INFO- 2086 UDK : 061:001:007
Primljeno / Received: 2012-02-17 Preliminary Communication / Prethodno priopćenje

SCIENCE AND PSEUDOSCIENCE IN POSTMODERN SOCIETIES

ZNANOST I PSEUDOZNANOST U DRUŠTVIMA POSTMODERNE

Željko Pavić
Department of Culturology, University J. J. Strossmayer, Osijek, Croatia
Odjel za kulturologiju, Sveučilište J. J. Strossmayera, Osijek, Hrvatska

Abstract
Enlightenment envisaged that humanity shall emerge from „self-imposed immaturity" and replace all forms of prejudice and ignorance with scientific knowledge. However, contemporary research show that in spite of growth of education levels, scientific literacy and scientific-technological achievements we could even speak about revitalization of pseudoscience. The author tries to show that, besides the spread of communication technologies and media which bring about „democratization" of knowledge and profit interests, this revitalization can be explained by the characteristics of postmodern societies as risk societies and by the inability of science to provide all-encompassing worldviews. Technological and social complexity causes human-created risks and new forms of uncertainty, whilst the individualization causes decline of trust in people and societal institutions. By analyzing alternative medicine, creationism, astrology and pseudohistory the author tries to show that, due to its methodical skepsis and self-limitation, science cannot provide those forms of symbolic safety which pseudoscience manages to do.

Sažetak
Prosvjetiteljstvo je predvidjelo da će čovječanstvo izlaskom iz „samoskrivljene nezrelosti" sve oblike predrasuda i neznanja zamijeniti znanstvenom spoznajom. Međutim, suvremena istraživanja pokazuju da se unatoč porastu obrazovanosti populacije, znanstvene pismenosti i znanstveno-tehnološkim postignućima može govoriti o revitalizaciji pseudoznanosti.. U radu se pokušava argumentirati da se, osim širenjem komunikacijskih tehnologija i medija koji dovode do „demokratizacije" znanja i profitnih interesa, revitalizacija može objasniti obilježjima postmodernih društva kao društava rizika i nemogućnošću znanosti da pruži sveobuhvatne svjetonazore. Tehnološka i društvena kompleksnost dovela je do pojave rizika koje je stvorio sam čovjek i koji izazivaju nove oblike nesigurnosti među ljudima, a individualizacija dovodi do pada povjerenja u ljude i društvene institucije. Na temelju analize obilježja i upotrebe alternativne medicine, nekih vrsta kreacionizma, astrologije i pseudopovijesti u radu se pokušava dokazati da znanost zbog svoje metodičke skepse i samograničenja ne može pružiti one vrste simboličke sigurnosti koje uspijevaju pružiti ovi oblici pseudoznanosti.

1. INTRODUCTION

The rise of modern Western civilization is critically connected to the idea of humanism. In the Renaissance period humanism is enclosed within the discovery of the classical culture of antiquity and tied to the belief in human grandeur and power of humanity to rationally shape it's own life in immanence. The Enlightment further emphasized the possibility of „man's release from his self-incurred tutelage" (Kant), while the series of discoveries and crucial theories from the period of Scientific Revolution in 17th and 18th century codified science and scientific methodology as prominent forms of knowledge. Newton's classical mechanics demonstrated new scientific methodology in a paradigmatic manner. A couple of mathematically expressed axiomatic laws could explain all earthly and heavenly motions arousing scientists' admiration, but also an admiration from literary and humanistic circles. Notwithstanding the fact that ocultism and magic played their part in the birth of modern science which co-opted some magic and ocultism ideas /**1**/[4], these two intellectual currents soon separated. In short, science and scientific methodology gained prominence and official status whereas non-science forms of knowledge continued to exist as an official alternative, although optimism of the Enlightment anticipated their demise. Pseudosci-

[4] E.g. Newton's theory of gravity as a force which acts at distance was originally a magical idea, and was therefore rejected by numerous contemporary scientists as an expression of archaic and unscientific way of thinking.

