Volume 3:3 (2014)

ISSN 2299-0518

Multi-disciplinary Quarterly Journal

STUDIA HUMANA

UNIVERSITY of INFORMATION TECHNOLOGY and MANAGEMENT
in Rzeszow, POLAND

Editorial Office: University of Information Technology and Management in Rzeszow, Poland

2 Sucharskiego Street
Rzeszów 35 – 225

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studia humana
QUARTERLY JOURNAL

Studia Humana
Volume 3:3 (2014)

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studia humana
QUARTERLY JOURNAL

Studia Humana
Volume 3:3 (2014), pp. 3—10
DOI: 10.2478/sh-2014-0009

Is Democracy Possible Without a Restriction of the Suffrage?

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Abstract:
Today, the concept of democracy seems inextricably linked with that of universal suffrage. But is it true? To let that anyone with a given age has the right to vote is a very good democratic practice, or would prefer to question the criteria for access to this right, perhaps to develop new systems? The current crisis of democracy in the Western world is symptomatic of a detriment of the political consciousness of the people? And yet it is very likely to be admissible and that only from the mass, the large numbers, rises the better choices? In this paper I try to answer these questions, drawing from personal opinions and thoughts, which I hope will inspire questions and curiosity in those who, like me, believes that any system is always perfectible, and that its aim should be to that perfection, without fear of asking uncomfortable questions. Personally, in fact, I can accept democracy as "the worst form of government except all the others that have been tried", to quote a famous statement by Winston Churchill. But not for that I give up, and I try other ways. Ways that are more satisfying, more fair and keep us away from the horrors that only an angry mob can do.

Keywords: democracy, suffrage, universal suffrage, alternatives to universal suffrage, suffrage reduction

This paper was first published in a previous, different version in the Journal of Liberty and Society, vol. III, entitled "Democracy and Universal Suffrage: a necessary evil?".

Democracy: since it could not make
what is right would be strong, it was done
so that what was right is strong.
Blaise Pascal

1. What is Democracy?

Democracy is a fleeting concept, and difficult to define. This word, indeed, hides a variety of levels for opinions, ideas so different from each other. Historically, in the embryo of the representative system that was the Athenian democracy, too often quoted in error, only one charge was out of the urn: the strategist or military magistrate. The other charges were determined by chance, the so-called τό αυτόματον (to automaton, the case), through a sort of heads or tails made with a broad bean (cited in [1, p. 13]).

The term democracy is still ambiguous since its birth in the fifth-sixth century BC. In fact, the word δῆμος (demos, people) lent itself to multiple interpretations. For the Greeks it could mean

πλῆθος (plethos, or the entire body of citizens), οἱ πολλοί (hoi polloi, that is, an undefined "many"), οἱ πολλονές (hoi pollones, ie, more), or ὄχλος (ochlos, ie the crowd) [2, pp. 5–6]. However, leaving aside for a moment this semantic problem (which is not so negligible as it is to decide who should exercise the power) as the real power belongs to those who exercise, how can the people not well defined, which is the owner of law, being awarded the right and power to exercise it? We know that the solution found by modern is representative democracy, or a representative transmission of the power.

But there is a big difference between the ancient democracy, and the so-called modern democracy: the first was in fact (at least in part) a direct exercise of power, the second is a way to limit it. The polis and the medieval communes had a short and turbulent life, but their political life resolved into a democracy without a state, in smalls towns established in a community. In Athens lived up to 35,000 people, and amongst them participated in meetings a minimum of 2,000 to a maximum of 5,000 people, according to our estimates. Only some of the decisions were actually taken by acclamation, and in any event, as well as it grown, the polis perished miserably, the intrinsic failure and inability to survive the expansion of space which established it and made it possible. When the term democracy emerged, after it was also vehemently rejected until the nineteenth century (remember a book written by Kant, who in 1795 criticized those who "had begun to confuse the republican constitution with the democratic one" noting that "the form democracy is necessarily a despotism" [4]), is in order to describe a totally different reality: our democracies are liberal-democracies, rich in mediation: the democracy of the ancient mind was a zero sum game, that translates into modern positive-sum decisions (compare [2, pp. 43–46]) In fact, if direct democracy of Athens were citizens (and as seen on the definition of citizens would be discussed, as that of the ancient Greeks had a long way from today, and not meant at all "the people" as we understand it today) to discuss and decide on at least some of the questions in the modern liberal democracy that is applied to the city, in a system that provides for the state (a concept that arises only in the fifteenth century with Machiavelli, and which has a long and troubled history, reaching affirm itself only in the nineteenth century, as stated in [2, p. 44]) and therefore has an area of infinitely greater and infinitely more complex problems, is to choose its representatives, acting on the issues.

In today's West, the word democracy seems to have now acquired the meaning which at least has the advantage of being more precise, of "majority rule". Indeed, in general, majority voting is seen as the means by which the people govern. Whether directly, even if minimally, such as choosing between different alternatives in a referendum, which most often indirectly, by choosing from time to time between the different candidates in an election. Despite this, however, even this simple definition has many problems[1].

However, in conclusion, the non-semantic meaning and the difficulty (or perhaps impossibility?) in the real world to find a "real" democracy, have already been devoted to words and ink, and from very eminent scholars and intellectuals more qualified than me. Anyway, just because it is difficult to define precisely, democracy becomes a difficult concept to evaluate and criticize.

Representative democracy in fact does not qualify as a government of knowledge, but as a government of opinion, based on a common sentiment in the *res publica*. Representative democracy would be enough so that public opinion of the public. But, as noted in *Homo Videns* by Giovanni Sartori, this is not always true, as "the videocracy[2] is manufacturing a massively hetero-directed review that apparently reinforces, but essentially empty, democracy as a government review", cf. [3, p. 46]). Or again, as Herstgaard says: "Opinion polls reign. Five hundred Americans are constantly being interviewed to tell us, that is two hundred and fifty million other Americans, what we think."

But at least you could agree that representative democracy aims to elect representatives as those that are most acceptable to the mass of the population. The systems with which the liberal-democracy elects representatives (i.e. the electoral laws) and the concept of mass of the population

(i.e. the elect), change from place to place, from a system to another and, occasionally, from an age to another.

2. How Does the Democratic Process Work?

The approval of the mass is, as manner of speaking, a *leitmotif* of democracy. But are we really sure that this is the best way to give shape to the executive and the legislative power? We are very confident that a democratic power of the people, by δῆμος (demos, people) and κράτος (cratos, power) is not even preferable an aristocrat best of the best power from άριστος (aristos, the better) and κράτος (cratos, power)?

However, beyond such bold assumptions and the simple rhetorical questions, that democracy is certainly a delicate machine, a complex process that needs to run an infinite number of conditions: active citizenship, freedom of information, awareness of the importance of their vote and trust in institutions, to begin with. And even after free and transparent elections. Nowadays it seems that the major Western powers, where our concept of democracy is widely accepted, it has totally forgotten this lesson. So much so that never in recent years, our democratic system is experiencing an identity crisis, and suffering increasingly heavy bordered by theorists of new systems, that image will return to direct democracy through the power of new technologies, or the advent of technocracy. Anyway, in those states where the crisis is being felt, far from trying to solve it within itself, the democratic system tries to transplant to other countries, like an urn itself was enough to make a democratic state and a legitimate government. Maybe it calms the conscience to believe that our system should be exported, and relieves us from concerns about the perfectibility and that more and more we crawl inside (after all if you need to export it, implicitly means that the better).

Democracy is a long journey, complicated and full of pain and defeats. A system to succeed and to work needs to be heard, and to be desired. It needs people ready to fight to defend it. How can you pretend to take it and plant it in a country with a different culture? Above all, is it really feasible and desirable?

In modern Western democracies, the executive power is held by the body which guides the country toward a government program under which it was elected. It's clear that there is not a best program, and that different ideologies and different ideas are equally valuable and potentially, at least theoretically, right. But simplifying the ability and opportunity to practice a policy of right or left, would be better to choose the best representatives of all ideologies? Among those who can implement a program feasible, viable and to carry forward the country (or at least not send it to hell)? Among the most able candidates?

Similarly, the legislative power is given to the organ in charge of legislating to create laws. Wouldn’t it be better in this role were to be elected the best, the more prepared and more able to create more useful policies for the community? It's clear that if these rhetorical questions were posed to anyone, the answer would be positive. But it is equally clear that an objection immediately arises: who does determines who are the bests? Through what criteria?

3. A Brief History of Universal Suffrage

The principle of universal suffrage is related to the ideas of the general will and political representation brought by Jean-Jacques Rousseau (1712–1778) in 1762 in his work *The Social Contract*. Based on these principles, we draw our assumption according to which political representation is standing in its own free will. The citizens in modern democratic states are the basis of the political system and universal suffrage is the elected legislative body of a State in the presidential republics, this is also for the election of the Head of State. The principle of universal male suffrage was introduced for the first time in the United States of America from their independence in 1776, but it was fully applied, however, with various restrictions based on wealth

and education, only in 1966 by two judgments of the Court Supreme. It is generally considered the date of 1893, in which New Zealand introduced universal suffrage, and male and female, as the first state in the world. In France in 1792, after the French Revolution, the Government introduced universal suffrage, but only for a short period of time. Only since 1946 in fact universal suffrage will be effective and stable. Europe moved in this direction during the nineteenth century: from a restricted suffrage – for the most part attributed to a portion of the population census or on the basis of education – passed gradually to universal suffrage. And throughout the nineteenth century the issue of universal suffrage will debated by various intellectuals, lined up on opposite sides. Alexis de Tocqueville (1805–1859), moderate aristocrat, though elected with a landslide victory (110,704 votes out of 120,000) was very critical towards this issue, stating in his memoirs that "there have been more ferocious than those of the revolutionaries of 1848, but I do not think there have been more foolish. They did not know or use of universal suffrage, or do without" (cf. [7, p. 385]). The progressive and feminist George Sand (pseudonym of Aurore Lucile Dupin Amantino, 1804-1876) instead wrote to Giuseppe Mazzini (1805-1872) in 1848: "We must recognize powerless in the face of this inevitability of a new political order in history: the suffrage Universal" (cf. [1, p. 29]). The same Sand wrote in 1869 to Gustave Flaubert (1821-1880) about the extended vote to all citizens "is just as stupid of divine law, though a bit 'less odious'"(cf. [8, pp. 577–578], translated by the author). Who, years later, in 1870, replied: "Dear George, respect, fetishism that they all have universal suffrage for me the most sick of papal infallibility. But do you really believe that if instead of being ruled by the French crowd was in the hands of the mandarins would be the point of chaos and doom in which we are?" (cf. [1, p. 29]).

Finally, it also recalls the situation in the Italian peninsula, only the Grand Duchy of Tuscany in 1848 granted limited suffrage for men and women. The first and only State which granted universal suffrage, then, though limited to the propertied classes. Among the very first to speak, in Italy, there Ippolito Nievo (1831–1861), which in a little-known essay, *Political revolution and the national revolution,* of 1859, criticize the distinction between the intellectuals and "the vast majority of the nation's illiterate, the rural populace": for Nievo the Risorgimento is a political revolution that has become a national revolution, establishing a system of representation based on the general universal suffrage (cf. [5, p. 63]). "Without that it will never be neither safe nor sustainable," writes Nievo. Among the supporters of direct universal suffrage, there is Carlo Cattaneo (1801–1869), who supports it, "excluding all the subterfuges that were invented by the forgers of the public vote." However, the same Cattaneo declares himself aware, with great foresight, that "universal suffrage is not a magic wand that can protect people from the momentary mistake." For Cattaneo science have to foster the policy and culture have to form the citizens (cf. [9, p. 100]).

The principle of universal suffrage was established, therefore, at least in Europe, in an era very different from today, where the historic cultural supremacy of the aristocracy was rightly questioned by the sale of patents of nobility and the rise of a class cultured medium that, once again rightly, wanted representation and voice on the choices of government.

The application was, inter alia, by no means fast: New Zealand in 1893 as the first country in the world, in Australia in 1902, in Finland in 1906, in Norway in 1913, in Denmark in 1917, Sweden in 1917 as in Russia, following the Russian revolution, the United Kingdom and Ireland in 1918, Germany in 1919, partly in Belgium in 1919, fully only in 1948, Canada in 1920, Turkey in 1923, in Ecuador partially in 1861, fully in 1924 in South Africa in 1930, Spain in 1931, Brazil and Uruguay in 1932, Cuba in 1934, India in 1935, Japan and France (after a brief period in 1792 to Following the revolution) in 1946, Argentina in 1947, Israel in 1948, Indonesia in 1949, in San Marino in 1958 in Switzerland, recognized the right to vote to women until 1971, Portugal has come full universal suffrage only in 1974. And yet, there is no universal suffrage in various countries, including Hong Kong, Lebanon, Brunei, Saudi Arabia, the UAE and, very special case, that I add just for the sake of completeness, Vatican City.

So, what now seems to us an innate right, natural and necessary, and the only way possible – is actually very recent history. And then, as the philosopher Michel de Montaigne Eyquem (1533–1592), “nature call our beliefs”. Natural rights are changing: for Aristotle, slaves were natural, and women naturally inferior. It is also, incidentally, a system already in crisis, after less than a century of effective implementation in much of the world. Do we really believe that universal suffrage is actually a step forward? An achievement of civilization? Or are we simply desperately attaching a system that does not work just because we feel familiar with it?

4. Democracy and New Media

With the advent of the internet and of the new information and communication technologies in general, with the reduction of the personal privacy of anyone but especially of public personalities, and the reduction of opportunity to "get away" by politicians and public figures, long short story, in a world where seems possible to know everything about everyone at any time, it's really still so important the influence of politicians on voters who are not particularly prepared over the topic? Their ability to influence the vote hiding the truth? In today's world, the spread of technologies that enable a more efficient and (more importantly) a much faster communication, has essentially two possible important effects on democracy. On the one hand, costs well highlighted by the theory of rational ignorance of the non-voting by Anthony Downs [10] (which, oversimplifying, in shorts define as rational for an elector to consider too expensive to inquire about who best suits his interested and so who he should vote to protect them, in relation to the real influence that his single vote can have on the outcome of the elections) can be assumed as greatly lowered. Indeed, with well spread and easy access to the web, and the vast amount of information available there, it would be reasonable to expect that today is much easier and faster than once to inquire about the various candidates and their programs, as well as to be aware of the actual capacity to pursue them or of their chances of winning.

On the other hand, if objectively the amount of information available to anyone is huge and easily accessible, and it's immeasurably superior in terms of plurality of voices and news update than what was available just a bunch of years ago, the average quality of them is very questionable. It is increasingly difficult to understand the real reliability of a source over the new ICT. The Internet provides anyone with a smartphone gigabytes of data on any public personality (or alleged). But how many of those data are really reliable? How much is it really possible to discern between a fanatic that post fictional news from his room, and a competent journalist who works hard on the field? Unfortunately, I suspect that the fast diffusion of blogs and social media, and subsequent use of these also to make information, has created a impoverishment of “professional” information.

