Working Paper

Vol 7 no 2 year 2015

Social Complexity: Operational definition

Bojan RADEJ

Ver. 2, July 2015

Ljubljana, July2015, Ver. 2
Slovenian Evaluation Society
Tabor 7, Ljubljana, Slovenia
info@sdeval.si, http://www.sdeval.si

Acknowledgment: I am deeply indebted and sincerely grateful to Slavica Miletić (Belgrade, Serbia) and Louise Zamparutti (Wisconsin, USA) for their devoted but tiresome language editing of this text.

Proposal for citation: Radej B. Social Complexity: Operational definition. Ljubljana: Slovenian Evaluation Society, Working paper, vol. 7, no. 2 (ver. 2, July 2015), 65 pp., http://www.sdeval.si/Studijska-knjiznica/Social-Complexity.html

About the Author: Bojan Radej is a methodologist in social research, publicist, innovator, and volunteer. Master degree in macroeconomics, University of Ljubljana -Faculty of Economics (1993). Professional Experience Record: Governmental Institute of Macroeconomic Analysis and Development (1987-04; under-secretary to the government), areas of work: sustainable development (1998-04), chief manager of the modelling department (1993-5); initiator and the first editor of Slovenian Economic Mirror (1995-8); Co-Editor of IB journal (2001-04). Founder and chairman of Slovenian Evaluation Society. Cofounder and administrator of Western Balkan Evaluation Network. CurriculumVitae: https://sdeval.academia.edu/BojanRadej/CurriculumVitae

*** This is the introductory chapter to my forthcoming book ‘Complex society in its golden middle’ ***

CIP - Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

316.4(0.034.2)

RADEJ, Bojan
Social complexity [Elektronski vir] : operational definition / Bojan Radej. - Ver. 2. - El. knjiga. - Ljubljana : Slovenian Evaluation Society, 2015. - (Working paper SDE ; vol. 7, no. 2)

Način dostopa (URL): http://www.sdeval.si/Studijska-knjiznica/Social-Complexity.html

ISBN 978-961-93348-7-4 (html)
280292864

Table of contents

Social Complexity: Operational definition

Bojan Radej

Abstract: Profound transformation is underway from postmodern to complex societies since the 1990's. It carries negative connotation that society became too complicated to comprehend. Efforts of mainstream science to decomplexify the view of social reality using methodological simplifications result in further complication. We insist that complex reality must be comprehended in a complex way. We begin by comparing alternative frames for studying complex phenomena: simple, systemic, chaotic and evolutionary. Comparison provides elements needed to outline complex methodology of research. It is founded on the incommensurability of social concerns. These can be comprehended from a meso level in marginal overlaps between evaluation domains of their vertical and horizontal meaning axis. Evaluation applies hybrid analytical categories with bi-modal content which are embedded in their polarities. Methodology is tested with three case studies, resolving problems of aggregation, integration, and organisation, to illustrate its holistic potentials, develop it further and discuss implications for ordering social relations.

Key words: Social complexity, Incommensurability of values, Mesoscopic thinking, Hybrid categories, Triadic logic

Complexity as a threat

Profound transformation is underway from postmodern to complex societies since the 1990's (Wallerstein, 1996). Societies have found themselves locked in a hybrid condition that is a characteristic mode of existence for systems in the process of transformation into an entirely different macroscopic state. On the local scale society is becoming increasingly cosmopolitan, while the global scale has become an approximation of the village (Mazrui et al., 1999). The deep changes are driven by contradictory forces typically interacting in 'irrational' ways. Modernity imposes uniformity on societies, since interdependence between causes of collective action is globally immensely enhanced. This is enforcing strong vertical dependence between micro and macro processes. Postmodernity is instead driven by chaotic impulses on micro level, denying validity of any 'grand narrative' (Lyotard, 1984), such as progress, emancipation, equality, that had formed a backbone of modernity.[1] People individually instead progressively aspire for autonomy from systemic concerns of the modern state to the extent that they organise their lives independently around their own communal concerns and mainly in horizontally oriented connections.

In divergent conditions, making statements about collective challenges like those arising from gender inequality, unsustainable development or social disintegration, brings about incommensurable situations and these tend to trigger tragedies (Hsieh, 2008): no matter which collective aspect is emphasised, it always imposes involuntary and illegitimate trade-offs that are increasingly disruptive for social stability. As social complexity grows, both the sources and severity of possible disruptions increase, diminishing the size required for potential

[1] Wikipedia; #Metanarrative, January 2014.

triggering events (Zolli, 2012) that could deflect whole societies from ordered to chaotic behaviour. Increased volatility leads to strategic uncertainty about appropriate response making societies more susceptible to large, deleterious events (Page, 2010). There is a widespread impression of over accumulated system tensions in contemporary societies that invariably lead to social disintegration (Abrahamson, 2003).

In the wake of social transformative challenge our understanding of its mechanisms and ways to effectively interfere with them remains largely underdeveloped. Societies are decreasingly comprehensible and manageable in a standard way. Caught in transition between two ages and two modes of reasoning, a whole generation loses all power to understand itself (Geertz, 2000). We are like travellers who explore unknown lands equipped with old maps (Benhabib, 2010) – like the short-sighted who are faced with far-reaching changes. Far reaching changes are imposed on present generation without safety guarantees for favourable outcomes. We are left in a dangerous zone with no default options at hand, with no possibility of return to the beginning for a new start, without alternatives offered to avoid existential challenges.

It comes as no surprise that complexity carries a negative designation both in the public and in scientific discourses on “the world is too complex to comprehend” topic (Morçöl, 2011), due to paralyzing uncertainty about the unpredictable consequences of interfering with a complex system (May, 2006). Complex situations imply complex coordination problems (Elsner, 2006) and these clearly entail complexity risk (Zolli, 2012).

There are numerous recent examples of high-level failures of complex social systems. A very intriguing one, despite relatively small irreversible damage involved, took place on the New York stock exchange with a momentary crash shortly after 2:30 p.m. on May 6th, 2010. Local reporter Bowley from The New York Times saw it as one of the most terrifying moments in Wall Street history with a brief 1,000-point plunge in Dow Jones Index, the largest intraday decline on record, which, some time later and equally abruptly, mostly entirely rebounded. According to his report, the chaos lasted only 16 minutes but left Wall Street experts struggling to come to grips with what had happened. The source of the turmoil, however, remained unknown. It had apparently set off algorithmic trading strategies, which in turn rippled across everything, pushing trading out of whack and feeding on itself — until it somehow homeostatically started to reverse (Bowley, 2010). This mysterious event nevertheless triggered an observable change in the exchange rate between $ and € on global financial markets, and it also affected the global price of oil and resulted, among other things, in an emergency meeting of the state council for national security in USA.

Because of their unregulatedness, financial markets have been often blamed as a potent source of systemic chaos. Stock market crashes are an entirely natural consequence of the fact that financial markets are complex (Rickles, 2011), multilevel and have several independent domains of operation – currency markets, stock exchange markets, monetary and fiscal policies of states – while their distinctive rules are in principle relatively simple or at worst complicated, but not complex.

Yet, the increasing threat of social complexity is not limited to largely unregulated, decentralised and dissipated processes. On the contrary, regulation itself is a mighty source of social complexity. Recall the catastrophic failure of the Fukushima nuclear power plant, one of the 25 largest in the world,[2] on March 11th, 2011 that resulted in a meltdown of three out of the plant's six nuclear reactors. The series of ruinous events was triggered by the most powerful earthquake ever recorded in Japan, and led to a disconnection in electric power leaving the plant wholly dependent on its emergency generators. The earthquake initiated an immense tsunami wave in the Pacific Ocean which soon hit the plant and flooded the emergency generators. Cut from electric power, the active cooling systems stopped working. The nuclear reactors began to heat up. The power failure also meant that many of the reactor control instruments failed. As power to the reactors' coolant systems and control rooms were not supplied, multiple hydrogen-air chemical explosions occurred on the plant from the 12th to the 15th of March. [3] Although no short term radiation exposure fatalities were reported at that time, some 300,000 people were evacuated from the area.[4] Radioactive water from the plant has been leaking into the Pacific Ocean and radiation was detected on the opposite side of the ocean, near Canada's West Coast, in 2013.

The Fukushima disaster may have been triggered by catastrophic natural events but it was human error that made it into one of the worst-ever nuclear accidents in history. This is the conclusion of the Executive summary of the Fukushima Nuclear Accident Independent Investigation Commission Report.[5] The investigation found that the nuclear disaster was 'manmade' and that all its direct causes were foreseeable. The report found that the plant was incapable of withstanding an earthquake and tsunami of such catastrophic proportions. It also outlined that bureaucrats put organizational interests ahead of duty to protect public safety. The government body promoting safety in the nuclear power industry failed to meet the most basic requirements: assessing the probability of damage, preparing for containing collateral damage in case of large-scale disaster, and developing evacuation plans. The report largely blamed the collusion between the plant's owner-operator, government regulators, dysfunctional governance and management bureaucracy. The blame should be put, according to the report, on systemic faults that supported flawed rationales for decisions and actions, rather than on the issues related to the competency of specific individuals. Fundamental causes for disaster are to be found in the ingrained conventions of Japanese culture: reflective obedience, reluctance to question authority, devotion to 'sticking with the program'.

[2] Wikipedia; #Fukushima Daiichi nuclear disaster, June 2014.
[3] Wikipedia; #Fukushima Daiichi nuclear disaster, June 2014.
[4] Wikipedia; #Acute radiation syndrome, June 2014.
[5] https://www.nirs.org/fukushima/naiic_report.pdf, March 2014.

Such harsh investigative conclusions should probably be read in the traditional Japanese manner of fatalistic self-criticism, rather odd for many non-Asian cultural conventions. Also there might be some veiled agenda behind the investigation that needed to contribute to impression that it is not nuclear technology that may become uncontrollable by standard practices of management in catastrophic condition but only professionals' deviation from the standards in the management, governance and business procedures. The alleged cause for the nuclear catastrophe is not complexity of the situation but deviation from simple rules of the profession. In this way the Report avoids identifying reasons for a catastrophe of such magnitude in a system of complex interdependencies with unpredictable outcomes that cannot be controlled with absolute certainty. Catastrophe may be reasonably expected as a possible, even probable result of a complex situation that is created in an inherently dangerous overlap between brainless large-scale technology, unpredictable nature and purposeful human systems locked in their structural and cultural framings. The assumption that a complex situation can be reliably controlled by basically simple means might itself become a powerful source of unpredictability.

A wholly unrelated illustrative case, incidentally also from Japan, clearly demonstrated that accidents spontaneously arise when technology, people and environment are linked in one big system of interactions involving a clash between linear and non-linear relations, or between order and chaos. Computer experts studied the following puzzle: what would happen if 1,500 pedestrians walked across the gigantic crossing in front of Tokyo's famous Shibuya Station while using their smartphones (The Japan Times, 10. Apr, 2014)? They figured out that only a minority of 36 percent of pedestrians would make it to the other side of the crossing without incident. The majority would bump into each other or drop their phones or fall and even get injured.

Complexity of social life is not limited to regulating high technology but is also engaged in every day routine operations, such as in collective choice aimed at achieving democratic and rational consensus about collective priorities. Social complexity proves to be counter-productive for collective problem-solving (Elsner, 2006) in the sense that from a single cause we cannot predict the outcomes at the outset of actions due to the strategic unpredictability of other, unknown causes and unintended effects which are not accounted for in conventional models of collective choice. Wide agreement has been achieved in the theory that collective results of social processes cannot be controlled centrally since they usually emerge independently from any specific judgment or aim of those involved, including those in power.

Centralized institutions have found themselves caught between their old habits and new reality. Politically dominant agents presently largely maintain their established privilege of ignoring destructive trends and pay limited attention to new demands. They continue imposing their own interests from above or behind our backs. The intricacy is that the outcomes of uniform impositions turn increasingly perverse in a complex setting. Established systemic mechanisms are decreasingly manageable and ineffective in routine reproduction of vertical structures of social domination. Old-style social coordination becomes dysfunctional which destabilizes society as a whole with amounting systemic inequality and structural injustice. It has been estimated (Oxfam, 2014) that 85 richest people on the planet own the same wealth as half of the world's population — 3.5 billion people. Similarly, 90 corporations have been responsible for two-thirds of the global carbon emissions generated since the onset of industrialism (Oxfam, 2014; Chomsky, 2014). Independent global studies consistently report that a strong majority of world population, between 60% to 80%, does not feel represented by their governments any more (United Nations in Kreisler, 2001; Eurobarometer, 2005; Henning, 2007; Halpin, Summer, 2008).

If the present trends continue, it is difficult to imagine any scenario that does not involve catastrophic social disintegration and loss of life (Coffman, 2011). A recent study authored by Motesharrei et al. (in Nafeez, 2014), has highlighted the prospect that global industrial civilisation could crumble due to a convergence of processes which breach system thresholds in main social domains. The combination of resource pressure and structural inflexibility can lead to collapse when factors converge to generate two crucial social features – the overstretching of resources due to the strain placed on the ecological carrying capacity of ecosystems and the extreme economic stratification of society into the rich and the poor, with middle class of welfare society increasingly disappearing. The structural imbalances that jeopardise social processes at the middle level, which intermediate between constitutive social oppositions, have played a central role in the process of the collapse of civilisations 'in all such cases over the last five thousand years' (ibid).

The search for a coherent rational basis for dealing with collective concerns is bound to fail because of the complex nature of these concerns. They are enigmatically wicked (Rittel, Webber, 1973) which invalidates any unitary concept aimed at addressing and resolving them. With wicked problems, facts are uncertain, values are in dispute, stakes are high and decisions are urgent (Funtowicz, 2006). They are uncertain due to the hardly reducible structural uncertainty, difficult to manage on a macro level with a variety of actors involved with diverse views and hard to grasp in the sense that they are ill-structured and difficult to interpret when relying upon standard models of reality and their classificatory schemes. Every wicked problem can be considered a symptom of another problem and, of course, nobody should try to cure symptoms, for curing symptoms can make the real disease worse (Rittel, 1972). With every conventional attempt to resolve them, wickedness of a complex situation will only be further complicated.

There is overwhelming support for the statement that complexity is dangerous. What science needs in these conditions is a breaking down of complex issues into separate, rationally manageable components (Chapman, 2004) until the resulting bits are simple enough to be analysed in a standard way with precision and high certainty. At the end explanations of the behaviour of parts would be aggregated into an understanding of the whole (Ramalingam et. al, 2008) by only a few invariant laws (Calhoun, 2006). The traditional Newtonian scientific paradigm merely needs to solve some drawbacks of its orthodoxy to enable the reconstruction of the leading modernist program (Manuel-Navarrete, 2001) despite increasing perceptions of real-world complexity. Much current thinking about social complexity therefore insists on the development of resilient social science with an uncompromising mission of 'killing the complexity' (Zolli, 2012) in this way, safeguarding strictly simple understanding of the real world.

We are faced with two extremes here. In modernist belief, for any system that is founded on the idea that reality is in its essence simple, complexity and ambiguity are denied (Ravetz, in Pereira et al. 2006). On the other extreme, as with postmodern chaotic relativism (Lyotard in Castellani 2009), ambiguity is depicted as the inner nature of all things. Science itself had mostly comprised social systems either in terms of causally organised simplicity (vertically) or in terms of irrationality of chaotic processes, thus horizontally (Hofkirchner, Schafranek, 2011). In both cases it avoided explaining an intermediate view of social complexity as situated between simplicity and chaos, and particularly how to link them in holistic interpretation, because social reality exhibits characteristics of both. Popper criticised the prevailing micro–macro scientific image of rigid social order as an opposite to complete disorder, with nothing in between. In a constructivist vein, he suggested, by words of Ulanowicz (2005), the existence of a middle ground, where interactions between contradictory and directly incomparable processes give rise to non-rigid structures that nonetheless retain their coherence over time. In this vein, micro–mechanisms on communal level and macro–behaviour of a complex system as a whole can be correlated only when the intermediate or meso–level is understood (Li et al., 2010).

Rigorously non-complex approaches to studying social processes, like micro or/and macro models in mainstream sociology and economics, may have problematic construct validity when their theories fail to reproduce a logic on the middle level of considerations, which is thoroughly complex but also most intrinsically social. The social field is inhabited with specific sort of phenomena that are qualitative and consequently impossible to define unanimously (Boyd, 2013), such as sustainable development or social integration. These are not directly knowable but can be comprehended only indirectly, through their imperfect manifestations and hybrid instances (Trainor, 2008). A socially complex phenomenon must be comprehended by evaluating what its different analytical presentations share in their different manifestations, in different contexts and for different agents. The working question is how to integrally observe interactions of multiple actors operating horizontally at a variety of systemic levels (Bousquet, Curtis, 2011), or more generally, how to construct holistic meaning from objectively confirmed but contradictory contributions.

We aim at responding pragmatically by proposing an operational definition of social complexity. The definition is not purely theoretical nor abstract nor does it strongly exclude nonconforming meanings. Nor is it analytical (like in Allen et al., 2014; Siegfried, 2014), developed merely for measuring its various parameters and taking an overly relativist and excessively inclusive view – because not everything that can be counted counts (Einstein).[6] The challenge lies somewhere in between where our knowledge about a given social fact is neither excessively totalising, nor excessively relativist but operating as intermediary between principal opposite positions.

Caught between simplicity and chaos

Monetarist Milton Friedman was convinced that complexity of a social phenomenon is merely scientists' impression until an appropriate explanation is found with a better theory (in Hollis, 2002) which can illuminate the complex issue in a simple way. Whenever one looks at very complicated systems in physics or in biology, one generally finds that its basic components and its basic laws are quite simple (Wolfram in Bousquet, Curtis, 2011) and few. Therefore, a precondition for the ability to control and govern complex processes is to translate them first into a set of simple issues.

In science there is a widespread philosophical presumption that simplicity is either a fundamental characteristic of reality or at least the highest virtue of theories describing it (Baker, 2013). Historically, the dominant view about why we should prefer simpler theories to more complex ones is based on a general metaphysical thesis that nature itself is essentially simple (Fitzpatrick, 2013), with the eternal symmetry between macro- and micro perspective.

Nature and order were mainly used as synonyms since ancient times, while instabilities indicated a deficit of knowledge (Schmidt, 2011). Even if at first glance harmony, simplicity and stability of nature seemed to be hidden (Schmidt, 2011) behind a complex diversity of forms in which they are manifested to ordinary men, there was no doubt about their existence. Clarity, beauty and simplicity, which emerged with the discoveries of the first mathematical, logical and natural proofs and laws, convinced wise men that they had been staring directly at eternal truths (James, 2002). For early Naturalists from Ionia (VI century BCE), Thales, Heraclitus and Democritus, the true nature of reality is hidden but simple, since all its manifestations can all be broken down into the most simple units called 'atoms'. Pythagoreans as principal forerunner of the scientific worldview (Fossa, 2011) who marked the beginning of the first outstanding era of intellectual progress in western culture, made the

[6] The statement first appeared integrally in quotable source with Cameron's 'Informal Sociology, a casual introduction to sociological thinking', p. 13, Random House, New York, 1963.

mathematical concept of harmony the central theme of their philosophy (Mainzer, 2005), assuming the timeless and infinite existence of nature as a whole (Schmidt, 2011).

The central argument in favour of presenting world as simple is linked to discovery of numbers as one of the most far-reaching intellectual constructions in the history of human thought. Pythagoras had claimed that numbers are the first principle for expressing cosmic harmony because they believed there is something inherent in a number itself that is fundamental to the way the world is and the way we can understand it (Seamon, 2008). Order becomes intelligible to human reason (Fossa, 2011) through numbers viewed as atoms of scientific fact since they enable measurement in real world, neutral comparisons of observations, and aggregation of findings into conclusions that can be presented in geometrical system and manipulated mathematically. Truth is specifically hidden in their rational proportions. They span in all realms: in music, weights, time intervals, and positions as well as in every existing dynamic force (Mainzer, 2005). It is through these simple numeric proportions that the *lógos* of the universe can be revealed.

Plato's cosmos as well was structured according to the idea of simple mathematical laws, intrinsic harmony, unchangeable order and universal stability (Schmidt, 2011). Kopernik, in this Platonic tradition, believed that only the simple can be real (Milkov, 2006). Leibniz claimed that the world rested in pre-established harmony. In order to count as a real being, each entity must be 'truly one', or endowed with genuine unity, a 'monad'. And in order to be a genuine unity, it must be a simple, indivisible entity. Hume suggested that a tacit assumption of the uniformity of nature is ingrained directly into our psychology (Fitzpatrick, 2013). A compatible attitude—and rhetoric—is shared by scientists throughout the modern period, including Galileo, Kepler, Newton, and Einstein (Baker, 2013). The latter was convinced that the history of physics justifies us in believing that nature is the realization of the simplest conceivable mathematical ideas (in Baker, 2013), such as $E=m \cdot c^2$, from which all more specific theories must proceed. The mainstream social sciences in the XX century are based on the same positivistic paradigm (Wallerstein, 1991).