ence happens to be one of these alternatives, with pretensions on scientific validity, argumentation which contains numbers, facts and theories resembling scientific ones as distinguishing characteristics when compared to other forms of „non-science". Contemporary research show that in spite of the rise of the population educational level, scientific literacy and scientific and technological achievements it is justified to speak of a kind of revitalization of pseudoscience. Alternative medicine, conspiracy theories and astrology are integral parts of everyday social life, especially media culture, whilst some sorts of pseudo-scientific creationism[5] very vital in the United States could be more often observed in Europe and even in Croatia. This dynamism on the marketplace of ideas, where science and pseudoscience are sometimes mixed to the point where they cannot be distinguished from one another, is acclaimed by those who make profit from the pseudoscience industry, but also from those authors and intellectuals who praise postmodern relativism and criticize scientific discourse as an expression of rich and powerful societies and civilizations. However, this dynamism brings despair into scientists and intellectual „enlighteners" who hardly can accept re-entrance into „self-incurred tutelage" and regret naïveté of the pseudoscience consumers, but also warn of actual and potential social harms which can be atributted to pseudoscience and pseudo-scientists. Despite the fact that there probably exist „flaws" in human cognitive apparatus which turn pseudoscience into virtually ineradicable phenomenon, basic sociological postulates warn us that most social phenomena perform some sort of individual or societal function. In this article we precisely try to explain which functions pseudo-scientific beliefs tend to perform i.e. we try to answer the question whether certain features of postmodern societies tend to bring about the spread of pseudoscience. In other words, we make an attempt to understand and explain paradoxical diffusion of pseudoscience in a world commonly self-described as scientific and technical civilization. With this purpose in mind we shall firstly try to define basic characteristics of pseudoscience and those types of pseudo-scientific beliefs most commonly found in contemporary (Western) societies.

2. BASIC CHARACTERISTICS OF PSEUDOSCIENCE

In pseudoscience we include all those claims/theories which pretend to be scientifically valid, but do not conform to the strict standards that scientific theories are expected to fulfill. Although in contemporary Western societies pseudoscience together with superstition and *new age* beliefs makes a separate complex of beliefs in one way or another opposed to science, this concepts should be distinguished from one another /**2**/. Superstition consists of the fragments of former religions or religious practices/rituals mostly directed towards practial use, magical influence on other persons, the future foretelling, etc. In an epistemological sense, superstition beliefs are most frequently based on various sorts of false associations or empirically unfounded beliefs. For example, some magical practices are based on the „similar-causes-similar" principle (e.g. voodoo magic), superstition related to the number 13 is probably connected to the 12 complete and 1 uncomplete lunar cycles, etc. Beliefs concerning „lucky" numbers, days and objects are based on a false premise that objects once associated with lucky events have to be associated with them in the future as well. Having in mind that several research show that conventional religious believers less often have superstitous beliefs Coll and Taylor (2004) conclude that superstitious beliefs can be understood as a compensatory beliefs that provide cognitive orientation and identity once provided by traditional religions. Therefore, both religious and superstitous beliefs provide certain level of simbolic security (answers on questions concerning one's own destiny, future, etc.), whereas individuals in most cases chose only one of these types of belief.

New age worldview is composed of cluster of beliefs coming from Eastern religions (e.g. reincarnation), parapsychological beliefs (e.g. spiritism) or beliefs associated with alternative medicine. This worldview represents one of the currents of new spirituality which reappears as an individualized and eclectic alternative for the traditional religions.

[5] As explained later, only those types of creationism which tend to explain empirical phenomena and contradict accepted scientific theories and methodology could be denoted as pseudoscience.

Pseudoscience, in contrast to superstition and most *new-age* beliefs, claims to be based on scientific arguments, but these arguments do not comply with strict scientific standards. As the most important characteristics of pseudoscience the following ones can be emphasized:

1. Non-falsifiable and vague statements – e.g. astrological forecasts, as one of the most common forms of pseudoscience today, are in most cases very vague and cannot be falsified.
2. Statements and theories which have been repeatedly falsified using rigorous tests based on the strict methodological principles – e.g. many branches of alternative medicine in most experiments do not show significant effect over and above the one which can be explained by the placebo.
3. Non-testability of theory by the independent observers – e.g. alternative medicine practicians offer to their clients very individualized therapy which cannot be repeated by anyone else.
4. Ignoring the contradicting evidence – psedoscience chooses only confirming empirical evidence.
5. Reliance on anecdotal evidence – non-reliable evidence is commonly regarded as reliable.
6. The burden of proof is on those who try to falsify pseudo-scientific claim (*argumentum ad ignorantiam*) – e.g. conspiracy theorists usually demand that their usually non-testable claims try be falsified. If not, they consider them proved.