Probably also to follow the trends and needs of the market, seems to me that professional of the information world are chasing the lower standards (at least generically, as a trend), and apparently are no longer interested in providing information that stands out in quality. And that's (maybe) harder to be found interested in the customers. Probably, the enormous changes that have distorted the daily lives of all of us in such a short time, have not yet been fully digested by the information business. Which today offers to the market essentially two things: either a model that is still strongly anchored to tradition, with all the limitations of the case, or alternatively, a heavily deflected version of the news pushed towards entertainment, with content closer and closer to the two-faced monster called “infotainment”. All this, in fact, does not make politicians more transparent and bare to the eyes of their constituents than they were fifty years ago. It's a matter of fact that today a photo stolen by a curious commoner with his mobile phone can go around the world in just a few minutes (seconds?), thing which would hardly have been possible just twenty years ago. But every single hour of every single day are stolen so many photos that the white noise becomes so high that becomes very difficult for any user to divide what is really interesting for him from what is not. And so anybody end up relying on sources that are deemed reliable person, who

may, to stay in the example, not mention this famous photo stolen. And that newspaper, perhaps, have special interests to present specific points of view, with all due respect to freedom of information and unfiltered promise and promoted from the web.

Also, as I said, the line between a newspaper and a blog is every day more and more tenuous, as it is becoming the one between information and entertainment. This does nothing more than make political advantage in the market in terms of electoral palatability those men who know how to use these media, or who surround themselves with experts who are able to do it for them. But on the other hand, this aspect is very different from the cultural revolution in the fifties saw the triumph of politicians more aesthetically pleasing to the advent of the debates aired on television rather than on the radio? The years passes, the media changes, and the skills necessary to dominate them and to reach popular consensus with them. But the fact remains that the average voter, originally fascinated by a beautiful voice, then by a nice-looking person, today is charmed by a person capable of being effectively placed on the web. None of these three capacities is intrinsically desirable, is better than the other two, or makes a politician cleverer or smarter than someone who does not have that ability. At least certainly not more than is desirable to elect politicians with the technical ability to carry out its program in its mandate.

5. Let everyone vote is truly democratic?

The so-called democracy (and I use the word called to underscore the fact that as already widely discussed; it is difficult to arrive to a clear definition of the term) is in crisis. And on this matter, I think we need to spend very few words: anyway we means this ambiguous word, indeed, there is no doubt that in the West we are experiencing a crisis of the democratic system. A crisis which, in my humble opinion, is mainly explained by one fact: the lack of awareness among people of the importance of their role in the operation of the system. Democracy is a delicate wheel, which provides for the operation of the sincere and conscious participation of the voters. Without this, it is impossible to talk about democracy if you do not feel belonging to the community, and you are not aware of the importance of their vote, you are not part of the demos, and then accepting the vote of that's everyone goes beyond the concept of democracy. And it's indeed harmful to the system.

And, I wonder, in how many cases today there is this awareness? Where do they feel the need to inform themselves and do well to ponder their choice in the urn? The logics that currently lead to vote are quite different. And I am not thinking only to the exchange vote, although paradoxically unethical in a democratic system could be considered legitimate and easily return to the voter in expanding the concept of "care of their interests." I am thinking especially to the masses instead of neo-teens who vote out of sympathy or approval, to the many disillusioned policy they choose the least bad of a nose, and just to those who believe that "so are all the same" and vote purely by chance. Or even in our country, to people who unfortunately do not have full use of his mental faculties, but which have been permitted to vote. Or finally the enormous masses, worse than all others, think they know. Voters who, in my opinion, now represent the majority percentage of the electorate, or at least dangerously close to half a slice. Fernando Savater writes: "Freedom is deciding, well, do not forget, realize that you're deciding" [6]. And how many realize it today?

John Searle has worked [11] at the beginning of his career, on the speech act theory, and in particular, for our interests, on what his master John Langshaw Austin called illocutionary acts. Illucutionary acts are acts of language which consist in saying something[3]. Beyond the locution, indeed, for Searle every speech act has an illocution, which can be accepted or not by the other part involved in the communication. This is very related to my point: in fact between two politician, at constant expressions, and with this I mean expressing the same concept, the same program, is the most able at managing illocution to get the best perlocutions. Or, in other words, also a good politician with a good program and useful skills to implement it, will not go far if he does not choose carefully the illocutions, maybe relying on a pro. Exaggerating (but perhaps, unfortunately, not too much), is the politician with the best illocutions to obtain the support of the electorate.

Indeed, if any form of communication is influenced by illocution and perlocution, as Searle speech acts theory states, the problem of democracy that we have examined is just a specific case of a problem inherent in every human interaction. Indeed, any information we, as human being, receive, is implemented through an illocution, and thus interpreted: this generates a perlocution from the receiver, and not just a "sterile" reaction at the information transposed.

The original concept of democracy is then meaningless for us so that you come to "impose" the vote in certain foreign countries. Countries in which the model, the Western culture of democracy, has never existed. With catastrophic results, among other things are easy to predict. If here, where it was born in the West, the Democratic machine sends dangerous signals of crisis and his wheel does not rotate any more, how can we expect it works where free information and awareness of the importance of voting is a mere illusion? Where centuries of trial and democratic culture have been explained to the masses, living a crisis for a disastrous war, in a few minutes from a stranger, who told everyone how beautiful and important is to put an X on a sheet? Surely democracy is not exportable practice, and most likely the West today exports it to hide their crises, and to feel a clear conscience. On the other hand, if there is need to export it, implicitly means that the democratic system is still the best.

However, for the same reasons that democracy is not exportable, in my opinion you cannot expect that it works now even with us. You cannot expect that a representative government chosen by people, is invested by the actual voters, who mostly have no real awareness and knowledge of exactly what they're doing. Just as it is happening in the West.

In addition, in my opinion it is absurd to claim that the mass choose the best. In addition to be representative, a government should be efficient and effective, and should work for the implementation of a program. In Italy, today, the confidence of Parliament to the Government (I remember once again that, although there is sometimes forgotten, until proven otherwise, we live in a Parliamentary Republic and the Prime Minister is elected by the people, but as long as he governs he has the confidence of Parliament), has expressed confidence about the program, and not the executive.

But how can the people, disinterested and uninformed, choose the best program? And how could the mass, even if the public were an interested and an informed one, (which, as I said, probably is not) opt for the very best choice? I will be objected that there is no choice at all. And this is true: politics is largely of visions and ideas, all lawful and no absolute best. But how can we hope that the synthesis of the choice of all out the best? It may be objected that the vote is a right, and that universal suffrage is one of the greatest achievements of modern civilians. In my opinion it is not, or rather, it probably was but now no longer is.

I will also tell you that the public, are generally poorly informed and interested in politics, in an electoral democracy does not decide issues, but chooses those who will decide, thus passing the buck by the electorate to elect, from demos to his representatives (cf. [2, p. 21]). But how can people not informed, or who will be selected to assess the best way to decide the issues? We must however have a responsibility to choose: there is for competent people and trust for advice about which specialist to contact? Maybe we do not go to a doctor that we trust to ask what is the best specialist in the square?

What should I think today is a potentially universal suffrage. That would really be a civil achievement. In fact, virtually every person shall have the right to vote, but to realize this potential the city itself must demonstrate an understanding of what it means to vote. Be careful, this does not mean that we should go to investigate, or even worse, to review the political and ideological ideas of a citizen (in this case in fact you would have at best a dangerous illiberal regime), or that only those who have a certain degree can vote (in which case there might be incurred in the dangerous problem of the culture of authoritarianism, and by the way you invest schools or universities are powers that are not at all suited to manage) or that the city should be responsible for knowing the codes of case law in detail as much as a magistrate. It s simply required that a national voter should have the most basic concepts of civic and political education to enable them to be aware of the

outcomes that their vote will help determine. For example, what is the difference between a presidential republic, a parliamentary and federal one? Among the Upper House and Lower House? What are the powers of the Presidency of the Council of Ministers and the Presidency of the Republic? What is the difference between a decree-law and a bill? What is the process of approving a law? What is a Parliamentary Committee? What is the difference between proportional representation method, majority and mixed? What is the difference between a party and a civic list? What is a minimum threshold? What is the difference in assigning a majority of the premium (and what it is, and how to determine) the majority coalition or majority-List? In fact, for example, vote for the list X with a proportional representation method can determine the outcome is completely different from those who would vote for the same list X by a method the majority, and the citizen has a duty to be aware of this, if to have the right to participate in the political life of a country.

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Notes

1. That things are not so simple is shown by the paradox of the 2000 election, in which a country like the United States, which is considered the most democratic in the world, elected to the presidency a candidate like George W. Bush, who had received a number of votes less than his opponent Al Gore.
2. According to Sartori, in our society now reigns sovereign primacy of the image: the visible prevails on intelligible, and the ability to abstract, to understand and therefore to distinguish between true and false is now atrophied. According to the eminent political scientist, this chilling reality has a unique and seemingly unexpected creator: television. It destroys more knowledge than it produces. And destroys even the human symbolic capacity, the process by which humans communicate articulating sounds and signs of "significant", and getting closer to the animal. This is not progress, but just the opposite. Professor says: "Knowing imaging is not democratic, as many say knowing through images-culture does not spread, it erodes the foundations. Television homogenizes the customs and fashions, but at the same time, it locked up in small villages in conflict. The amount crushing more and more quality. And for a moment if we delude ourselves to be free citizens in a free market, we have perhaps forgotten that we are not TV customers, but companies who buy space advertising".
3. According to the speech act theory, every speech act consists of three parts: locution (i.e., the structure and the wording), illocution (i.e. the target, the communicative intention) and perlocution (i.e. the effect of the linguistic act on the interlocutor).

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studia humana
QUARTERLY JOURNAL

Studia Humana
Volume 3:3 (2014), pp. 11—15
DOI: 10.2478/sh-2014-0010

Graph of a Reflexive Game and *Bélles-léttres*

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Abstract:
The authors consider reflexive games that describe the interaction of subjects (agents) making decisions based on an awareness structure, i.e., a hierarchy of beliefs about essential parameters, beliefs about beliefs, and so on. It was shown that the language of graphs of reflexive games represents a convenient uniform description method for reflexion effects in *bélles-léttres*.

Keywords: reflexive games, awareness structure, phantom agent, graph of a reflexive game, reflexion effects in bélles-léttres.

The papers [1], [2], [3] considered a new class of game-theoretic models known as *reflexive games*. They describe the interaction of subjects (*agents*) making decisions based on an *awareness structure*, i.e., a hierarchy of beliefs about essential parameters, beliefs about beliefs, and so on. A solution of a reflexive game is an informational equilibrium which generalizes the definition of a Nash equilibrium from noncooperative games.

The term "reflexive games" was introduced by V. Lefebvre in 1965 (see [4]). The cited work and his other publications (e.g. [5]) represented qualitative discussions of reflexion effects in interaction among subjects (actually, no general concept of solution was suggested for this class of games). Similar remarks apply to [6], [7], [8], where a series of special cases of players' awareness was studied. The monograph [9] concentrated on systematical treatment of reflexive games and an endeavor of constructing a uniform equilibrium concept for these games.

An important concept in reflexive game analysis is the notion of a *phantom agent*. As a matter of fact, a phantom agent exists in the beliefs of a real or phantom agent and possesses certain awareness within the framework of these beliefs. If a reflexive game involves agent 1 and agent 2, then agent 12 represents agent 2 in the belief of agent 1.

The mutual awareness of real and phantom agents is modeled by a directed graph (called the *graph of a reflexive game*). A node corresponds to a real or phantom agent; an arc between two nodes demonstrates the awareness of one agent about another agent (according to its direction). For

instance, the graph $1 \leftrightarrow 2$ indicates that agents 1 and 2 have identical and adequate awareness about each other. Similarly, the graph $1 \leftarrow 2 \leftrightarrow 21$ means that agent 1 has adequate awareness of the opponent, whereas agent 2 gets mistaken.

Informational equilibrium evaluation requires the knowledge of the goal functions of all players. Meanwhile, the graph of a reflexive game can be constructed without specification of the goal functions of agents. Instead of the quantitative correlation of interests, this graph illustrates the qualitative correlation of awareness of reflexing agents.

Scientific literature contains a subjective description of an objective reality and strives for maximal objectivization. Contrariwise, imaginative literature (also known as *bélles-léttres*) naturally has reflexion – any fiction portrays a reflexive reality, i.e., results from author's reflexion. This paper provides a series of examples to elucidate the following: the graph of a reflexive game can be employed to model reflexion effects in *bélles-léttres*.

Example 1 ("Detective story"). Consider an investigation officer and an offender. Denote them by agents 1 and 2, respectively. Consequently, the procedure of crime detection is described by the graph of reflexive game in the form $2 \leftarrow 1 \leftrightarrow 12$ (the phantom agent 12 means that the offender strives for convincing the investigation officer in his own innocence). The fact of crime detection is described by the graph $1 \leftrightarrow 2$.

More sophisticated cases of awareness are also possible. For instance, Smerdyakov and Ivan Fedorovich (*The Brothers Karamazov* by F.M. Dostoevsky) possess nonidentical awareness about the murder of the father and the attitude of each other to this fact. In the eyes of Smerdyakov, the situation (the graph of reflexive game) has the form "Smerdyakov" $\leftarrow$ "Ivan Fedorovich wishes father's death" $\leftrightarrow$ "Smerdyakov is the murderer." According to Ivan Fedorovich, the situation appears as "Ivan Fedorovich" $\leftarrow$ "Smerdyakov is innocent" $\leftrightarrow$ "Ivan Fedorovich does not wish father's death."

Similar circumstances take place in *Crime and Punishment*. Raskol'nikov does not know that the investigation officer knows he is the murderer. Denote them by agents 1 and 2, respectively. In the mind of Raskol'nikov, the graph becomes $1 \leftarrow 12 \leftrightarrow 121$. On the other hand, the complete graph of reflexive game acquires the form presented by Fig. 1.

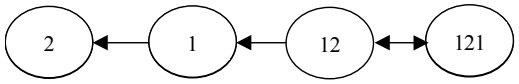

Fig. 1. The graph of reflexive game in "Detective story"

Example 2 ("Spy story-1"). Suppose that two states (*A* and *B*) and a public servant play the following game. The servant represents a high-level official of state *A* and (simultaneously) an intelligencer of state *B*; this fact is unknown to state *A*. The graph of reflexive game in such situation can be found in Fig. 2. The nodes of the graph indicate the following (real and phantom) agents: 1 – state *A*; 2 – state *B*; 3 – the servant; 12 – state *B* perceiving the servant as a faithful official of state *A*; 13 – the servant as a faithful official of state *A*.

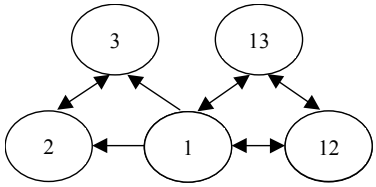

Fig. 2. The graph of reflexive game in "Spy story-1"

Next, study a slightly complicated modification of the previous plot.

Example 3 ("Spy story-2"). The situation resembles the one described in Example 2. The difference is that the servant actually works for state *A* (and sends specially made information to state *B*). In this case, the graph of reflexive game is demonstrated by Fig. 3.

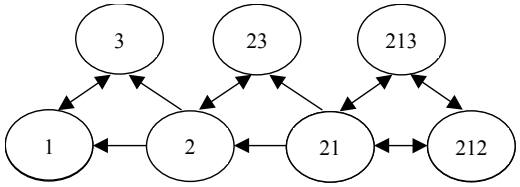

Fig. 3. The graph of reflexive game in "Spy story-2"

The nodes of this graph correspond to the following (real and phantom) agents: 1 – state *A*; 2 – state *B*; 3 – the servant; 21 – state *A* believing wrongly that the servant represents its official having no contacts with state *B*; 23 – the servant working for state *B*; 212 – state *B* having no contacts with the servant as a high-level official of state *A*; 213 – the servant being a faithful official of state *A*, having no contacts with state *B*.