There is, however, scant empirical evidence that the world is really simple (Oreskes et al., 1994). It seems difficult, says Fitzpatrick (2013), to formulate the thesis that nature is simple. Such a thesis is either obviously false, or too vague to be of any use. There are too many counter-examples to the claim that we live in a simple universe. Fitzpatrick takes the example of the ancient philosophic picture of the atomic nucleus as 'uncuttable',[7] indivisible basic unit of a physical matter. Several alternative atomic models have been developed in the Twentieth Century when direct observation of the atom became feasible: it lead to the discovery that the atom consists of protons and electrons (Thomson in 1909). Rutherford (in 1909) proposed a planetary model of the atom in which a cloud of electrons surrounds a small, compact,

[7] Wikipedia, #Atomic Theory, October 2014

positively charged nucleus. New discoveries of nuclear particles followed later, from circular orbits of electrons with ability of quantum leaps – transition to lower or higher orbit (Bohr in 1913), describing electrons as waveforms (Schrödinger, 1926), to the theory about the positions of electrons in an atom in terms of probabilities (Heisenberg in 1925).[8] Physics also presented neutrons and neutrinos, weak and strong nuclear forces and Higgs particles as a source of matter, as well as leptons, quarks, photons and guons. Subsequent discoveries have led to a much more complex atomic picture of nature (Fitzpatrick, 2013) and full understanding of the atomic model and identification of the basic unit of physical matter is still not achieved.

If simplicity cannot be confirmed empirically as a characteristic of nature itself, it is at least relevant as a prime theoretical virtue. Kant has validated the maxim that rudiments or principles in science must not be unnecessarily multiplied (in Baker, 2013). Many philosophers believe that, other things being equal, simpler theory is better (Baker, 2013), since its empirical content is greater and it is better testable (Popper, 1992), which makes it superior in terms of efficiency. In Leibniz's view, the best theory contains a maximum of individual variety falling under a minimum of general laws (in Craig, 1998). Similarly Einstein (in Baker, 2013) said that the grand aim of all science is to cover the greatest possible number of empirical facts by logical deductions from the smallest possible number of hypotheses or axioms.

To the present day, scientist have largely accepted a medieval rule which has come to be known as Occam's razor: explanatory entities which are needed to formulate a truth statement must not be multiplied beyond necessity, since simplicity is the preferred explanatory approach. The rule states that one should always apply simpler theories until simplicity can be traded for greater explanatory power of more complex elaborations. [9] Thomas Aquinas, the Italian scholar from the XIII century made a similar argument: 'If a thing can be done adequately by means of one, it is superfluous to do it by means of several; for we observe that nature does not employ two instruments if one suffices'.[10] Newton affirmed a conclusion that, 'we are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances' (in Hawking, 2003). Finally, for some authors starting with Pythagoras, simplicity is an ultimate and a priori epistemic principle which must be taken as a direct evidence for truth (Swinburne, 1997).

The scientific ideal of simplicity has been first systematically materialised in the Newtonian scientific paradigm. He developed highly idealized model of reality (Moreno et al., 2011) which showed how one generic idea, for instance universal gravitation, explained both the

[8] Wikipedia, #Niels Bohr; October 2014.
[9] Wikipedia, #Occam's Razor, May 2014.
[10] Wikipedia, #Occam's Razor, May 2014.

motions of celestial bodies and apples falling on the ground (Siegfried, 2014). Isaac Newton described reality as an organized simplicity with only one path leading to truth. It is unilineal, since it assumes that only one credible description of a given issue is valid, imposing itself at the end, when all doubts are removed, as evident and free from ambiguity. In a simple world we deal with 'known knowns' (Stacey, 2002), an eternally ordered and stable realm, where real things follow strict rules. There is little disagreement about how to comprehend phenomena because the laws describing them look the same from different perspectives (Fitzpatrick, 2013).

Simple systems are linear when an increase in the size of an input to the system gives a proportional increase in the size of output – i.e. when the cause-effect relationships are transparent and the arrow of causality can be, at least in principle, easily discerned from physical causes. One event must lead to another, in either a deterministic (absolute) way or at least in a stochastic (probable) way (Andersson, 2003), so that a future state can be precisely predicted from a previous state.

For Auguste Comte science is a positivistic project. It is based on empirical observations that are used to generate and test abstract laws (Turner, 2003). Relevant data for their inquiry exist and can be – in principle – measured, analysed and tested, as well as replicated in analogous situations. What makes scientific positivism positive is precisely the certainty granted by objective empirical confirmation (Calhoun, 2006), following some strict confirmation rules of scientific method.

Theories developed in the frame of this paradigm can either be built up from analysing observations or, if developed top down, tested against observations. In either way, this approach is reductionist, since it obtains the parts from fragmentation of the whole, or understands the whole without relation to the parts (Baker, 2013). A simple system is reductionist either as indivisible atomic or invariant under division because its quality is intrinsic.[11]

Despite its unification purpose, the principle of simplicity does not rule out diversity. Diversity between parts is below their surface appearance connected with the same intrinsic content or value which is applied as a common denominator able to unify them all. When diverse phenomena share a common unit of measurement they are said by Pythagoreans to be '*arithmos*';[12] phenomena are comparable for the purpose of numerical quantification. Diverse elements of a simple system are commensurable, meaning that elements are regarded as fully compatible in at least one, but essential characteristic. The term 'commensurable' comes from Euclid's Elements, in which line segments *a* and *b* are commensurable if there is some third segment *c* that is a common unit of length in terms of which *a* and *b* can both be equally

[11] Wikipedia, #Atomism, February 2010.
[12] Wikipedia, #Pythagoreans, November 2011.

appropriately measured. Otherwise *a* and *b* are not '*arithmos*' but '*alogos'* , unreasonable or incommensurable, hence delinquent cases against the universal rule. Subjective, less tangible or even irrational aspects of evaluation must be by Newtonian scientist properly recognised and discounted.

Standard accounts of knowledge see science finally as a progressive enterprise since, under the rational condition, it generates a body of knowledge which is expected to progressively converge on the truth (Bradie, Harms, 2012) and increase in depth, range and predictive power. New models or theories will be compatible with old knowledge and expectantly will accumulate vertically into a grand synthesis of philosophy of science, as a precondition for integral understanding of all aspects of reality from one specified viewpoint. This idea still fascinates present science (Morçöl, 2012). A unified theory of everything is an ideal of ultimate, all-encompassing and perfectly organised knowledge into a model of the world that encompasses different aspects of physical dimensions – such as classical physics together with the quantum model (Fisher).[13] Another similar project is evolutionary synthesis (Huxley, 1940), economic synthesis (micro – macro, by Hicks, 1937, and Samuelson, 1955), or more recent ideas which include into the general theory also spiritual dimensions (Wilber, 2000; see Skinner, 1997; Capra, 1982).

The Newtonian paradigm set a framework for classical scientific program that is established as general frame of reference. It is held as 'normal' (Kuhn, 1970) and applied as a doctrine for mainstream scientists. It is undoubtedly an enormously successful model, especially in physics and chemistry, where it has made the most progress by focusing on phenomena that, either due to their selectively studied properties, or due to the conditions in which they are investigated, allow for very strong simplifying assumptions (Moreno et al., 2011).

The main purpose of normal science is for Kuhn to convey the idea that like someone doing a crossword puzzle or a chess problem or a jigsaw, the puzzle-solver expects to have a reasonable chance of solving the puzzle and revealing the great picture. One of the foremost risks of the 'normal' condition in science is that there is no challenge of received wisdom. The effort of searching for truth is not reflective since it feels no need to evaluate frames within which it is constructed. It is not questioning paradigmatic issues, it is not deep. With his theory of relativity Einstein has offered guidance for a very cautious application of scientific conclusions, in particular when attempting to generalise validity beyond their limited observation potentials. As he demonstrated, relative movement of bodies can be described for different observers only on dissimilar ways (Hollis, 2002). Relativity implies that classical science can produce valid results only in a very narrow frame (Bourdieu in Couldry, 2005). Our understanding can be thus only relatively valid and enclosed within the borders of concrete experience (James, 2002), as partial and contextual. Each truth claim

[13] Wikipedia, #Michael Fisher, March 2014.

involves unexplained residual since it ignores unobserved reality and so usually antagonises another truth claim derived from observation of the other face of the same fact, which is itself incomplete. Furthermore, according to Schrödinger (1996), universal primary qualities such as space and time, are not even directly accessible to senses (capable only of relatively valid observations) but emerge purely as hypothetical constructions of the mind. Scientific epistemology, conceived in Newtonian and Kantian terms as the study of what can be known with certainty, begins to seem impossible (Skinner, 1997) from the Kuhnian revolutionary perspective.

The essentially restricted capacity of the classical scientific programme for uniform discovering of absolute truths has been illuminated by three prominent theorems in physics, mathematics and economics which emerged in the second quarter of the XX century: theorems of indeterminacy, incompleteness and impossibility. For German physicist Werner Heisenberg and Danish physicist Niels Bohr, as leading authors of quantum mechanics, indeterminacy places fundamental limits on the applicability of the classical deterministic concepts of science (in Hilgevoord, Uffink, 2012). One striking instance of classical physics is its presupposition that exact values can be assigned to all physical quantities simultaneously (Hilgevoord, Uffink, 2012). On the other side, Heisenberg (in 1927) pointed out that the act of measurement cannot simultaneously illuminate with precision all characteristics of the inquired object, which leads the scientist to inherent uncertainty and he/she can do nothing about it (Hilgevoord, Uffink, 2012). He specifically stated that the more precisely the position (location) of a particle is determined, the less precisely its momentum (speed) can be known,[14] and vice versa. The state of the object and its processes are integral for understanding the object, but can be observed only separately, as two distinct faces of the same phenomenon. The principle asserts a fundamental physical limit to the precision and objectivity of the observer's insight into reality. Consequently, scientific objects exist or must be constructed as multifaceted units in which only one aspect of the whole can be objectified at a time, while the others are held passive in their assumed condition (or actively antagonised like frequently in social systems: e.g. between local or global perspective of a given social issue).

Another closely related but independent obstacle to full implementation of the classical scientific paradigm is that measurement is never accomplished in isolation from the observer. The phenomena require an observer in order to be learned about and understood.[15] However, measurements cannot be made without the observer's affecting the observed systems which triggers ‘the observer effect’. A commonplace example is checking the pressure in an automobile tire; this is difficult to do without letting out some of the air, thus changing the

[14] Wikipedia, #Werner Heisenberg, June 2014.
[15] http://www.grc.nasa.gov/www/k-12/numbers/math/mathematical_thinking/observer.htm, December 2013.

pressure.[16] In researching reality we have therefore a condition of double complexity, characterised both by uncertainty as a fundamental principle of reality and by the observer's subjective interference with the objectification process.

Postmodern sociologists similarly discuss essential indeterminacy in social analysis for an accurate comprehension of reality (Portis, 2008). Fixed meaning is impossible when clashed with shifting and contradictory voices (Stern, 1996). Derrida challenged the hegemony of determinate meaning as fixed understanding is impossible, replacing it with that of indeterminacy. In every truth claim there is always present an irreducible aspect of contradictions and internal opposition. At the heart of existence is then *différance*, not essence (Derrida, 1978), as an unresolved sediment or the residual which is otherwise indispensable for comprehension of truth claims. From observation that knowledge is different from truth since it is incomplete, Goethe wrote: 'To know anything, one must leave out a piece of the truth' (in Mainzer, 2005). For Badiou (2005) in every situation there is the void, which usually goes unaccounted and so "haunts" the situation.

Incompleteness, as the second theorem, establishes inherent limitations of all but the most trivial axiomatic statements[17] as a general characteristic of any ideally uniform Newtonian mathematical construct. The theorem was stated by Kurt Friedrich Gödel, Austrian mathematician, at approximately the same time (in 1930) as Heisenberg's. Gödel demonstrated the impossibility of a self-validating mathematical system (Byrne, 1998). Specifically, any formal theory which contains a theory of natural numbers cannot be proved self-consistent by means of principles which can possibly be expressed within the theory in question (Menger, 1937). Any consistent formal system is incomplete; in each formal theory there is a statement, a sort of residual, which can neither be proved nor disproved (Raatikainen, 2014) within this particular formalism. Axiomatic mathematical systems must therefore either sacrifice the absolute distinction between true and false (from Aristotelian law of excluded middle)[18], or must sacrifice uniformity as a totalizing account of truth.[19]

Gödel's theorem can be explained with the assistance of Russell's self-referential paradox (1901). Russell (in Fioretti, 1996) notes that, if one claims that a collection of propositions contains a proposition stating that 'all propositions are either true or false', such a statement could not be legitimate unless 'all propositions' referred to some already definite collection which is not possible, since a statement about 'all propositions' is itself a new proposition, which can also be false. This can be illustrated on a case of trying to compose a list of all lists: if such a list does not write itself on the list, which it shouldn't to avoid becoming self-referential, the list is incomplete, as there will be one missing. It is no longer a list that

[16] Wikipedia, #Observer effect, July 2014.
[17] Wikipedia, #Gödel's incompleteness theorems, October 2012.
[18] Wikipedia, #Law of excluded middle, April 2014.
[19] http://www.integralscience.org/mathpoetics.html, June 2013.

contains all lists, so it cannot become what it is supposed to be (Badiou, 2005). Only if we allow paradox or some irrational content, can truth (list of all lists) in a more complete formulation be revealed, implying that the truth is beyond purely rational comprehension. The conclusion is, at least in our interpretation, that monistic statements are not rationally complete as they also involve some unexplained residual content which is, rationally observed, non-rational. The possibility of holistic understanding necessarily involves a sort of impureness which connects it to complex structure of thought consisting of both rational and irrational content.

The third in a row is Arrow's impossibility theorem (1951) in the theory of social choice that is relevant for large part of social sciences. It implies that, once democracy is agreed upon as indispensable, full collective rationality is impossible to be attained (Schnellenbach, 2005). A group where everybody has the same voice cannot decide on the most rational alternative for all. The theorem has deeply challenged the core presumption that simple majority rule institutions, on which the present model of democracy is built, is sufficient to solve a social dilemma, and appropriately translate citizens' preferences into public decisions that are accepted as fully representative, fair, and legitimate amid a fundamental difference between rationality at the individual and group levels (Evans et. al, 2002). Social sciences try to understand collective processes and consistently organise collective meaning, e.g. when attempting to construct 'the social welfare function' (Bergson, 1938; Samuelson, 1964). Its function is to state in precise form the value judgments required for the derivation of the conditions of maximum economic welfare.[20] A function is derived by ranking all pairs of social alternatives with which each voter is faced as less desirable, more desirable, or indifferent. One of the formal reasons for impossibility is non-transitivity (cyclicality) of individual preferences: if a voter prefers X to Y and Y to Z, then the voter must logically consistently prefer X to Z, which is not always the case due to possibility of non-transitive group preferences arising from transitive individual preferences (the Condorcet's paradox of aggregation, in 1785; Munda, 2012), due to nondual structure of individual preferences, when decisions are multi-dimensional, or merely due to impact of tastes, cultural or other irrational factors on preference ranking. A voter with transitive preferences is considered in social choice theory as rational; a voter with non-transitive preferences is regarded as irrational (Munda, 2012).

Clearly all three theorems bring forward an irrational element that arises integrally with generalisation of rational claims. Every holistic aspiration should involve irrational factors (Bourdieu, 2004). This has been especially emphasised with a plural scientific revolution that took place in the 1970s. It has been triggered by Kuhn who first radically suspended the Newtonian idea of unilineality of science. He developed a ground to elucidate the idea of

[20] Wikipedia, #Social Welfare Function, February 2014.

science as a multiple and multilinear process that produces knowledge from different aspects which may not be compatible, and even less able of grand synthesis.

Kuhn attacked classical positivism from a different direction than mainstream science: not in relation to its constraints for reaching absolute validity but from the point of incompatibility of divergent scientific contributions, that result from their inherent partiality. The scientific revolution declared that rationality must be brought down from its regulative heights and its universalist pretensions abandoned (Dascal, 1997). Kuhn first assessed the history of science and noted that periodically whole areas of science are overturned by new theories, e.g. the Ptolemaic conception of the Earth-centred cosmos (II century BCE) was replaced by a Kopernican model in which the Earth revolves around the Sun (XVI century) – in this way proving Earth's marginal location in the cosmic structure of universal order. This also implied marginalisation of humans' observational point. The discovery had emphasised the process that resulted in throwing rational inquiry out of the central position even in rational concepts of truth. The sacred direct line which previously was believed to operate in the centre between the knower and the cosmic order was irrevocably disconnected.

The possibility of a revolutionary overturning of prior theories demonstrated a far greater relativity of the status of scientific claims (Mendel-Gleason, O'Brien, 2013) than previously thought. What the positivists saw as immutable logical truths suddenly became contingent and historical (Mendel-Gleason, O'Brien, 2013), even culturally dependent and contextual statements. The Newtonian view was that science is a neutral arbiter between competing theories. Kuhn denied this, holding that the nature of scientific observation is influenced by prior beliefs and experiences. In general the factors that determine a choice of theory are not fixed and neutral but vary and are dependent on the 'disciplinary matrix' within which the scientist is working (Bird, 2013).

Formally speaking, an endless number of theories can be constructed with a particular body of data, just as an endless number of curves can be geometrically constructed to pass through a finite number of points (Barnes, 1997). There are no facts independent of our theories about them, and in consequence, there is no a unique way of scientific viewing, classifying and explaining the world that all rational persons should accept (Skinner, 1997). When confronted with multidisciplinary issues, even the most competent, honest and disinterested scientists may arrive at different problem framing and conclusions because of systematic differences in the way they collect and interpret data, which hypothesis they apply and how they summarize their findings (Mumpower et al., 1996). Different theories weigh the appearances of the same world differently.[21] So it cannot be expected that two neutral scientists observing the same object will make the same theory-neutral observations (Bird, 2013).

[21] http//:www.europeanevaluation.org, January 2009.

Even though it is necessary, following Gödel's theorem, to apply two essentially different formalisms to complete a given truth statement, it is nevertheless a common situation in science that an overlap between essentially different theories, even those belonging to the same disciplinary field (e.g. microeconomics and in macroeconomics) is non-existent. Different theories may essentially differ, since the terms employed by one theory may fail to be definable in the context of another theory (Feyerabend, in Sankey, 2007) – so it is not possible to understand one paradigm through the conceptual framework and terminology of a rival paradigm. Given the inability to define, even less directly translate their constitutive terms, such theories may not share statements in common (Sankey, 1997) and may not overlap. Theories are rational in incompatible frameworks so they may appear to each other as irrational, essentially incomplete, ignorant and thus wholly inappropriate platform for generalisations. To account for the differences that impede communication between the advocates of rival paradigms, Kuhn introduces the term incommensurability (Sankey, 1997).

Incommensurability is a concept relating to 'value beyond measure' (Hardt, Negri, 2000). It is contrary to a classical concept of rationality that is based on commensurability of values (Hayek, in Munda, 2006). The Webster Dictionary (in Flores-Camacho et. al., 2007) defines incommensurability as a word which extends beyond the concept of measure as it also covers qualitative distinctions in situations, when we are lacking a common basis of comparison with respect to a quality, such as value, good, or excellence, normally subject to comparison – previously referred to as primary qualities. Rival theories can of course still be compared and legitimised, but not universally against uniform and objective scale (Skinner, 1997), nor without also accounting for a subjective, irrational and chaotic content. Hofman[22] refers to Nicholas of Cusa who clarified the source of incommensurability in this way: 'The finite mind can … not attain to the full truth about things through similarity. For the truth is neither more nor less, but rather indivisible. What is itself not true can no more measure the truth than what is not a circle can measure a circle'. The theoretical conviction that truth is mediated through incommensurable disagreements leads to the rejection on theoretical grounds of the quest for unity in science established on rational consensus (Trainor, 2008).

A concept of incommensurability represents a specific form of negation that is logically different from the classical true-false dichotomy since it allows for several true statements about the same issue that are equally valid but produce opposite conclusions. According to an old saying, there are two kinds of truths (Stent, 2004). The first kind is an ordinary truth, which is so simple and clear that its opposite is obviously false – this is the Newtonian situation. The other kind is a deep truth, whose opposite is also a deep truth – the complex situation. The concept of incommensurability needs to be better incorporated in social research to handle the latter kind of truth claims.

[22] 1950, http://www-history.mcs.st-andrews.ac.uk/Extras/Cusa_Informed_ignorance.html, July 2014.

This is certainly not a very original proposal! The first who dared to question a commensurable concept of truth from the aspect of irrationality in Western part of the world, and so paved the way for acknowledging incommensurability of truth claims in science, paid dearly for his outrageous assertions. The discovery of incommensurability is recognised today as one of the most far reaching accomplishments of early Greek mathematics, which is entirely confirmed by philosophy of science in the XX century (Bird, 2013) but which also triggered the first grand crisis in the history of mathematics (Chaitin, 2000). Ironically, the avalanche was set off already by one of the founding fathers of Western science, Pythagorean scholar Hippasus of Metapontum.

Pythagoreans believed in harmony and this is easily understandable in light of beauty – symmetry and simplicity – of their mathematical achievements. Consider the sides (a, b) and the hypotenuse (c) of an isosceles right triangle in the Pythagoras theorem $a^2+b^2=c^2$. If mathematical rules obtained with geometry really represent universal laws, and if these laws are as simple as the Pythagoras theorem and as mutually consistent as geometrically obtained rules obviously are, this implies that the world and the truth about it must be in principle beautifully simple and harmonious.

