one's ethical behavior. For the successful application of the synthetic teaching method, it is necessary to gradually create a good mathematical basis - a portfolio of theoretical knowledge acquired at least at the level of understanding. The individual elements of the portfolio are interconnected in one organic unit on the basis of suitably chosen examples and tasks. Students will gradually realize that all tasks are solved by a suitable combination and application of theoretical knowledge. At the same time, they gradually acquire the basic methods of solving the problems. The students will solve most of the tasks individually or with little help from the teacher. The awareness of one's own ability to solve a task is an insignificant motivating factor to advance in the acquisition of mathematical knowledge.

4. Possibilities of using the synthetic teaching of analytical geometry

As we mentioned above, analytical geometry arose as a synthesis of two areas of Mathematics. It could be said that we think geometrically when solving a problem and find the solution algebraically. by looking at the usual analytical geometry textbooks, however, we find that individual knowledge of analytical geometry is presented in them in a relatively separate and simplified form. Geometric reasoning is used predominantly to create a formula that is subsequently used as a substitution for geometric reasoning. In task collections, the emphasis is placed on practising the solution of tasks based on the use of formulas. In essence, basic algorithms are practised, with a series of formulas in the center. In this way, pupils can create an image of analytical geometry as a relatively separate part of Mathematics. Analytical geometry becomes a set of formulas for them to learn how to use them in solving a task. The success of problem-solving in analytical geometry is conditioned by memorizing a large number of formulas. According to research, such approach leads to s passive acquisition of knowledge by students and often to their resignation [5]. Malcolm Gladwell in his Outliers, writes that ten thousands of hours of practice are needed to master a subject field [6]. If we transfer this idea to teaching Mathematics, students will not be mathematically mature due to the number of hours spent by calculating mathematical tasks, often of the same type (just changing numbers). Mathematics requires many hours of mathematical work to master it. It consists of solving a variety of tasks requiring conceptual thinking. Through this way of thinking, pupils learn how to choose, use and apply different methods in solving tasks. In essence, they form their own task solving based on their knowledge and skills. They do not use finished products offered by a teacher or a textbook, but they make their own and often original solutions. In this context, another problem with textbooks is that tasks are largely taken out of the context, only mathematical tasks are solved. The pupils then do not know where the knowledge can be applied, which significantly reduces their motivation to learn [7]. We think that the teaching of analytical geometry, having mathematical formulas in its center, results in the isolation of this thematic unit from the other parts of Mathematics. This way of teaching has little impact on the development of independent creative thinking. At the same time, it may also have overlap into their ethical behavior. In the case of

life-threatening conflicts, they can replace their own way of solving by searching for a quick solution - some recommended behavioral pattern. Recommended behavioral patterns help humans, but they do not always comply with their code of ethics. Conflict occurs most often when two (or more) heterogeneous elements collide. This can happen within a thinking subject - internal conflict, or in relation to other people - external conflict. However, conflict does not necessarily lead to something negative. Conflict has energy that can be used to find new valuable solutions. TThis successful „meeting" of two parts of Mathematics can be illustrated by an example of searching for a tangent to the circle. There is also a symbolic subtone for selecting a sample example - as for tangent we look for common points that occur at the center of two geometric formations.

5. Tangent to the circle

In common textbooks, the study of the tangent to the circle begins by deducting the general equation of the tangent to the circle. However, pupils are often offered, especially for reasons of time, the given equation as a finished product. This is followed by examples and tasks for using this equation. However, it is not necessary to know the general equation of the tangent to solve the problems of the tangent. This equation can be discovered when solving tasks in an analytical geometry environment. To discover this equation, the knowledge about the circle and line from planimetry and knowledge from algebra is sufficient. Thus, it is possible to solve the problem in the spirit of the founders of analytical geometry. We will solve this task by synthesizing knowledge mainly from these two parts of Mathematics. In the spirit of the synthetic way of teaching, pupils will be enriched with new concepts of analytical geometry during the solution. In other words, the conceptual apparatus of analytical geometry will be constructed during the task solving.

Example: This is the equation of the circle. $k{:}(x-3)^3+(y+12)^2=100$. Find the general equation of the tangent to the circle k that passes through points a) L[9;-4], b) M[5,2].

