Rainer E. Zimmermann &
Vladimir G. Budanov (eds.)

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Preface

This third volume of the INTAS series assembles the results of the language project within the co-operation, primarily carried out by the subgroups of Kassel and Moscow. The editors thank the EU commission for the funding of the project, and Wolfgang Hofkirchner for the funding of this present volume.

Rainer E. Zimmermann, Vladimir G. Budanov, in November of 2004.

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The Internet as a Self-Organizing Socio-Technological System

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Abstract

The Internet is generally considered as a global technological system of networked computer networks, as the network of networks working with TCP/IP. Such definitions see the Internet as a purely technological system, they forget that knowledgeable human activities make the Internet work, the technological structure can't be separated from its human use and the permanent creation and communication of meaningful information through the Internet. The technical process of data transmission in the Internet known as routing is a mechanistic one. Self-organzing systems involve certain degrees of freedom, chance, unreducibility, unpredictability, and indeterminacy, hence when considering the Internet a purely technological system, it can't be characterized as self-organizing. Social self-organization is a self-referential, mutual process where structural media and human actions produce each other. The Internet is a global socio-technological system that is based on a technological structure consisting of networked computer networks that works with the help of the TCP/IP protocol and stores objectified human knowledge, human actors permanently re-create this global knowledge storage mechanism by producing new informational content, communicating in the system, and consuming existing informational content in the system; the technological infrastructure enables and constrains human communication. The Internet consists of both a technological infrastructure and communicating human actors. Together these two parts form a socio-technological system, the technological structure functions as a structural mass medium that produces and reproduces networked communicative actions and is itself produced and reproduced by communicative actions. The technical structure is medium and outcome of human agency, it enables and constrains human activity and thinking and is the result of productive social communication processes. Important qualities that are connected with the Internet as a socio-technological system are Open Source, Virtual Reality, globalization, and many-to-many dialogue. Tradtional mass media have been based on one-to-many-communication, whereas the Internet is based on many-to-many-communication. Hence the Internet has a large

intrinisc democractic potential. In the terminology of Vilém Flusser it can be said that it could support a shift from discursive media society to dialogic media society.

1. Introduction

The aim of this paper is to show that the Internet should not be considered as a purely technological system, but as a socio-technological system, and that concepts of social systems and the media that are based on self-organization theory are suited as a foundation for doing so. First I will point out that technological conceptions of the Internet are insufficient (part 1). Then I will outline some foundations of the self-organization of the self-organization of the media and social systems (part 2), I will argue based on this foundation that the Internet is a self-organizing socio-technological system (part 3), and I will show that virtual reality, globalization, and many-to-many-dialogue (in the sense of Vilém Flusser) are central aspects of the Internet (part 4). Finally I will make a short conclusion (part 5).

It is well known that the Internet originated from the ARPANet, a decentralized military computer-based communication network that was set up in the 1960ies by the US government and was expected to survive a nuclear attack. Important Internet-based applications have been e.g. Telnet, FTP, Gopher, LISTSERV, Archie, Finger, IRC, Talk, Usenet, MUD, Email, X.500, WHOIS, WAIS, Veronica, Ping, Netserv, Netfind, Knowbot, Hytelnet. Probably the best known and most influential Internet-based technology is the World Wide Web (WWW) that has been created by Tim Berners-Lee at CERN in 1990. This concept allows a user-friendly browsing in a shared information space by making use of a Web browser like Mosaic, Internet Explorer, Netscape, Lynx, Viola, Opera, Mozilla, or Safari. The userfriendliness of the WWW is one of the factors that has contributed to the massive boom of the Internet.

The Internet is generally considered as a global technological system of networked computer networks, as the network of networks. The Federal Networking Council has defined the Internet in 1995 as the global information system that "1. is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons; 2.is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols; and 3. provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein". The RFC 2026 of the Internet Engineering Taskforce (IETF) has a similar definition that defines the Internet as "a loosely-organized international collaboration of autonomous, interconnected networks, supports host-to-host communication through voluntary adherence to open protocols and procedures defined by Internet standards". Such definitions see the Internet as a purely technological system, they forget that knowledgeable human activities make the Internet work, the technological structure can't be separated from its human use and the permanent creation and communication of meaningful information through the Internet. Hence we should define the Internet as a global socio-technological system that is based on a technological