However, the Pythagoreans did not know about irrational numbers. Legend says that during one of their not so rare escapades, taking their brotherhood across the Aegean Sea from mainland Greece back to Sicily, around 470 BCE, a tragedy happened (Choike, 1980). It all started with the Eureka moment (as Archimedes would call it some two centuries later), when Hippasus came to a discovery that the dimensions of certain mathematical objects lack a common unit of measurement (Bird, 2013, such as the side (in length of 1) to the hypotenuse of an isosceles right triangle, equal to $\sqrt{2}$ = 1,41421356237309… – which cannot be expressed precisely. The hypotenuse is in this case incommensurable to the sides as there is no commensurate unit that can be used to measure all three exactly (Bird, 2013) in their relative proportions. It later turned out in mathematics that the same characteristic applies to many other numbers such as π, the circumference of a circle with its radius, and Euler's number e, the base of the natural logarithm as well as golden number φ. So one can for instance always split an apple in 2, 3, 4 of whatever equal parts s/he wishes, but cannot split it in $\sqrt{2}$, π, e or φ equal parts, simply because these cannot be defined in relative terms, so they are said to be irrational numbers, behaving quite inharmoniously when observed in a conventional way. With this discovery two different and radically opposed systems of thought were set against each other – they may be called the irrational system and the rational system (Fossa, 2011).

Finding that some numbers are in incommensurable relations implies that the universe cannot be assumed to be as harmonious in a Pythagorean way anymore. Since Hippasus we shall comply with the conclusion that simple rational proportions are only part of the law of the universe. Now everybody can predict how the legend concluded, since the rule applied in such cases in ancient time has remained unchanged in essence (though varying in its modalities) to the present day. He who brings disharmony through irrational claims to the community of all decent and well thinking people cannot reasonably anticipate to be accepted with tolerance. Hippasus was unanimously accused of treachery by his fellows. Betrayal is a mortal sin, so he was promptly punished by being thrown over the board of the boat to feed the fish and to keep the idea of harmony in its simple frame intact.

Kuhn was much more fortunate since he only faced criticism that his paradigm as a whole is anti-realist and cannot be relevant to scientific field. He was thrown only into irrelevance by some. Nola and Sankey (2000) nevertheless defend his original position and reassert that irrationality in discussion about truth does not refer to the real world. Reality is of course only one but nobody can perceive it integrally on all levels and in all coexisting domains simultaneously. What is rejected by Kuhnian philosophy, Nola and Sankey insist, is not the real world, but a monistic theory of classical method. Classically narrowed perceptions of reality may be yet internally consistent conceptions, but they mostly progress independently and at best only marginally overlap. Only a fragmentary approach to objective truth is feasible – this incompleteness is responsible for incompatibility of truth claims. The Newtonian three of science cannot be ever schematized with such clarity as it can be achieved, for instance, with the Darwinian three of life.

Advocates of the old scientific paradigm have nonetheless proved resilient with their capacity to respond to the increasing multiplicity of knowledge with new concepts without essentially modifying the majority of the paradigm's core assumptions. One very successful theory which is among the first to contribute to decomplexifying scientific objects of research is the system theory. The system theory (von Bertalanffy, 1968) emphasizes relations between sometimes loosely connected components in natural or social systems that are composed of components that are related in a complicated ways.

The systems approach was initially established as a reaction to the Newtonian analytical method (Arbnor, Bjerke, in Andersson, 2003). Reality, according to the systems approach, comprises interacting parts, which consequently cannot be first treated independently and then simply aggregated to describe the whole as in the analytical micro to macro approach (Andersson, 2003). Laszlo (1972)[23] noted that the systems theory went one step beyond the Newtonian ideal of 'organized simplicity' which understood the whole through its parts, or understood the whole without relation to the parts (Baker, 2013). In systems the only way to fully understand a problem is to understand the parts in relation to each other and in relation to the whole (Capra, 1996). Two characteristics of systems are relevant here: equifinality – that it allows for alternative ways of attaining the same conclusion (convergence) and multilinearity since different conclusions can be achieved from the same inputs (divergence;

[23] Wikipedia, #Systems theory, note 6, April 2012.

Cicchetti, Rogosch, 1996). Hooker (2011) analogously distinguishes two system's functions: multiplexing when many component roles are combining to realise a single function and multitasking when the one component playing roles in realising many functions. The theory is thus not aiming any more to understand single main causal mechanism in a system but the network of driving forces that affect a system as a whole (Anderson, Johnson, 1997).

Different meanings can be organised when guided by system thinking (Checkland, 1993) which was considered by its proponents a major step in the quest for a unity of science. 'Its major goal is to generate a new type of unity: not based on the reduction of concepts, methods or even laws of all sciences to the ones of a single science regarded as more essential; but rather a formal unity based on the generality and ubiquity of the system concept' (Hofkirchner, Schafranek, 2011). There are some general principles that reflect a common architecture emerging in all diverse systems (Moreno et al., 2011). Systems are isomorphous (Pouvreau in Hofkirchner, Schafranek, 2011). Hence the theory can serve as a bridge for interdisciplinary dialogue[24] between autonomous and substantively dissimilar areas of study, until they are organised as systems. This earns system theory a transdisciplinary character equally applicable in a variety of unrelated areas.

The system theory is holistic in less strict of a way than the Newtonian ideal because it rejects essentialist notions of units (Emirbayer, 1997). The criteria for something being a system are specified regardless of the explicit substantial content of the phenomenon in question (Hofkirchner, Schafranek, 2011). The theory imposes on the researcher a demand for 'desubstantiation' (Bourdieu, 2004) of their inquiry if they want to understand phenomena better – it demands synthesising what is known about relations between objects (system's parts) instead of about some selected commensurate characteristics of objects themselves. There are incomparable sources of knowledge and they can be comprehended integrally, but not directly, since they are incompatible, and only through relations between them when observed in broader systemic context, where they make sense to each other merely through their marginal co-relations. This is not to say that a relational perspective is independent from the real world of objects. Yet, it imposes itself essentially differently – as an intermediary and indirect (Thurén, in Andersson, 2003) perspective of reality with more subtle insights into weak and unprincipled connections between otherwise incompatible contents that are themselves stated in strong and principal terms.

The system theory with its indirect approach decidedly pushes classical science towards the paradigm of complexity, but only for a small segment of the gap between them. A system is commonly understood as more than the sum of its complicate structure of relations (Bousquet, Curtis, 2011), since it orders them into a new higher meaning, which makes it creative. However, as the new quality arises hierarchically it is not necessarily perceived in the same

[24] Wikipedia, #Equifinality, August 2013.

way by the system's parts. For instance, a social system can improve its control mechanisms over its parts for their more efficient functioning, which leads to improvement on the macro level of the system but it may be nevertheless simultaneously perceived as deterioration from the aspect of its members on micro level. System theory loses sight of the autonomy of systemic elements in comparison to the whole so it is horizontally reductionist (Müller in Hofkirchner, Schafranek, 2011).

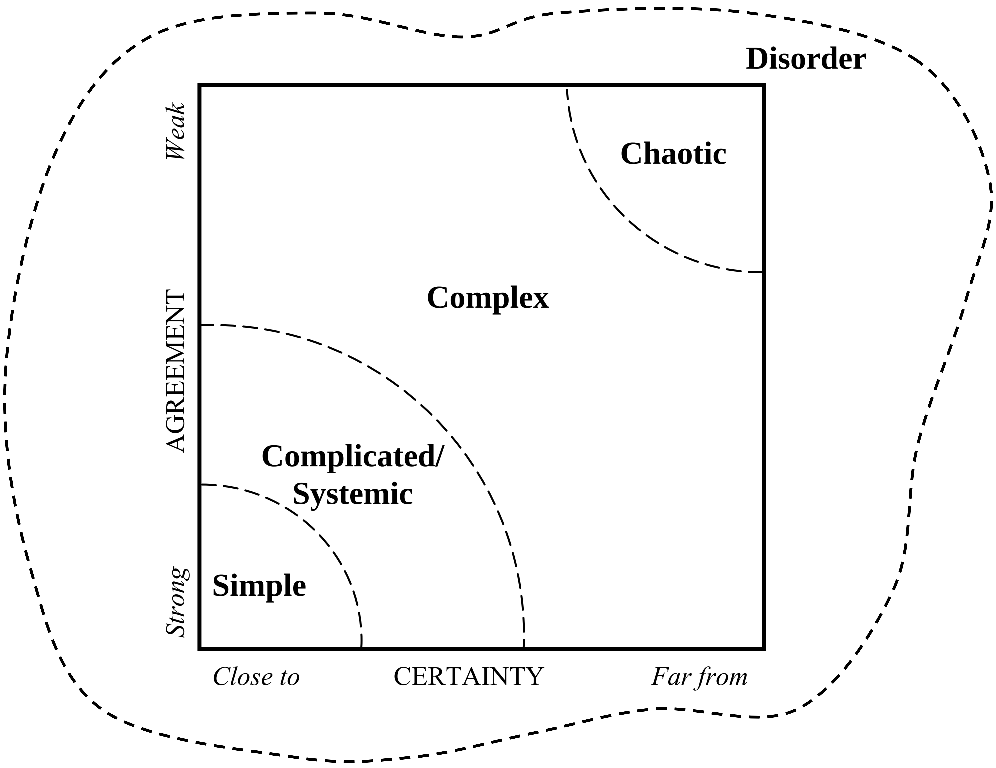
The systems are biased in favour of macro view of reality, which is a serious shortcoming in the face of social complexity. Luhmann (1995) emphasized the core research task for systems theory was to understand and model stability in the social system as a whole. The foundational concept of 'system' in sociology is designed in a linearly ordered structure mired in old notions of a self-balancing equilibrium (Walby, 2003) because systems prefer stable configurations (Simon, 1962). The optimal state for the system is where they behave linearly (Ramalingam et al., 2008) and attain stability and equilibrium (Zahra, Ryan, 2007). A complex system on the other hand develops far from equilibrium where it can most effectively test the boundaries of the system for existence of any more suitable trajectory (Byrne, 1998). Complex processes that are far from equilibrium must be maintained in their far-from-equilibrium conditions – otherwise, they go to equilibrium and creative processes cease to exist (Bickhard, 2011). So the systems theory, in particular the first-generation models, proved incapable of neutrally explaining systemic change and remained biased in favour of existing structural settings. A complex system on the other side is inherently systemic without being also resilient on its internal structure (Byrne, 1998). Systems are constructed with the aim to be purposefully manipulated, while complexity is self-organising in an unpredictable way. Systems have isolated elements, while complexity results from interdependence between constituents. Systems revolve around rules (Dopfer, 2011); complexity revolves with learning (Ramalingam et al., 2008). System is usually construed in terms of parts that are not themselves modelled as systems (Bickhard, 2011) while complex system consists of parts that are themselves complex (sub)systems.

Differences between ordinary systems and complex systems are insurmountable. System theory's decomplexification strategy obviously cannot be furthered enough to shield Newtonian science against the threat of complexity. It nevertheless accomplishes indispensable achievements towards a complex conceptualization of social research since it contributes vital new approaches on which later theories could be solidly built – in the first place desubstantiation of holistic aspirations, cross-sectional reasoning and capacity for intermediation between systemic constitutive opposites.

The theory of truth (James, 2002) offers alternative frames for constructing scientific claims. Simplicity, complicatedness, complexity, and chaos are the main. Complicatedness is located in the overlap between simplicity and complexity while complexity is intermediate between simplicity and chaos. Simplicity and chaos account for conceptually pure and homogeneous concepts of truth while complicatedness and complexity are hybrid and heterogeneous concepts of truth. For this reason complexity is able to cross the bridge between simplicity and chaos and to explain the interplay between them (Baranger, 2001). Gell-Mann (in Bousquet, Curtis, 2011) accordingly points to the word's etymology: Latin *plexus* means 'braided' or 'entwined', from which is derived *complexus*, meaning 'braided together'.

All four alternative frames are neatly schematized in Agreement and Certainty Matrix (ACM; Stacey, 2002) – where the certainty axis refers to the quality of the knowledge, while the agreement axis refers to a conflict about what is considered the truth (in Picture 1). We propose to add to this scheme a concept of disorder to relate each frame to the unknown as an irreducible aspect of the world as it is, as well as of our knowledge about it.

Picture 1: Schematization of alternative theories of truth



Source: Stacey, 2002, adapted.

In the ACM frame the core of the system theory is accommodated in the zone of complicatedness. Complicatedness arises from the attempt to force an explanation of the more complex phenomena in terms of the simplest forces (Bentley, 1895). A researched issue becomes complicated as a result of confusing interactions arising from a too narrow treatment. It refers to a system of 'known unknowns' having many parts; there may be multiple right answers but they are partial, making it hard to understand analytically and integrally. A complicated system has nevertheless very simple organization (Ahl, Allen, 1996). Its causes can be individually distinguished so they can be addressed piece-by-piece (Poli, 2013). They can be controlled and the problems they present admit permanent solutions

(Poli, 2013). Traditional science has excelled at simplifying the complicated (OECD, 2009). However, what is complex is not necessarily complicated, like friendship. And what is complicated needs not be complex, like a watch.

The most opposite theory to organised simplicity in the inner part of the ACM scheme is the theory of chaos. When introduced, it triggered the Kuhnian type of break with classical paradigm (Gleick, 1991). It dismantles Newtonian paradigm by implying non-linear relations between variables of the model of reality, and describes a world in which nothing is certain: things are not just unknown but unknowable (Stacey, 2002).

The theory was developed from the work of meteorologist and mathematician Edward Lorenz (in Gleick, 1991) for systems like weather that develop in self-replicating manner over large number of iterations. System’s development is extremely sensitive to even the slightest differences in initial conditions. Another way of portraying the chaotic dynamic is that when repeatedly running the mathematical simulation with different, but arbitrarily close starting points of a given variable, the resulting overall process trajectories quickly become no more similar than two runs with starting points chosen at random from anywhere in the space of all possibilities (Yin, Herfel, 2011). The sensitivity on initial conditions means that the position of a system at a particular moment will have an influence on its future evolution so that in chaotic systems history matters (Ramalingam et al., 2008). Sensitivity of this kind is the death of reductionism.

In the absence of linearity, cause-effect relationships cannot be deciphered – for instance, exactly which butterfly’s wings fluttering in tropical forests of Africa caused the snow storm on the other side of the ocean? In a world which is reigned by chaos a multitude of chaotic processes take place that partly correlate and partly develop independently, like air temperature, air humidity and air pressure. For predicting weather it appears relevant to investigate their correlations horizontally not only to explain as much as possible the causal factors that decided the value of leading parameters for each separate process relevant for weather changes in a vertical perspective.

Chaotic systems are characterised by relationships between small and large system variables, in such a way that a small incident, if it spreads long enough, can trigger an overall system effect. The whole system impact is thus not obtained as previously by cumulative building up from parts, but with spreading from small to large. Chaotic process may trigger systemic change at a macro level, yet not on its own but in combination with breaching the system’s thresholds when its spreading reaches system’s upper limits of stability. A result is bifurcation of the system, which may be seen as another type of threshold beyond which the system abruptly changes its long-term behaviour (Lorenz, in Zahra, Ryan, 2007) and the structure of its macro landscape (Hooker, 2011) and may again be run largely by orderly forces.

Despite involving a paradigmatic break with the classical paradigm the inner logic of chaos is actually quite simple. Chaos theory is a mathematical branch of dynamical systems theory, which, in turn, can be traced back to Newton (Capra in Castellani, Hafferty, 2009). Despite the apparent messiness of chaotic systems, the set of rules that it adopts in its associated processes can be quite simple to represent analytically (Foster, 2004) with so called iterative equations. These start with an initial value for *x*, insert it into the equation and then use the result of the equation in the next calculation step for *x,* and so forth, blindly and mindlessly, until it 'hits the wall' of systemic thresholds. Stewart (1997) explains chaos as apparently random behaviour with a purely deterministic source involved in simple replication of its rudimentary form, called a fractal. This is a geometric figure that does not become simpler when you analyse it into smaller and smaller parts (Baranger, 2001). A fractal repeats itself in a self-similar pattern beyond all levels of observation as a scale invariant – incapable of producing novelty in vertical direction. Well known examples are the Sierpiński triangles (1915, see Picture 2.4, later) or Mandelbrot sets (in Gleick, 1991).

The theory of chaos is also reflected in sociology, in the irrational programme of postmodernism (Byrne, 1998), as well as in economics, where chaos is implied as a frame in which neoliberal market theories are formulated, like by Hayek; more on this follows later. Nevertheless, social systems, markets included, are usually complex rather than chaotic or stable (Manuel-Navarrete, 2001). These two shall be clearly distinguished in any theory formation. Chaos deals with a few variables that are strongly interdependent. Complexity deals with a large number of variables that are networked and connected with varying degrees of strength (Mitchell in Bragin, 2010). Chaos starts with one or a few simple equations and evolves into a pattern of apparent randomness but remains bounded with narrow possibilities – as they are set with specific form of fractal (Mitchell in Bragin, 2010) and systemic thresholds. Complexity instead starts with a highly distributed set of agents in apparently random arrangement and then creates patterns of macro order, which is not necessarily bounded so it can take the transformation of a system in many directions (Mitchell in Bragin, 2010). While complexity theory is strikingly similar to chaos theory, complexity theorists maintain that chaos, by itself, does not account for the coherence of self-organizing, complex systems (Waldrop, 1992).

Herbert Simon (1962) understands a complex system as a system that is subject to a number of conflicting constraints, with partly independent and partly dependent contents (Easterling, Kok, 2002). Complexity is studied to identify common structures and ordering mechanisms behind apparently unstructured systems out of equilibrium with many heterogeneous parts (Gernot, 2010). As it exhibits a hybrid nature between simplicity and chaos it is appropriate to approach complexity as a hybrid concept. In this regard complexity is seen as *chaos déterministe* since it spans 'on the edge of the chaos' (Prigogine, Stengers, 1982). This is the constantly shifting battle zone between stagnation and anarchy, the one place where a system can be spontaneous, adaptive, and alive (Waldrop, 1992). When a system is performing far away from its static equilibrium it needs to maintain high structural flexibility and creativity (Prigogine, Stengers, 1982) to reproduce. But at the same moment it is not that far from equilibrium to fall completely into chaotic state; a moderate level of structuredness is still preserved. Members or components of a complex system are not permanently locked in to a particular position or role, like they are locked in the simply ordered system, but they neither fall completely out of control.[25] Therefore here we are not dealing with chaotic complexity but with organized or ordered complexity. This specific type of complexity is particularly relevant in the formation of scientific claims about social facts as partly contradictory and partly overlapping truths, and, for the same reason, in studying social systems as partly ordered and partly chaotic, free and autonomous.

The core feature of complexity is apparently linked to its middle location. It is situated in the middle ground which enables intermediation, observing not only the laws of chaos, but simultaneously also those of order (Manuel-Navarrete, 2001) in correlation between coherent and random behaviour, so that a compromise between simplicity and chaos as well as between structure and surprise becomes feasible (Kauffman, 1996). Before the importance of an intermediate or mesoscopic concept of complex systems is addressed with due attention, which is basically our main concern, we will first conclude the presentation of the ACM frame and draw its further implications for the underlying project.

The only remaining category to be addressed is the concept of disorder. Disorder is that sphere of the perceived reality into which our intelligibility has not yet descended to inhabit it with mental concepts and order it into recognisable pattern. A motive for incorporating disorder into a concept of knowledge management is to keep one away from Pythagorean bigotry arising from specific concept of truth that disconnects the irreducible link between the known and the unknown. What is known scientifically never exists absolutely without sharing its existence with vast surrounding areas of disorder and the unknown. Accounting for surrounding disorder is then like a shield protecting scientists against generalisations of their findings beyond narrow horizons of applied abstract models of reality. This merely demands that each scientific truth, in particular about social phenomena, is presented in a humble way – only in a specified context and with limited validity so that it is determinedly subjected to further modification. With social complexity in mind, the researcher aims to remove every reference to infinity and absolute validity from his research, both from model assumptions and from achieved research conclusions. Complexity therefore brings truth claims closer to a human scale, which is always to an extent irrational, out of order.

Therefore, the opposite of ordered simplicity is disorder, not chaos, and far less complexity. Concepts of simplicity, chaos and complexity are closely related because they all belong to a

[25] http://lostgarden.com/2006/04/managing-game-design-risk-part-i.html, October 2012.

broader family of ordered systems. This means that different orders of order are involved in different theories of truth. Organised complexity is hence not the opposite of simplicity but, just the contrary, it is a more generally valid version of it, since it is instituted on far less restraining core assumptions, which are first of all disconnected from gods and cosmic order. In this manner it becomes obvious why it is necessary to study real social phenomena as complex. Comparisons between different theories of truth indicate that to a certain extent but definitely not beyond it. Weaker orderliness of a theory of knowledge may increase our capacity for recognising more generally valid truths, despite their intrinsic messiness.

Although radically different theories of truth are available to a pure Newtonian system, the simplicity as its essence proved indestructible in each of them. Individual characteristics of simplicity, such as linearity and unilineality can be entirely eliminated in alternative theories, but characteristics of simplicity cannot be eliminated integrally from any alternative to obtain a sort of strictly non-simple theory of truth. There is no need for resignation, because elimination of simplicity in the first place eliminates our ability to understand anything in a systematic and ordered way. The only facts worthy of our attention are those which introduce order and so make it accessible to us (Poincaré, 1914).