Solution:

a) The point L may be inside the circle, on the circle, or outside of the circle. Depending on its position, the way the task is solved is determined. From planimetry we know that the tangent can be constructed only in the second two cases of the position of the point L. To determine its position, it is enough to compare its distance from the center of the circle with its radius. We position the point L with respect to the circle by fitting the coordinates of the point L into the circle equation k. After fitting $LS = PS$, it means that the point L is a circle k and is the touch point of the tangent.
The searched tangent is a straight line, thus it will have a general equation $t{:}ax+by+c=0$. To determine the parameters a,b,c, we will use the knowledge of the planimetry. The radius of the circle constructed at the touch point is perpendicular to the tangent at that point. This means that the vector $\overrightarrow{SL}$ (S the center of the circle k) is a normal vector of the tangent t, its coordinates $\overrightarrow{SL}=(3;4)$ are the searched parameters a,b. To determine the value of the parameter c, we use the point L that fits the tangent, and after the coordinate point L is inserted into the equation $3x+4y+c=0$, we get the solution $3x+4y+c=0$. The searched tangent to the circle k has the equation $t{:}3x+4y-11=0$.

b) Like the solution a), first we determine the position of the point with respect to the circle. Its distance from the center of the circle S is $2\sqrt{32}\doteq 12,2$, which is more than the radius of the circle. The point M is outside the circle and it is possible to construct two tangents to the circle k. For this reason, there will be two general equations of the tangents. Even in solution b) we will proceed by using the knowledge of planimetry. We know that if we want to build a tangent to a circle we need to know the touch point. This would be constructively build with a Thales´ circle k_T with a center at the center of the line SM and a radius $r_T=\frac{1}{2}|S,M|$. Therefore, as the first step of the solution, we find the analytical expression of the Thales´ circle $k_T(O,r_T)$. The point O is the center of the line SM, so it has the coordinates $O[4;-5]$ and the radius is $r_T=5\sqrt{2}$. On the basis of the obtained values, we draw the equation of the Thales´ circle.
$k_T{:}(x-4)^2+(y+5)^2=50$

Touchpoints are common points of circles k a k_T. In the case of the analytical representation of the circles, this means that the coordinates of the touch points are the solution of the following system

$$(x-3)^2+(y+12)^2=100$$
$$(x-4)^2+(y+5)^2=50$$

We will use the knowledge of algebra to address it. After adjusting the individual equations, we get the system in in the form

$$x^2+y^2-6x+24y+53=0$$
$$x^2+y^2-8x+10y-9=0$$

After deducting equations and adjusting, we get the equation

$$x+7y+31=0$$

From the algebra perspective, this is an equation with two unknowns that do not have a definite solution. However, the given equation can be perceived as a new condition that must be met by the coordinates of the intersections of the given circles and thus the coordinates of the searched touch points. If we look at this equation with the "eyes" of analytical geometry, we have a general straight line before us. The finding that the intersections of the circles lie on the line is not surprising since every two points clearly determine the straight line. However, we know from the planimetry that the intersections of the two circles lie on the line perpendicular to the centerline of the circles. The

perpendicularity of the line $p: x + 7y + 31 = 0$ to the line $\overrightarrow{SO}$ is shown by the fact that the vector $\overrightarrow{SO} = (1,7)$ is the normal vector of the line p. Based on the above, we can say that the coordinates of the searched touch points must match the analytical expression of circles, k_T and lines p. As the next step, we compile a simpler system of equations for calculation

$(x-3)^2 + (y+12)^2 = 100$

$x + 7y + 31 = 0$

We will solve this system by a substitution method. Its solution consists of two arranged pairs, which are at the same time the coordinates of the touch points of the tangents from the point M to the circle k. The touchpoints have coordinates

T_1[-3,-4] a T_2[11,-6]

After construction of the touch points, it is possible to construct tangents from a planimetry point of view. Even with the analytical solution, it is already possible to write the equation of the tangents, because each of them already knows two different points. The tangent t_1 is determined by the points M, T_1 and the tangent t_2 is determined by the points M, T_2. The formation of general equations of the tangents is a basic skill in analytical geometry. Searched tangents have equations

$t_1: -3x + 4y + 7 = 0$ a $t_2: 4x + 3y - 26 = 0$

6. Evaluation of the task solving procedure and topics for discussion

In the above-mentioned way of solving the task, we have consistently followed the basic idea of creating analytic geometry. When creating a task solution, we used the same idea as if it were a planimetric task designed to construct a tangent to a circle. The only change is that we used algebra elements to implement the individual steps of the solution. In other words, the algebraic tools - the equation - were used instead of geometric tools. In this sense, the solution offers pupils an alternative - geometric reasoning can be written using algebra, so that the position of individual points can be determined by means of coordinates. Such an approach is advantageous, for example, in determining the positioning of geometric configurations in stereometry for pupils who have a spatial imaging problem. A significant benefit is developing the ability to perceive equations as real-world geometric objects. The entry $(x-3)^2 + (y+12)^2 = 100$ is no longer perceived as an equation (algebraically) but also as a circle (geometrically). As a circle that is not drawn but written. As we can see from this picture and from this entry, where is its center and what its radius is. In this way, the pupils also acquire the necessary mathematical super vision that goes beyond both geometry and algebra. This is also manifested in the solution of the system of equations, where they are constantly aware that while solving the system of equations, the result will be common points of the circles. From their experience of system solving they know that after equations subtraction