In view of the fact that epistemological weaknesses of pseudoscience should be obvious the the rational individuals, it follows the question – how is it possible that many people believe in pseudo-scientific claims? Apart from the sociological explanation which is layed down in a separate chapter of this article, a part of the popularity and vigor of psedo-science can be explained with inherent cognitive biases. Namely, false beliefs coming from the imperfections of human cognitive apparatus had always been in existence and contemporary pseudoscience is in some part based on them. Goldacre /**3**/ points out to the several of them: randomness, regression to the mean, positive evidence bias, interpretation bias, availability bias and social influences. Randomness corresponds to the tendency to create regularities where they actually do not exist. For example, series of experiments showed that people will create a regularity from the series of random events. This tendency manifests itself especailly in pseudohistory i.e. conspiracy theories where historical contingencies are turned into a backstage game with rules created by powerful and ill-intentioned indidviduals and groups. Regression to the mean is a statistical tendency which brings extreme results in one measurement closer to the mean in the second measurement. This well-known tendency, usually unrecognized by persons not familiar with scientific methodology, is a result of the random measurement errror which changes direction in sequential measurements and can be controled with experimental designs. For instance, efficiency of the alternative medicine can be partially attributed to the regression to the mean. Positive evidence bias corresponds to the tendency to pick only those data which confirm the hypothesis instead of looking for the evidence which might falsify it. Customary heuristic means available in the scientific methodology, such as nul-hypothesis formulation, represent a counter-tendency which can control positive evidence bias. However, these means are rarely implemented in everyday thinking. Interpretation bias, also well-established in psychological experiments, is linked to the tendency to intepret new information in the light of already accepted personal knowledge and attitudes. Due to availability bias people tend to base their decisions on visually atractive and emotionally loaded data instead on the large quantities of impersonal data. And finally, conforming to the social influence often hinders correct conclusions and leads to adoption of false statements and theories.

3. THE MOST COMMON FORMS OF PSEUDOSCIENCE

3.1. ASTROLOGY

Created probably in 2 000 BC in Mesopotamia astrology is connected to the belief in godlike nature of planets i.e. to the supposed possibility of reading gods' messages from the movements of the planets. Until the establishment of Christianity astrology served as a tool for fortune-telling i.e. as

a practial guide for everyday decisions and behaviours. Scientific revolution from the 17th century provided scientific explanations for planets' movements discrediting astrology and moving it into spheres of pseudoscience and superstition. Renewed interest for astrology was created by the mass media in the beginning of the 20th century when newspapers start to publish daily horoscopes in order to amuse their readers. Astrology bases its predictions on positions on some celestial objects – Zodiac stars and planets. Zodiac signs carry significant meanings due to the fact that they lie in the ecliptic and the astrological significance of the planets comes not only from their proximity to the Earth but also because their seemingly random movements imply their goodlike nature i.e. independence /**4**/. Astrology is classified as a pseudoscience because it doesn't meet criteria belonging to scientific explanation /**5**/. Namely, basic postulates of astrology are vague and ambiguous, whereas conclusions which are drawn from these postulates are subjective – every astrologer often reach different predictions. In addition, astrological empirical predictions are vague and ambiguous and don't hold up when rigourously tested.