Prigogine and Stengers (1982) claimed that simplicity belongs to our macroscopic observation of reality when we are searching for general truths. They seek support for their claim in citing Bergson who explained that one and the same object can be seen as simple from one aspect and as complex from another. But these two are not equally genuine. Simplicity belongs to the object and symbols we apply to describe it, and complexity belongs to our observations, when we move around the object, applying incommensurable explanatory approaches. An observer sees a system as complex when he has more than one single description of it, and these descriptions cannot be reduced to only one (Fioretti, 1996). The complexity therefore emerges not from denial of simplicity but from different organisation of multiple simpler meanings (Bousquet, Curtis, 2011).

It becomes apparent along the main lines of this section that a system theory and a theory of chaos both remain silent on how to strike a balance between rational and irrational complements of truth, as they both develop only one aspect of this duality and remain ignorant to its counterpart. As one-sided theories, they are not capable of invoking qualitative novelty either with better understanding or more cohesive ordering of social complexity. Because linear reasoning never surpasses its piecemeal approach, it cannot generate deep understanding. Similarly, a non-linear chaotic system only frenetically iterates its fractals in all directions without much rational sense. System theory and theory of chaos do not produce their results beyond their own purely rational or purely irrational platforms which would be otherwise evidently needed for the possibility of a more comprehensive understanding of complex social reality.

The important feature of complex systems is that they usually must be understood as creatively evolving processes (Durlauf, 1997). The fundamental mechanism of creative emergence was first explained in biology by Darwin (1859, *On the Origin of Species*) and his theory of evolution of life. However, it turned out that direct extrapolation of evolutionary logic from biological organisms to social processes may effectively constrain explanation of specific form of creativity that is seen in complex social systems. Evolutionary theory is nevertheless a major step forward in scientific understanding of complex processes.

Conformism of social evolution

The theory of evolution is an older sister to complexity approach (Dopfer, 2011). Evolution is first of all a philosophical concept of historical origin of the world, denying the idea of unchangeable reality as portrayed in classical physics (Sloan, 2010). Evolutionary theory introduces understanding that the existing world is neither inert nor externally imposed on us. As a consequence, understanding of evolving phenomena is always unfinished and emerging trough partly contradictory and partly synergetic contributions of all diverse drivers that somehow cluster together, even though they have individually independent predispositions and affinities.

The theory of evolution developed a deeper understanding of emergence of new quality in the ecosystem, initially in the case of evolution of new biological species. It explains progression of living systems' forms from simple to complex (Sloan, 2010). Novelty in nature emerges with a creative process that goes far beyond blind amplification of basic forms assumed in previous theories. It denotes the theory of the change as non-aggregative and a non-linear process. The simple thinking and the chaotic thinking are yet not removed from evolutionary approach. They were merely assigned to limited roles that are more in line with their slim potentials for explaining qualitative emergence of novelty – either in search for deeper truth or in elaboration of systemic transformation.

Evolution of a new form advances vertically by an iterative, chaotic like, but nevertheless ordered emergence of novelty. It consists of three phases or sub-processes:[26] variation, selection and retention. The first phase, variation, is considered blind or random, and happens typically by a small change, by mutation in the genetic pattern. The atomist idea is clearly preserved in evolutionary theory even though it applies entirely different logic to physical atomism. Novelty is not established with reassemblance of atomic content but with deviation from it following mutation in genes in a parental DNA, which is otherwise integrally inherited by all generations.

[26] Wikipedia, #Evolution, February 2013.

The second phase of evolution is selection of the organisms with the fittest variants of novelty that are best suited to survive and reproduce in a given environment. [27] The creative act of novelty emergence is accomplished at the selection phase which is the intermediate level of evolution. The features of the fit variants are retained[28] in the third phase and passed on in offspring in new generation. After that, they can again undergo variation, starting a new round of evolutionary iteration. The process may gradually develop novelties into a distinctive characteristic of a new specie that is finally classified as more complex form, higher on the tree of life. It is important to note how evolutionary theory combines non-linearity in emergence of novelty with linear classification of emerged life forms from less to more developed. Theory of evolution explains how a non-linear process spontaneously emerges into linear ordered patterns – an important idea which plays a crucial role in social sciences, explaining spontaneous vertical emergence of social structure – or how systemic order evolves from the chaos of unstructured society.

The Darwinian model explains evolution by vertical transmission (Lewens, 2013) from the chaotic level of genetic interplay to the ordered level of organism, and further to the level of specie. But selection as a main evolutionary mechanism is itself a vertical process. There is therefore a deeper vertical process nested in general verticality of evolution. Stephen Jay Gould argued for a hierarchical view of evolution, with selection occurring at many levels (in Erwin, 2007). Okasha (2006) also emphasises that the selection mechanism operates on different levels from lower to higher. It starts as a selection between individuals forming a narrow group or cluster in its local context with the aim to crystallise a certain collective characteristic that is, in its specific way, vital for a group. On the next, higher level selection continues between groups. The evolutionary algorithm is further explained by some authors along the entire multi-level hierarchy of life, from single living cells to super organisms like society or even the whole planet Earth (Gaia concept; Lovelock, Epton, 1975). Furthermore, biological evolution forms vertical lineages (Brandon, 2010). It could be therefore held that it is these lineages that evolve, and that only within such vertical lineages we will properly apply the term natural selection (Brandon, 2010).

Despite its close relatedness to complexity, evolutionary theory cannot gain capacity for successfully explaining complex processes. Even though the tree of life develops with its branches in dissimilar directions representing intrinsic diversity of life, it nevertheless remains rooted in one point of life, represented by common ancestors as its origin. Each branch of the tree as well as the tree as a whole always remain genetically predetermined by its origin. This is a serious shortcoming of evolutionary theory for elaborating complex phenomena that, first of all, demands abolishing any concept of the common denominator as the primary source of

[27] Wikipedia, #Evolution, February 2013.
[28] Wikipedia, #Evolution, February 2013.

meaning constructed through elementary similarity instead of through incompatibility of diverse core meanings. This subverts any attempt to directly transplant the evolutionary mechanism from explanation of biological processes to social systems.

Serious difficulties are linked to applying evolutionary approach from biology to explaining complex social processes because of symptomatic discrepancies in unfolding evolutionary processes in biology and in social systems. To comprehend them appropriately for our purpose, it is especially useful to understand the difference between vertical and horizontal axis of evolution – the latter being especially pronounced in social systems. Furthermore, contradictory understandings of horizontal evolution are currently used in methodology of social research that further distort complex comprehension of complex issues. We will consider these notions in more detail step by step.

Social sciences can be still regarded as adolescent in the family of sciences. They have performed rather poorly in comparison with older sciences, like physics and chemistry, with especially disappointing contribution to fulfilment of their main goal to develop scientific grounds for establishing an enlightened, just and free world with sustainably prosperous societies (Condorcet, in his *Sketch for a Historical Picture of the Progress of the Human Spirit*, 1795).[29] One of decisive reasons behind this unfulfilled promise is linked to the circumstance that social sciences, despite dealing with massively horizontal processes, borrowed scientific apparatus from older sisters, e.g. from biology, which developed their theories dominantly in vertical direction. Social sciences remain poorly equipped for comprehending society in its intrinsic social essence as they are still lacking their own distinct philosophy, scientific paradigm and independent methodological apparatus that is capable to account integrally for multiplicity of social reality, indirect manifestation of crucial social processes, and intermediate mode of reasoning about them.

The theory of biological evolution has been a particularly inviting reference since it is originally linked to social sciences. Darwin was familiar with Adam Smith's evolutionary concept of the invisible hand by which market stability evolves non-linearly between independent forces of demand and supply, analogously to spontaneous emergence of stability in biologic habitat due to contradicting aspirations of predators and prey. Darwin also studied political economist Robert Malthus and his demographic principles that explained long-term social stability with a mechanism of increasing social and health strain on a too-expanded population until the balance is restored with a scarce economic resource base. Social sciences have been thus understandably wide open to adopt evolutionary logic from biology as one of their building blocks and a principal mechanism for explaining social change following a unilineal idea of universal progress.

[29] Wikipedia, #Marquis de Condorcet, March 2014.

Despite their close relatedness, the application of biological evolution theory for the interpretation of social processes has always raised theoretical controversies. Natural and social systems are both systems in evolution but their process characteristics are importantly different. Biological evolution is Darwinian; it transmits inherited parental traits on offspring. Social evolution is also Lamarckian (Hayek, 1992) with a remarkably pronounced horizontal aspect of evolution. Social evolution transmits knowledge and experiences accumulated during the life-time of individual, so we can learn from each other, not only inter-generationally from parents, and we can also innovate and create novelty. As experiences and knowledge transmit much faster than hereditary traits between generations, cultural evolution is much faster (Hayek, 1992) and incomparably more diverse.

Social systems are evolving around about what is valued (Bovens et al., 2008) by members of society. Values are ingrained in members' scopes and expressed in their different political visions, environmental concerns, and culture – while evolution in nature has no aim and final goal (Heylighen, 1989), except improving efficient response to changing external demands from the environment. 'Unlike migrating swallows or foraging ants, we are not programmed to know what to do. Instead we are an experiment in free choice' (Hubbard, 2008). Our freedom is to serve our own aspirations for shaping the social world by our specific visions of commonality.

Introduction of value-based scopes into the evolutionary mechanism is decisively changing the perspective. It shifts focus of evolution from individuals as its objects to an invisible reality of values (Hollis, 2002). Centrality of values in objectification of social reality means that the arrow of causality is also inverted where mental scope replaces objective cause (Giddens, 1989) as a source of change. Internally aspired goals, not some external factor, become the mechanism for driving real changes that bring about goal fulfilment.

Cultural ecologist Julian Steward (1955) has criticised the contributions of standard social evolution as unilineal because it interprets social change as vertically uniform along only one main progressive idea from less to more developed forms, in the same way independent of a broader context. Societies evolve according to their specific internal conditions and external requirements, which may vary between them so widely that their selection mechanisms are not directly comparable and far less directly transferable. Take for instance the following example from anthropology. Time is perceived in a given culture in circular dynamics with rituals and ceremonies which repeatedly return its members to foundations of their communal scope, following the same repetitive pattern without inducing change in structure of community (Gell, 1992). Their social dynamics is periodic when it orbits its fixed scope so it cannot yield new social forms. In such a frame creative powers of evolutionary progress are disabled. Some other cultures, like Western society, understand time differently, as an arrow flowing from past to future in a linear manner (Gell, 1992), so they understand their social world as unfolding along an irreversible progressive trajectory, with evolution as its determining logic.

Contrary to evolution in nature, social evolution is a parallel, distributed and 'multilinear' process (Steward, 1955). Different scopes reflect multiple views of social reality and each view has its own evolutionary lineage. These multiple views are socially constructed, so it is always necessary to be explicit about the underlying social, political, cultural, economic and many other values that radiate through each vertical progression. Steward resolutely rejected the mainstream view, pointing out that social evolution is differentiated and must be observed as multilineal. These multiple lineages are related to each other as partly parallel (vertically) and partly overlapping contents (horizontally). Furthermore, nature only evolves outwards when creating new forms of life, while social evolution at the same time also evolves inward, trying to become more inclusive and capable of emerging horizontal coherence between internally diverse compounds.

The object of selection itself is completely different. In a democratic society selection is not leading to the extinction of the unfit individuals. For sociologist and economist of Norwegian origin Thorstein Veblen (1899), the objects of evolutionary selection are institutional formations which are formed to protect members from harsh selection process from the outside (Michod, in Hammerstein, 2003). When everybody structurally protects themselves from selection its mechanism is shifted to the higher level of social hierarchy (Turner, Maryanski, 2008). Protective institutions and the whole social formations as inert structures gradually become obstacles to social change and so they become the target of evolutionary selection (Hodgson, 2008). Individuals as political agents are not passive victims of evolution. They can in part bend evolution for their own aims when selecting a mechanism of selection, such as with application of free market rules or within democratic process.

Austrian economist Joseph Alois Schumpeter (1942; in *Capitalism, Socialism and Democracy*) in his theory of economic evolution did not, like Veblen, build on the Darwinian concept of natural selection, except metaphorically. With the evolution he refers no longer to the selection of the fittest but to the general dynamics of the accumulative transformation of the system as a whole (François, in Fuchs, 2003) due to innovations such as in technological or institutional systems. He is among the first authors who formulated social evolution as a mechanism of overall social change involving the transition between two qualitatively different macro states (Dopfer et al., 2004) – such as before and after introduction of a technological innovation.

Biologists initially conceptualized the horizontal axis of evolution as less important. For many orthodox authors it is even not an independent form of evolution; rather they regard it as a part of variation (Gontier, 2006). It is nevertheless a common error assuming that evolutionary logic in general is somehow tied exclusively to vertical processes (Adams, 2009), even in biology. Some contemporary authors also see evolution as a massively horizontal process (Riofrio, 2013) – such as in the case of horizontal gene transfer (Woese, in Adams, 2009), hybridization, parasitism, or symbiogenesis (Gontier, 2006).

The horizontal axis of evolution is emphasised still more in a social context due to its cultural, ideological, religious and other multiplicities which normally push social evolution in several directions at the same time (Heylighen, 1989). Simultaneously unfolding incomparable processes assemble society as a horizontally complex structure (Bourdieu in Couldry, 2005; Ravetz, 2003) in which various social cores are conjectured as holistic, but they are not all encompassing, so they are related to each other at least in evaluative comparisons. This comparison invokes a horizontal axis of differentiation as indispensable for more understanding complex social processes. However, their inclusion in methodology of social research has typically been all but integrative.

Two opposite approaches have been taken in methodology of research to account for the horizontal axis of social complexity. The first one takes the horizontal as an explanatory axis along which issues of primary importance for the understanding of a given complex issue are addressed directly by their substantive content. The other view takes them as mainly relating to secondary meanings that emerge indirectly in hybrid terms formed in marginal overlaps between substantive issues of primary importance.

The first approach builds on the observation that horizontality originates from multiplication of primary structures of meaning so it organises them in a multilineal way. In this manner horizontality is approached with ‘pillarization’ of multiplied meanings into non-overlapping domains, such as economic, social and environmental domain of sustainable development (see Picture 2.1, later). Pillars are integral for holistic understanding of the researched complex phenomenon; they are organised as disconnected to each other, so they can be understood only in a divisive way that justifies segregation. Multiplicity does not play any connective role here and this is contrary to the horizontal perspective. Because of the non-overlapping pillarization of contents, horizontal meanings are effectively wasted and methodologically corrupted back into vertical comprehension, where primary social concerns remain confronted and incapable of any coherence, even of the most primitive aggregative one.

In the methodology of social research this is often entirely ignored. Vertical interpretation of horizontal content is practiced broadly, e. g. by authors of human development index (HDI; UNDP).[30] This index has been introduced ‘to shift the focus of development economics from national income accounting to people-centred policies' (ul Haq)[31] and so to replace Gross Domestic Product (GDP) per capita as a leading development indicator for measuring and

[30] Wikipedia, #Human Development Index, October 2014.
[31] Wikipedia, #Human Development Index, October 2014.

comparing the level and progress of general social welfare between countries (as a matter of fact, it has not been developed specifically for this purpose but is usually applied in this way). HDI therefore uses much broader welfare account when defines human development as an aggregate of three constitutive sub-indices, which are defined as *incommensurable* measures of development, Gross National Income p.c., years of schooling and life expectancy at birth. However, their aggregation is prohibited by definition. Summary human development index thus straightforwardly suppresses the original triadic and incommensurable composition of the concept of human development.

Another methodological example of 'horizontal pillarization' is available in evaluation guidelines prescribing procedures for including horizontal evaluation criteria, such as gender equality (or sustainable development, social cohesion, quality of life…) into policy impact evaluation (in EU for instance 2001/42/EC, SEC(2005)791, ESPON, 2006). Guidelines generally agree that gender equality is a horizontal issue since it equally relates to all vertical, sector specific concerns in public realm. However, they suggest evaluators only to ask how sector specific policy measure directly contributes to realisation of the main goals of gender equality, such as improved equality of representation and enhanced employment for women. They do not inquire how the policy measure impacts gender equality indirectly on all other, non-included aspects of gender inequality. It makes for instance little sense to increase employment of women if other social conditions of inequality are not abolished. These manifest in their separated roles from the aspect of sex, class, and race – as justified in feminism with intersectional theory (Kimberlé, 1994).

To avoid the methodological inconsistency of pillarization, the horizontal aspect of social evolution is alternatively conceptualized as comprising only secondary meanings which are envisaged as dominant to vertical ones. Hayek explains that our primary intentions and actions are one thing, but their aggregate social wide effect is something completely different. If a person only did what she thought she is doing, the collective truth and objective knowledge of social facts would be contained within a simple statement of intentions (Hayek in Vernon, 1976). This was evident already to Scottish philosopher Adam Smith (1776) in his work *An Inquiry into the Nature and Causes of the Wealth of Nations*. He built the assumption that secondary meanings are essential for the proper understanding of social processes into his key concept of the invisible hand of the market coordination between opposite economic aspirations of consumers and producers. Market selection is a wiser coordinator and aggregator than the most knowledgeable agent (Harms, 2011). It spontaneously extends social order (Hayek, 1992) from less to more ordered by means of market evaluation of a tacit (or dispersed, secondary) knowledge of market agents. This knowledge is in itself useless to isolated individuals and becomes meaningful only in interaction or overlap with others, and only indirectly and unintentionally. The result of free exchange between many contradicting contributions is self-balancing and spontaneously producing order out of chaos.

Even before Smith, Scottish philosopher David Hume wrote in his *Treatise of Human Nature* (1739) that those things which are for the public benefit are not a product of primary values such as of rational calculation (in Barry, 1982). The happiness of a community is not promoted by trying to instil a passion for the public good in people directly through a set of primary values – fairness, sustainability or gender equality, but only by animating them with a 'spirit of avarice and industry, art and luxury' so that the same result comes about indirectly (in Barry, 1982). Popper also takes the view that the unintended consequences of action are the principal concern of social science and that the existence of such consequences is a precondition for the very possibility of the scientific understanding of a complex society (Vernon, 1976).

Hayek was among those who had understood a concept of the invisible hand as an unsurpassable absolute. He perceived economy's selection mechanism as *deus ex machina* operating with invisible forces as if it was incorporated in a black box. The spontaneity of market coordination cannot be elaborated step by step since it operates behind our backs; it is hidden to our eyes, inaccessible to our minds and as a result leaves everybody without a possibility of substantive interference with the aim to bring about specifically aspired social outcome. All one can rationally do when faced with a mechanism of such horizontal complexity that can never be fully understood is to submit to it (Hayek, 1992). The situation is again Pythagorean: for those relying on uniform conception of world, in this case in its classical opposite, non-linear irrational variant, it is more appropriate to refer to the invisible but universal forces than to rethink orthodox models in the face of complexity of the real world. The idea of a black box is certainly a more civilised solution than throwing heretics to the fish – but still hardly satisfactory for the modern scientific mind that remains sincerely devoted to neutral search of objectively verifiable truth.

The Smithean and Hayekian type of evolution is horizontal (Hooker, 2011) and entirely flat. Its vertical outcome is social order but it is seen merely as a spontaneous consequence and thus submitted to the main force of horizontal processes. Horizontal meanings are here imposed as decapitated since they do not possess any evolutionary scope on their own. For Hayek this is wholly appropriate since the outcome of market coordination is always the best possible (1992) and nobody should even try to interfere with it with the aim to make it produce any specific outcome or order. However, if all processes in a social system were decisively indirect and secondary, society as a self-sustaining unit would gradually lose its inner compass, forget what differentiates it from external environment and become senseless. This is presently experienced with commercialised mass culture and with neoliberal models of global market competition which increasingly work against basic human rights, common goods and achievement of wider social aspirations.

Distortion of complex meaning in exclusively horizontal perspective is further present in postmodern sociology which best describes the situation of social chaos in a society that lost its unifying dominant values in vertical direction altogether. Postmodernism decomposes contemporary society into a collection of relativized meanings which signify nothing and go nowhere (Zerzan, 2004). What is again utterly lost with separate horizontal application of non-linear logic for explanation of social processes is the very possibility for multiple and incomparable evolutions that previously in the first place called for a horizontal explanation of complex social issues.

If vertical to horizontal rotation of the evolutionary axis is evaluated with categories introduced in the ACM frame, then the free market ideal and also a postmodern situation belong to chaotic processes driven by mere expansion of the same scale invariant fractal of selfishness or relativism. Horizontalized chaotic evolution must be then clearly distinguished as a different type of evolution from original Darwinian vertical evolution and from complex evolution (Heylighen, 1989) that integrates vertical and horizontal aspects of explanation as equally important.

The conclusion from the one-sided application of the horizontal axis in the above two approaches seems rather obvious. If horizontality is taken either exclusively in the macro – pillarization, or exclusively in the micro setting, represented by secondary meanings, then methodological inclusion of horizontality into social research cannot really improve an understanding of complex social issues but will only throw it back into one dimensional reasoning. Complexity is killed again, without being previously deciphered for its illuminative messages.

A conclusion is being crystallized from the opening lines to this end: vertical and horizontal explanatory axes of evolutionary theory are both indispensable and thus remain insufficient for comprehending social complexity if one of them is applied in ignorance of the other.