For all examples discussed above, the maximal rank of reflexion equals 2 (and the length of the maximal sequence of indexes makes up 1). In literary works, higher reflexion ranks appear "once in a blue moon". Still, some examples do exist.

Example 4. The Emperor and the Assassin (1998), a movie directed by Kaige Chen, describes the interaction of a Chinese emperor and an assassin. The latter is sent to the former as an ambassador of a neighboring state. Meanwhile, the emperor knows that the ambassador is an assassin. And the assassin knows this, as well.

The corresponding graph of reflexive game is illustrated by Fig. 4.

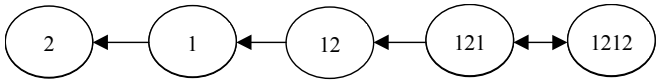

Fig. 4. The graph of reflexive game in *The Emperor and the Assassin*

The nodes of the graph stand for the following (real and phantom) agents: 1 – the emperor; 2 – the assassin; 12 – the assassin believing that the emperor knows nothing about him; 121 – the emperor believing that the visitor is an ambassador of a neighboring state; 1212 – an ambassador of a neighboring state.

The role of emperor's wife in the movie's intrigue can be observed in the graph of reflexive game (see agent 3 in Fig. 5).

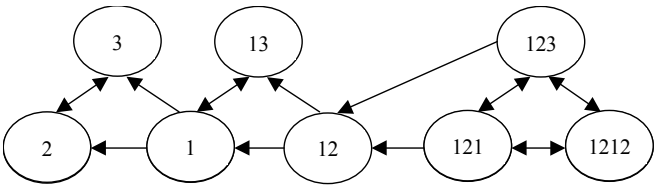

Fig. 5. The role of emperor's wife in *The Emperor and the Assassin*

In recent years, the existence of several reflexive (virtual, probably, embedded) realities underlies the plots of many movies. In this context, we mention *The Matrix*, *The Thirteenth Floor, Vanilla Sky*, *Avalon*, *The Truman Show*, and others. Interested readers would easily draw the corresponding graphs of reflexive games (using the approach suggested here).

The concluding example is quite a different matter.

Example 5. We cite an epigram by Coventry Patmore, known as *The Kiss*:
'I saw you take his kiss!' '"'Tis true."
'O, modesty!' 'Twas strictly kept:
He thought me asleep; at least I knew
He thought I thought he thought I slept.'

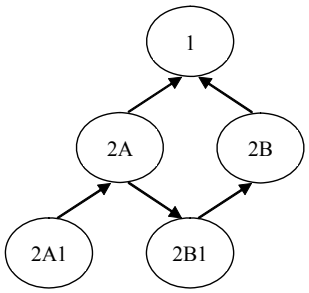

Fig. 6. The structure of lady's awareness in *The Kiss*

Figure 6 demonstrates the awareness structure of a lady kissed by an admirer in this epigram. Nodes of the graph correspond to the following real and phantom agents: 1 – the lady (here we have two incoming arcs, since the lady is not sure about the situation); 2A – the admirer, believing that the lady is sleeping; 2B – the admirer, believing that the lady thinks he considers her sleeping; 2A1 – the sleeping lady (this node admits no incoming arcs, since the lady is sleeping and performs no reflexion); 2B1 – the lady, believing that the admirer thinks she is sleeping.

Therefore, the language of graphs of reflexive games represents a convenient uniform description method for reflexion effects in *bélles-léttres*.

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QUARTERLY JOURNAL

Studia Humana
Volume 3:3 (2014), pp. 16—28
DOI: 10.2478/sh-2014-0011

Question of Consciousness: to Quantum Mechanics for the Answers

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Abstract:
The article presents the possible role of consciousness in quantum-mechanical description of physical reality. The widely spread interpretations of quantum phenomena are considered as indicating the apparent connection between conscious processes (such as observation) and the properties of the microcosm. The reasons for discrepancies between the results of observations of the microcosm and macrocosm and the potential association of consciousness with these reasons are closely investigated. The mentioned connection is meant to be interpreted in the sense that the probable requirement for a complete understanding of quantum theory is the adequate description of consciousness within it and that the correct theory of consciousness should include quantum-mechanical theoretical apparatus. In this context, the question about the methods of scientific cognition is discussed, in particular, the problem of the place and the importance of intellectual intuition in science and philosophy of science. The author draws the conclusions about the current state of the "measuring" problem in its relationship with consciousness.

Keywords: consciousness, measurement, philosophy of science, quantum mechanics, intuition

This work is an output of a research project implemented as part of the Basic Research Program at the National Research University Higher School of Economics (HSE).

1. Introduction

Since the times of ancient Greek philosophy lots of research was addressed to the problem of consciousness. The reflections on the phenomenon of consciousness and its origins are also to be found in the earlier mythological literature. However, its specific critical rationalist approach was formed in antiquity. Thereafter, the interest to the problem of consciousness grew stronger so many sometimes deep and noteworthy different points of view on this problem came out presently. Current research does not deal with details of consciousness interpretations of various kinds so the long subject formation history is to be left aside. Main point of interest for this article lies in analyzing the dimensions that link the phenomenon of consciousness and the natural science – quantum mechanics in particular (this science subdiscipline is to be further named according to conventional meanings by quantum theory and quantum physics). The consciousness is to a certain extent an important element of quantum mechanics but is not under the proper reflection of this

theory (the theory include no mathematical description of consciousness). According the last point the following statement is (or possibly is not) meant to be proposed: the quantum theory is incomplete in the sense of its consciousness description absence (or the opposite way: the existing consciousness theories are incomplete because of their absence of any quantum-mechanical description). Quantum physics is also called non-classical and in particular for its mandatory requirement to give proper consideration or at least to presume the particular observer performing the measurements – due to Heisenberg indeterminacy principle. Sometimes this is stated as follows (which in fact is not entirely correct): the world varies depending on whether we observe it or not. The classical physics does not apparently based on such statements. The reality properties in classical physics do not depend on the fact or absence of its investigation. The same relations with the properties of reality occur in quantum physics until the very moment when this reality is being observed by the conscious viewers. Here the entire aspect is which is to be reflected in this article – rational consciousness. Such consciousness aspects as rational reality (and itself) awareness are primarily recognized. So the present research is to be deemed to the effect of abolition of different consciousness concepts and its possible associated ideas' meanings evaluation necessity.

The mathematician, Roger Penrose, [20, p. 145] named quantum mechanics "mystical" theory just as of the strange link between the reality performance and the fact or absence of our observation (realizing) of it at a particular time moment. There are various philosophical interpretations of this mysterious quantum-mechanical phenomenon which all grew from the lack of any explanation of this fact in quantum mechanics itself (through its terms, mathematical tools technique). The critical analysis of these interpretations becomes the subject of current research. The final conclusions concerning the role of consciousness in quantum mechanics are planned to be based on such analysis. The following statement on the research subject is also applicable: the role of quantum mechanics in consciousness identity and performance conceptualization.

In order to start the direct analysis of the connection between consciousness and quantum mechanics, it is necessary to give at least brief description of several key principles of the quantum mechanics itself which frame the range of concerned with this research issues.

2. Some Interpretation Problem

Herein the complicated interpretative problem arises. Basically the only way of adequate representation for modern physical theories is to be depicted in the mathematical form. This fact knocks the bottom out of attempts to speak about the quantum physics on natural language rather than on mathematical one. The natural language has the lack of completely equivalent concepts to express the necessary for an accurate description of physical, and thus the mathematical, phenomena mathematical abstractions. This applies especially to the physics of the 20-21 century. Much more serious problem is caused by the above: in what way the philosophy of modern physics (and all the natural sciences) is at least applicable to such cases? Whether is it quite possible at all? Is it granted that philosophy should be mathematical (i.e. operating the language of mathematics)? While attempting to reach philosophical understanding of the principles of modern science such a serious problem is being revealed. For example, A. Koyré (who generally admitted the existence of "translation" problem) boldly addresses to Newton and then Einstein as to outstanding philosopher-metaphysicians [15, p. 24] and in the same time states the philosophy being the forbear of science and serving as its basis. What should be stated as philosophy in this case? Is it possible to find at least one of Einstein's works matching the common criteria of philosophical research? Or the traditional principles of philosophy ought to be revised nowadays? The question of language choice remains then in the discussion: which language is the most suitable for philosophy of physics and mathematics. This research mainly managed to avoid the direct confrontation with the named problem and covers mostly established by now interpretations (however, all the above mentioned forces to assume none of such interpretations being entirely correct).

Galileo maintained rather radical position on the connection between nature, philosophy and mathematics (Galileo statement according this matter is possibly the same famous as his fabulous "It does move all the same" in popular culture):

> Philosophy is written down in that splendid Book (I mean the Universe) that is always open for our eyes, but possible for being read only by ones who learn the language at first and learn how to understand the inscribed signs of it. It is written in the mathematical language and its characters are the triangles, circles and other geometric figures which are the way to understand the each and every word of it and if failed to understand you have to only roam in the dark labyrinth [8, p. 41].

Penrose has similar and even more radical point of view. According to him mathematical objects (geometric, mathematical concepts and theories) do really exist and they in particular amount for the only true reality [20, pp. 96-97], [21, pp. 12-13]. He repeatedly names himself a Platonist and argues that the objects of mathematics do exist objectively (not all of them), timelessly and spacelessly, they exist initially – in the world of ideas, and they represent the true. To be more accurate, the mathematical (and geometric) objects do piece out the world of ideas. For this reason a scientist does not invent but discovers them. Some Plato dialogues (*The Republic*, *Timaeus*, *Epinomis*) clearly states mathematical entities to be parts of ideal world, meaning them to be intelligible, to be ideas. For example, Plato's *The Republic* contains the concept of the perfect "by itself" quadrangle: "... the idea is not addressed to the drawing but to those figures which are uniforming to it. They elicit from only the quadrangle itself and its diagonal but not for the very depicted diagonal" [23, 510d]. In Plato's *Epinomis* the numbers are under consideration: "We need to put the number in the base of everything" [22, 977d] and "It's the first time god grafted us the understanding of what we are shown; and then he has shown us [a number] and is still showing" [22, 978c]. He stated numbers to be ideal essences (the ideas) and so mathematics as their operator to be the supreme science. Here the famous Pythagorean "Everything is the number" is also applicable (curiously, according to Jonathan Barnes [1, p. 21], there is no convincing evidence that Pythagorus was actually interested in mathematics!)

However, one detail which was indicates by T. Gaidenko and could be unknown to R. Penrose still remains very important: if the numbers belong(and they definitely are)to the ideal world and do exist as the particular only intelligible and spaceless ideas, the geometric objects are by contrast in different situation [9, pp. 127-128]. Geometric figures surely depend on space and therefore should be placed between the sensible world and the ideal world. Here appear the difficulties with such objects as the Mandelbrot set: pure mathematical abstraction which could nevertheless be represented in graphics and is regarded as a geometric object? The same situation is with the Riemann sphere, the vectors sum according to the parallelogram rule, the geometrical representation of complex numbers (with the axes of the real and imaginary numbers), the Hilbertian space. Thus, many of intelligible mathematical entities could be spatially represented, that means them to have analogies in the sensible world! Moreover, Plato's world of ideas is not identical to the world of mathematical objects: for example, Penrose's attitude to the existence of bed idea in it is still not clear [23, 597a].

The role of mathematics review is important in this research considering the probable connection between concepts of computability (algorithm, resolvability) with the consciousness performance. Moreover, such mathematical concepts as complex numbers are also very significant for the quantum probabilities estimation – mostly because they are "absolutely fundamental to the structure of quantum physics" [20, p. 236]. Let us recall that a complex number maintain the form $a + ib$, where a and b are real numbers, and i (imaginary number) is the square root of -1. Real numbers specifics lies in the fact of their presentability as the non-terminating decimals and that the set of real numbers is greater than the set of rational numbers and is not countable (curiously, the real numbers were discovered by ancient mathematician and astronomer Eudoxus (5–4 centuries

BC)). The first recorded use of complex numbers dates from the 21 century (associated with the works of Gerolamo Cardano and Rafael Bombelli). Such advanced mathematics development seems to be of spectacular value. However, the theories of physics dominancy are also supported by the very convincing arguments [10, pp. 259–262].

3. Specific Features of Quantum Physics

Quantum mechanics in contrast to classical physics effectively conducts studies on the microcosm phenomena, characteristics and actions of such its components as atoms, electrons, protons, photons, etc. Specificity ("non-classicality") of it resides in its perception of microcosm as arranged in fundamentally different way than macrocosm, although the second seems to be "composed" of the elements of the first. In other words, the same what is observed at the level of the microcosm cannot be observed at regular for direct observation level. The reason for such peculiarity lies in what is known as wave-corpuscle duality: atomic components (photons, electrons, etc.) act both as particles and as waves. In other words, the correct (could be named objective apart from Niels Bohr and his followers statement of objective real world view absence in quantum mechanics) of insisted that in, objective picture of the real world does not exist) description of reality is possible only using the two opposite classical concepts. Such usage of mutually exclusive sets of concepts became the distinguishing characteristic of quantum mechanics and bears a name of Bohr complementarity principle. Given phenomenon was experimentally confirmed through the famous double-slit experiment where the particles (even single ones) create a wave (interferential wave) pattern being mostly interpreted as conducting the wave behavior of elementary particles. That is the process when one emitted particle passes through two slits at once thus being the wave. But the most amazing thing here is that in case if the tracing particles passage detector is installed near the one of the slits so the interferential pattern does not take place and the particle behaves itself as a particle. On the one hand, this experiment could lead us to the conclusion that the reason of conflict with our intuition lies in fact of that particles and fields concepts are not fundamental so there is the need to search for more fundamental components to explain the experiment properly. Another interpretation includes the thought that the microcosm is really regulated by such rules so the interference occurs when there is no exact *certitude* which slit the particle is going to pass through and vice versa.

There are also later versions of the double-slit experiment: an experiment with a laser beam splitter which splits the laser beam (emitting one photon at regular intervals) into two beams. The foundations stay the same: if the detectors are installed the photon behaves as a particle, if do not – s a wave. The distance between the two paths can reach many light years. Nevertheless, the interferential pattern depends on the presence or absence of the particles detector [11, p. 190].

Passage of a single particle (upon the detector presence) through one slit or the other is determined by the classical method of probabilities counting. Roughly said, there are two alternative ways which are half to half of the one possible variant (way A + way B = 1). However, upon the detector absence the interferential pattern should result from the two alternative ways sum (their superposition). But here the complex numbers are also additionally used as coefficients (extra factors) to the alternative ways sum ($A + iB$). In other words, quantum mechanics states the various alternatives for the same object actions are determined by the superposition of these alternative ways with complex factors. The only problem for such statement is the lack of the suchlike examples in macrocosm. For instance, it is difficult to imagine the situation when Socrates nationals see him in all the possible alternatives: when he has already taken the poison, when he has not yet, being in different places and performing all the different actions that he could perform at the same time. They see instead the only one situation. The real meaning of the complex coefficients in such situations and the way of their influence on visual macrocosm world view are not completely clear points. Despite of its obvious empirical confirmability why are quantum mechanics actions not noticeable in macrocosm?