Astrology offers amusement and partial self-reflexion to its users as well as reduction of anxiety inherently present in today's „risk society". The first function is mostly related to users who consult simplified astrological predictions present in mass media horoscopes. For them, horoscope serves as amusement and they do not trust it very much. For them horoscope also provides a chance to reflect on themselves, their relationships with other people and future. Second function of horoscope reading is related to the forms of „new spirituality" which emphasize man's intereconnectedness with Nature and Universe (new age movement, eco-misticism, teosophy, etc.). In this sense horoscope offers a deep understanding of one's identity and place in the world which are unboundly connected to the Nature. Interconnectedness of astrology and other forms of new spirituality is demonstrated by the fact that new spirituality believers and practitioners often believe in astrology i.e. astrology forms a part of their worldview. Moreover, it can be noted that the rise of the astrology at the end of the 19th century coincides with the rise of alternative spirituality (magic, theosophy). Third function of astrology can be related to the characteristics of contemporary societies as „risk societies" in which technological and societal complexity creates new risks brought about by human agency which creates new forms uf unsecurity. Therefore people use alternative kinds of knowledge, astrology being one of them, in order to „predict" societal processes and behaviour of other people and alleviate tensions created by insecurity, mistrust and suspicion. For instance, Weimann /**6**/ established that higher level of anxiety leads to more frequent reading of horoscope, although more anxious people do not neccessary hold higher level of belief in horoscope. Hence, reading astrological preidctions can lower uncertainty and anxiety, even when people don't intimately believe in these predictions.

3.2. ALTERNATIVE MEDICINE

Today's medicine developed from the three independent approaches: alopathic (medicine based on scientific principles), osteophatic (medicine based on body manipulation) and homeopathic medicine („similar-causes-similar" principle). Today's official medicine is alopathic whereas all other medical approaches are considered as alternative medicine. Some of the examples of alternative medicine include homeopathy, osteopathy, herbalism, acupuncture, biofeedback, hypnotic therapy, etc. Although alternative medicine encompasses various branches, all types of alternative medicine are based on certain fundamental intellectual, political, emotional and health principles. Kaptchuk and Eisenberg /**7**/ mention four of them: nature, vitalism, „science" and spirituality. As these authors point out, these unifying principles provide alternative medicine with certain identity and enhance its strength when colliding with official medicine. Alternative medicine emphasizes nature by distinguishing certain polar oppositions such as natural-artificial, low technology – high-technology, organic-sintetic, raw-processed etc., wherein first term holds positive and second term negative connotations. Positive evalution of nature leads to the emphasising the therapies which use non-syntetic medicaments (herbal medicine, meditation, acupuncture, etc.). Vitalism uses various types of usefull and benevolent „life forces" with different names in different types of alternative medicine – in homeopathy

„life essence“, in acupuncture „chi“, in *new age* medicine „psychic energy“ /**8**/. Vitalism is strongly connected to the idea that willpower and autonomy are main determinants of one's health. Although from the point of view of official medicine most types of alternative medicine represent pseudoscience, alternative medicine considers itself as a science. However, standards for what constitutes a science are much different when compared to the biomedicine which uses randomized experiments and clinical trials. In opposition to this abstract and generalizing approach, alternative medicine claims to approach patients in a holistic way taking into account their life experiences. In oppostion to biomedicine which study direct causes of disease, alternative medicine claims to take into account individual's sense of general well-being and life purpose. Alternative medicine is often based on a spirituality giving it's users a promise to reveal ultimate meanings and connection to the Universe. Therefore certain therapeuthic means such as meditation and vegetarian diet have the purpose of betterment of physical health but they have transcendental meanings as well /**9**/. According to the research /**10**/ between one fifth and one third of population in European countries used alternative medicine, younger and educated persons beeing more frequent users in average. There are several reasons for using alternative medicine as a supplement or an alternative to the biomedicine /**11**/. Firstly, it can be used as a suplement in chronic desease treatment (e.g. rheumatism and back pain). Secondly, poor relations with general practitioner can lead to the search for an alternative. And finally, postmodern value system leads to lower trust in scence, stronger emphasis on emotions and holistic notions of health. Alternative medicine sometimes also serves as a worldview which provides existential comfort earlier provided by religion. As mentioned by Kaptchuk and Eisenberg /**12**/, alternative medicine appeal consists not only of medical aspects i.e. from possibility of ilness curement or alleviation of symptoms. Often alternative medicine also enhances sense of purpose and individual spiritual strength.