To grasp social complexity as a distinct concept of understanding social reality, one has to draw from rich previous attempts at explanation, starting with Newton's original paradigm and later advancements in philosophy of science such as system theory, theory of chaos and theory of evolution. None of them alone is sufficient as a frame for studying complexity, since it is not reducible to any of them. Although that concept of social complexity cannot but, paraphrasing Schrödinger (1996), stand on their shoulders, a lot can be learned from studying pre-complex theories and their achievements in improving comprehension of various aspects of the real-world complexity.

On one side, evolutionary algorithm submits to one of the defining aspects of Newtonian paradigm: it accepts atomist and verticalist logic – even though in wholly original self-organizing way (Moreno et al., 2011). On the other side, the evolutionary principle sharply differs from the principle of simplicity because it creates qualitatively new forms, i.e. it is creative. Evolutionary theory also shares common characteristics with chaos theory by depending on small initial changes and iterative developments. But nonlinearity of chaos operates in a horizontal direction. Contrary to simplicity and chaos, micro and macro level processes are connected in the system theory and in evolutionary theory only indirectly, via the mesoscopic intermediary – either through the selection process or by their cross-sectional causal (input-output) relations between constituents.

Evolutionary explanation alone, despite its obvious holistic potential for producing order from chaos, is not sufficient to describe social complexity. A biological organism evolves when it tries to escape selection as its main condition, while a complex agent embraces emergence as a mechanism for enhancing creativity of those operating in dis-equilibrium of transforming system. Further, social processes cannot be explained without taking into account distinct oppositions about the principal issues. The social world is first of all the site of continual struggles to define what the social world is (Wacquant, 1989). This kind of conflict linked to the aspiration to understand itself is unknown in natural processes.

Natural selection is blindly unfolding as a by-product of learning by doing and trial and error (Hooker, 2011). Evolutionary diversification by the means of small differentiation is nothing more than the repetition of the same formative mechanism that takes place within existing systems (Luhmann, 1995). Evolution actually discourages wide deviation in any direction (Cooley, 1897). It is preserving rather than changing types, where radical novelty on a macro level of species is achievable only over the very long term, and with many intermediary steps. The principle of survival of the fittest is primitively conservative and primarily negative, as it excludes and removes poorly adapted units (Erwin, 2007). The progressivist concept of evolution is actually about higher forms in the same frame, not about deep transformative processes.

Belgian philosopher Isabelle Stengers (1997) clarifies that complexity differs from evolutionary emergence in that ‘the notion of emergence implies a physical genesis of the new, whereas the notion of complexity would correspond to a conceptual genesis’. For instance, Schumpeterian ‘creative destruction’ is able to change the system in every particular structural feature, however it is not ‘deconstructively creative’ (Derrida, in Lawlor, 2008), it is not able to go beyond its structural predispositions. It is rather obvious that some of the most far reaching inventions in the history of science materialized non-evolutionary as radical anti-systemic events, as revolutions, induced by the excluded, which developed their ideas in parallel, marginal or directly opposite to the dominant selection mechanisms at the market, in research institutions or in corporations.

The classical evolutionary framework is highly valued for its original contributions to scientific apparatus, but it nevertheless remains too narrow for explaining radical change in a complex social system. So the inquiry continues focusing on the question of how to finally formulate emergence of meaning and mechanism of structural changes in the presence of deep contradictions inherent in every socially complex phenomenon.

Hybrid resolution in the middle

The most recurring difficulty in previous attempts to comprehend complex social reality is linked to the question on how to methodologically connect vertically with horizontally differentiated evaluation of social facts, or how to philosophically link primary with secondary meanings, or how to mathematically integrate rational or proportional with non-proportional or irrational numbers.

Groenewegen and Vromen (1996) have developed a thesis that evolutions in horizontal and in vertical directions are simultaneously present and equally important. Vertical evolution transmits individually favourable characteristics to the level of the group. Horizontal processes crystallise which group characteristics are the most favourable. Sterelny (2007) applied the same distinction in analogy to social processes when he developed a theory with two types of social complexity: vertical and horizontal. Vertical complexity measures the depth of the hierarchical organization an agent experiences – e.g. individuals hierarchically nested in families, villages, tribes... Verticality relates to a micro-macro division resulting from a discontinuity between individual and collective levels of judgment about social matters. Different levels of factual description are irreducible – equally fundamental, but a conclusion from studying social reality obtained at each level is autonomous and thus incommensurable to those obtained at other levels.

When discussing vertical social complexity, we do not think of different social realities but of different frames on different levels of analysis (Ritzer, 1990). Wiegleb and Bröring (in Easterling, Kok, 2002) explain that shifts in scale by the observer are instrumental since they can produce homogeneity out of heterogeneity. We can bring order out of chaos simply by de-magnifying the resolution and extent of the perspective at which reality is observed and applying more aggregate data to observe through a less dense grid of details and in lower resolution or in slower dynamics.

Levels of observation hence do not exist as separate realities. They only determine how we see the world. They position observer in relation to the object of observation, to frame his perspective on the relation specific-general. Bar-Yam (2004) says that levels are constructs that permit the observer to locate the self relative to a set of objects distributed in space, time and magnitude (Easterling, Kok, 2002). It explains nothing in and of itself, but its frames facilitate the discovery of ordered patterns from chaotic processes (Gibson et al., in Easterling, Kok, 2002), which arise in dependence of the observer's scope, and so wholly reliant on horizontal perspective, not on level of observation.

On the other hand, horizontal social complexity is linked to differentiation at a given systemic level (Lynch in Cat, 2010), e.g. among individuals, but also between classes, genders, and religions. James (2002) offers a simple example illustrating his conviction that a given reality can be observed differently, in dependence of the specific scope of the researcher to which observed reality only passively submits. For instance, 27 is equal to 3^3, 3×9, $26+1$, $100-73$ etc.; these variants are equally valid and application of a particular one wholly depends on the specific needs of the scientist. Meaning emerges for a particular observer because s/he predicts its appearance within the given research scope and biased understanding (Weinberg in Easterling, Kok, 2002). Dilthey, the German idealistic thinker from the XIX century in this regard wrote that human life can be understood only in social categories, such as scope, value, and ideal which all exist in horizontal relation to each other and which are not needed in classical description of physical or biological objects (Hollis, 2002).

Vertical and horizontal perspectives of reality are independent but equally valid for explaining complex social issues. Bar-Yam (2004) offers useful illustration. He distinguishes between the scale in vertical and the scope in horizontal direction: 'Consider observing a system through a camera that has a zoom lens. For a fixed aperture camera, the use of a zoom couples scope and resolution in the image it provides. As we zoom in on the image we see a smaller part of the world at a progressively greater resolution… We must allow a decoupling of scope and resolution, so that the system as a whole can be considered at differing resolutions as well as part by part. For this purpose scale can be considered as related to the focus of a camera—a blurry image is a larger scale image—whereas scope is related to the aperture size and choice of direction of observation.'

On one hand there is a demand for integrating two meaning axes of complexity, vertical and horizontal, while on the other there is a request that axes remain separated as independent presentations of complex reality. This begs a methodological solution in social research that simultaneously enables both. One possible option, rather conventional but entirely sufficient for the purpose, is orthogonal organisation of axes as independent, but still minimally intersecting. Orthogonalisation emphasizes not only that horizontal and vertical aspects of complexity are independent, but also that they can make sense to each other merely when we succeed in devising worlds in the middle ('*zwischenwelten*'; Willke in Ankersmit, 2005), that mediates between them. A feasible solution for framing 'the middle kingdom' (Ulanowicz, 2005) of complexity is to substantiate both axes with their multiple constitutive domains and relate them to each other against what they are not – vertical axis on micro-meso-macro domains and horizontal axis on its substantive scope domains such as A, B and C (as illustrated in Picture 2, later), depending on the researcher's concrete scopes. If this reads a bit too sophist, let it then serve only as a schema of an argument for a forthcoming discussion. Before proceeding on to the resolution of the methodological challenge, we first capitalise on recent accomplishments to refine the platform from which the discussion takes place.

One thing is obvious. The concept of social complexity cannot escape dual logic. It is ingrained in the orthogonality of its explanatory axis, just the same as it was found out previously that the concept could not get rid of simplicity that is engraved in some sort of orderliness of complex social system. However, monistic and dualist approaches are both revealed as powerless, which leads one to apply instead plural or triadic thinking about social complexity. Social complexity is founded on the incommensurability of relations. Incommensurability refers to an intrinsically plural situation since it allows for several true statements about the same issue. This enhances triadic logic, which is formalised between at least three domains – between true, false and possible and analogously between three independent agents, three objects, values, paradigms...

Dual logic is nevertheless indispensable for understanding the emergence of triadic relations. Hegel wrote that to produce triadic logic, manipulation of two orthogonal distinctions is needed – such as between universal and particular, and between direct and indirect (Vernon, 1976). Family for example rests on direct relations but it puts forward particular ends, while state rests on indirect relations but it aspires for universal ends. Civil society is located between the two and is characterized by universality and mediacy (Vernon, 1976). Lynch (in Cat, 2010) similarly points out that pluralism arises from a duality between vertical and horizontal valuations. Vertical pluralism is inter-level pluralism, the view that there is more than one level of factual description. Horizontal pluralism is intra-level pluralism, the view that there may be incompatible descriptions or facts on the same level of discourse.

A short digression to the dualist formula of triadic structures in Hegel: an intersection between two dualities must produce more than a mere triadic result – the missing situation from the above formulae is an indirect provision of the particular content and this would fit, in the ACM scheme, into the area of chaotic systems. Residual ‘r’ from the philosopher’s implicit equation ($2\times2=3+r$) may have been seen for Hegel as irrelevant – probably because the residual does not operate in the classical frame of logic that he applied. However, omission of *r* is not appropriate beyond the simple frame. We therefore feel contested to propose the emergence of a triadic structure in a way that also includes chaos: manipulation or intersection of two distinctions produces a triadic (complex) outcome with chaotic residual. Our discussion is nevertheless about the triadic structure of complexity to which we shall return again.

Social complexity therefore consists of dual and triadic thinking. The former is put forward by two explanatory axes of complexity, vertical and horizontal. The latter is put forward with triadic assembly of each axis as consisting of substantively incommensurable domains. Orthogonal orientation of explanatory axes constructs the plane of complexity which is further divided into cross-sectional landscape of causes and effects or input and output relations between domains. Such organisation describes the world in the middle as partly connected and partly disconnected contents.

Such presentation is methodologically feasible by an application of a cross-sectional Leontief's square input-output matrix (only its first quadrant; 1953). Matrical presentation links dual (columns, rows) and triadic thinking (three domains of each column, row) in a characteristic mesoscopic way that puts forward a view of complex social phenomenon as an organised network (Rossiter, 2006) of relations. The organised network is a hybrid structure consisting of partly closed relations (placed on diagonal fields) and partly opened relations (non-diagonal fields) which are integrally presenting partly ordered and partly chaotic interactions in society. A mesoscopic approach to studying complex phenomena is wholly appropriate for the initially stated purpose since it allows for the specific organisation of partly independent and partly dependent meanings that account for the interconnectedness of all things in a complex reality as well as for their separation in our minds (Ravetz in Pereira et al., 2006).

The idea of organised or ordered social complexity only deals with 'realistically complex systems' (Heylighen, 1989) which consist of only permissible diversity (Galston, 2002) represented by the triadic structure of domains. Presently the complexity science is mainly researching the behaviour of phenomena characterized by large numbers and at maximum diversity between parts. Complexity of large numbers is situated on the lowest level of the system's presentation, while our specific form of social complexity is mesoscopic. A meso level is operational in a moderate span of diversity and social systems are also specifically characteristic for their moderate span (Simon, 1962). The moderate span is situated between the small span, involving reasoning about the system exclusively at only one level of observation such as micro or macro, and large span that is achieved with Pythagorean like direct communication between wise man and gods.

Ordered social complexity is a mesoscopic concept that is developed with triadic logic. Triadic reasoning has deep roots in the very beginning of human intellectual development. French comparative philologist Georges Dumézil (1987) studied ideology between archaic civilisations dating back to the early II millennium BCE, which practiced triadic organisation of society: the classes of wise men, warriors and labourers. Similarly, the Vedic teachings recognised three coexisting worlds (Swami, 2000). The macrocosm is the vast, all-enveloping natural universe. The second is the middle or meso universe of our relations with other sentient beings. The microcosm is a private universe known inwardly by each individual. Philolaus, a Pythagorean scholar, argues that in our thinking of the cosmos as a whole, three starting points of thought must be assumed: limiters (like shapes, forms and structures), unlimiteds (continua, like time, space), and harmony, the third element to hold these two extreme elements together. Similarly Jacques Le Goff, French historian who researched middle age Christianity, elaborated the emergence of purgatory as the third level of the afterworld, connecting heaven and hell. A trichotomous doctrine where man consists of three parts – body, soul and spirit – is pursued already in the teachings of St. Paul, the Gnostics, and later by Thomas Aquinas in the XIII CE when Christianity was reviving its Indo-European character (Le Goff, 2009). Thomas Aquinas, for instance, claimed that body and soul are entities of the natural physical world, while to the spirit he attributed the property of immateriality.

In modern twentiety century science, Polish mathematician Jan Łukasiewicz formally developed a three-part logic as an extension of the Aristotelian two-part logic (true-false), 'this most obstinate of all superhuman Absolutes' (Baylis, 1936). Łukasiewicz was the forerunner of paraconsistent logic that is devoted to the study of logical systems based on inconsistent theories (i.e., theories which have contradictory theses) but which are not trivial (Schumann, Smarandache, 2007). A triadic statement is true, or false, or possible – a particularly important option when studying propositions with more than one true statement. There are diverse possibilities for occurrence of such statements, such as in discussing undecidable propositions between many valid claims, or when relating to the future (Baylis, 1936), when dealing with qualitative concerns or when addressing universal claims, absolute terms or any other instance of infinity.

The most far-reaching explanation of triadic thinking, at least for our narrow concerns, was contributed by philosopher Charles Sanders Peirce (1931, 2004). He developed a scheme in which triadic thinking is given an outstanding role. He starts with recognising three phenomenological categories of reality: firstness, secondness and thirdness. 'Firstness' governs absolute qualities; 'secondness' oversees relative forces and 'thirdness' rules mediation. Each of these conforms to one of three basic forms of logical reasoning about the nature of reality: monads (such as Pythagoras, Leibniz, or Einstein…), dyads (Aristotle, Descartes, or Durkheim…) and triads (Heraclitus, Dumézil, Le Goff, Dopfer…). Each further matches one of the three philosophical views on the fundamental composition of reality (Ford in Cheal, 2008): monist, dualist and pluralist.

Firstness is related to essence, substance, energy or being which is independent from anything else. It is logically not controversial, it can only be source of everything, and it leads nowhere but exists in itself as a primary quality. Primary qualities are those which characterize the fundamental nature of the physical world (Locke in Craig, 1998) as it is in itself, substantively. Its inherent logic is monism – a view that there is only one principle in universe. Despite its many appearances and diversities, the universe is really just one thing, to which everything is commensurate (Huffman, 2006). From such a system we can in principle derive a single correct answer to any moral problem. All genuine questions must have one and only one true answer (Crowder, 2003).

Monism has the advantage of simplicity — once it has been substantiated or determined what the super value is, much of the hard work has been done (Mason, 2008). The seamless moral system, once known, will enable us to iron out all dilemma and conflicts and make possible a perfected society in which there will be universal agreement on a single way of life (Crowder, 2003). Examples of monistic frames are religious dogma, logic, universal values or classical concepts of a science as unified. The Pythagorean ideal of cosmic harmony comfortably resides in the same neighbourhood.

Secondness is for Peirce a category of actually and specifically existing matter that leads to something other than itself. The idea must be reckoned as an easy one to comprehend as it is eminently tangible. In Peirce's words, the second is that which is what it is by force of something to which it is second. It meets us in such facts as 'another', 'relation', 'effect', 'dependence', 'independence', 'negation', 'reality', or 'result'. Secondness implies dualistic logic, with two substantive but antagonistic claims about each social fact, such as micro and macro. A given observer is immersed in secondness immediately when addressing absolute categories of firstness. These can be described only partially, in one of their antagonist manifestations.

The dyad is the metaphysical correlative of the proposition or hypothesis, as the monad is of the term (Peirce, 1931, 2004). In the words of Lefèbvre (in Goodchild, 2008) a binary thinking is useful for identifying contrasts, oppositions and antagonisms. As soon as something is discussed, related, or linked, it becomes a concept or an idea – that which is 'dual' (Macmurray, 1935), divided, the expression of im/balance or causal interaction and also necessarily of exclusion of the unfitting. The search for truth throws scholars into permanent antagonism not only against the absolute but also against each other. Dualism therefore liberates the truth from monistic impositions at the high price of tearing down its assumed unity.

Thirdness finally is not concerned with things and relations between them but with representations. It operates in between, on a meso level to intermediate thought, novelty, generality, convention or rule. The third is for Peirce that which is what is owing to things between which it mediates, so it acknowledges diversity and imposes plurality on the research(er). Pluralism is a device for talking about incommensurable issues since it is mesoscopic and, consequently, neutral on the issue of ultimate truth bearers (Beall, Restall, 1999). In the geometry of thinking, thirdness implies a triangular approach (Goodchild, 2008; Fuller, Applewhite, 1975) that produces for the researcher multifaceted conclusions with heterogeneous content.

Why stop at three?, asks Peirce. Why not go on to find another distinctive conception of reality with four or five domains for each axis of complexity, and so on indefinitely? The reason is, he explains, that while it is impossible to form a genuine three without introducing something of a different nature from the unit and the pair, four, five, and every higher number can be formed with the same meso logic by mere complications of threes. Chinese philosopher and poet Laozi, has it this way in the *Tao Te Ching*, a classical Taoist teaching from the VI century BCE: 'Tao gives birth to one. One gives birth to two. Two gives birth to three. Three gives birth to all things and all beings.'[32] There is no essential need to extend triadic logic further. A given complex issue certainly can be analysed into an even higher number of horizontal domains but these cannot rise to the height of philosophical categories as fundamental as those that have been considered between 1, 2 and 3 (Peirce, 2004), or beyond absolute, dual, or meso logic.

A short digression may be helpful here. Classical physicists will refuse a triadic conception of reality, claiming that physics needs to operate in a four dimensional time-space continuum consisting of three spatial dimensions and one temporal dimension. For physicists the fourth dimension adds another layer of irreducible complexity to a three dimensional spatial representation of reality. Such an assertion may not be correct in Peircian terms. Physicists do not discuss the four dimensional concept at all but three domains ('dimensions') on the spatial axis with one temporal axis. Dimension as a category consists of (three) domains and these are not defined on the same level of abstraction as the axis (two). Just as the spatial axis consists of three domains – width, length, and height, the temporal axis consists of past, present, and future. So the time-space continuum in physics might not be conceptually any different from vertical-horizontal continuum of social complexity – both are presented with two intersecting axis each consisting of three incommensurable domains. Back to Peirce!

None of these three forms of logical reasoning, firstness, secondness and thirdness has any advantage over the other. If illustrated with mathematical operators, firstness is about the counting of commensurable content, secondness implies division, while plural relies on multiplication – and all three are needed in research methodology. The monistic method is appropriate for classification, logic, and mathematics; the dualist method is appropriate for applying causality, dialectics, and correlation; thirdness will be emphasised in actions that generate meaning from initially incomplete, inconsistent and thus complex concerns (Peirce, 1931, 2004). More plainly, triadic logic is a useful substitute in social sciences for heretics eating fishes and for magical black boxes.

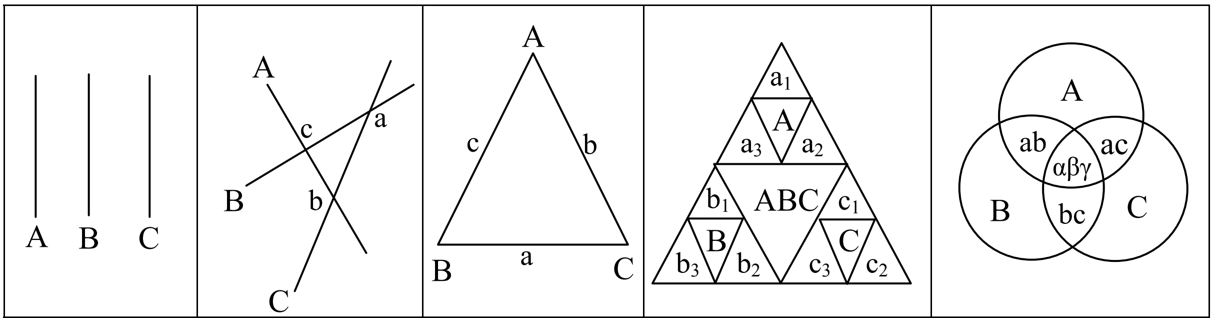
The realm of triadic reasoning and its capacity being demonstrated, there is an opportunity for a pause to review the path travelled so far. For the purpose of a working summary it will be helpful to illustrate how triadic thinking emerges through previously compared frames of reasoning: the simple, the complicated, the systemic, the chaotic and the ordered complex ways (Picture 2).