Before proceeding with the current hypotheses on this let us briefly recall the quantum mechanics method of probabilities counting. Since the particle acts as a wave (when we do not track its actions) the probability of its location in a particular place could be determined by not the classical probabilities but the concept of amplitude. Mathematically, this probability amplitude is constituted by multiplied by a complex number alternative ways. A wavy line could be a better but not the exactly correct example – the higher is the crest of the wave, the larger is the amplitude. Accordingly, the highest probability of locating the particle is in the moment of the upper crest, the least – on the lower one. However, the particle could also be detected at lower crests despite of their low probability of particle to appear in "there". This implies that theoretically there are many possible locations of the particles. Next question seems to be appropriate here: is it possible to find out the location of the particle before its location observation? The answer is that you could not. Moreover, the standard quantum mechanics states it to be wherever it could be, so its location is described by superposition (all state vectors sum). In other words, before the exact observation the particle had no specific location. Such assertions are in crucial contradiction with our intuition and the observations of the everyday world. The act of observation (i.e. perception) turns out to be forcing the particle to locate in particular place while it has been everywhere it could before and has been described as acting exactly as the wave function. In fact, observation act here consists of switching the quantum level to the classical one, of the "increase" to the macroscopic level. In mathematics, this is the same with drawing the squared absolute value of quantum complex amplitude module – the simple procedure performed on the Argand subspace (defined by axes of the imaginary and real numbers) with the involvement of the Pythagorean theorem. The mentioned manipulation of drawing the squared absolute value of quantum complex amplitude in physics bears the name of the wave function collapse. According to the last wavy line example this resolves itself into the following: the very moment of the particle state recording, its localization, the one wave crest becomes the top and the others are down to zero. This appears as if it was our observation (consciousness) that makes the particle to select a specific location (and the quantum mechanics laws cease to describe its condition).

Let us keep in mind the fact that the classical physics is deterministic: if the location and impulse (or speed) of the object there is the theoretical possibility to predict its original and final location (although the actual situation is more difficult – the evolution of more than two particles interaction causes difficulties). But in quantum mechanics it is incorrect to claim the particle being located in a particular place at a particular time due to Heisenberg indeterminacy principle which states the location and impulse of the particle impossible for accurate measurement. The more precisely we state impulse of the particle, the less clear its location is for out observation, and vice versa (let us not to go into details of this known fact, but let us note that according to one of the most popular interpretations this is the way how the observer does unavoidably disturb the microcosm). For example, if a probability wave has the same grade amplitudes and wavelengths so the particle impulse has been defined correctly. This means the observation act (wave function collapse) to result in particle location detection in any place with equal probability because of equal squares modules at any wave area. So the particle location is completely undetermined. The situation when the so called "wave package" has been specified is appropriate in quantum mechanics: when location and impulse are limited to a specific range and, therefore, are approximately determined.

The Schrodinger equation describes the time evolution of a quantum system. Its form is not an important factor here, but its measurement act description absence in its structure is critical. The equation in this regard describes the world being deterministic: the evolution of the wave function as a superposition of probabilities is predictable, but indeterminacy arises with the start of observation and attempts to locate the particle (or define its impulse) so the switching the quantum level to the classical one happens. Indeterminacy arises due to the fact that the choice of the microcosm components being observed occurs intentionally by accident, in the unpredictable way. So the Schrodinger equation in not applicable here – cause of the wave function collapse. Erwin

Schrödinger himself was not pleased by this situation (the absence of correspondence between the quantum mechanics world modeling and what is observed in reality). Macrocosm has no superposition. His "Schrodinger's cat" imaginary experiment and many modifications are widely known. In the following there will be described the applicable to this research modification of this equation.

4. The Measurement Problem

Let us afford such freedom and imagine Socrates with a vase of poison instead of the cat. Then assume that no one is around him to observe his actions. The original Schrodinger's imaginary experiment is based on the role of subatomic unobservable effects described by a wave function directly influence the final cat condition as a superposition of alive and dead conditions. However, quantum mechanics does not include the statements on differences between macrocosm and microcosm patterns (moreover, all the objects of macrocosm, instruments and the observer him/herself are made up of elementary particles). Therefore, the microscopic conditions are to be overleapt (although, the Socrates poisoning quantum mechanism such as decay of a radioactive atom is easy to modify).So Socrates is holding a vase. If there is no observer (and no "measuring" process), then his condition is described as a superposition of possible alternatives – in other words, he has drunk the poison and died plus he hasn`t drunk and stayed alive. For the waiting outside Athens citizens (and also for the quantum mechanics) Socrates is simultaneously both alive and dead. And at the very moment of anyone entering the room, Socrates chooses a specific condition – either alive or dead, but no one has ever seen him both alive and dead. With the help of previously mentioned complex probability factors we could state the Socrates condition superposition being not just the sum of the two conditions – alive and dead – but the presumption of all possible complex combinations – and they are all different! For clarity (which is incorrect) this could be represented as follows: for example, the state vector of Socrates being 16% dead and 84% alive is possible (this is close to the dramatic A. Tolstoy fairy tale on the adventures of Pinocchio: Pinocchio "is more alive than dead", etc.). However, the entering the room observer will never see such a condition. As a result of wave function collapse which the observer provokes by the recognition of what is going on in the room Socrates appears to be either fully alive or completely dead. But this does not turn out to be the core problem. The problem is what Socrates feels about it himself. Obviously, he perceives nothing of the kind (no complex superposition of his conditions). He is self-aware when alive and, supposedly, is not when dead. This means that the reality is different depending on the observer. As Socrates measures his condition by himself, he surely knows that he does not fit into Schrödinger equation and that he is clearly alive. For those who are outside and cannot see him, Socrates is a complex superposition of dead and alive conditions and could be described by Schrödinger equation. There seems to be no contradiction in case Socrates is dead and has no recognition of what is happening anymore, but does not it? For outside observers he is still dead + alive, that is why *at all* it cannot be stated if Socrates has died, as when dead he would not be self-aware and he would not be observed by anyone.

As mentioned above, problems of this kind did not satisfy Schrödinger and he believed that his equation cannot be applied to macrocosm objects, such as, for instance, Socrates. However, this is only his private opinion and in quantum mechanics there are no valid grounds for not doing so. Contradictions to it may only come from our perception, intuition and the way we recognize reality, which cannot be considered to be a strong scientific argument.

Concerning this matter a question may appear: what are the legitimacy criteria for Schrodinger equation? Why should we accept it? For example, the equation includes quite questionable members, even combinations of members, the usage of which may be interpreted as a certain mathematical "trick" for the purpose of achieving the targeted results. Who decides that the equation is appropriate and applicable? It is natural to think that this decision is made by those rational beings who recognize the results of the equation's implementation, and because the

equation corresponds to the results of experiments demonstrating the nature of microcosm. Another answer is that our conscience determines "legitimacy" following the fitting criteria of our perception and of what we consider "reasonable" based on our experience, observations, etc. Laws of energy conservation and second law of thermodynamics, for instance, are considered, to some degree, irrefutable postulates of physics. However, can we surely say that the evolution of the Universe will not turn backwards in some distant future because of the changes in entropy process, so that the entropy will be decreasing while the degree, on the contrary, will be increasing? This can't be surely stated, as well as the same thing can't be stated about the conservation laws (refer to Koyre's works on this issue [15, p. 24]). But accepting these laws is in full correspondence with our mental *intuition*. There are plenty of other examples from the science history. Einstein introduced the cosmological constant relying on the intuitive believe that the Universe can only be steady state, which he has later admitted to be the greatest mistake in his life. On the same grounds, the grounds of reason, Aristotle, Hipparchus and Ptolemy considered Earth to be the center of the Universe, and the Universe to be finite. Newton, however, did not even accept a possibility of gravity being a feature of objects themselves. In a certain sense has been developed the Descartes' statement that "we cannot doubt of our existence while we doubt, and that this is the first knowledge we acquire when we philosophize in order" [4, p. 316]. But nothing has prevented Zhuang Zhou to *doubt* contrary to Descartes (and even long before him) "whether Zhou is dreaming himself a butterfly or the butterfly is dreaming itself as Zhou" [28, p. 35]. It really seems to contradict reason, intuition, common sense (that is all). Nevertheless, in the history of philosophy, starting from the antiquity, there has been a question: why reason (or even experience, as we anyway understand it through our conscience) should be considered a sufficient basis for claiming any truth? Heraclitus' statement (way before the skepticism) is very representative: "I know nothing of anything" [17, p. 124]. Probably, such doubts had evolved in the course of time into Schopenhauer's belief that the world is nothing more than our perception of it, "everything exists only for the subject" [24, p. 20]. As shown by the examples from the field of physics, this problem troubles not only philosophers.

The history of misconceptions proves that reasonable grounds (as in the statements like, "this is false beyond reasonable doubt" and vice versa) rely on intuition, the character of which is determined by the knowledge that people have in a particular culture-historical period. For example, the proof of God's existence by Thomas Aquinas seemed right as it completely satisfied mental intuition of educated people of his time. However, with the development of knowledge and ideas, gaining the experience in with the appearance of new philosophic concepts, Thomas' proof started to lose its intuitive obviousness.

There is a counter-example: counterintuitive principles of quantum mechanics generally formulated above were such in the first half of the 20th century, but for the following generations of physicist these principles may already be grounds for intuition.

Cognitive problems which originate from quantum mechanics have various interpretations and alternate solutions. Let us consider particular (the most well-known) ones.

5. Interpretations of the Measurement Problem

1. According to Niels Bohr, the very problem of measuring operations as an attempt to explain why the rules of physics change during the transition from microlevel to macrolevel has never been a problem. There is no point in describing anything that is not provided for experimental observation. One should only work with something that exists, without raising senseless questions that have no answers. In other words, there is no reality rather than the one described by science.

2. A different point of view (derived from Heisenberg's ideas) which appeals to our consciousness is that wave function is not real. It only reflects human understanding of reality and cannot be considered an objective phenomenon. Consequently, wave function collapse means the change of understanding.

3. The next approach ascends to David Bohm [3, p. 369] who as well as Einstein [18, pp. 454–457] shared deterministic views on reality. According to him, particles in fact take certain positions and have certain speeds regardless of whether we can observe them or not. However, in accordance with the inderterminancy principle we cannot be aware of both simultaneously. Worth to mention that Bohm's theory challenges Bohr's complementarity principle, meaning that instead of wave-particle duality it postulates separate existence of particles and their waves. This approach is also known as the "hidden variable" theory. Therefore, our knowledge of reality has its limits, but the reality itself has objective features irrespective of our awareness (or whether we are observing it or not).

4. The fourth approach, probably the most unconventional one, belongs to a group of scientists (Girardi, Riminiand Weber) [2, p. 201]. They have obviously taken into account the possibility of bringing certain altercations into Schrodinger equation in such a manner that it would still "work" (technically, it is a kind of a mathematical "trick"). The idea of the innovation is that the wave function sooner or later collapses by itself with no interference of the observer who carries out conscious measurements. But this hardly ever happens, approximately once in a billion years for every particular particle. It is this "infrequency" that guarantees no evident contradictions with the conventional quantum-mechanical representation of the world. And it is an advantage, as the records of quantum-mechanics are extremely precise, otherwise the contradictions would appear. Thus, from time to time certain particles, so to say, measure themselves, but their whole development up to this accidental hardly probable event is described by a standard wave function. In this way the new theory explains the principal divergence between the behaviors of microcosm and macrocosm: as the macrocosm objects consist of multitude of elementary particles, the function collapse of separate particles constantly happens there. This process causes a peculiar chain reaction (determined by the "tangling" of all the wave functions) which makes the functions of other particles to collapse. As a result, a macrocosm object always takes a certain position, has a certain speed (though subjected to reservations even in macrocosm) and is not observed as a complex superposition of all possible conditions. Such an approach is rather attractive, because it ruins the mystical halo around quantum-mechanics (as well as Bohm's theory) eliminating the magical role of consciousness in interception of reality. However, it should be noted that all the mentioned approaches are only acceptable interpretations of the reality and there is no evident experimental proof of any of them).

5. The next theory is known as quantum decoherence [11, pp. 209–212]. It can be reduced to a statement that the visual environment and its influence on objects make these objects choose certain configurations, which are usual for observation. Schrödinger equation can be applied not only to microcosm but also to macrocosm considering that the objects of the real world are not isolated, but exposed to the outer influence (fields, elementary particles). And though from the macroscopic point of view this influence is insignificant, in reality it is sufficient to disturb the coherence of a macroobject. This influence on the wave function, which describes the development of microcosm in the course of time, suppresses interference. It means that the visual world "takes measurements" by itself and the human role with his conscious observation again loses its meaning. But there is a different point of view: Penrose makes an interesting observation concerning decoherence. His point is that decoherence brings us back to the matter of consciousness and implicitly suggests the acceptance of multiverse hypotheses [21, p. 1031].

6. Schrodinger equation can not be applied to conscious creatures (Jenő Wigner's concept [27, pp. 168–182]) meaning that it objectively describes reality only until it is not recognized by the observers in the relative proximity. According to Penrose, this leads to paradoxes [20, pp. 294–295]. Although these phenomena are considered to be paradoxes for the only reason that they are objectionable from the point of view of meeting the requirements of reasonableness. Assuming that in the universe there are other conscious observers the wave function collapse would represent a different portrait of the same region of space to different observers (as at the moment of observation various characteristics of reality are set randomly). Let us assume that the observers in the Milky

Way have recorded a supernova explosion in the Coma Berenices asterism, while the observers from the Andromeda Galaxy have not. Did it really happen or not, regardless space-time continuum, fixed by the special theory of relativity? This may be not an evident example but to a certain extent it reflects a more general problem. After all, there is no need to go that far and search for the inhabitants of Andromeda galaxy, the Earth would be more than enough, or even just a laboratory is required. Let us assume that a researcher takes measurements (for better evidence we shall consider that he is observing microcosm, axial direction of an electron spin, for example). After taking measurements he would inform another researcher who is not observing anything about the results in order to record them. But can such results be objective? It is highly *probable* (in the quantum-mechanical sense) that the second observer would get a completely different result under the same conditions (for the reason microcosm random nature at the moment of wave function collapse). Is it worth speaking about objective reality in this case if it is different depending not only on whether it is being observed or not but also on who is observing it?

7. John Wheeler [26, pp. 182–217] suggested an even more radical concept. As the reality chooses a particular condition (one of the possible alternatives) only as a result of conscious observation, the whole evolution of the universe up to the moment when consciousness was shaped becomes determined (i.e. obtains fixed specific values) only after the formation of consciousness. It is a very interesting theory especially because it leads to further questioning such as: what does it mean “to observe the past” in the quantum-mechanical sense, if we are speaking about the human history, of course, rather than space observation. In the latter case we literally see the past. But even if we understand it this way, there are known complexities. A photon traveling for many light years from a different galaxy (in an experimental case with a beam splitter) causes interferentional picture on Earth. It means, that for many years its condition has been described by a wave function and it was as if “smeared out” all over the universe where it could get, which a great variety of alternatives is! But with a detector installed, interference disappears, thus all through the history the photon had a particular trajectory. If the detector is absent – again the interference occurs. It may seem that the past changes depending on the act of observation, world's history is being rewritten. Here it should be noted that from the mathematical point of view this fact does not create any paradox. Paradoxality is rather a result of a certain philosophic interpretation.