3.3. CREATIONISM

Theory of evolution, despite its empirical foundations, has spured lots of controversies since its emergence. The idea that humans are only one of the numerous animal species directly contradicts theological concepts of great monotheistic religions. Furthermore, theory of evolution could be used for explanation of human behaviour and in this framework many types of behaviour with moral significance can be linked to some evolutionary function thus „de-moralizing“ these behaviours. E.g. parental behaviour and love can be linked to the usefulness of this kind of behaviour for gene-survival. In this manner seemingly unselfish emotions can be reduced to „genetic egoism“. And finally, theory of evolution had been misused in the form of social darwinism. Social darwinism stated that laws of natural selection should be valid in human society as well and this served as an intelectual justification of colonial and racist movements. At the end of the 19th century eugenic movement proclaimed that the goal of humanity should be genetic improvement of human race mainly by impeding procreation of biologically „inferior“ races and individuals (mental patients, criminals, etc.). Due to the aforementioned reasons in some countries there is a widespread public opposition to the theory of evolution. According to a research cited in Scott /**13**/ only 44 per cent of Americans agree that „human species had developed from earlier animal species“ whilst, according to the other research cited in Thompson /**14**/, only 10 per cent of Muslim students at British universities believe in validity of the theory of evolution. Theological opposition to the theory of evolution is usually labeled as „creationism“ or „creation science“ although all branches of creationism cannot be marked as pseudoscience. As noted, creationism can be divided into several branches having in mind the level of opposition to the theory of evolution /**15**/. For instance, so-called *Young Earth Creationism* claims that Earth is only few thousand years old, the creation of Earth and development of life happening exactly as described in the Bible. The *Gap Theory* acknowledges Earth being old a few billion years, however this branch of creationism claims that a long period of time had passed between the creation of Earth and creation of humans which also happened exactly as described in the Bible. In this manner this theory tries to reconcile Biblical genesis with geological evidence. So-called *Progressive Creationism* asserts that God created families of plants and animals i.e. that

God is responsible for the macroevolution (evolution above the level of species). Inside specific species evolution continued to develop as described by the theory of evolution. In other words, progressive evolutionists accept the validity of microevolution rejecting macroevolution at the same time. *Theory of inteligent design* represents especially important branch of creationism since it finds its supporters among some scientists from natural sciences. This theory accepts that evolution really happened and that species evolved from one another while rejecting the notion that natural selection, instead of God, served as a mechanism which drives the evolution forward. The main argument proposed by this theory is so-called *irreducible complexity* of the evolved organic systems. The logic of the argument is as follows. Specific parts of the organisms are too complex to have evolved from the less complex structures since transtitional forms should have been evolutionary non-adaptive. For example, the wings of birds couldn't evolve from the front legs of previous species due to the fact that transitional forms couldn't serve either for flying either for walking and other purposes. Though this argument might sound convincing, evolutionary biologists can indeed find proofs that biological structures are not irreducible complex i.e. that all complex organic systems have their less complex predecessors which served some evolutionary purpose and increased adaptive potential of the organisms. For instance, human eye hadn't developed as a complex structure in only one step but in several steps, whereas in each step less complex structure was being replaced by the more complex and more adaptive one /**16**/. And finally, so-called *theistic evolution* claims that species had evolved in a way described by the theory of evolution but this process was intended and led by God. An instance of this could be God's intervention in human evolution by creating human soul. This is a current position of the Catholic church on evolution and cannot be labeled as pseudoscience since it divides religion and science into two separate spheres.

4. SOCIAL CONTEXT OF PSEUDOSCIENCE

As mentioned earlier, flaws of human cognitive apparatus can surely partly explain popularity and acceptance of pseudoscience. However, we believe that it is no coincidence that pseudoscience flourishes precisely in postmodern societies i.e. in societies in which numerous types of risks are omnipresent. The characterization of contemporary societies as risk societies in our opinion doesn't represent a historical novelty. On the contrary, it could be stated that today's societies inherit basic characteristics of modernity i.e. that postmodern situation represents a kind of continuity and radicalization of modernity. Giddens /**17**/ warns of „shadow-like" character of modernity whereat promises of economical welfare are followed by poverty, repetitive and dehumanizing work and ecological crises. Concentration of power in the form of national states besides democratic also creates totalitarian varieties wherein pacifying powers of market economy can also be turned into strengthening of military power by means of technological inovations. This shadows of modernity lead Giddens to conclude that the world in which we are living is „stressfull and dangerous" /**18**/. Besides potential and real dangers brought by modernity, its insecurity manifests itself on a more fundamental level as a consequence of institutional reflexivity. Namely, modern societies abandon traditions and open towards the future, which is by definition uncertain and problematic /**19**/. On a psychological level modern reflexivity implicates anxiety as undefined and unconcious fear which is a result of loss of everyday social routines. In contrast to traditional societies in which past, present and future are merged by epistemological and moral principles saying that everything that exists should exist in that precise way and that will continue to exist in such a way in the future, modern societies are open towards alternative modes of thinking and acting, whereas the future appears as a kind of emptiness /**20**/.