structure of networked computer networks that works with the help of the TCP/IP protocol and is used by human beings in order to share and communicate knowledge. The Internet consists both of a technological and a social-communicative realm. The technological part enables and constrains human communication and is itself produced and permanently reproduced by the human communicative part. I don't agree with the argument that the Internet is a technological system that is structurally coupled to social systems so that the technological Internet and social communication system mutually form environments for each other (Palacios 2003). The specific social systems are themselves networks of communication and networks of networks, they form themselves a social Internet. Hence I wouldn't use the term Internet in a narrow technological sense, but in the broad sense of a network of networks that consists of a technological subsystem (a network of computer networks) and a social subsystem (a network of social communication networks). The two subsystems of the Internet form environments for each other and are structurally coupled, but this takes place within a connecting whole that we call the Internet.

The technological part of the Internet is based on the TCP/IP protocol that defines how data packages are created and integrated and where they shall be addressed to. Routers are computers that link component networks, they hold routing tables. When a router is confronted with a data package, this package includes an address where to send the package. The router looks up a part of this address in the routing table and sends the package to the next router that repeats the same operation. Routing tables specify where depending on the destination of a data package, a specific routing computer shall send the package. TCP/IP enables the linking of heterogeneous networks, it is a transmission technology that is independent from the underlying transmission technology. Internet hosts, i.e. computers that store digital data that is included in the Internet, have domain names (e.g. cartoon.iguw.tuwien.ac.at), the address space of the WWW is organized hierarchically. These names are translated into 32-bit numeric identifiers (IP addresses) by a specific service called the Domain Name System (DNS). Application programs (like Netscape or Outlook) send requests to the DNS to convert the domain names the users type into an input field (e.g. a URL like http://cartoon.iguw.tuwien.ac.at/christian/ or an e-mail address like christian@igw.tuwien.ac.at) into Internet addresses. When a host demands data from another host or sends data to another host, the IP addresses of the sending and the destination host along with the specific data that is broken down into several packages is sent to the router. The router determines with its routing table to which router the data package must be sent. There are several hops until the data is finally transmitted to the destination host, in each hop the data package is transmitted to a router that is closer to the destination. The routing tables are used to determine the next hop. To each network connected to the Internet a network identification number (ID) is assigned by the Internet Network Information Centre (NIC), the IP addresses of all hosts connected to this network contains this network ID. Furthermore each IP address contains a host ID that is specified by the local network manager.

The technical process of data transmission in the Internet is a mechanistic one. The computer programs running on a router determine exactly where an incoming data package must be sent to as well as alternative routes if the primary, secondary, etc. route should be unavailable. The Internet is a technologically decentralized net-

work, but this is not a sufficient condition for considering it as self-organizing[1]. In self-organizing systems there is a strong element of freedom, chance, unreducibility, unpredictability, and indeterminacy. In Internet communication, each data package is numerically organized in bits, for each incoming data package identified by 32 bits for the source host and 32 bits for the destination host, an exact output is produced by the router, this output consists of 32 bits that identify the next router. Given the conditions of available routers, it is predetermined which output will be produced. Hence the operations are not emergent, but mechanically reducible to computational logic. Concerning its technological structure, the Internet is not a self-organizing, but a mechanical system.

Peter Bøgh Andersen (1998) argues that the WWW is a new type of self-organizing technical system[2] because it is based on recursive processes between clients and servers, chaotic browsing processes in the long run strive for identifiable attractors (certain web pages that are well indexed in search indexes, have a good design, etc.), bifurcation takes place when new WWW attractors come and old ones go, self-reference is created by the syntactic structure of URLs and by Web spiders, there is a self-similar structure of the WWW that is based on client-server-communication, there is self-repair due to the updating of links and the deleting of dead links by spiders, the Internet is differentiated into subsystems, it is dynamic and can't be controlled by one central intentional agency, and it can itself strongly facilitate its own reproduction, development, and repair.

Andersen fails to show how the WWW is reproducing itself because he analyses Web processes as independent from human users and argues that the essential actors in the Web are software programs like clients, servers, spiders, and agents. Hence he says e.g. that clients and servers are communicating and that the WWW is a "technical autopoietic system" (Andersen 1998: 38). "Although it is ultimately people that actually make things happen on the net, the complex result of their millions of activities is beyond individual planning; qua complex system the net acquires properties that force its users to new actions and inventions that they would never have thought of, had it not existed" (ibid.).