8. John Wheeler's student Hugh Everett [7, pp. 315–324] proposed probably the most popular interpretation of the quantum theory in mass culture – the idea of parallel universes (often called multiversal interpretation). The core of Everett’s concept is that wave function collapse does not happen at all and Schrodinger equation describes reality in a most correct way. The point is that all possible alternatives provided by the wave function find their realizations, but each of them does in its separate parallel universe. It means that a variety of additional universes constantly appears with all possible combinations of alternative events. This interpretation to a great extent simplifies the problem of measurement and seems to lessen the mystical role of consciousness in the evolution of the universe. However, it is not completely true. A logical question comes up: if there is such a variety of universes and their number keeps growing, why do we recognize ourselves only in one particular universe and are not aware of the others? As an objection, it is likely that we do recognize ourselves in all the universes, but in each independently. It ruins the intuitive concept of the unity of consciousness, the idea of self-identification: how can we be sure that it is “us” in the additional universes, if each of our doppelgangers has a different consciousness? This issue is collateral to the problem of teleportation, which we shall consider further.

Another problem is connected with the experimental evidence of the existence of parallel universes. Finding such evidence appears to be very problematic (and actually impossible) for obvious reasons. Still some physicists, for instance Alexander Guts [12, pp. 320–325] and David Deutsch, believe that such a test is possible with the help of the so-called “shadow particles”. Describing interference of a photon, Deutsch comes to a conclusion, that interference is determined by the influence of “shadow photons”, invisible particles that prove the existence of innumerable parallel universes (where these photons exist) [5, pp. 43–45].

9. Mikhail Mensky suggests an even more challenging approach. Accepting Everett's idea, he disagrees with the conclusion that the role of consciousness in objective shaping of reality reduces to zero. He, on the contrary, claims that consciousness is responsible for the choice of alternatives! Then he goes even further, stating that the choice of alternatives between parallel universes is consciousness [16, p. 108] (literally, consciousness is what separates the alternatives). Mensky is obviously so obsessed with this idea that he keeps expressing it again and again all through the book. In addition his interpretation preserves the idea of objective visual world (as he understands it), the world of all quantum superpositions, while he believes that it is the consciousness that carries out subjective separation of the alternatives. However, a human being is capable to perceive this objective world, the world of quantum superpositions, when he is unconscious: in a trance, while dreaming or meditating (in fact it is a modern understanding of the unconscious). Mensky believes that his concept can explain such wide-spread phenomena as clairvoyance, telepathy and other supernatural abilities. It is in the unconscious state (in the senses described above) that a person gets the ability (rather chances to have the ability) of "superintuition" (direct vision of truth). Perceiving all the universes in their superposition, an individual acknowledges all probabilities and their realizations. One of the last chapters in Mensky's book is titled "Why quantum concept of consciousness turned out to be successful". Here, not to confuse anyone, we must emphasize that it is not true. Mensky's quantum concept of consciousness is not at all successful (if under success we understand acceptance by the academic community). At least in this Universe! The reason is that Mensky's ideas are purely speculative and "facts" about all-possible wonders that he provides as examples have no scientific proof.

Mensky pays attention to the fact that Wolfgang Pauli, one of the founders of quantum physics, cooperated with Carl Jung on the issue of the role of consciousness (and the unconscious) in physics, but he mentions that the results of this cooperation have never been published. However, it is only partially true. Pauli and Jung published the work "The Interpretation of Nature and the Psyche" [19]. The aim of Pauli's research was to analyze how archetypes influenced Keppler's ideas, Jung's research at the same time, was devoted to the theory of synchronicity, which is used for the explanation of mystical superabilities that are attractive to Mensky.

There is an opinion, that Everett's theory violates the parsimony principal, which is a part of the "real" world. Still it is not a strong argument. This point comes directly from subjective perception of "how the things should be around" based on mental intuition. Some other criteria of a "proper" theory are popular among physicists and mathematicians. They are aesthetics [21, pp. 22–23] and simplicity. Moreover, quite often it is these criteria that determine the choice of approach or initial data. But certainly it is not about the objectivity of choice.

10. Another point of view on the measurement subject relates to nature of the observers. Is it necessary to obtain consciousness through the observation process for the collapsing of the wave function? Obviously, such a statement lacks enough confirmation. Thus, the following hypothesis is to be stated: the macrocosm bears the condition which is observed because of its constant being "measured" by different observers. For example, by animals (or bacteria).

6. Conclusions and Assumptions

Let us draw some conclusions about a possible connection between consciousness and quantum mechanics (for more details refer to works by Paul Dirac [6] and John Bell [2]). The question may be formulated in two ways: what is the role of quantum processes in the consciousness performance and, on the contrary, what is the role of consciousness in quantum processes? This article is mostly devoted to the latter question. To answer the first one requires an answer to a different question: how is consciousness structured and how is it functioning? Definitely, this question remains open. Although, there are a number of arguments that are of physiological character (in case that we adhere to the views that consciousness can be reduced to brain functions) – we shall skip them, as the description of brain structure would hardly be of any help. There is another important question:

how does consciousness work? Can we view brain as a certain computer that carries out calculations (which are reduced to what we call consciousness)? If so, then consciousness is actually a complex of programs that set the algorithms of calculations (algorithms in the sense of Alan Turing's machines). However, Kurt Gödel had proved that any considerably complicated mathematical theory is undecidable. In Turing machines case this means that there is no universal Turing machine that can resolve any mathematical problem, i.e. there are always such problems that cannot be solved algorithmically (the algorithm to solve them has not been discovered). If we devise an algorithm for such problems, anyway the new undecidable ones will appear. It should be noted that such problems can be solved in theory, but the existent algorithms are useless for the purpose. If we accept that consciousness is a kind of such program containing algorithms, we'll have to admit that there are numerous problems that cannot be solved by consciousness. Another problem described by John Searle [25] is that such a program will lack true understanding of calculations it is performing, so it is not analogous to consciousness. Thus, the man's mind and consciousness cannot be regarded as a classical computer (with appropriate software). Despite this, Deutsch [5, pp. 238, 337] claims that the brain is a typical computer operating on the basis of classical physics, i.e. it does not follow the rules of quantum mechanics. However, according to Deutsch, consciousness necessarily functions in reliance on the acceptance that our copies exist in the doubtlessly real parallel universes, "the fruitfulness of the multiverse theory in contributing to the solution of long-standing philosophical problems is so great that it would be worth adopting even if there were no physical evidence for it at all" [5, p. 339]. Regarding the multiversehuman brain turns into a cross-functional computer intricately avoiding the problem of undecidability (which seems not to be even considered a problem by Deutsch).

The following questions are appropriate here: does the intellectual intuition an algorithmic process? If not then may it be the quantum process? These issues are interesting for discussion but have still no at least approximate answer.

Penrose in his turn adheres to the point of view that consciousness is not a program and brain is not a computer particularly due to the fact of undecidability of certain problems. He insists that the very possibility to evaluate any algorithm legitimacy means that consciousness is not a complex of algorithms, because this evaluation is not algorithmic [20, pp. 411–413]. Indeed, how do we decide which mathematical operation should be used, that a certain result is legitimate, how do we select and formulate criteria of truth? Eventually, can there even be an algorithm for an algorithm? As Gödel has proved such an algorithm does not exist, but even if it would there would be another question: what criterion of truth can be applied to this algorithm? Would it be algorithmic? Is the process of wave function collapse algorithmic? If not, which is much likely to be so, it means that consciousness as an observer of reality can perform uncomputable processes and definitely cannot be interpreted as a classical computer program. It should be emphasized that such considerations remain correct if we do not take into account possible dualism of consciousness and body meaning that consciousness processes can be reduced to brain function. For example, the aforementioned Mensky holds a radical opinion that consciousness is not a brain tool, but just the other way round, brain is a tool of consciousness.

Penrose in his last fundamental work *The Road to Reality*, 2004, while bonding quantum mechanics to consciousness states that consciousness does not determine subjective observation and its results, but rather physically real wave function collapse is responsible for the work of consciousness [21, p. 1032] (Penrose prefers to speak of state vector reduction). Besides Penrose also does not consider brain to be a quantum computer (using Schrödinger equation to describe reality). He believes so for the simple reason that brain as a macroscopic object functions in a full accordance with the rules of classical physics. But he also believes that to understand the phenomenon of consciousness completely quantum mechanics should be modified in a way to connect it to the general relativity theory. As is well known, such connection is required to solve the problem of gravity, which is explained in general relativity theory, but is not applicable to quantum theory. It means that, according to Penrose, gravity plays an essential role in the problem of

measurement. It is the gravity effect that provides objective reduction, with which the common macrocosm finds its realization and serves as a forthcoming of quantum reality. Then a conscious observer is unnecessary and consciousness does not determine the reality. It should be noted that such approach to the problem of observation becomes possible within quantum mechanics only if certain altercations are brought into standard quantum theory (like Bohm, Girardi, Rimini and Weber's approaches).

Concerning the quantum computer (still a hypothetical device nowadays, producing calculations based on quantum superpositions, containing operations with complex numbers) it is now worth speaking about its applicability only in terms of complexity theory, the increase of calculation effectiveness [20, p. 402]. There are no grounds to suppose that quantum calculations are closer to the actual work of consciousness than classical calculations, as there is no proof of superpositional probabilities in the work of consciousness.

The problem of consciousness was thrown into sharp relief in connection with arguments on the matter of such quantum phenomenon as teleportation which ceased to be hypothetical after an experiment carried out in 1997 [11, pp. 442–446]. According to the experiment teleportation should be considered a kind of replication, a creation of a copy with the perseverance of initial object (in fact, it is a process of duplicating structure and binding characteristics of elementary particles). Let us assume that a teleportation of a human being takes place (of course, currently it is impossible, and is unlikely to be ever possible due to principal complexity of the process, that is not the point). This poses a question: would the copy have the same consciousness? If yes, so would it be the same as the original one? Brian Green claims that it would, the same one, as he is conceived that there is no other reality as the reality of elementary particles (or their alternative description), which means that consciousness can be reduced to a certain arrangement of those particles.

The followers of the viewpoint that consciousness is able to change the reality in quantum processes (initiate a wave function collapse) sometimes provide anthropic principle as an argument. According to it, the Universe is such, because of the observers' presence. In other words, humans could not exist in a universe with different physical characteristics. It supposes the necessity of consciousness. This does not sound convincing. For instance, if we consider other basics of mental intuition, especially the fullness principle (refer to A. S. Karpenko [13, pp. 1508–1522] and [14, pp. 1660–1679]) and the law of sufficient reason, we can assume that all possible universes exist with their courses of nature, including ours. Then anthropic principle makes no sense and the presence of conscious observers only proves that all probabilities should be realized, including this one.

Generally the question of connection between quantum processes (interference, wave function) and consciousness remains open. Its complexity is principal and was formulated by V. P. Zubov in a different way, "…how can we bridge physics to physiological psychology, which is to do something completely opposite to what Descartes' theories as well as all the following did, which was separating physics from physiology?"[29, p. 60].

From Koyre's point of view "the objective structure of existence determines the role and meaning of our intellectual abilities" [15, p. 21], which means that quantum mechanics should somehow determine consciousness if we admit that it sufficiently describes reality.

Possibly, this issue to a certain extent depends on the progress in creation of quantum computers. Quantum artificial intelligence might give an answer not for the nature of consciousness, but at least on the connection between consciousness and quantum mechanics. It is also possible that because of the hidden unavoidable character of microcosm, according to the quantum mechanics, the answers will never be found at all. As Heraclitus once said, "nature likes to hide" [17, p. 193].

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studia humana
QUARTERLY JOURNAL

Studia Humana
Volume 3:3 (2014), pp. 29—42
DOI: 10.2478/sh-2014-0012

Natural Selection or Problem Solving. Critical Re-evaluation of Karl Popper's Evolutionism

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Abstract:
Among the philosophers and the educated audience the name of Sir Karl Popper is usually associated with the critical method, evolutionary epistemology, falsification as a criterion for the demarcation of scientific knowledge, the concept of the third world and with his dislike to dialectics and contradictions. This article is aimed to show in what way all these things are connected in the evolutionary researches of the philosopher and the new conceptions, which he contributed to studying the mechanisms of evolution. Also there is an attempt to comprehend the evolutionary views of Popper, test them for falsification, relate his epistemology with his claims, which he puts forward to the theory of objective knowledge evolution and show the obvious contradiction between them.

Keywords: evolution, epistemology, selection principle, Popper.

> For the dogmatic attitude is clearly related to the tendency to verify our laws and schemata by seeking to apply them and to confirm them, even to the point of neglecting refutations, whereas the critical attitude is one of readiness to change them – to test them; to refute them; to falsify them, if possible. This suggests that we may identify the critical attitude with the scientific attitude, and the dogmatic attitude with the one which we have described as pseudo-scientific (Karl Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge*)

1. The Tautology and Unfalsifiability of the Selection Principle

"I have always been extremely interested in the theory of evolution and very ready to accept evolution as a fact" (*Popper*, 2002: 194). This is how Popper begins one of his richest in evolutionary ideas articles "Darwinism as a metaphysical research programme". In this very way – according to the title of the article – he evaluated the status of Darwinism in the period of his first referring to the evolutionary topic: "I have come to the conclusion that Darwinism is not a testable scientific theory, but a *metaphysical research programme* – a possible framework for testable scientific theories" (*Popper*, 2002: 195).

And what could we expect from the author of the falsification concept? He was the one to raise a question of the scientific character of the selection principle, which is the foundation of both the traditional Darwinism and its modern interpretation – the synthetic theory of evolution. In his notes to the cited article Popper directly points out that he called Darwin's theory a metaphysical

programme “due to the fact that it is not falsifiable” (*Popper*, 2002). Beside that, Popper supported another opinion which is widespread even among the evolutionary biologists – the opinion about the tautology of the selection principle:

> To say that a species now living is adapted to its environment is, in fact, almost tautological. Indeed we use the terms “adaptation” and “selection” in such a way that we can say that, if a species were not adapted, it would have been eliminated by natural selection. Similarly, if a species has been eliminated it must have been ill adapted to the conditions. Adaptation or fitness is defined by modern evolutionists as survival value, and can be measured by actual success in survival: there is hardly any possibility of testing a theory as feeble as this (*Popper*, 2002: 199).

However, Popper did not prove his thesis about the unfalsifiliability of Darwinism and the natural selection principle either in the article mentioned above or in his other works. He only gave this explanation of the selection principle tautology. And in his late works he even made an attempt to renounce this statement (*Popper*, 1978) (see the analysis of this attempt below). For this reason, let us do it instead of the author of this method, by stepping to the boots of the supporter of falsification as a criterion for the demarcation of scientific knowledge.

Developing Popper's thought, we can formulate the tautology of the selection principle as follows: the statement of fact of a certain state, achieved by a system by means of this or that selection does not confirm anything except the fact that the system is not in any other state. This is the complete scientific content of the idea of “selection”. In fact, the real reasons of this or that process are substituted by the selection principle. For example, to “explain” any evolutionary phenomenon within the frameworks of the theory of evolution it is considered to be enough to point out, that the natural selection was favorable to it or even simpler, that it has appeared as a result of the natural selection. If, for example, physics was built at such level of scientific rationale, then we would be content to explain the order of distribution of the liquid layers with different density in a vessel simply by some act of selection. In fact, this is absolutely true, but it has no scientific meaning without the laws of system formation, i.e. without the principles indicating not the possibility of this or that state, but the impossibility of others. A theory, which limits the realization of some phenomena, is considered to be scientific only if the predictions of this theory are testable. The theory, which states that liquid layers are distributed in a vessel in the optimum way because of the natural selection, is not scientific – its conclusions are irrefutable. This completely corresponds to Popper's idea that the laws of nature “do not assert that something exists or is the case; they deny it. They insist on the non-existence of certain things or states of affairs, proscribing or prohibiting, as it were, these things or states of affairs: they rule them out. And it is precisely because they do this that they are falsifiable” (*Popper*, 2005: 48).