A complex situation is most primitively schematized in the simplistic manner by three parallel lines (pillars, A, B, C in Picture 2.1), where each line vertically represents one incommensurable domain with independent understanding of a given complex social issue,

[32] http://www.with.org/tao_te_ching_en.pdf, April 2014.

for instance economic, social and environmental domains of sustainable development. Vertical presentation with pillars is effective in emphasising differentiated primary evaluation domains, but it cannot go beyond principal concerns since it does not involve horizontal intersections between pillars, which are permanently invoked in real life by conflicts and synergies between domains. These are incorporated in Picture 2.2, with points (a, b, c), obtained through a triangulated set of intersecting lines, which are connective for pairs of domains (A-B, A-C, B-C). This sort of presentation falls into the category of complicated ones with lot of elements of different relevance linked in an accidentally composed network of relations without a systematic focus or identifiable structure.

Picture 2: Main approaches to ordering triadic structure



2.1 Simple (P)	2.2 Complicated (P + T)	2.3 Systemic (P + T)	2.4 Chaotic (P+T) $^{\times}$ (P+T) …	2.5 Complex (P+T+K) …

Legend:
- Three domains of a complex system: A, B, C.
- Three structuring principles of the system: P = Pillarization; T = Triangulation; K = Correlation.
- Three operators: '+' operation at the given system level, '$^{\times}$' operations between two subsequent levels; '…' extension of triadic structure into itself or beyond itself.

Next, more advanced possibility is to present triadic structure in a systemic way with a triangle (Picture 2.3) that integrates two previous approaches. Triangle involves two components: independent primary domains of evaluation in three angles (A, B, C) as well as secondary relationships between pairs of them presented with three sides of the triangle (a, b, c), which are connective for the system as a whole. In this illustration, relative to previous one, what is connective for the system are not occasional intersections due to accidental situations denoted by points, but systematic links. A and B are for instance economic and environmental development domains, while c is an environmental impact assessment of economic impacts (EU's 'SEA Directive' 2001/42/EC)[33] which is routinely practiced as a policy-making instrument for environmentally sound economic investment on micro or macro level.

A more hierarchical presentation is obtained by the Sierpiński triangle (Picture 2.4). This puts forward a chaotic view, with a fractal triangles embedded within a larger triangle. It

[33] http://ec.europa.eu/environment/eia/sea-legalcontext.htm, May 2014.

successfully shows how a given triadic system is divided on sub-systems or modules on many higher and many lower levels, but without overlaps between (sub)domains.

The last in a row is complex presentation with a Venn diagram (Picture 2.5), consisting of three partly overlapping and partly non-overlapping circles, to differentiate indiscriminately between primary (A, B, C) and secondary content of the researched complex phenomena. The diagram illustrates results obtained from Leontief's matrix with correlation of its non-diagonally overlapped domains (see the first two case studies). Correlational synthesis is obtained in two phases: it emerges first as an overlap between two domains (ab, ac, bc) and then in triadic overlap between three binary overlaps (αβγ). The diagram presents a research process in which thinking with pure categories (A, B, C) gradually transforms, where possible, into reasoning with hybrid categories (Byrne, 1998), ab (…) and αβγ. Nevertheless, large areas of existing knowledge about researched social phenomenon are appropriately represented in the diagram with non-overlapping areas that are incommensurable and therefore cannot be synthesised any further.

It is rather obvious that Venn's presentation of triadic structure is superior to previous ones because of its most structured presentation of relations between domains. It extends a mesoscopic area of judgment – that is not incidental (2.2) nor barely relational (2.3) but transformative. Pictures from 2.1 to 2.5 gradually develop an increasingly more comprehensive understanding of the meso level horizontality – from complete absence in the first, to incidental, punctual intersection in the second to linear or relational in the third. The fourth one is not more effective in exhibiting overlaps but remains relevant since it shows that the triadic process can extend into itself (ABC, A, a_1, …). The last presentation (2.5) is mesoscopic. It adds a set of heterogeneous categories, which are obtained by correlation as operator of hybridisation emerging on the margin of principal concerns. Hybrid categories emerge in overlaps between an otherwise incompatible system's domains but only on their periphery and thus without interfering with the domains' core meanings located in their non-overlapping centres. Overlapping regions allude to broad areas of horizontal trade-offs and synergy between domains, despite their separateness in their cores. We shall return to mesoscopic reasoning soon and elaborate on it further as essential for proper understanding of complex social phenomena. Before that we also want to get better acquainted with a triadic structure of the other, vertical axis of complexity.

Vertical complexity is presented in Venn's diagram with three levels, denoted by A (B, C) on the lowest level, ab (ac, bc) on the middle level and αβγ on the highest level – the same triadic pattern is repeated in the formation of each of system's domains on sublevels a_1 of A (b_1 of B, etc.), as well as on higher level, since ABC as an entity is probably part of some broader complex system, such as one consisting also of DEF and GHI, etc. Therefore, the vertical structure consists of a narrower triadic hierarchy on the lower level that is nested in broader triadic hierarchy on the level above – similar to what was previously established about nested vertical evolutions for biological processes.

Vertical complexity has been approached in a triadic manner by several authors in various disciplines of social sciences. As already mentioned, Veblen was among the first social scientists who went beyond classical micro-macro division and understood society as a triadic hierarchical structure. His analytical approach constructs a micro-meso-macro framework in which micro relates to individual habits of action and thought, meso to institutions and order, and macro to the cultural complex of society (Brette, Mehier, 2005). Schumpeter came to analogous conclusion about the importance of intermediate level of vertical complex structuration. The proper analytical structure of the evolutionary system is in terms of micro–meso–macro (Dopfer, 2006).

Ravetz (in Pereira et al., 2006) claims that a given complex issue is a three-level structure because it is arranged hierarchically in relations above-, below- and co-. At level zero (co-), the observer makes evidence of details on the level below to recognise their common characteristics from which a structured pattern on the level above is composed. A three-level organisation of systems has been formalised by O'Neill et al. (in Easterling, Kok, 2002) with their hierarchy theory of levels. It roughly posits that the researched phenomenon needs to be described at a minimum of three separate levels. The level of interest at which the observer is situated (level 0) is a component of a higher level (+1) with slower dynamics acting over larger distances, forming constraining boundary conditions for the immediately lower level (-1). Level 0 is divided into constituent components at the next lower level. Processes operating at this level are generally faster moving and lesser in spatial extent, providing the mechanisms that regulate level 0 behaviours above it (see Easterling and Kok 2003).

Triadic vertical complexity is a particularly relevant concept for explaining self-organisation capacity of complex systems and how co-existence between order and chaos is possible to attain. The rule is simple but in a complex way. To comprehend a multilevel system it is necessary to understand the processes between its levels, how they relate to each other, such as micro to meso and meso to macro level (Dopfer, 2006). Relatedness between levels is a necessary condition for the emergence of higher-level structure (order, meaning, quality) out of lower-level randomness (Easterling, Kok, 2002). While chaos may reign on scale n, the coarser scale above it (n+1) may be capable of self-organization (Baranger, 2001) and order. Disorder self-organises into ordered pattern when observer takes broader view. Self-organisation emerges from the amplification of low-level random fluctuations that result in the self-selection of higher-level properties (Prigogine, Stengers, 1982). Order in complex system emerges in a vertical direction, in other words out of nothing – out of unstructuredness, not from any pre-existing substantive rule but spontaneously, just like Hayek explained – however, it cannot be isolated from its predetermined chaotic frame of ordering, which necessarily predestines its later ‘spontaneous’ outcomes. Its spontaneity is an illusion earned by passionate ignorance of multilevel complexity of coordinative challenge; it is a matter of the evolutionary scientist's *The Fatal Conceit* – the opposite from what Hayek had in mind with the title of his book. Our main line of thought is of course not about scale invariant models of social reality.

Dutch authors Geels and Kemp (2000 in Geels, 2002) have developed, building on O'Neill et al., their multi-level perspective (Geels, 2007) for studying technological transitions. According to their model, the system's macroscopic transitions come about through the alignment of processes at different analytical levels. They distinguished three levels. At the micro-level alternative ideas, technologies and initiatives are developed by individuals or small networks in 'niches'. At the meso-level dominant rules and practices are set into patchworks of otherwise independent regimes; this is 'sociotechnical regime' level that accounts for the stability of existing systems and the occurrence of trajectories. The macro-level accounts for exogenous macro-developments and describes the changes in the 'landscape', determined by slow modifications in political culture, worldviews and social values (Rotmans, 2002). The three levels provide different degrees of structuration to activities in local practices (Geels, Kemp, in Geels, 2002). In niches, structuration is relatively weak, because networks are precarious and cognitive rules are diffuse and unstable. Actors need to use a lot of effort to uphold the niche. In sociotechnical regimes, structuration is stronger. It remains possible to deviate from regime-rules, but this is difficult, and takes a lot of effort. Sociotechnical landscapes are hard to deviate from, providing stronger structuration (Geels, Kemp, in Geels, 2002). The landscape level consists of meta-structures, like equilibrium, integration or sustainability, containing wider contextual factors that cannot be logically and even less technically modelled directly from any specific point of view.

Neo-Schumpeterians Kurt Dopfer, John Foster and Jason Potts (2004) have developed an analytical framework for evolutionary economics based on three-level architecture. Micro refers to the individual and the systems they organize, and macro consists of the population structure of systems of meso. They are placing the meso-domain at the central stage of the evolutionary framework (Tae-Hee, 2008; Dopfer, 2006). This does not of course reduce research back to a single level perspective since meso can be explained only between micro and macro levels; furthermore, the meso level is itself organized hierarchically on lower sublevels (see the first case study).

Awareness of the fundamental importance of mesoscopic level reasoning for holistic understanding has prehistoric roots. It can already be found in mystical traditions, thousands of years before it was introduced to Western civilisation (Pont, 2004). Heraclitus of Ephesus (in V century BCE) placed humans on the intermediate level between gods and apes, because humans have some characteristics of both.[34] Ironically again, Pythagoreans themselves saw their mission in organizing a temple or a city as the mesocosm isomorphic to the macro order of the universe (Fossa, 2011). This was a mediating middle level through which the microcosm of the individual had been brought into relation to the macrocosm of the universe (Campbell, 1960). In Plato's ideal state, a polis is a mesocosm which operates as the intermediate level between the macrocosm of the universe of nature and the microcosm of the individual (Pont, 2004). Buddhist philosophy also applies meso logic of un-excluded middle path, which transcends contradictory claims about existence and so it leads to deeper insight into reality.[35]

Despite its deep roots, the concept of meso has been introduced in modern science only recently. System theory corresponds to the fundamental idea of meso (Andersson, 2003) since relationships that compose the system belong equally to members and to the system itself. The meso level is further emphasised in the theory of evolution, in particular in its selection phase (Lennox, 2010).

In emerging theories of social complexity meso is located at the intersection of vertical and horizontal axes of complexity that integrally account for all main contradictions involved in evaluation of complex social issues. Meso emerges where the individual collide with the collective (see Ostrom, 1990), where connection between the microcosm of the individual with the macrocosm of all (Campbell, 1960) is achieved. It is a plane on which the 'substrate of social' is generated (Goldspink, 2000). Meso is therefore the perspective from which the modelling of social complexity is the most tractable 'a priori' (Easterling, Kok, 2002). It represents human's perspective (Heraclitus), where observer is located (O'Neill, Ravetz), where life of polis unfolds (Plato) and where meaning is emerging.

Meso perspective introduces a model of a society 'whose middle is included' (Geertz, 2000), due to its unfolding in 'the un-excluded middle' (Wallerstein, 2004). Giddens (1989) has identified a social field of a radical middle. The new middle is radical because it involves unbridgeable oppositions and it is middle because it is non-exclusionary. The radical middle rigorously distances itself from traditional political centrism formed for softening binary oppositions in society with unprincipled compromises (Giddens, 1989). Besides, it is not relativistic like Merton's (1968) middle range perspective holding that we can aim only at understanding limited topics, which is never about broad, abstract entities such as 'society' or 'social system' (Geels, 2007).

Mesoscopic thinking is recognisable by one key its characteristic: it has no dogmas or doctrines; it introduces what Malthus (in Cremaschi, Dascal, 1996) described as the 'doctrine of the middle'. Mesoscopic thinking is not principal but pragmatic and so, in the first place, it

[34] Wikipedia, #Heraclitus, December 2014.
[35] Wikipedia, #Middle Way, December 2014.

is only a method, only a corridor in a hotel lobby which leads to many different rooms or theories, each branching away from it into its own narrow niche (James, 2002). It is inherently intelligent since intelligence is a mesoscopic phenomenon. *Interlegere* (lat.) means ability to read between the lines of a given complex content (Krishnamurti, Bohm, 1986), ability to overcome obstacles by thinking, hence the ability to deal with cognitive complexity (Gottfredson, 1998) where partly contradicting and partly converging claims must be weighted. Moreover, medical research demonstrated that brain dynamics is a mesoscopic process. It usually refers to the neural activity or dynamics at intermediate scales of the nervous system, at levels between neurons and the entire brain (Liljenström, 2011).

Mesoscopic description (Dopfer et al., 2004) or '*une déscription médiane*' (Prigogine in Wallerstein, 1998) of complex matter is specifically recognisable by its bi-modality, since it takes into account categorical opposite horizons between which it operates, and for hybridity of its apparatus, since it shares characteristics with opposites. A given bi-modal category is inserted between its polarities as doubly embedded into them, and so involving part of both. Socio-economic development is for instance a hybrid category with the capacity for mesoscopic evaluation of economic and social development despite their essential incommensurability. With the assistance of a bi-modal view, deep dual opposition, e.g. of economic to social, are translated into triadic structure: economic, socio-economic, and social, with the purpose to present them mesoscopically in coexistence without contradiction (Flores-Camacho et al., 2007). Meso-level observation has the capacity to intermediate between polarities and to at least partly synthesise their contents. Idea of bi-modality is well symbolized in a character from archaic mythology: Janus, the most important ancient Roman god. He has a double and intermediary nature as the god of beginnings and transitions, and thereby of gates, passages,[36] representing the middle ground between otherwise non-overlapping worlds – he is accordingly symbolised by a head with two faces able to look simultaneously forward and backward and to understand incompatible meanings.

Understanding of the main arguments in favour of mesoscopic description of complex social issues brings us finally to the point where all necessary elements are obtained for synthesising operational definition of ordered social complexity. A given social issue is a doubly complex phenomenon when its interpretation consists of orthogonalized vertical and horizontal explanatory axes; when these are internally plural and composed of at least three incommensurable meaning domains with partly overlapping and partly non-overlapping content; when meanings of overlapping content are evaluated 'irrationally' – against the other and so against what it is not, substantially; when evaluation applies hybrid analytical categories which emerge for the observer at the meso level in bi-modally constructed triadic logic and only in a specified spatio-temporal context with predetermined scale and scope of

[36] Wikipedia, #Janus, September 2014.

evaluation. Now we need to insert this operational framing into the study of complex social phenomena.

Mechanisms of social causality are changing. This drives transformation of social practices that calls for a profoundly modified representation of social life. For their valid description we need new models and a new kind of social thought (Touraine, 1992): 'This thought should be as different from classical sociology as that body of thought was from the political of the sixteenth or eighteenth centuries'. Inquiry into social complexity derives from general concerns. These are addressed in relation to the need for a reconstruction of methodology for a less constraining research of social phenomena that 'universalises preconditions of access to the universal' (Bourdieu, in Couldry, 2005). What is needed now is to develop new '*mathématique sociale*' (Condorcet, 1785) the mission of which is almost opposite to the mission of its classical precedent: not to institute rationality in place of irrationality, science in place of mysticism, but to negotiate a balance between rational and irrational aspect by means of opening black boxes, that presently hamper complex elaboration of social phenomena. Non-scientific contributions should be incorporated into standard scientific practices to replace its hasty generalisations with evaluation of incommensurable scientific results and humble interpretation of their significance within broader public concerns.

Three case studies have been accomplished to test the operational definition given above, with three purposes: to illustrate its practical application, to further extend its methodological features and to draw its broader conclusions relevant for discussion about characteristics of emerging new 'anti-postmodernist' social model. Mesoscopic thinking is not anti-modern, neither is it non-postmodern. It only aims at connecting a modernist and postmodernist 'program' without invoking either macro totalitarian or micro relativist impositions.

The first two case studies are evaluative. Evaluation itself is not a science (Forest, 1977; Trapnell, 1984), nor is it its substitute, but an integral complement, at least in social research. In the social studies facts do not speak for themselves like they appear to do in physics but they provide only a frame for reasonable judgment. What precedes scientific research and what follows it is inherently linked to valuation (Hollis, 2002). Scientific practice is concerned with the search for causes and laws, while evaluation is concerned with the search for meaning (Winch, in Hollis, 2002). The art of evaluation in particular lies in ensuring that the measurable and commensurable do not drive out the immeasurable (Matarasao, 1996) and incommensurable.

The imperative for integrating social sciences with evaluation is linked to profound methodological challenges due to our inability to make direct comparisons, trade-off and synthesis of incompatible scientific results about socially complex phenomena. Researching social reality with holistic aspirations – collective or inter-generational – raises questions not only about truth but also about right and wrong, about justice and injustice, hope and hopelessness (Tilly, 1978). However, truth, right and good need to be rigorously distinguished in evaluation. Truth and justice are sometimes opposed to what a society recognizes as necessary for the preservation of the common good. For instance, when a subsistence income (aspect of truth) is set by policy measures below the agreed limit of poverty (normative aspect), as it is presently in Slovenia, this contributes to the reproduction of material conditions of miserable life in a society as a whole (evaluative aspect of good). Evaluation can extract new messages from manipulation of existing social facts. It has relevance for broader understanding of social reality, but science usually fails to take different values into account or even (discriminately) discounts them.

To illuminate severe methodological difficulties in researching collective good under the social complexity, our first case study examines an aggregation problem (Scriven, 1994) in impact evaluation of large scale and multi-scope policy interventions. Scientific assessments of a given policy measure's varied positive and negative impacts tend to produce non-cumulative and non-complementary results (Bovens et al., 2008). It is for instance a very common situation that economic impacts of a given policy intervention are positive while environmental impacts are negative. This divergence between incommensurable evaluation criteria makes it impossible to synthesise evaluation conclusion about policy intervention. Furthermore, microscopic assessment of impact of individual policy measures on specific evaluation criteria, when aggregated into summary indicator of overall impact, is often incompatible with wide social impact when assessed from other data that are not related to monitoring of the particular measure. It is a common situation, for instance, that policy measures are evaluated as successfully achieving previously set program or project goals, while the overall situation in a targeted area or for beneficiaries is not improving. Micro-macro incommensurability of impacts triggers a serious difficulty in evaluation methodology concerning how to form a consistent evaluation summary.

However, it turns out that evaluators usually think in terms of simplicity, not complexity. They fail to observe that the majority of policy impacts are hybrid in nature so they are at least weakly incommensurable and can be aggregated at least partially and then synthesised by correlation in their overlaps.

After finding a mesoscopic solution for a conventional aggregation problem in vertical direction, the same problem is next studied in a horizontal direction, simply by broadening the number of evaluation domains from three to four. It turns out that with this extension Dopfer et al.'s (2004) classification of meso 1, meso 2, and meso 3 sublevels can be expanded adding the sublevels 2a and 2b, in this way illustrating mesoscopic capacity to extend into itself. This case study illustrates that large-scale and multi-scope social matters are complex, implying that they need to be studied in meso-meso-meso framework. Three main findings are drawn. First, a precondition for neutral evaluation is not only to accomplish an objective analysis of analytical data but also an evaluative synthesis of analytical findings. Second, mesoscopic synthesis is partly aggregative in commensurable contents and partly correlative for weakly incommensurable contents to account equally for overlapping and non-overlapping meanings. And third, meso logic expands its argumentation so that it extends into itself, getting increasingly deeper, instead of increasingly more detailed, increasingly more heterogeneous, instead of more specific. This study was accomplished on the case of sustainable impact evaluation of development programme for Slovenian north-eastern region Pomurje (Radej, 2014).[37]

As already argued in the opening pages, social disintegration is among the most symptomatic indicators that modern societies have become complex. It is not that importance of social integration is ignored in social sciences. Durkheim (1897) showed that social integration is either pursued organically from below or it is mechanically imposed from above. However, practicing these divisive strategies of integration in present complex conditions is among the main drivers of further social disintegration. How to resolve this contradiction and provide for integration in the presence of social complexity is the main concern for the second case study accomplished on evaluation of the national energy program's impacts on territorial cohesion of Slovenia (Golobič et al., 2008; Radej, Golobič, 2013).[38]

Giddens (1989) tries to escape divisiveness of the integration process so that he approaches it with his circular structuration theory as relating the macro system as a whole to its microscopic parts, and parts to the whole. He applies a double hermeneutic principle as two-way understanding of connections between an agent and a structure as incommensurable, though equally important, social levels. The theory claims, similar to Hayek's spontaneous emergence of order, that agents on a micro level first produce structural order through their interactions. Once established, the new order refines a framework inside which agents interact. Finally, the newly established order is either accepted and affirmed with submission or again challenged from below.