As emphasized by Giddens /**21**/ the concept of *risk* should be differentiated from the concept of *danger* because risks are related to dangers that are estimated and quantified whereat risks are possible only in „... a society which is orientated towards the future – and which sees the future as a territory that needs to be conquered, colonized" /**22**/. In traditional societies various dangers which threatened the integrity of individuals and whole societies couldn't be controled in principle and according to the usual notions they depended on destiny, luck or the will of gods. Modern societies

introduce the concept of risk i.e. calculability and control of danger wherein the future is brought into the horizon of the present time. Nevertheless, in spite of the fact that in modern societies life of the most people could be described as less dangerous than in traditional societies, life becomes more risky by definition, and in postmodern societies these risks become intensified and hard to calculate. Giddens /**23**/ therefore differentiates between *outside* and *manufactured* risks. Outside risks refer to dangers not made by humans and this type of risks existed in all hitherto societies (disease, wars, natural disasters, etc.) Manufactured risks are brought into effect by humans who disturb stabilty of natural processes (e.g. ecological crisis) or by disturbing routine social relations (e.g. globalization, changes in family life, etc.). Both types of instability define the situation in which people are „... facing personal future which is much more uncertain than in the past, together with all possiblities and dangers which it brings" /**24**/. Bearing in mind that manufactured risks are usually the result of advancement of science and its technological applications, the attitude towards science becomes more suspicious and this suspicion and mistrust are also enhanced due to the fact that scientific claims are sometimes contradictory, especially when it comes to human health.

In a similar vein the role of risk in postmodern societies is conceptualized by Ulrich Beck /**25**/. For him, the societies of the *second modernity* are precisely *risk societies* because in these societies the possibility of risk calculation and control is lost. Instead, *concious un-knowledge* i.e. production of unintended consequences appears, some of which can be dangerous. Therefore it is seemingly paradoxical that „...science and technology – instead of lessening them – add their own insecurities to the general insecurities causing hardly understandable consequence for many, ..., instead of putting out political fires, they pour the oil into the flame of ethical, ecological and political controversies" /**26**/. As pointed out by Beck, in situation of the impossibility of controling and quantifying risks cultural stereotypes and prejudices can play very important role. However, we could certainly add to this remark that pseudoscience and pseudoscientists play the role of once morally uncorupted science promising to people lower risks and „demasking" science which is merged with corporate and professional interests or, in best case, in reductionist modes of knowledge. We could say that pseudoscience now promises the return in fictional „scientific heaven" in which all scientists are honest, risks non-existent or very small, in any case reliably predictible. By saying this we surely do not intend to claim that contemporary science doesn't abound with unethical research, hidden interests and unfounded reductionism. For instance, in medical research manipualtion with statistics and doses, publication biases towards positive findings and their multiple publication are often to be found /**27**/. Public relations industry often publices opinions of experts with conflict of interest although claimed to be objective and unbiased. However, pseudoscience leads the criticism of official science *ad absurdum* and, more importantly, it does so because of clear material interests, offering an alternative not based on facts and scientific methodology. In our opinion, by doing this pseudoscience parasites on existing structural weaknesses of modern science, using these weaknesses for its own profit interests.