Consequently, the selection principle does not possess the necessary property of the scientific concept – the limitation of applicability. Any scientific law is truly scientific not because it shows the possibility of existence of some phenomena (it is clear without any laws), but only on condition of proving the impossibility of the existence of the other. The energy conservation principle is valuable not because it states the feasibility of transmission and transformation of energy, but because it proves the impossibility of phenomena like perpetuum mobile. In other words, the formulation of the energy conservation principle itself supposes some options of its falsification – the phenomena, the proof of which existence will disprove this law (in our example it is the perpetuum mobile).

And has the selection principle got such options? Let us assume, that we decided to conduct a final experiment to either prove or disprove the natural selection principle. Having analyzed the environmental factors, we suppose that the A-trait will appear among the population after several generations as a result of adaptation. But after completion of the experiment we have found out that the B-trait appeared instead. Can the selection principle be disproved by that? Not at all! While

analyzing the results, we will only conclude that the environmental factors were estimated incorrectly and the B-trait appeared in absolute correspondence with the selection principle – the adaptation took place there! So, not any result of the experiment (either A, B, C, D, or E-traits, etc.) can disprove the selection principle. The mismatch of the results and prognoses only confirms our mistakes made while analyzing the selection factors and criteria, but it does not falsify the theoretical principle itself. The attention should be drawn to the fact that the selection principle is theoretically unformalized and cannot be included into any logical constructs. Thus, the selection principle has not participated in developing the prognoses in our experiment, i.e. it has not been a part of any logical constructs. And that's why any result of the experiment can either prove or disprove it.

The same situation is with the analysis of paleontological data – any discovered empirical phenomenon, which is against the expectations, can disprove everything, but not the selection principle. The biological phenomenon itself is an evidence of its adaptiveness (or non-adaptiveness) and consequently confirms the selection principle.

We can only agree with Karl Popper's statement, that:

> If we do not know how to test a theory we may be doubtful whether there is anything at all of the kind (or level) described by it; and if we positively know that it cannot be tested, then our doubts will grow; we may suspect that it is a mere myth, or a fairy-tale (*Popper*, 1962: 117).

And consequently, if we accept Popper's conception, the natural selection principle in its direct formulation as a statement of adaptation of the most adapted (or survival of the fittest) is not falsifiable, and that is why it can not be acknowledged as a scientific one.

2. Selection Criteria or Problem Solving

It is important to note, that in his very work "Darwinism as a metaphysical research programme" Karl Popper not only treated the modern evolution theory in the most critical way, but also formulated some principles and hypotheses, which could support its development. The first thing, Popper pays attention to, is the straightforwardness and unambiguity of interpretation of the selection principle in Darwinism: singling out only one criterion of its realization – the survival.

Popper himself considered the method of error elimination and revealing and solving the problems to be the main method of realization of evolutionary movement in cognition and thought, and believed that this method should be applied to *every step of cognitive activity,* not only to the estimation of its final result – a ready theory. And in biology the natural selection (in fact the same method as trial-and-error method) is unambiguous and linear: genome variations – selection of the fittest. In other words, obvious variability of the growth (ontogeny) of biological entities and their behavior and, consequently, the plurality of selection criteria of the ontogeny and behavioral deviations from the genetically predestined standard in traditional Darwinism are ignored. The selection criterion is always the same: survival or non-survival. If we apply this biological scheme directly to epistemology, then the natural selection in scientific cognition should be narrowed down to variations of the original hypotheses and elimination of the ready theories and not by many specific criteria, but on the general grounds of acceptance or non-acceptance. The attention should be drawn to the fact that except the elementary cases of particular adaptation of the organism (like the coloration melting into background) there is no definite selection criteria in evolutionary biology – we can only speak about the selection of the fittest. And the particular cases of adaptation (like the coloration) are "solved" by the death of the entities, which does not meet to a definite selection criterion. Seeing the mismatch between Darwin's selection principle and his own ideas of evolutionary movement mechanism, Popper supposed that: "every organism and every species is faced constantly by the threat of extinction; but this threat takes the form of concrete problems

which it has to solve. Many of these concrete problems are not as such survival problems" (*Popper*, 2002: 207). Here and further in the cited article Popper primarily paid attention to the fact, that not the statement of selection itself has the scientific content, but pointing out selection criteria – the problems that are solved by selection.

Developing Popper's thought, it could be mentioned, that the natural selection is only a *method of variational search for an optimal course* to obtain a result, a way of solving the problem. For realization of this method it is necessary to fulfill two conditions: to have (1) a variation (a random search) of system's parameters and (2) the mechanism of testing of the obtained results against the *given optimization criteria* (or in Popper's terms – *the definitely extracted problem).*

In other words, the natural selection is first of all the selection by a *criterion.* Therefore, such notions as "criteria" and "the conditions of selection" should be the focal points of any theory based on the conception of selection, i.e. the "problems" itself and not the principles of their solving or methods of providing the original variability or the ways of fixing the obtained results should be the elements of the theory. The evolutionary movement should be described as a gradual interchange of the selection criteria. And it should connect these criteria into systems.

Any mention of obtaining a result with the help of selection – whether it concerns the adaptation to insignificant variations of the environmental parameters or the macroevolutional changes in the organism – first of all should be complemented with the indication of the selection criteria. In other words, if it is stated, that the system achieved a certain state with the help of some selection, the certain criteria of this selection should definitely be indicated. It is obvious, that this state is not predetermined by some random fluctuations of the elements of the system and it is not a consequence of variations, it is determined by some externally given conditions. That is to say, the realized state or some evolutionary phenomenon cannot be explained only by indicating the method or way of its achievement.

3. The Variational Method of Problem Solving

For further discussion of Karl Popper's evolutionary views it is necessary to make another addition concerning the nature of the selection method.

The selection is only a selection and nothing more. The selection does not have any varieties, because it is an elementary method of finding an optimal trajectory. Its content includes only a single-cut scheme: variation – the evaluation of the correspondence to the conditions of selection. And when we speak about different types of selection, we have in mind either different selection conditions and criteria (for example a propelling selection, a stabilizing selection etc.), or different objects of selection (an organism, a population, a species). In other words, the traditional phrase from the evolutionary biology texts: "many types of selection take part in the evolution of a system" in terms of standard language of scientific goal setting means that *the coordinated movement of system's elements or coordination of system's separate processes is implemented through the method of variational search providing that there are several selection criteria.* Such rephrasing definitely separates the *method* of solving from the *task* itself. When we state the problem like this we are to study not an "object", torn apart by the multi-directed driving forces, but the whole system, which is considered to be a variety of coordinated elements (processes). Moreover, it becomes clear that processes in the system are not one-level - they are subordinated to each other in a hierarchical way, i.e. some of them can set the selection criteria for the other ones. And the most important thing is that using this approach it is impossible to take refuge in phrases about "the supreme role of selection", its "driving creating force" etc., because it is clear, that the selection is only a method, the way the system functions and to describe its movement the selection conditions (criteria) should be indicated first of all, i.e. it is necessary to reveal the system's elements (processes) and the principles of their interaction.

In exact sciences (physics, math, etc.) the evolutionary calculations are only a computational method and do not have any theoretical meaning. Evolutionary (variational) computational methods

are of no more importance in theoretical investigations than the other ones. Only certain results, obtained with the help of some methods, i.e. the ideas and theories, but not the methods themselves, are scientifically comprehended.

4. The Attempt to Justify the Selection Theory

As it was mentioned, many years after he marked the selection principle as the unscientific one, Popper tried to redeem himself:

> The theory of natural selection may be so formulated that it is far from tautological. In this case it is not only testable, but it turns out to be not strictly universally true. There seem to be exceptions, as with so many biological theories; and considering the random character of the variations on which natural selection operates, the occurrence of exceptions is not surprising. Thus not all phenomena of evolution are explained by natural selection alone (*Popper*, 1978: 343).

However, it is noteworthy that Popper substitute the notions in this assertion: the problem of *tautology and unfalsifiability* of the natural selection theory is substituted by the issue of its *universalism and absoluteness.* It is clear, that even if it is possible to indicate some evolution phenomena, which are not connected to the natural selection in any way (by the way, Popper did not give any examples), it does not make the theory untautological and does not indicate the possibility of its falsification. The problem of the falsification of a theory should not be reduced to the indication of the phenomena, which are beyond its reach. The latter should not be confused with the phenomena, which are forbidden by this theory.

The theory, which can be falsified, should, first of all, have testable predictions: the predictions, which definitely follow from it and can be true or false, can correspond or can not correspond to the empiric data. So, the natural selection theory, as we indicated before, is not falsifiable for elementary reasons – it does not have any testable predictions. Or, to be more precise, the only testable prediction of the natural selection *theory* is the *empiric* fact of selection itself (which is tautological in essence).

However, Karl Popper suggested his version of verifiable consequence of the selection theory: "…gradualness is thus, from a logical point of view, the central prediction of the theory. (It seems to me that it is its only prediction.)" (*Popper*, 2002: 200). First of all, it is noteworthy, that the "graduality" cannot be considered as a consequence of the selection principle, because it is an attribute of the variational method of task solving itself. Although, we can of course present the graduality as a consequence of the theory: *if the movement of a system is implemented with the help of variational approximation method, this movement is gradual.* And this is a single rational conclusion, which follows from the theory – because neither the starting point, nor the direction of a system movement can follow from the method, the way of the movement implementation.

Let us analyze this single conclusion. The analysis shows, that it falsifies the selection theory – the irregularity and discretion of evolution is considered to be an admitted empiric fact. On one hand it is positive – we can conclude, that the natural selection theory is scientific (because it is falsifiable), but on the other hand we have to admit, that it is false, because its *single* prediction is empirically disproved. (Here it is noteworthy, that we speak about the theoretical principle, that pretend to be scientific and not about the empiric phenomenon of the natural selection, which cannot be disproved.)

Although, the problem of graduality is, of course, a problem of proportions: what seems a saltation to us, while we analyze periods of giga-years, may be a seamless transition in the time slot of life of a population. Nobody actually considers the natural selection a gradual one-dimensional process. A saltation can be described not as a speed-up of singular natural selection processes, but

as *a result of their correlation, coherence, coincidence of their directions in time*, which are randomly distributed in the course of the "seamless" evolution.

However, such approach is not a justification for the natural selection theory (which was falsified while analyzing its prediction on the graduality of evolution), but a development of another theory. And the main elements of this theory should be not the selection processes themselves (which are implemented with the help of variational approximation), but a total of their *criteria (goals)*. The analysis of the evolutionary occasions, which are only implemented with the help of selection, and, in actual fact are the conditions and criteria for the latter shall comprise the content of this theory. And this very evolutionary theory should show, why there are some concentration of evolutionary occasions, correlation of some different-level processes in certain moment of biosphere history and, as a consequence, complexly synchronized, localized in time and space evolutionary phenomena appear.

5. Evolutionism and Natural Selection

Before proceeding to the critical re-evaluation of the evolutionary epistemology as a whole and Karl Popper's interpretation of it in particular, I would like to make some remarks on so familiar to our ears (and minds) link of notions "evolution – natural selection".

It must be acknowledged, that a definite connection of the natural selection theory and evolution – *we speak about evolution and have in mind the natural selection, and when we speak about the natural selection, we have in mind evolution* – did a bad service to the evolutionism. Even creationists often do not criticize the empiric fact of gradual historical development of more and more complex biological entities (in actual fact the evolution itself), but they criticize Darwin's theory or, to be more accurate, the natural selection, its tautology and theoretical inadequacy. The creationists pursue a rather trivial strategy: they prove that natural selection and Darwinism are unscientific and then conclude that there is no evolution. And they did not actually elaborate this scheme – it was presented to them by the orthodox Darwinists, who identified evolution with natural selection.

Thanks to the orthodox evolutionary biologists the scheme "evolution – natural selection" started doing the rounds. For example, the evolutionary epistemology is called so not because it studies the evolution of scientific cognition (the evolution of cognition is a subject of any epistemology), but only because the selection principle is acknowledged in it as the mechanism and the source of this evolution. And the *evolutionary cybernetics* practically does not deal with any evolution – it only uses the variational and optimizing methods of calculation – i.e. the selection principle – for computer simulation of complex processes and solving the ill-formalizable tasks. It is fancy, that variational method of calculation is not called the *evolutionary* one in physics – in actual fact it is the same method of finding an optimal solution by varying the parameters.

Although it is noteworthy, that in evolutionary-cybernetic researches and, per se, in computer simulation of system adaptive movement, there are no phrases like "the genetic algorithm determines a certain state of programmed units population" or "the enumeration of possibilities in their behavior is the driving force and the reason of these states". The technologists (unlike the biologists) are aware of the fact that the simulated variation and selection is not more that an optimizing method of task solving and the solution is not a result of selection, but it is determined by the task itself , i.e. the initial conditions and the optimizing criteria. Although, perhaps, every time while loading the virtual population evolution program, the researchers' hope that something new and unusual will appear on the screen – something, that biologists call a result of creative activity of selection... But, alas, occurs only what must occur: the solution of an optimizing task and extraction of the most appropriate variants. And these researches undoubtedly have the scientific sense, but they correlate with evolution theory no more than aircraft dynamics correlates with navigation.

6. Evolutionary Epistemology or the Psychology of Creativity

> Traditional epistemology has studied knowledge or thought in a subjective sense – in the sense of the ordinary usage of the words "I know" or "I am thinking." This, I assert, has led students of epistemology into irrelevances: while intending to study scientific knowledge, they studied in fact something which is of no relevance to scientific knowledge. For *scientific knowledge* simply is not knowledge in the sense of the ordinary usage of the words "I know". While knowledge in the sense of "I know" belongs to what I call the "second world", the world of *subjects*, scientific knowledge belongs to the third world, to the world of objective theories, objective problems, and objective arguments... (*Popper*, 1972: 108).

It is strange to hear such arguments against traditional epistemology from Karl Popper – one of the founders of the most subjective variant of epistemology – the evolutionary one.

The focal point of the evolutionary epistemology is a trivial thesis that in science theories come and go under the influence of criticism and self-criticism. Popper said that:

> The evolution of scientific knowledge is, in the main, the evolution of better and better theories. This is, again, a Darwinian process. The theories become better adapted through natural selection: they give us better and better information about reality (*Popper*, 1984: 239**)**.

But he did not even mention the analysis of the evolutionary cognition as a historical progression of the intellectual innovations, the scientific ideas, which are both the driving force of formation and the selection criterion for hypotheses and theories. The evolutionary epistemology is not interested why certain scientific cognition problems appeared in a certain historic period, the main fact is, how the current scientific activity is adapted to them.