In this model, a society as a reason and a cause of itself (Fuchs, 2003) operates organically as a chaotic self-referential circular causal system. It is not wrong to apply circular explanation to the issues which are circular in their nature. However, structuration theory explains integration with a principle that escapes the meso level and only locks explanation into another version of a black box where micro and macro can accommodate each other in direct interaction, even though they are acknowledged as incommensurable. The standard description of the integration mechanism in sociology is caught between simplistic (Durkheim, Marx) and chaotic (Giddens, Hayek, postmodernists) explanations. Instead we

[37] http://www.sdeval.si/attachments/article/105/sde_DZ_1-14_Apples%20and%20Oranges%20%2815feb2014%29.pdf
[38] http://www.sdeval.si/index.php/domov/39-objave/objave/490-divided-we-stand

suggest a mesoscopic approach that lies between them and addresses a social integration venture with triadic logic of social complexity.

For this purpose a new hybrid analytical category of weak balance is first introduced. Social integration is now approached with three measures: the first is strong balance as an indicator of mechanic integration between evaluation domains organised as vertical pillars in monist fashion. The second is a measure of cohesion, which is obtained through correlation from the overlap between pairs of evaluation domains that measures strength of organic integration on a horizontal axis in a dualist manner; weak balance, as the third measure, is a category of thirdness, doubly embedded in the previous two since it is obtained from correlation between domains (organic aspect) but measures balance between domains (mechanic aspect). The newly introduced bi-modal category evaluates mutuality of cohesive links for those involved in social relations. Such a measure is needed in social research of integration to enable distinction between cohesion, which is one-sided and asymmetrical, as in a globalised market, imposed on everybody leaving all without workable alternatives, and cohesion that is symmetrical between essentially diverse but equally valued agents, as between trusted partners, friends or lovers.

This case study suggests that mechanic and organic aspects can be effective in social integration only to the extent that they contribute to enhancing mutuality of relations beyond existing normative requests (mechanic part) as well as beyond legitimate, but always narrow local or private concerns (organic part). The mesoscopic strategy of social integration implies that barriers to free access of diverse members to the social arena and to local and global commons need to be progressively suspended. Historical examples of fundamentally improved social cohesion due to enhanced mutuality of relations are the abolishment of slavery and outlawing racism. Granting voting rights to women is another case. Since the end of the Second World War we see the provision of basic human rights, including gender equality, special needs of children and older populations, as a key driver for further social integration. The presently increasing emphasis with the same integrative motivation is linked to free public access to information, the idea of 'the Open Everything' (Steele, 2012). A further increase in mutuality of relations will probably demand guaranteeing economic safety for all members of societies in future, e.g. by introduction of unconditional basic income (van Parijs, 2001).

The conclusion from the second case study is that social integration unfolds on a meso level and can be appropriately explained only through evaluation of its otherwise incompatible constituting processes. Furthermore, where mainstream social sciences see a black box there are in fact operating mesoscopic processes. Finally, evaluation does not constrain scientific projection when narrowing validity of its results. Just the opposite! It actually extends the field of scientific insight with enlightening new intermediary mechanisms of synthesis, integration, and transformation that operate with a whole set of new hybrid categories that in large part still wait for appropriate recognition in methodology of social research.

The first two case studies deal with systemic concerns, aggregation and integration, in the presence of social incommensurability. In context of social complexity these two are rather primitive holistic strategies. The former builds on amassment of some rather arbitrarily selected characteristics of social facts that assumingly represent all relevant features of all diverse social phenomena. The latter connects society with a mechanism in which impositions from above onto those below still play an important role. In a systemic perspective, the individual's freedom must always be traded for the achievement of higher goals of the society as a whole. Both strategies with their simplistic assumptions are importantly constrained for comprehending the core idea of social complexity that requires independence of social concerns from any centralised or uniform impositions.

Neither of the previous two cases is therefore an ideal illustration for the specified purpose. Meso as generic approach (Prezioso, 2010) is easily applicable in evaluation of rational systems. However, following its operational framing, meso level reasoning is intrinsic for evaluation of social (organic) processes with irrational content. This challenges the systemic and rational view of social complexity that is applied in the first two case studies. Our initially stated purpose is very specific comprehension of social complexity that is invoked from the aspect of irrationality. We have previously presented arguments with elements of drama to justify heresy as an original starting point for reasoning about social complexity.

We are not dealing with complexity of systems but with social complexity! In the ACM framework, systemic and complex phenomena are clearly distinguished. Systemic processes are linked to the structure of organisations, like government and state. For studying society in its unstructured, organic and chaotic form, social process shall not be approached as a systemic but as an anti-systemic category (Wallerstein, 2006) and so studied beyond primitive imperatives of systemic synthesis and integration. The anti-systemic perspective starts from the aspect of exclusion as one of three basic logical relations beside inclusion and overlap (Feyerabend, 1975). Incommensurability as the core concept of social complexity emerges from exclusion of the irrational element in the search for truth, so it is reasonable to demand presenting the concept of social complexity first and foremost in a Hippasian heretic manner which in its implications suggests an entirely specific pattern of social structuring, different from synthesis and integration. The third possibility is accomplished by the means of exclusion and separateness between incompatible constituents of society.

Every ordered system, be it a state or a country club, produces its structures with the means of exclusion for a part of unfitting members with the aim to protect system's internal consistency and stability from their irrational demands. In response to systemic exclusion those excluded tend to establish themselves not only against the system to fight exclusion and defend their universal rights of citizens but more importantly, as an autonomous, anti-systemic form of sociality, which embraces its exclusion from the system. This is the main subject for the third case study (Radej, 2013).[39]

The recent wave of mass popular dissent, such as the Occupy movement in 2011 and afterwards, claiming to represent the 99% majority of the population excluded by ruling political and economic elites, reminds social sciences that it is essential to understand social dynamics from the perspective of social exclusion. One of the leading theorists on anarchism in Germany at the beginning of twentieth century, Gustav Landauer (1900) is remembered for demanding construction of a separate community with 'the inclusion of the excluded as excluded' (Agamben in Blair et. al, 2002). Exclusion in this model is not concerned any more with the dark side of society, but arises as a starting point for radical social innovations.

Anti-system movements, like anti-globalist, anti-nuclear or anti-elitist are among drivers of this process. However, they have suffered from their inability to create vertical structuration. They refuse vertical structuration of movements because their exclusion is exactly the result of an overly vertically structured society. Their massively prevailing horizontalism of relations with other movements invokes 'the tyranny of structurelessness' (Freeman, 1972). As a result, they fail to develop cooperation against the system and this hampers their effectiveness in achieving outstanding social innovations. This situation is outlined here as an organisational problem of anti-system movements.

We first postulate that an organisational problem is a complex matter. Movements can resolve their organisational problems first by abandoning programmatic similarity as a common denominator to which all must first submit as a precondition for closer cooperation between diverse partners. However, it is easily observed that movements are usually more radical in their programs than in their operation, or vice versa, e.g. classical trade unions with radical programs and opportunist activity or the Occupy movement with weak programs but radical actions. Movements' program-action footprints are usually inconsistent unless they connect to other movements with symmetrical opposite footprints of program-action inconsistency. Together they form an internally heterogeneous coalition with a consistent footprint, which nevertheless protects their categorical dissimilarity.

Three main types of anti-systemic movements are usually distinguished, reflecting three different modalities of social exclusion: reformist, revolutionary and autonomist. When they overlap into hybrid forms to achieve a more structured level of cooperation, three coalitions are obtained: quasi-, semi- and orto-anti-systemic coalition. None of them represents the anti-system movement integrally. They complement each other in three directions: the first is effective in mobilising new followers, the second in producing new autonomous alternatives

[39] http://www.sdeval.si/index.php/domov/39-objave/objave/502-with-exclusion-to-the-community.

to the existing but dysfunctional systemic services and the latter in defending boundaries of already achieved autonomy. The initially postulated organisational problem of anti-system movements can therefore be resolved mesoscopically with formation of an anti-systemic structure which emerges vertically through horizontal overlap between three anti-system coalitions (overlap between overlaps).

With the resolution of the organisational problem the initial anti-system conflict between Society and the System ('the good' against 'the bad') is deconstructed into two independently unfolding confrontations. On one side there is an antagonism between System's structure and Anti-system's structure (bad vs. bad) and on the other side we obtain a conflict between competing interests among social groups (good vs. good).

Mesoscopic ability to coordinate deep system conflicts between the ruler and the ruled demands isolation of antagonistic social struggles into structural battles that leave Society deantagonised. Antagonism is a specific form of political struggle for the hegemonic imposition of rigid structures (Shinko, 2008) so it can be consistently addressed only against alternative rigid structure (Anti-systemic) and not, as presently, against unstructured society as an essentially plural phenomenon.

When unstructured society sets itself free from any particular type of structural contradiction, it releases large new potentials. Breaking down black boxes of social sciences will release a colossal amount of dark energy of social sciences that is presently systematically suppressed with the depreciatory consideration of social irrationality as perverse and vicious, of instabilities not as normal but as deficits of knowledge, of social incommensurability as delinquent, social hybridity as impure and wicked, and of social exclusion as a form of obstruction of normality of social life. Mesoscopic framing in the anti-postmodern model of society instead understands that the releasing of social dark energy is a precondition for the possibility of new enlightening of societies with a new perspective that puts forward an imperative of plural address of amounting legitimate tensions between their members' incompatible but otherwise explicitly holistic aspirations.

Ambition for more integrated understanding of social complexity took us on a journey from the authoritative centre of modernism (order, uniformity) to the radical middle of anti-postmodernism (hybrid, marginal overlaps) via the relativist periphery of postmodern (chaotic, anarchic) thought. Rather than kill complexity, it would be better to understand mesoscopic conditions under which social complexity is maintained.

Bibliography:

Abrahamson M. 2003. Functional, Conflict and Neofunctional Theories, in Ritzer, Smart (Ed.).
Adams R.E. Energy, Complexity and Strategies of Evolution. Avá 14(jul. 2009):1-33.
Ahl V., T. F. H. Allen. 1996. Hierarchy theory. Columbia University Press.
Allen B., B.C. Stacey, Y. Bar-Yam. An Information-Theoretic Formalism for Multiscale Structure in Complex Systems. eprint arXiv:1409.4708, September 2014.
Anderson V., L. Johnson, L. 1997. Systems thinking basics - from concepts to causal loops. Waltham, Pegasus Communications Inc.
Andersson N. A. 2003. Mesoeconomic Analysis of the Construction Sector. Doktorsavhandling, Lund Institute of Technology, Lund University.
Ankersmit F. Political Monadology. The Johns Hopkins University Press, Theory & Event, 8/3(2005).
Arrow K.J. 1951. Social Choice and Individual Values. Yale University Press.
Badiou A. Universal Truths & the Question of Religion. Interview with Adam S. Miller, Journal of Philosophy and Scripture, 3/1(Autumn 2005):38-42.
Badiou A. 2005. Being and Event. Trans. Oliver Feltham. New York and London: Continuum.
Baker A. 2013. “Simplicity”, in Zalta (Ed.).
Baranger M. 2001. Chaos, Complexity, and Entropy: A physics talk for non-physicists. Cambridge: New England Complex Systems Institute.
Barnes B. 1997. Thomas Kuhn, in Skinner (Eds).
Bar-Yam Y. A Mathematical Theory of Strong Emergence Using Multiscale Variety. Wiley, Complexity, 9/6 (2004):15-24.
Baylis C.A. Are Some Propositions Neither True nor False? The University of Chicago Press, Philosophy of Science, 3/2(April 1936):156-166.
Beall J.C, G. Restall. 1999. Defending Logical Pluralism. University of Tasmania, Macquarie University.
Benhabib S. 2010. Pravice drugih. Tujci, rezidenti in državljani (The rights of others. Aliens, residents and citizens. Cambridge University Press, 2004). Ljubljana: Krtina, Temeljna dela.
Bentley A.F. The Units of Investigation in the Social Sciences. Annals of the American Academy of Political and Social Science, 5(1895):87-113
Bergson A. A Reformulation of Certain Aspects of Welfare Economics. Quarterly Journal of Economics, 52/2(1938):310-34.
Bertalanffy von, L. 1968. General System Theory. New York: George Braziller.
Bickhard M.H. 2011.Systems and process metaphysics, in Hooker (Ed).
Bird A. 2013. “Thomas Kuhn”, in Zalta (Ed.).
Blair J., M. Kanuga, S. Shukaitis (Eds.) 2002. 19 & 20: Notes for a New Social Protagonism. Colectivo Situaciones. Wivenhoe: Minor Compositions.
Bourdieu P. 2004. Znanost o znanosti in refleksivnost (Science de la science et réflexivité; Éditions Raisons D'Agir, Cours et travaux, Paris, 2001). Ljubljana: Liberalna akademija, transl. and foreword D.B. Rutar.
Bousquet A., S. Curtis. Beyond models and metaphors: complexity theory, systems thinking and international relations. Routledge: Cambridge Review of International Affairs, 24/1(March 2011):43-62.
Bovens M., P. ’t Hart, S. Kuipers. 2008. The politics of policy evaluation. The Oxford Handbook of Public Policy.
Bowley G. 2010. U.S. Markets Plunge, Then Stage a Rebound. New York Times, May 6.
Boyd R. 2013. “Scientific Realism”, in Zalta (Ed.).
Bradie M., W. Harms. 2012. “Evolutionary Epistemology”, in Zalta (Ed.).
Bragin J. 2010. Review of Mitchell M., Complexity: A Guided Tour (Oxford University Press: New York, 2009), Journal of Artificial Societies and Social Simulation, 13/2(2010).
Brandon R. 2010. ‘Natural Selection’, E.N. Zalta (Ed.).
Brette O., C. Mehier. 2005. Veblen’s evolutionary economics revisited through the micro-meso-macro framework: the stakes for the analysis of clusters of innovation. Bremen: 17th EAEPE Annual Conference, November, 10-12.
Burchell G., C. Gordon, P. Miller (Eds.). 1991. The Foucault Effect: Studies in Governmentality. Hertfordshire: Harvester Wheat sheaf.
Byrne D. 1998. Complexity theory and the social sciences: an introduction. New York: Routledge.
Calhoun C. 2006. The Critical Dimension in Sociological Theory, in Turner (Ed.).
Campbell J. 1960. The Masks of God: Primitive Mythology. London: Secker & Warburg.
Capra F. 1982. The Turning Point: Science, Society, and the Rising Culture. New York: Simon and Schuster.
Capra F. 1996. The web of life: a new scientific understanding of living systems. New York: Anchor Books.
Castellani B., F.W. Hafferty. 2009. Sociology and Complexity Science. Berlin: Springer.
Cat J. 2010. “The Unity of Science”, in Zalta (Ed.).

Chaitin G.J. 2000. A Century of Controversy Over the Foundations of Mathematics. Pittsburgh: Carnegie Mellon University School of Computer Science Distinguished Lecture (2 March), an edited transcript.
Chapman J. 2004. System failure - Why governments must learn to think differently. 2nd ed., London: Demos.
Cheal J. 2008. The Three Logics. Reframing and Sleight of Mouth. Oakhurst: GWiz Learning Partnership.
Checkland P. 1993. Systems Thinking, Systems Practice. New York: John Wiley & Sons.
Choike J.R. The Pentagram and the Discovery of an Irrational Number. Mathematical Association of America: The Two-Year College Mathematics Journal, 11/5(Nov., 1980):312-16.
Chomsky N. 2014. Ecology, Ethics, Anarchism. Interview, by Javier Sethness, Alter.net, 3rd April.
Cicchetti D.,F.A. Rogosch. Equifinality and multifinality in developmental psychopathology. Cambridge University Press: Development and Psychopathology, 8/4(1996):597-600.
Coffman J.A. 2011. On causality in nonlinear complex systems: the developmentalist perspective, in Hooker.
Cooley C.H. The Process of Social Change. Political Science Quarterly 12(1897):63-81.
Couldry N. The Individual Point of View: Learning From Bourdieu's 'The Weight of the World'. London: Sage, Cultural Studies ↔ Critical Methodologies, 5/3(2005):354-72.
Craig E. (Ed.). 1998. Routledge Encyclopedia of Philosophy. London: Routledge.
Cremaschi S., M. Dascal. Malthus and Ricardo on Economic Methodology. History of Political Economy, 28/3(Autumn 1996):475-511.
Crowder G. 2003. Pluralism, Relativism and Liberalism in Isaiah Berlin. Presented to the Australasian Political Studies Association Conference, University of Tasmania, Hobart, 29 September – 1 October.
Dascal M. 1997. Epistemology, Controversies, and Pragmatics. Presented at the conference "After Post-Modernism Conference", University of Chicago, November 14-16.
Derrida, J., 1978. Of Grammatology. Baltimore: The Johns Hopkins University Press.
Dopfer K. 2006. The Origins of Meso Economics Schumpeter's Legacy. Jena: Max Planck Institute of Economics, Evolutionary Economics Group, The Papers on Economics and Evolution no. 610.
Dopfer K. 2011. The origins of meso economics: Schumpeter's legacy and beyond. Journal of Evolutionary Economics, Springer-Verlag, web version.
Dopfer K., J.Foster, J.Potts. Micro–meso–macro. Springer: Journal of Evolut. Economy 14/3(2004):263–79.
Dumézil G. 1987. Tridelna ideologija Indoevropcev (L'Idéologie Tripartie des Indo-Européens, Latomus, Bruxelles, 1958). Ljubljana: ŠKUC, Znanstveni inštitut Filozofske fakultete. Zbirka Studia Humanitatis, translation and foreword D.B. Rotar.
Durkheim É. 1897. Le Suicide: étude de sociologie. Paris: Alcan.
Durlauf S.N. 1997. What Should Policymakers Know About Economic Complexity? University of Wisconsin - Department of Economics, and Santa Fe Institute, Report 97-10-080.
Easterling W.E., K. Kok. Emergent Properties of Scale in Global Environmental Modelling – Are There Any? Integrated Assessment 3/2–3(2002):233–46.
Elsner W. 2006. Real-World Economics Today. University of Bremen.
Emirbayer M. Manifesto for a Relational Sociology. The American Journal of Sociology, 103/2(1997):281-317.
Erwin D.H. 2007. Darwin Still Rules. New York Times, June 26.
ESPON - 3.2, Vol. 5. 2006. Spatial Scenarios and Orientations in Relation to the ESDP and Cohesion Policy – Territorial Impact Assessment, Final Report, p. 2-97.
Eurobarometer. 2005. Special Eurobarometer 215 / Wave 62.1 – TNS Opinion & Social.
European Commission. 2001. SEA Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment.
European Commission. 2006. Impact Assessment Guidelines. SEC(2005)791.
Evans T.P, E. Ostrom, C. Gibson. Scaling Issues With Social Data in Integrated Assessment Modeling. Swets & Zeitlinger, Integrated Assessment, 3/2–3(2002):135–50.
Feyerabend P. 1975. Against Method. Outline of an anarchistic theory of knowledge. London: Humanities Press.
Fioretti G. 1996. A concept of complexity for the social sciences. Laxenburg, International Institute for Applied System Analysis, Working papers, no. 144.
Fitzpatrick S. 2013. Simplicity in the Philosophy of Science. John Carroll University, Internet encyclopedia of philosophy.
Flores-Camacho F., Gallegos-Cazares L., Garritz A., Garciá-Franco A. Incommensurability and Multiple Models: Representations of the Structure of Matter in Undergraduate Chemistry Students. Springer, Science & Education 16(2007):775–800.
Forest L. 1977. Methodology for Extension Evaluation: Some Crucial Questions. University of Wisconsin.
Fossa J.A. What makes a Pythagorean Pythagorean? Sociedade Brasileira de História da Matemática. Revista Brasileira de História da Matemática, 10/20(2011):165-72.
Foster J. 2004. Why is Economics not a Complex Systems Science? School of Economics, The University of Queensland, Discussion Paper No. 336.
Freeman J. The tyranny of structurelessness. Berkeley Journal of Sociology, 17(1972-73):151-65.