$x^2 + y^2 - 6x + 24y + 53 = 0$

$x^2 + y^2 - 8x + 10y - 9 = 0$

they will get an "insoluble" equation from the point of view of algebra. But a geometric view says that by subtraction we get the straight line equation. This conflict is solved very smartly. What makes algebra no more insoluble is a valuable inter-result in terms of geometry that will be useful in finding the final solution. The location of the search for the continuation of the system solution, or another way of solution, is followed by a geometric survey of the properties of the obtained line. Based on the research of the new object - lines, we have gained new insights. The equation that is derived by subtracting the general equations of the circles is the equation of the line perpendicular to the centerline of the circles, and the intersections of the given circles are located on them. Therefore, the searched intersections of the circles can be obtained as intersections of one of the circles with the obtained line. Thus, it was possible to construct a new, simpler system of equations

$(x-3)^2 + (y+12)^2 = 100$

$x + 7y + 31 = 0$

After solving the problem, the solution described above offers a space for natural discussion. Firstly, the geometric debate. The question arises whether by subtracting the two general equations of the circles, we obtain a line on which there are intersections of the circles. By using simple examples, it can be shown that by subtracting the two general equations of the circles we always get the straight line equation. It is always perpendicular to the centerline. But it can not be used to effectively search for the mutual position of circles because we would have to find its intersections with both circles separately. However, if we know that the circles are intersecting, its use leads to a more efficient way of sharing their points. The geometric and algebraic view is constantly overlapping with the solution. Primary is geometric since it is a geometric task. Algebra serves as an effective tool for realizing geometric ideas and solution steps. At the heart of pupils' reflections are not equations but geometric objects - circles and lines. The results of their findings are put down symbolically (algebraically).

We can also lead an algebraic discussions. Pupils are taught that, when solving a system of equations with two unknowns by an addition methods, they try to create one equation with one unknown, which they then solve and the result fits into one of the original equations to get the value of the other unknown. In essence, they have learned that by using the addition method, after the addition of equations, one of the original equations can be used only if one already knows the value of one unknown. In the example solution mentioned, the two "rules" were violated. This has led us to the object perception of equations and to the geometric interpretation of the solution of the system of equations. Pupils are enriched by the knowledge that by adding together two equations we have acquired not only the new equation but also the new condition that must be met by the sought solutions of the

system of equations. The new condition means the new equation that the search points must meet. Its object interpretation and determination of its relationship to the objects examined will reveal the possibilities of its use in solving the task. They realize that the result of solving the system of equations may be not only single points but also a whole line. Pupils gradually perceive that mathematical equations receive content to solve real problems. It is possible to say that the equations come to life in real conditions and are ready to communicate with the solver and gradually reveal their secrets. Knowing that the equations are realistically interpretable has never pushed humanity forward.

7. Conclusion

The proposed teacher's code of ethics also includes the following point: "Teacher leads their pupils to independence and critical thinking. Within their and also their pupils' abilities and possibilities, they strive for the complete development of the pupil personality" [8]. In this context we consider the following essential to keep in mind: that Mathematics has arisen to help people solve problems. Teaching Mathematics has a legitimate ambition, to be the enrichment of man's solving abilities. And in this spirit, there is still an up-to-date question of finding new methods of teaching Mathematics. The problem of students´ understanding and mastering Mathematics is currently one of the most emphasized topics of expert public discussion. New ways of teaching mathematics more effectively and attractively are being searched for [9].

In general, a common feature of new methods is that the pupil's personality and not the Mathematics itself is the center of learning. Mathematics should be incorporated into the pupil's thinking and gradually enriched. During the process of teaching, one (mathematical) problem needs to be handled at different levels of complexity, one more variation in one situation. There is a need to guide pupils to find creative and often unusual ways to solve the problem. We think that the synthetic way of teaching Mathematics is one of the possible ways of a complex development of a pupil's personality. It leaves the student with the solving freedom and supports their critical thinking. The pupil is not in the position of the receiver of the complete problem solving but is led to create their own solutions to the problems encountered. If a pupil is taught separately during schooling and thinking, there is a great assumption that later in life they will critically accept the opinions offered and solve the problems. They will be "set" to accept only solutions that do not conflict with their own code of ethics. If such a solution is not offered to them, they will come up with their own, ethically "clean" solution, making themselves a contribution to their surroundings.

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