In actual fact, the evolutionary epistemology grows out of epistemology, because it focuses its attention on the method of searching for a scientific solution, on its psychological support (human curiosity, thirst for knowledge, educability, variability of thinking and behavior). Almost all problems, which are discussed in evolutionary epistemology, are the problems of psychology of creativity and scientific community sociology. And the focal point of it is not a relation of a scientific knowledge to its subject and not a rational correlation of scientific theories (different sets of knowledge), but the forms of an individual construction of knowledge and methods of its collective rating. And only the abstract method of trial-and-error without a relation to a specific content of knowledge is considered. In other words, the essence and the interconnection of evolutionary phenomena – the innovative ideas, the progression of which implements the gradual development of knowledge – are not even discussed. It is acknowledged, that to prove the evolution of scientific cognition is enough to refer to natural human curiosity, which originates from adaptive activity of animals and which makes a person to write and rewrite some texts a hundred times, and to scientific controversies, which may originate from rams butting heads on a mountain path.

However, it must be admitted, that the above-mentioned arguments are mostly of terminological character. "Evolutionism" of evolutionary epistemology depends on what we understand under the term of evolution – either it is an individual cognitive movement in a certain period of time from the germ of an idea till the completion of a theory or historical development of knowledge as a social phenomenon? However, apart from the terminological answer, there must be a solution to both problems: a careful examination of evolution of particular knowledge or theory cannot explain the nature and objective laws of scientific evolution as an integral system.

In fact, all these special aspects of the evolutionary epistemology completely correspond with their biological prototype – Darwin's theory, whose object of study in not the evolutionary phenomena (system innovations) themselves or their progression, or the objective law of their time-

and-space distribution, but the mechanism of their local realization. And not the realization of significant evolutionary events, but small adaptations to the specific aspects of an environment. And what about the evolution of the biological system as a whole? It happens somehow gradually, maybe... If a small adaptation trait can appear as a result of a selection, then the significant changes in a system will occasionally appear someday. The most important thing that it is not forbidden by the selection theory.

The *evolutionary biology* deals with the biochemical support of variability rather than the historic movement of the biological system, so, in fact it is only a theory of populations' adaptation to singular environmental changes. And like this the *evolutionary epistemology* is interested not in the content of evolving knowledge, but in psychophysiology of its formation with the help of enumerative technique and the competitive sociology of its entities (theories) in the scientific community, i.e. the psycho-social environment, which locally provides the scientific process.

It is noteworthy, that Thomas Kuhn's shows no interest to evolution of meaningful knowledge, evolution of ideal, but it is more entitled to the name “evolutionary” than the evolutionary epistemology itself. The conception of historical alternation of “normal” and revolutionary periods of science development reflects the real evolution of scientific knowledge. Kuhn's researches we can compare with systemic evaluation of paleontological investigations in biology: to formal descriptions of biosphere history structures and the objective laws of their interchange. However, paleontology provides only empiric evidence of biological evolution, so Tomas Kuhn's epistemology indicates only the structural characteristics of the scientific knowledge history.

But we have digressed from the main topic – Karl Popper's evolutionism and his evolutionary epistemology.

7. What is the Difference between Einstein and the Amoeba?

The essence of Popper's evolutionary epistemology is most vividly shown while comparing Einstein's and amoeba's cognitive activity (the favorite Popper's example).

> One may say, from the amoeba to Einstein there is only one step. Both work with the method of tentative trials (TT, and of error elimination EE). Where is the difference? The main difference between the amoeba and Einstein is not in the power of producing TT, tentative theories, but in EE, in the way of error elimination. The amoeba is not aware of the process of EE. The main errors of the amoeba are eliminated by eliminating the amoeba: this is just natural selection. As opposed to the amoeba, Einstein was aware of the need for EE: he criticized and tested his theories severely (*Popper*, 1972: 246).

In this discourse on the methods of cognition the epistemological subject itself – i.e. the scientific knowledge – is missed. Undoubtedly, the most essential point of cognitive activity evolution (which is understood in its widest sense from the amoeba to Einstein) and, per se, of the evolution in whole is a progress in *methods of achieving a result,* in problem solving methods (by Popper), i.e. in *the perfection of the selection principle implementation.* And in the very revealing of this progress there is Karl Popper's merit. Unlike the traditional biological approach to selection, which is interpreted as a single-step act of the complete elimination of inviable deviations, Popper proved the evolution of the selection principle itself: from the simplest biological scheme of amoebas to variativity and selection in behavior of higher animals (see his version of biological evolutionary theory below) and to conscious criticism and elimination errors in a theory, but not of the entity which has made them, implemented by scientists (such as Einstein).

But in spite of the mentioned step forward in understanding the selection principle (the method of trial-and error), the example of comparison the amoeba's and Einstein's cognitive activity

shows us, that evolutionary epistemology in its Popper's version should be related to the evolutionary methodology of knowledge. (And it is a great achievement, because in other its versions the selection methods are taken from biology without any correction or refinement). It must be acknowledged, that the epistemological essence of difference between the *cognition* of amoeba and scientist is not as much in a method, in conscious or unconscious selection, but in the result – in a new knowledge, in intellectual innovations. From the epistemological point of view, which, as Popper said, should be considered as "the theory of knowledge, especially of scientific knowledge" (*Popper*, 1972: 245) Einstein is different from the amoeba, as well as from the great majority of Homo Sapiens, because he took part in generation of the new knowledge. And here we can repeat the thought, that any epistemology should differ from psychology and scientific cognition methodology above all by its subject, should reveal the objective laws of formation of new scientific knowledge from the previous one and prove the necessity of scientific knowledge evolution and not the peculiarities of a personal or collective provision of this process.

So, let us sum up: Einstein differs from the amoeba at the level of epistemological (not bio-psychological) research, because the biological entity has nothing to do with the scientific knowledge in any way, it does not produce or fix anything outside itself. The connection between a scientist and an amoeba can be seen only at the level of elementary methodology of solving the variational tasks, if there is an understanding of the essential difference between the selection criteria: in the first case the main criterion is an adequate reaction to external forces (if we speak about a separate organism) or the best possible adaptation of population to an environment, and in the second case there is a correspondence of hypotheses to a scientific idea, when we speak about an individual cognition, or the correspondence of the theory to this or that criteria of a scientific paradigm.

8. Epistemology and Adaptation

> But, roughly speaking, almost all forms of knowledge of an organism, from the unicellular amoeba to Albert Einstein, serve the organism to adapt itself to its actual tasks, or to tasks that may turn up in the future (*Popper*, 1999: 64).

This thesis one more time confirms the conclusion, that Popper with his evolutionary epistemology did not solve the main task, which he set to himself even not within the scope of epistemology (the scientific cognition theory), but within cognitive methodology and psychology, within the evolutionary cognitive theory. The idea that animals (both populations and individual highly organized life forms) have cognitive ability is rather trivial. The disputable question is whether we should call the result of such activity (the result of adaptation) knowledge. The main task of any theory, which studies the *cognitive* evolution, is, first of all, to show the very *evolution,* to indicate the principle differences between the cognitive acts at different stages of evolution and not to state the permanence of mechanism and essence of cognition in the entire course of evolution. But Popper in his conclusion showed the opposite solution of such seemingly simple problem – he reduces the scientific cognition to the adaptive adjustments of cytozoon. Although, it is so clear, that Einstein's knowledge (the knowledge not of a simple man, but a genius, who developed a new theory) in no way does not "serve his organism for adaptation". Even if it is possible from any point of view to consider the scientific cognition as an adaptation, we should not do it in relation to concrete person, who produced them, and, of course, in relation to other people, but only in relation to society as a whole (and it concerns only applied, but not fundamental science).

So, Popper's evolutionary theory "links knowledge, and with it ourselves, with the cosmos; and so the problem of knowledge becomes a problem of cosmology" (*Popper*, 1990: 39) instead of showing the significant difference between the scientific (social) knowledge and elementary biological (genetic) one and revealing the mechanism of their transition from one to another.

Popper duplicated the approach of the traditional biological evolutionary theory, using such methodology. The modern synthetic evolutionary theory even does not try to show the need and the regularity of principal differences between evolutionary phenomena (organisms, which have different level of complexity) and to find the differences in these phenomena implementation mechanisms or reveal the evolution of such mechanisms. Instead of this really evolutionary task, the opposite one is being solved – to show that each and every evolutionary phenomenon should be reduced to the elementary (that is not primitive, but original) biochemical reactions and the method should be narrowed down to a one-dimensional survival selection.

The arguments against Popper's epistemology, which concern the impossibility of substantiating the fact of a scientific progress or such short term of its realization (*Resher*, 2000: 213–214) – are the traditional arguments against any theory, based only on a selection principle (enumerative technique or trial-and-error method). But to argue about it is senseless both within the evolutionary epistemology and biological selection theory. And Karl Popper himself indicated the reason of such pointlessness – the selection principle itself as a scientific conception is tautological and unfalsifiable.

So, we could criticize Popper's evolutionary epistemology only because it is not an epistemology, not a *scientific cognition theory,* as he said. On one hand it does not study the substantial side of the scientific cognition, its evolution, evolution of its forms and interaction of its elements, and on the other hand all Popper's conclusions, concerning psychology and methodology of formation of knowledge relate not only to any form of *human* cognition (including the unscientific ones), but they extend to the cognitive activity of biological organisms, i.e. they do not concern the peculiarities of the *scientific cognition.* (For justice' sake it should be mentioned, that Popper himself was inclined to relate his research with the "evolutionary theory of knowledge", not with epistemology (*Popper*, 2000: 194), which really corresponds its subject).

9. Karl Popper's Third World and Cognitive Evolution

The strangest thing is, that when Popper reduces his epistemology to elementary individual and collective forms of selection, to the trial-and error method, it does not correlate with his revolutionary ideas of the third world objectiveness – an independent world, inhabitants of which "are, more especially, theoretical systems " (*Popper*, 1983: 439) . While speaking out against the subjective epistemology, and for the objectiveness of knowledge and stating, that "epistemology should be engaged in studying the scientific problems, problem situations and scientific predictions", and that "the study of a *largely autonomous* third world of objective knowledge is of decisive importance for epistemology" (*Popper*, 1972: 111), he forgot about all these things in his evolutionary epistemology and spoke about nothing, but a role of a subject in cognitive process.

The matter is, that after conceiving Popper's conception of the third world, we should focus our attention on the objective interdependence of the scientific knowledge elements and not on the process of knowledge origin, i.e. not on the particular ways and methods of its generation. And only after it we should conduct the analysis of the way of its generation in the secondary subjective world, basing on objective and independent evolutionary laws of scientific ideas and theories. But Karl Popper seems to forgot his thesis:

> An objectivist epistemology which studies the third world can help to throw an immense amount of light upon the second world of subjective consciousness, especially upon the subjective thought processes of scientists; but *the converse is not true* (*Popper*, 1972: 112),

and did "the opposite" in his evolutionary epistemology – tried to substantiate the evolution of scientific cognition, basing at its subjects' actions.

And just by referring to the conception of the third world, we can find out the *epistemological* difference of the amoeba's and Einstein's cognitive activity. Popper came close to solving of the problem and stated, that the third world "has a strong feed-back effect upon us; that is to say, upon us qua inmates of the second and even of the first world" (*Popper*, 1972: 112), but he did not directly connect this effect with the element of his cognitive scheme – error elimination (EE). Yes, there is a difference between the error elimination by elimination of the subject itself and the critical analysis, but it is a formal difference, which relates the way of the movement implementation, not to its nature, i.e. it does not relate to epistemology as a *scientific* cognition theory. And it is clear, that the most important thing in error elimination is not the form of its implementation, but the *criterion*, according to which it is implemented. For Einstein this criterion is formed under the influence of Popper's world of objective knowledge and manifested as an *idea,* which precedes the selection act. And not only the amoeba, but also the majority of people, which are not engaged in science can not have the criterion of elimination of an incorrect hypothesis. The amoeba has its *own* world of objective "knowledge" – evaluation indicator of behavioral acts ("hypotheses").

Actually, such development of Karl Popper's ideas really give us the key to building a subjectless epistemology – all acts of individual and collective "error elimination" are presented not as basic driving force of science, but as local implementation and objectification of ideas as the selection criteria. Here we should definitely distinguish on one hand (1) the objective existence of ideas and knowledge, and on the other – (2) the knowledge generation process, implemented by way of selection of hypotheses and theories, according to the objective criteria, formulated in the third world. Or, if to express the same in Karl Popper's words:

> We should constantly be aware of the distinction between problems connected with our personal contributions to the production of scientific knowledge on the one hand, and problems connected with the structure of the various products, such as scientific theories or scientific arguments, on the other (*Popper*, 1972: 114).

It is clear, that from such point of view on cognitive evolution, the selection procedure itself has only supportive meaning, being not more than a form of objective ideas movement implementation. Man (a scientist) fulfills a double function in this scheme of scientific cognition: on one hand he is generator of ideas and detector, which filters them basing on some transcendental idea or criterion, and on the other hand – integrator of world of objective knowledge, who extracts ideas and criteria from it in process of learning and studying a problem.

> …New problems, – as Popper wrote – arise from our own creative activity; and these new problems are not in general intentionally created by us, they emerge autonomously from the new relationships which we cannot help bringing into existence with every action, however little we intend to do so (*Popper*, 1979: 119).

If we paraphrase these general conclusions on Popper's ideas in biological terms, we can say, that the evolutionary theory of biological phenomena can and should be presented as a theory of a gradual interchange of selection criteria, in which the organisms and populations are the cognitive, integrative and realizing subjects. And the natural selection and the forms of its implementation (genetic, ontogenetic and behavioral mechanisms) should join the theory as the variable methods of evolutionary movement implementation. "A random movement is accepted when it fits into the higher level structure, – as Popper wrote– otherwise it is rejected" (*Popper*, 1977: 147).

10. Karl Popper's Evolutionary Theory

As it was already mentioned, Karl Popper's evolutionary approach (both in cognitive theory and in biology) suggests a lot of selection criteria, that is *problems* that should be solved – and, the most important is the multilevelness and hierarchicalness of these problems, and, consequently, of their solutions. Popper stated that solving the more long-term problems (of high generality) not only precede the particular solutions, but does not recede to them (*Popper*, 2000: 208). The traditional biological evolutionary theory is based on a strict succession of adaptations and, therefore, presents the significant systemic changes in organism as a result of succession of small adjustments and narrows all selection criteria down to survival.

Popper tried to take Darwinian conception away from an endless circle of tautology, tried to break a self-referent chain: in the course of natural selection survives the most adapted, and the most adapted is that which survives in the course of natural selection. He included into this chain a lot of selection criteria, which he called the problems solved by the trial-and error method.

> In our system, not all problems are survival problems: there are many very specific problems and sub-problems... Our schema allows for the development of error-eliminating controls... that is, controls which can eliminate errors without killing the organism; and it makes it possible, ultimately, for our hypotheses to die in our stead (*Popper*, 1979: 244).

But, unfortunately, Karl Popper did not go further than stating the diversity and hierarchy of the selection aims (problems and their solutions). Although he made a step forward in biological evolutionary theory, by suggesting his version in his article "Darwinism as a metaphysical research programme".

Karl Popper based his "suggestions for an enrichment of Darwinism which might explain onto-genesis" (*Popper*, 2002: 201) on two points: (1) the statement, that the directional movement of biological evolution cannot be explained on the basis of single-level selection scheme, single selection criterion and solving of one only problem – the survival; and (2) the conclusion, that the total of selection criteria (problems) makes the hierarchy and solution of the highest (behavioral) level problems can directly influence the selection criteria at the lowest anatomical level, directing and fastening its evolution.