Fuchs C. 2003. Modern Society – A Complex, Evolutionary, Self-Organising, Antagonistic System. Vienna University of Technology, Institute of Design and Technology Assessment.
Fuller B. R., Applewhite, E. J., 1975. Synergetics: explorations in the geometry of thinking. New York: Macmillan Publishing.
Funtowicz S. 2006. Post-normal science - Environmental Policy under Conditions of Complexity. Ispra, EC-JRC/ISIS.
Galston W.A. 2002. Liberal Pluralism: The Implications of Value Pluralism for Political Theory and Practice. Cambridge University Press.
Geels F.W. Feelings of Discontent and the Promise of Middle Range Theory for STS Examples from Technology Dynamics. Sage, Science, Technology, & Human Values, 32/6(November 2007):627-51
Geels F.W. Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Elsevier, Research Policy 31/8-9(2002):1257-74.
Geertz C. 2000. Available Light: Anthropological Reflections on Philosophical Topics. Princeton, NJ: Princeton University Press.
Gell A. 1992. The anthropology of time: Cultural Constructions of Temporal Maps and Images. Oxford/Providence: Berg Publishers Press, 341 pp.
Gernot E. 2010. Consequences of theories of complexity for the socialism of the 21. Century. University of Oslo.
Giddens A. 1989. Nova pravila sociološke metode (New Rules of Sociological Method: a Positive Critique of interpretative Sociologies, London: Hutchinson, 1976). Ljubljana: ŠKUC, Filozofska fakulteta, Studia Humanitatis.
Gleick J. 1991. Kaos: Rojstvo nove znanosti (Chaos: Making a new science, Penguin, 1987). Ljubljana: Državna založba Slovenije.
Gödel K.F. Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme, I., Monatshefte fuer Mathematik und Physik, 38/173(1930).
Goldspink C. Modelling social systems as complex: Towards a social simulation meta-model. Journal of Artificial Societies and Social Simulation, 3/2(2000).
Golobič M., Marot, N., Radej, B., Tomšič, M. G., Kontič, B., Gulič, A. 2008. Spremljanje in presoja prostorskih vplivov sektorskih politik. Ljubljana: Urbanistični Inštitut RS.
Gontier N. 2006. Introduction to evolutionary epistemology, language and culture, in Gontier N., van J.P. Bendegem, D. Aerts (Eds.), Evolutionary Epistemology, Language and Culture - A non-adaptationist, systems theoretical approach, Dordrecht: Springer.
Goodchild B. Triadic classifications and triangular thinking: their use in urban planning and urban design. People, Place & Policy Online 2/3(2008):122-31.
Gottfredson L. 1998. The General Intelligence Factor. Scientific American Presents 9/4(1998):24–9.
Groenewegen J., J.J. Vromen. 1996. A Case for Theoretical Pluralism, in Groenewegen J., (Ed.), Transaction Cost Economics and Beyond. Dordrecht: Kluwer
Haferkamp H., N.J. Smelser (ed.). 1992. Social Change and Modernity, Berkeley: University of California Press.
Hall M.J. W., D. Deckert, H.M. Wiseman. Quantum Phenomena Modeled by Interactions between Many Classical Worlds. Phys. Rev. X/4(October 2014).
Halpin H., K. Summer. Network organizations for the 21.century. Turbulence, 4(July 2008):55-63.
Hammerstein P. 2003. Why is reciprocity so rare in social animals? A protestant appeal. In Hammerstein P. (Ed.), Genetical and cultural evolution of cooperation, Cambridge, MA: MIT Press
Harms W. 2011. Evolutionary games and the modeling of complex systems, in Hooker (Ed).
Hawking S. 2003. On the Shoulders of Giants. Philadelphia, Running Press.
Hayek F.A. 1992. Usodna domišljavost: Napake socializma (The Fatal Conceit: The Errors of Socialism, The University of Chicago Press. 1991). Ljubljana: KRT, No. 69.
Heisenberg W. Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik. Zeitschrift für Physik 43/3–4(1927):172–98.
Henning D. 2007. Poll shows 82 percent of Germans feel politically disenfranchised. The International Committee of the Fourth International, World Socialist Web Site, 16 Januar.
Heylighen F. 1989. Self-Organization, Emergence and the Architecture of Complexity, in: Proceedings of the 1st European Conference on System Science, Paris: AFCET.
Hicks J. Mr Keynes and the Classics: A Suggested Interpretation. Econometrica, 5/2(April 1937):147-59.
Hilgevoord J., J. Uffink. 2012. "The Uncertainty Principle", in Zalta (Ed).
Hodgson G. M. Generalizing Darwinism to social evolution: Some early attempts. Journal of economic issues, 39/4(December 2005):899–914.
Hofkirchner W., M. Schafranek. 2011. General system theory, in Hooker (Ed).
Hollis M. 2002. Filozofija družbene vede. Uvod. (The philosophy of social sciences, Cambridge University Press, 1994). Maribor: Aristej – Dialogi.
Hooker C. 2011. Introduction to philosophy of complex systems, in Hooker (Ed).

Hsieh N. 2008. “Incommensurable Values”, in Zalta (Ed.).
Hubbard B.M. 2008. An evolutionary synthesis. A new world view: Weaving Together a New Memetic Code for the Optimum Future for Humanity. Santa Barbara: Foundation for Conscious Evolution.
Huffman C. 2006. “Pythagoreanism”, in Zalta (Ed.).
Huxley J. S. (Ed). 1940. The New Systematics. Oxford University Press.
James W. 2002. Pragmatizem in volja do verovanja (Pragmatism: Will to believe, 1906, Lowell Institute; 1907, Columbia University). Ljubljana: Krtina, Temeljna dela.
Kauffman S. 1996. At Home in the Universe: The Search for the Laws of Self-Organization and Complexity. New York: Oxford University Press.
Kimberlé C. W. 1994. Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color, in Fineman et al., The Public Nature of Private Violence. New York: Routledge.
Kreisler H. 2001 Conversation with Manuel Castells. Identity and Change in the Network Society. Berkeley: Institute of International Studies, Conversations with History series.
Krishnamurti J., D. Bohm. 1986. The Future of Humanity: A Conversation. San Francisco: Harper & Row.
Kuhn T.S. 1970. The Structure of Scientific Revolutions. The University of Chicago Press.
Landauer G. 1900. Kroz odvajanje do zajednice (Durch Absonderung zur Gemeinschaft, lecture 18. June, in Friedrichshagen-Berlin), in Izbor tekstova i odlomaka, Aleksa Golijanin, 2011, Žurnali/Lista blok-45.
Lawlor L. 2008. “Jacques Derrida”, in Zalta (Ed.).
Le Goff J. 2009. Nastanek vic (La naissance du Purgatoire; Gallimard, 1981). Ljubljana: ŠKUC, Znanstveni inštitut Filozofske fakultete. Zbirka Studia Humanitatis.
Lennox J. 2010. “Darwinism“, in Zalta (Ed.).
Leontief W. Environmental Repercussion and the Economic Structure: An Input-Output Approach. Cambridge MA: The MIT Press, Review of Economics and Statistics, 52/3(1970):262-71.
Lewens T. 2013. “Cultural Evolution“, in Zalta (Ed.).
Li J., W. Ge, W. Wang, N. Yang. Focusing on the meso-scales of multi-scale phenomena—In search for a new paradigm in chemical engineering. Elsevier, Particuology 8(2010):634–39.
Liljenström H. Intention and Attention in Consciousness Dynamics and Evolution. Journal of Cosmology, 14(April – June, 2011):4848-58.
Lovelock J., S. Epton. 1975. The Quest for Gaia. New Scientist, 65/935(1975):304.
Luhmann N. 1995. Social Systems. Stanford: Stanford University Press.
Lyotard J.-F. 1984. The Postmodern Condition: A Report on Knowledge. Minneapolis: University of Minnesota.
Macmurray J. The Dualism of Mind and Matter. Cambr. Univ. Press: Philosophy, 10/39(July 1935):264-78.
Mainzer K. 2005. Symmetry and complexity. The spirit and beauty of nonlinear science. Singapore: World Scientific Publishing.
Manuel-Navarrete D. 2001. Approaches and Implications of using Complexity Theory for dealing with Social Systems. University of Waterloo: Department of Geography.
Mason E. 2008. “Value Pluralism”, in Zalta (Ed.).
Matarasao F. 1996. Defining Values. Evaluating arts programmes. Bournes Green: The Audit Commision, The social impact of the arts, Working paper 1.
May C. A rational model for assessing and evaluating complex interventions in health care. Springer: BMC Health Services Research, 6(2006):86-97.
Mazrui A.A., A. Schweitzer, A. Luthuli, I. Khaldun, A.D. White, W. Rodney. 1999. Towards a Constructive Plural Order. Contribution to the Debate on The Challenge of Pluralism. Paris: UNESCO.
Mendel-Gleason G., J. O'Brien. 2013. The Philosophy of Science. Spirit of contradiction Blog, 18. April.
Menger K. The New Logic. The University of Chicago Press: Philosophy of Science, 4/3(July 1937):299-336.
Merton R.K. 1968. Social theory and social structure. Third edition, Glencoe: Free Press
Milkov N. Mesocosmological Descriptions: An Essay in the Extensional Ontology of History. Humboldt State University, Essays in Philosophy, 7/2(2006):1-19.
Morçöl G. 2011. Why Complexity Theory? What Kind of a Theory is it? Paper prepared for presentation at the Governance of Complex Systems Conference, Rotterdam, June 23-25.
Morçöl G. 2012. A complexity theory for public policy. London: Routledge.
Moreno A., K. Ruiz-Mirazo, X. Barandiaran. 2011. The impact of the paradigm of complexity on the foundational frameworks of biology and cognitive science, in Hooker (Ed).
Mumpower J. L., T. R. Stewart. Expert Judgement and Expert Disagreement. Taylor and Francis: Thinking and Reasoning, 2/2-3(1996):191-211.
Munda G. A NAIADE based approach for sustainability benchmarking. International Journal of Environmental Technology and Management, 6/1-2(2006):65–78.
Munda G. Choosing Aggregation Rules for Composite Indicators.Springer, Social Indicators Research, 109/3(December 2012):337-54.

Nafeez A. NASA-funded study: industrial civilisation headed for 'irreversible collapse'? The Guardian, Friday 14 March 2014.
Negri A., M. Hardt. 2000. Empire. Cambridge, Mass. & London: Harvard University Press.
Nola R., H. Sankey (Eds.). 2000. After Popper, Kuhn & Feyerabend: Issues in Theories of Scientific Method. Kluwer, Australasian Studies in History and Philosophy of Science.
OECD. 2009 Report on Applications of Complexity Science for Public Policy: New Tools for Finding Unanticipated Consequences and Unrealized Opportunities. Paris: Global Science Forum.
Okasha S. The Levels of Selection Debate: Philosophical Issues. Philosophy Compass, 1/1(January 2006):74–85.
Oreskes N., K. Shrader-Frechette, K. Belitz. Verification, validation, and confirmation of numerical models in the earth sciences. Science, 263(1994):641-46.
Ostrom E. 1990. Governing the commons. Cambridge: Cambridge University Press
Oxfam. 2014. Working for The Few. Political Capture And Economic Inequality. Oxfam Briefing Paper 178.
Page S.E. 2010. Complexity in Social, Political, and Economic Systems. Santa Fe Institute.
Peirce C.S. 1931. The Collected Papers Vol. I.: Principles of Philosophy, in C. Hartshorne, P. Weiss (Eds.), Cambridge, Mass.: Harvard University Press.
Peirce C.S. 2004. Izbrani spisi o teoriji znaka in pomenu ter pragmaticizmu (Selected Readings in the Theory of Sign). Ljubljana: Krtina, Temeljna dela.
Pereira G., Â., S. Guedes Vaz, S. Tognetti (Eds). 2006. Interfaces Between Science and Society. Sheffield: Greenleaf Publishers.
Poincaré H. 1914. Science and méthode. London, Thomas Nelson and Sons.
Poli R. A Note on the Difference Between Complicated and Complex Social Systems. Trieste: the SE European Division of The World Academy of Art and Science, The Cadmus Journal, 2/1(October 2013):142-7.
Pont G. Philosophy and Science of Music in Ancient Greece: The Predecessors of Pythagoras and their Contribution. Torino: Kim Williams Books, Nexus Network Jurnal, 6/1(Spring 2004).
Popper K. 1992. Simplicity. The Logic of Scientific Discovery. 2nd ed. London: Routledge.
Portis L. The 1968 Generation and Postmodern Thought. Divergences - multinational, multilingual and libertarian review, 15(October 2008).
Prezioso M. 2010. Researching in geography, it is possible to match science, theory and practice of the territorial development. Presented at the conference: Primijenjena geografija u teoriji i praksi, University of Zagreb, 5-6 December.
Prigogine I., I. Stengers. 1982. Novi savez - Metamorfoza znanosti (La Nouvelle Alliance, Gallimard, 1979). Zagreb: Globus, Zbirka Novi svijet.
Raatikainen P. 2014. “Gödel's Incompleteness Theorems”, in Zalta (Ed.).
Radej B. Apples and Oranges: Synthesis without a common denominator. Ljubljana: Slovenian Evaluation Society, Working Papers, 7/1(February 2014).
Radej B. Več-nivojski vidik družbene kompleksnosti in njen pomen za metodologijo družbenega raziskovanja. Ljubljana: Slovenian Evaluation Society, Working Papers, 3/3(2010).
Radej B. With Exclusion to the Community. Ljubljana: Slovenian Evaluation Society, Working Papers, 6/2(July 2013).
Radej B., M. Golobič. Divided we stand: Social integration in the middle (B.Radej, M.Golobič, 26 pp), Ljubljana: Slovenian Evaluation Society, Working Papers, 6/1(June 2013).
Ramalingam B., H. Jones, T. Reba, J. Young. 2008. Exploring the science of complexity. London: Overseas Development Institute, Working Paper 285.
Ravetz J. 2003. Pluralistic uncertainty management. The Post-Normal Perspective. Notes for the lecture: Pluralistic uncertainty management: social scientific basis. EU Advanced Summer Course in Integrated Assessment. University of Maastricht: ICIS.
Rickles D. 2011. Econophysics and the complexity of financial markets, in Hooker (Ed.).
Riofrio W. Ubiquity symposium: Evolutionary computation and the processes of life information, biological, and evolutionary computing. Ubiquity, May(2013):1-10.
Rittel H. On the Planning Crisis: Systems Analysis of the 'First and Second Generations'. Bedriftsokonomen 8(1972):390-6.
Rittel, H., M. Webber. Dilemmas in a General Theory of Planning. Policy Sciences 4(1973):155-69.
Ritzer G. 1990. Micro-macro linkage in sociological theory: Applying a metatheoretical tool, in G. Ritzer (Ed.), Frontiers of sociological theory: The new syntheses. New York: Columbia University Press
Ritzer G., B. Smart (Ed.). 2003. Handbook of Social Theory. London: Sage.
Rossiter N. 2006. Organized networks. Media theory, creative labour, new institutions. Rotterdam: NAI publishers, Institute of network cultures studies in network cultures.
Rotmans J. Scaling in Integrated Assessment: Problem or Challenge? The Integrated Assessment Society, Swets & Zeitlinger, Integrated Assessment, 6/1(2002):266-79.
Samuelson P. 1955. Economics. 3rd edn. New York: McGraw-Hill.

Samuelson P. A. Theoretical Notes on Trade Problems. Review of Economics and Statistics, 46/2(May 1964):145–54.
Sankey H. 1997. Incommensurability: The Current State of Play. University of Melbourne, Department of History and Philosophy of Science.
Sankey H. Review of Sherrin Roush, Tracking Truth: Knowledge, Evidence, and Science. Review of Metaphysics 61/1(2007):158-59.
Schmidt J.C. 2011. Challenged by instability and complexity... questioning classic stability assumptions and presuppositions in scientific methodology, in Hooker (Ed).
Schnellenbach J. The Dahrendorf hypothesis and its implications for (the theory of) economic policy-making. Cambridge Journal of Economics, 29/6(2005):997-1009.
Schrödinger E. 1996. Nature and the Greeks, and Science and Humanism. Cambridge University Press, Canto, foreword R. Penrose.
Schumann A., F. Smarandache. 2007. Neutrality and Many-Valued Logics. Belarusian State University.
Scriven M. The Final Synthesis. London: Sage, American Journal of Evaluation, 15/3(1994):367-82.
Seamon D. 2008. “Intensify this Awe”: Threeness, the Triad, and Christopher Alexander. Department of Architecture, Kansas State University.
Shinko R.E. Agonistic Peace: A Postmodern Reading. London: Sage, Millennium - Journal of International Studies, 36/3(2008):473-91.
Siegfried T. 2014. There’s a new way to quantify structure and complexity. Science News, 22. September.
Simon. H.A. The Architecture of Complexity. Proceedings of the American Philosophical Society, 106/6(December 1962):467-82.
Skinner Q. (Ed). 1997. The Return of Grand Theory in the Human Sciences. Cambridge University Press.
Sloan P. 2010. “Evolution”, in Zalta (Ed.).
Stacey R.D. 2002. Strategic management and organisational dynamics: the challenge of complexity. 3rd ed. Harlow: Prentice Hall.
Steele R.D. 2012. The Open-Source Everything Manifesto. Transparency, Truth, and Trust. Berkeley: Evolver Editions.
Stengers I. 1997. Power and Invention: Situating Science. Minneapolis: University of Minnesota Press.
Stent G.S. Paradoxes of free will and the limits of human reason. Proceedings of the American Philosophical Society 148/2(June 2004):205-12.
Sterelny K. Social intelligence, human intelligence and niche construction. Social Intelligence (2007):375-92.
Stern B.B. Deconstructive Strategy and Consumer Research: Concepts and Illustrative Exemplar. The University of Chicago Press: The Journal of Consumer Research, 23/2(Sep., 1996):136-47.
Steward J. 1955. Theory of Culture Change: The Methodology of Multilinear Evolution. University of Illinois.
Stewart I. 1997. Nature's Numbers: : The Unreal Reality Of Mathematics. New York: Basic Books.
Swami S. 2000. Dimension of Good and Evil. Helsinki: Jani Koivuniemi.
Swinburne R. 1997. Simplicity as Evidence for Truth. Wisconsin: Marquette University Press.
Tae-Hee J. 2008. The Micro-Macro Synthesis in Veblen’s Institutional Economics. Buffalo State College.
Tilly C. 1978. From Mobilization to Revolution. New York: Random House.
Touraine A. 1992. Two Interpretations of Contemporary Social Change, in Haferkamp, Smelser (Eds).
Trainor B.T. Politics as the quest for unity. Perspectivism, incommensurable values and agonistic politics. London: Sage, Philosophy & Social Criticism, 34/8(2008):905–24.
Trapnell G. 1984. Putting the evaluation puzzle together. Training & Development, 38/5(1984):90-3.
Turner J.H. 2003. The Origins of Positivism: The Contributions of Auguste Comte and Herbert Spencer, in Ritzer, Smart (Eds.).
Turner J.H., A. Maryanski. Explaining Socio-Cultural. Evolution. Symposium / Social Sciences and Natural Sciences – What Connection? Bologna: Società editrice il Mulino, Sociologica, 3/2008.
Ulanowicz R.E. 2005. A Revolution in the Middle Kingdom, in H. Lillienstroem and U. Svedin (Eds.) Micro-Meso-Macro: Addressing Complex Systems Couplings. London: World Scientific.
Van Parijs P. 2001. What's Wrong With a Free Lunch? Boston: Beacon Press.
Veblen T. 1899 Theory of the Leisure Class: An Economic Study of Institutions. New York: The Macmillan Company.
Vernon R. The ‘Great Society’ and the ‘Open Society’: Liberalism in Hayek and Popper. Canadian Journal of Political Science / Revue canadienne de science politique, 9/2(June 1976):261-76.
Wacquant L.J.D. Towards a Reflexive Sociology: A Workshop with Pierre Bourdieu. Sociological Theory, 7/1(Spring, 1989):26-63.
Walby S. 2003. Complexity theory, globalisation and diversity. Presented to conference of the British Sociological Association, University of York.
Waldrop M. 1992. Complexity: The Emerging Science at the Edge of Order and Chaos. New York: Simon and Schuster.

Wallerstein I. 1991. Unthinking Social Science: The Limits of Nineteenth Century Paradigms. Cambridge: Polity Press.
Wallerstein I. 1996. The Rise and Future Demise of World-Systems Analysis, 91st American Sociological Association.
Wallerstein I. 2004. The Uncertainties of Knowledge. Philadelphia: Temple University Press.
Wallerstein I. 2006. Uvod v analizo svetovnih-sistemov (World-System Analysis. An Introduction, 2005). Ljubljana, Založba /cf*.
Wallerstein I.1998. Utopistics, or, Historical Choices of the Twenty-first Century. New York: New Press.
Wikipedia, see footnotes by #Keywords.
Wilber K. 2000. A Theory of Everything: An Integral Vision for Business, Politics, Science and Spirituality. Boston: Shambhala Publications.
Yin G., W. Herfel. 2011. Constructing post-classical ecosystems ecology, in Hooker (Ed).
Zahra A., C. Ryan. From chaos to cohesion—Complexity in tourism structures: An analysis of New Zealand's regional tourism organizations. Tourism Management 28(2007):854–62.
Zalta E.N. (Ed.). The Stanford Encyclopedia of Philosophy. Stanford University: Center for the Study of Languages and information, various editions.
Zerzan J. 2004. Katastrofa postmodernizma (The Catastrophe of Postmodernism, New York, Future Primitive, 1994), in John Zerzan, Anarhoprimitivizam protiv civilizacije, Jesenski i Turk, Zagreb.
Zolli A. 2012.Want to Build Resilience? Kill the Complexity. Harvard Business Review, blog.

Kolofon

Naslov:	»Social complexity: Operational definition«
Podatki o avtorju:	Radej Bojan
Podatki o izdaji ali natisu:	1. Izdaja
Kraj in založba:	Ljubljana: Slovensko društvo evalvatorjev/Slovenian Evaluation Society
Leto izida:	Ver 1: 2014; ver 2: July 2015 (Vol. VII, No. 2)
Naslov knjižne zbirke:	Delovni zvezek SDE/ Working papers SiES
Podatki o nosilcu avtorskih pravic:	SDE, Ustvarjalna gmajna 2.5/Creative Commons 2.5, Slovenija
Podatek o nakladi (število natisnjenih izvodov):	Elektronska publikacija,
Mednarodne identifikatorje (ISBN, ISMN, ISSN):	ISBN 978-961-92453
Maloprodajno ceno publikacije:	Publikacija je brezplačna/Free.

About the SES's Working papers series

Publishes scientific and technical papers on evaluation of public policies and from related disciplines. Freely accessible on the internet. Already published:

Sponsor

SDE operation is nonfinacially supported by IER – Institut for economic research, Ljubljana, http://www.ier.si/