A combination of cultural prejudice, unfortunate political circumstances and pseudoscience interests and tragical consequences which can result from this combination Goldacre /**28**/ demonstrates on an example of refusal of using antiretrovirus medicine during the AIDS epidemics in South Africa. Namely, a very quick spread of AIDS epidemics took place there - in 1990 only 1 per cent of population was HIV-positive, while this share rose to 25 per cent in the following ten years – creating paranoid fears in population and local politicians based on a belief that epidemics was in fact created by intentional human intervention. Due to animosity towards the West precisely western medicine and pharmacutical companies had been declared as the main culprits of the epidemics. An alternative way of treating the disease was found in consuming indigenous African fruits and vegetables as well as in vitamin pills which, accompanied by pseudoscientific explanations, were offered by pseudoscientists from the West.

Hence, in postmodern societies there is a decline of trust in traditionaly institutions, science included. In contrast with former societies, a person doesn't hold a fixed identity but choses his/hers own identity and worldview. In postmodern societies, due to risky consequences of science and

technology among other things, there can be noted a certain relativism and „democratization" of knowledge that assert that everybody can believe in whatever he/she wabnts to believe and that nobody can impose own worldview and values on others. Pseudoscience offers fixed identities and clear worldview that science cannot offer. For example, astrology offers a possiblity of controlling one's own life, alternative medicine offers ability to control one's own health, pseudohistory and conspiracy theories claim that historical events are a result of international acitivites of few „evil" persons, etc. All these thing science cannot promise or offer. In addition, there is a notable trend of relativization of knowledge in social sciences and humanities, especially regarding the endeavours to show knowledge and science as completely culturally embeded and dependent on power interests. In accordance with these lines of thought Western science is often portrayed as a consequence of Western patriarchal domination over different types of minorities (other civilizations and races, women, etc.). Therefore by fighting scientific hegemony the relativistic jargon lowers confidence in science and opens up the space for pseudoscience. In addition to macrosociological factors, popularity and spread of pseudoscience can also partially be attributed to the mass media interests and modern communication technologies /**29**/. Mass media found their interest in promoting pseudoscience due to its profitability (wide audience). For instance, respectful publishing companies once witholding from publishing pseudoscience today publish it even more often than scientific literature. Modern communication technologies, mostly the Internet, enabled rapid spreading of pseudoscientific ideas – pseudoscientists can gather their followers online in a very short time. The Internet, besides its numerous virtues, contains a myriad of ideas and information which complicates the capacity of selective and critical stance towards them.

5. CONCLUSIONS

Contemporary societies can be described as risk societiesin which risk is mainly incalculable and created by science and technology complex. New technologies created a possibility of ecological disasters that could bring the world to an end (e.g. nuclear military weapons), dense economic relations provoke economic crises wich rapidly spread throughout the world, health risks from GMO food, new technologies, chemical additives are not completely known and controled, etc. These risks cause fear of the future with attempts to foresee it and gain symbolical control over it by alternative, non-scientific forms of knowledge. Further anxiety is provoked by the most important characteristic of modern societies – *individual interest*. In contemporary societies it is expected to follow own interests whereas this idea was transfered from the field of economy into societal field. In economy, a person following his/her own interests creates inovative and competetive impulses which enable economic progress. This type of individualization creates lack of trust among people and instability of all traditional social institutions (family, religion, political institutions, etc.). Besides universal human inclination towards cognitive biases, social context desribed above creates a fertile ground for development and spread of pseudoscientific theories. Pseudoscience promises the level of symbolic certainty which science, due to its methodological boundaries, cannot offer. This having in mind, it can be safely concluded that pseudoscience will always be able to found its place in the marketplace of ideas i.e. that disapperance of science cannot be foreseen. However we believe that two factors could be pointed out in relation to the more rational discussion of science and pseudoscience. Firstly, good scientific education i.e. spreading of scientific literacy, especially knowledge of scientific methodology, could prevent pseudoscientific theoris from being (too) easily exepted. Although this thesis can remind of naive enlightment, we believe that deep understanding of scientific methodology raises the level of criticism and controls one's own biases and prejudices. For instance, good understanding of the logic of experimental research should bring better understanding of the merits of scientific and alternative medicine. Secondly, we believe that it is important to have open and continuing public discussion about ethical and social implications of science, as well as about risks inherent in applications of scientific discoveries and technologies. In that way a part of the lost confidence in science might be restored and pseudoscience might lose a part of its *raison d'être*.

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