Popper suggested to distinguish

> external or environmental selection pressure from internal selection pressure. Internal selection pressure comes from the organism itself and, I conjecture, ultimately from its *preferences* (or "aims") though these may of course change in response to external changes (*Popper*, 2002: 201).

At first glance the scheme of his evolutionary concept is rather simple: (1) changes in behavior ("preferences") of organisms (in the course of generations), caused by changes in external conditions, which are implemented without any changes in a genome; (2) can promote the selection of the organisms, which have "skills", supporting these behavioral changes, and, as a final result (3) lead to genetic fixation of anatomic traits, meeting the requirements of new "preferences" which act as new selection criteria, as new problems at an anatomic level.

Actually, Popper stated, that the cognitive behavioral activity, which is implemented without any changes in a genome, can set the selection criteria for morphology modifications and determine the direction of selection.

> …Every behavioral innovation by the individual organism changes the relation between that organism and its environment: it amounts to the adoption of or even to

> the creation by the organism of a new ecological niche. Thus the organism, by its actions and preferences, partly *selects the selection pressures* which will act upon it and its descendants. Thus it may actively influence the course which evolution will adopt. The adoption of a new way of acting, or of a new expectation (or "theory"), is like breaking a new evolutionary path (*Popper*, 2002: 210).

Popper explained his "prediction about such internal selection principle" in a form of a diagram: p > s > a ("the preference structure and its variations control the selection of the skill structure and its variations; and this in turn controls the selection of the purely anatomical structure and its variations" (*Popper*, 2002: 203)).

But neither philosophers, nor biologists accepted this conception of a multi-level hierarchic selection. Biologists acted like that for quite objective reason: it was based on a genetically false prediction, that there are some genes, which are separately responsible for "preferences" (p), "skills"(s) and autonomy (a).

However, it is easy to bring the conception of the multi-level selection and the interdependence of its criteria (the solved problems in Popper's terms) to correspondence with the modern biological data. We should only consider a trivial thesis, that *every level of selection – for example, behavioral, organismic (ontogenetic) and cellular (genetic) – has the particular mechanisms of providing the selection: the particular variable parameters and forms of fixation of the result.* Behavioral variations appear in several generations with the help of training and imitation. The morphology of an organism can vary within acceptable variants of ontogeny and appear in generation through the influence of maternal organism on embryo (see the epigenetic evolutionary theory (*Shishkin*, 1998)) – and the ontogenetic selection goes without any changes in genome as well as on a behavioral level. And the selection based on a standard genetic mechanism occurs only at cellular level – or, more specifically, at cellular reproductive line. In fact, Popper's conception narrows down to stating the existence f several relatively independent selection levels, *every higher one of which can be considered as an external environment for the lower one:* ontogeny adapts to the behavioral environment and the cellular reproductive line adapts to the ontogenetic changes. It is natural, that the adaptation of every lower level goes in direction of providing the best possible support and providing the reproduction of a higher level phenomenon, which, as a final result, should gradually lead to genetic fixation of behavioral phenomena. (To learn more about the conception of level selection see (*Boldachev*, 2007: 138–150)).

Philosophically generalizing the expounded conception of level selection in Karl Popper's terms, it can be concluded, that the problems, created by biological organism by its behavioral activity are a far more significant and strong selection criterion for the ontogenetic ways, and, consequently, the genetic selection than an abstract environment. And to explain the trend of evolution is possible only considering a hierarchy of interrelated problems.

But let us give word to Popper himself:

> Thus men like Butler and Bergson, though I suppose utterly wrong in their theories, were right in their intuition. Vital force ("cunning") does, of course, exist – but it is in its turn a product of life, of *selection*, rather than anything like the "essence" of life. It is indeed the preferences *which lead the way*. Yet the way is not Lamarckian but Darwinian (*Popper*, 2002: 209).

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DE GRUYTER OPEN

studia humana
QUARTERLY JOURNAL

Studia Humana
Volume 3:3 (2014), pp. 43—46
DOI: 10.2478/sh-2014-0013

Do Judaic Political Views Belong either to Leftists or Rightists?

Furio Biagini, Professor of Judaism History at the University of Salento, studies the history of the Jewish labor movement and the Jewish emigration to America as well as links between Judaism and anarchism and the Jewish opposition to Zionism, such as the group of ultra-Orthodox Jews, Neturei Karta. He has published many books on these subjects: *"Il Risveglio": storia di un giornale anarchico ginevrino dall'attentato di Breci all'avvento del fascismo, 1900-1922* (1991); *Nati altrove: il movimento anarchico ebraico tra Mosca e New York* (1998); *Mussolini e il sionismo* (1998); *Il ballo proibito: storie di ebrei e di tango* (2004); *Torà e libertà* (2008).

Andrew Schumann: In the beginning of 20th century, the Jewish traditionalism became so sensitive to the left-wing political views from anarchism to socialism. For example, many Rabbis became Jewish ideologists of anarchism. Many others were human rights advocates. Until the middle of 20th century, the left-wing ideology was not a rare phenomenon among Rabbis. We can remember Rabbi Abraham Joshua Herschel who participated in the Selma Civil Rights March with Dr. Martin Luther King. How is it possible to explain such a strong influence of the left political views on the Judaic communities of that time?

Furio Biagini: Judaism is usually associated with capitalism, but within it there are the faintest glimmerings of modern socialism. Socialism is an ideology of the nineteenth century that is deeply rooted in the human longing for justice on earth. Prophets and Socialists share common social goals. At the bases of all the commandments in the Law of Moses there is the denial of the concept of property. "For the land is mine, but you stranger and resident with me". The man is a guest in the world of Ha-Shem and the property is given to him only as a pledge. There are many other social ideas in Judaism. Jews are obligated to provide for all the poor people in the community, support the widow, protect orphans. Also, the land division in Israel among the tribes was according to population. Besides, the laws concerning the Kohanim and Levites have a social foundation. Lastly, we can not forget the voice of the prophets against the political power and their hope for a better

world. As wrote Moses Hess in 1862: “The Jewish spirit is a social-democratic spirit down to its very essence”. Of course, Judaism and Socialism are different, but certainly among them there are many elective affinities. For this reason, many Jews believed that Socialism was a part of their background.

An high percentage of Jews in the Socialist movement, was revolutionary or reformist, it is an undeniable historical phenomenon, at least until the middle of the last century. Even in past centuries groups of Jews fought for freedom and social justice, or for establishing forms of utopia. Socialism was seen as the modern, secular version of messianism and of the promise of a better future advocated by the prophets.

Other factors come into play in recent times. On the wake of the French Revolution the world offered to the Jews freedom and equality, even if not exactly fraternity, opening opportunities that until that moment were only a dream. The Jews took full advantage, but at the cost of a radical change in their way of living and feeling Judaism. The cosmopolitan message, the vision of a fairer society attracted the members of a minority anxious to free themselves from the status of “pariah”, to use a term of Hannah Arendt. The betrayal of the expectations, the manifestations of modern anti-semitism, combined with the emergence of the figure of a new Jew secularly educated, strengthened the utopian aspirations for a new world of freedom and justice and certainly explain the presence of many Jews in the ranks of revolutionary movements. In Germany the Jews became the pioneers of the Socialist movement. We remember: Moses Hess, Karl Marx and Ferdinand Lassalle, who son of a merchant Jew founded in 1863 the “Allgemeinen Deutschen Arbeitervereins”, predecessor of the modern Sozialdemokratischen Partei Deutschlands. Even in Russia, the Socialist movement emerged when Jewish workers founded in Vilnius, on October 7, 1897, the “General Jewish Labour Bund in Russia and Poland”. The name was inspired by workers’ party in Germany and the organization sought to unite all Jewish workers in the Russian empire into a united Socialist party, and also to ally itself with the wider Russian socialdemocratic movement to achieve a democratic and Socialist Russia. At the turn of the 19th century there were numerous Jews among the leadership of all major revolutionary movements: Rosa Luxemburg, Otto Bauer, Eduard Bernstein, Rudolf Hilferding, Karl Radek, Anna Kuliscioff, Gustav Landauer, and so on. We cannot also forget that the Socialist utopia was also present in the Zionist movement. I think about Ber Borochov, one of the founders of the Labor Zionism and the Kibbutz, a concrete and lasting expression of the utopian communitarianism.

Andrew Schumann: Recently, the right-wing political views have dominated in the Judaic communities. What is a reason for such dramatic changes? After all, the radical right-wing views are popular among some Orthodox Jews now. Let us recall the social activity of Rabbi Ovadia Yosef and his sometime scandalous political statements. Why is there no voice of leftist Rabbis now?

Furio Biagini: The Shoah and the Stalinist persecutions deleted from Europe the Jewish proletariat. Survived only the bourgeois élite integrated into the establishment, and as such oriented on conservative positions. It is the end of a happy anomaly, as Enzo Traverso argues in his book *La fin de la modernité juive: histoire d'un tournant conservateur* (Paris: La découverte, 2013). Today, the main representatives of Jewish thought, for the most part, are linked organically to the liberal conservative culture, for example Raymond Aron, Leo Strauss, Saul Bellow and Elie Wiesel. As Enzo Traverso says, this change is represented by two protagonists in the history of the ‘900: Lev Trockij, emblem of internationalism, and Henry Kissinger, German Jew naturalized American citizen, symbol of American imperialism. Of course, these two souls, the revolutionary and the conservative, always have been part of the Jewish political culture (This is true for every culture). Disraeli was a contemporary of Marx, as Kissinger of Chomsky. But, in the past, the Jews were the

forerunners of modern globalization, in spite of their wishes, and their cosmopolitism was the natural enemy of nationalism. From Spanish and Portuguese marranos to the forced pariah status described by Hannah Arendt, Jews have been alternatives to the system. Even those who were far from the religious traditions, non-Jewish Jews, to paraphrase Isaac Deutscher's well-know term, were the enthusiastic bearers of the greatest Jewish heritage, the messianic hope, even if this hope was only literary or political.

This world has disappeared with the distruction of the Jewish presence in Europe, the mass emigration to the United States and the birth of Israel (the establishment of a Jewish State, which was a forced choice or, in some way, necessarily determined as a result of growing anti-semitism). Of course, it was not an automatic change and a critical wing is still alive, wing that often clashes with Zionism. However, it is a minority view. Today, the Jewish messianism takes Israel as providential event of redemption, especially after the Six-Day War in 1967. So, was born a civil religion that believes Israel the sole legitimate representative of the Jewish people and of the victims of the Shoah. For this reason, for the first time in history, Jews and European right are no longer incompatible (the European right who wants to mend the guilts of his anti-semitism), since the barrier of anti-semitism has fallen: a link often reinforced by a islamophobic common feeling.

Andrew Schumann: Relationships between the Judaic and Islamic worlds have been worse and more stressful. What or who can contribute to normalisation of their relationships? How far can the Islamic traditionalism be compatible with the Jewish traditionalism? Is it possible to expect any political or cultural dialogue between Iran and Israel?

Furio Biagini: Judaism and Islam have a lot in common; but are opposed to Christianity which is the product of an interaction between Greek and Hebrew culture; for Judaism and Islam Christianity is an impure form of monotheism because of the concepts of incarnatiom, Trinity, adoration of Saints and the use of effigies. Judaism and Islam have a Book, *Torah* and *Koran*, and also oral tradition from wich derives a law (*halacha* and *sharia*). The study of this law is also considered a value in both religious traditions and their legal, mystical and philosophical systems have significantly interacted over the centuries and learned from each other. Both Judaism and Islam are essential “anarchist theocracies” because the only entity with which they relate themselves in a way of obedience is God; besides, they do not have clergy and religious authority: it is essentially a function of individual mastery of the religious sources the ability guide the community in accordante with their teachings. The Judaism saw Islam as a pure form of ethical monotheism.

In addition, these traditions see their role as applying to all spheres of life, which means that inevitably they are political to a greater or lesser extent. Then it is not at all surprising that when meetings of Rabbis and Imams are arranged, they find they have much in common. Historically the Jews were certainly better off under the Muslim rule than under the Christian rule. In the Muslim world the Jews were free to practice their religion without interference and the Jewish communities were generally protected but, of course, as long as they accepted their second class status codified in the Pact of ‘Umar, lived peacefully and cooperatively with their Muslim neighbors. The collapse of Ottoman Empire and the rise of modern nationalism led to the clash between the Jewish nationalist aspiration for self-determination in the ancestral homeland of the Jewish people and the struggle for national self-determination on the part of the regional and local Arab populations. This territorial conflict that seems to assume the character of a religious conflict is a fight between two nationalisms claiming ownership of the same land.

Furthermore, there are other deeper links. Judaism and Islam both exist outside the mainstream Western intellectual discourse which lies at the heart of liberal democracy and the modern nation state. This has a number of profound implications. Both religious traditions have to confront the

conflicts between their world views and modern democracy. Additionally, in countries where Jews and Muslims are in a minority, they face prejudice based on common misunderstandings which means that anti-Semitism and Islamophobia are in fact two sides of the same coin.

The way to confront these misunderstandings is to learn more about each other's religious traditions. I think that a worthwhile dialogue requires focus on text study and social responsibility projects. There are, of course, many examples in Europe and Israel where Jews and Muslims co-operate and work together: school, medical institutions, university course, religious institutions.

In this framework are include the relationships between Israel and Iran. Jewish and Iranian people have lived in peace over millennia. For hundreds of years Iran has consisted of multi-ethnic and multi-religious groups living side by side. The country has the second largest Jewish community in the Middle East outside Israel and the Iranian Jews have their own representative in the Iranian Parliament (Majlis) and arguably face less discrimination than religious minorities elsewhere in the region. Iran wants to be recognized as a regional power that cannot be excluded from the geopolitical games of the region. Briefly, Iran claims a role in the political, economic and military fields. An understanding between Israel and Iran would help the cause of peace regionally and globally and also serve the interests of the two nations. An Israeli-Iran dialogue makes sense sooner rather than later.

Andrew Schumann: The heyday of the Jewish culture took place in the period between two world wars. Yiddish was a language of this culture mainly. We can refer to some masterpieces of Judaic cinema, such as the *Dybbuk or Between Two Worlds* directed by Michał Waszyński in 1937 in Poland, which have so organically put the Judaic culture into the modern forms of art. Now the Orthodox and Chassidic Judaic communities are conservative enough and are badly put into the recent world trends of culture. They are rather encapsulated. What or who can contribute to the recent heyday of the Judaic culture? Where are those forms of art, science within which it can be put into the modern trends?

Furio Biagini: The nineteenth century, in fact, saw the abandonment of Jewish orthodoxy by a large sections of European bourgeois society. It was the period in which the presence of a Jewish intellectualism, first in Europe and then in the United States, reached its maximum relief. In the development of contemporary Jewish thought these were the most diverse tendencies, increased especially during the years of Nazi persecution; while the establishment of the State of Israel in 1948 constituted an event of capital importance in the history of international Jewry, whether under the religious profile or cultural profile. In fact, the concepts of identity as "people" and "homeland", in some ways absents in past centuries, have now assumed a prominent position in the social and religious context. The consequences of these circumstances, whether ethical or historical-philosophical, are still to understand and evaluate at all. Maybe the actual culture of the State of Israel, combined with the Jewish american culture, can contribute to the recent heyday of the Judaic culture. The culture (art, science, etc.) that now is elaborated in the life of the Israeli society and the Jewish community on the United States represents the major contribution to the general evolution of the Judaic culture. Today more than yesterday, Jerusalem and New York are the principal focus of the development of Jewish culture.