That the Internet can't be individually controlled is not an argument against its social character. Even when software spiders create new links, update search engines, etc., the Web can only become a meaningful semantic space by human activity. No computer program can create meaningful information, the production of meaning is an essentially human activity, a technological system can't produce meaning. When there is a technological network of data that is maintained by software agents, but not used by a single human, there is no self-organization because the agents' activities are fully determined whereas human activities are shaped by unpredictability, creativity and chance. The WWW is a socio-technological system consisting of networked computer networks that enable the social networking of human communication and the human creation and distribution of meaningful information. Ander-

[1] Sady Plant is wrong in arguing that the Internet is self-organizing because there is no centralized control of it. "No central hub or command structure has constructed it. […] [it is a] multiplicitous, bottom-up, piecemeal, self-organizing network which […] could be seen to be emerging without any centralized control" (Plant 1997: 49). Such an analysis sees the Internet as a purely technological system.

[2] The title of the essay of Sandra Braman (2000) sounds promising and one expects to read why the Net is a self-organizing system. She simply lists some aspects of self-organization and the information economy, but doesn't show why the Net should be considered as a self-organizing system.

sen tends to describe the WWW as a purely technological system and hence reduces self-organization to a technological level. All purely technological system are mechanical systems, but self-organizing systems are non-mechanical systems. Hence it is necessary to stress the central importance of human actors in the WWW in order to consider the latter as self-organizing. Talking about the Internet, the WWW, Cyberspace, Virtual Reality, etc. means to not only talk about networked technologies, but also about networked communication, knowledge, human values, and culture. The self-organization of the WWW is mediated and enabled by human agency, human communication at a distance is mediated and enabled by the technological structure of the Internet.

Heylighen/Bollen (1996) argue that the WWW could develop into a "super-brain" or "associative memory" if learning algorithms could be generalized in such a way that the WWW permanently learns from its users. "The brain of the users themselves would become nodes in the Web: stores of knowledge linked to the rest of the Web, which can be consulted by other users or by the Web itself". The advantage of this "super-brain" would be that one could use the unlimited knowledge and intelligence of others in order to solve problems. The WWW is a giant storage mechanism of human knowledge, but this doesn't mean that it is a brain itself. The networked communication of human beings mediated by the Internet results in new emergent results. The WWW is based on human activities, without human activity it is a dead, mechanic, non-self-organizing system. If it were technologically possible to link human brains directly with the Web, this would indeed enhance the dynamic structure of the Web, the Web would become a medium that links human brains not indirectly, but directly. But I doubt that such a system would under the social power conditions we are facing today develop into a "super-brain" because such a system would have to display collective intelligence and collective wisdom. It is very likely that it would be used to manipulate, control and homogenize individuals and to facilitate the domination of certain groups by other groups. Heylighen and Bollen don't take into account the fact that in a highly stratified society, the vision of a "super-brain" has totalitarian implications that remind us of George Orwell's 1984. The WWW is not a "global brain", it is not a biological phenomenon, but a socio-technological system where networked computers enable the indirect linkage of human brains. Linkage here means that human beings make use of the system in order to communicate and co-operate.

Considering the Internet as technological system or as global brain doesn't take into account that it is a socio-technological system that is based on human activity and where computer networks mediate human communication. "The Internet is fundamentally comprised of flesh and blood, millions of people with varying degrees of technological sophistication, of different ethnicities, with a variety of beliefs and values, who are using the Internet for a diverse set of reasons. It is through the complex interrelations among the assorted human actors and the machines by which they are interlinked that the Internet self-organizes" (Granic/Lamey 2000: 96).

I suggest considering the Internet as a self-organizing socio-technological system. For doing so, I first have to point out some foundations of a theory of social self-organization.

2. The Media and Social Self-Organization[3]

Social analysis has to start from real, sensual living human beings that produce in a society and enter social relationships. Societal structures don't exist externally to, but only in and through human agency. By interaction of human actors, new social qualities and structures can emerge that cannot be reduced to the individual level. This is a process of bottom-up emergence that is called agency. Emergence in this context means the appearance of at least one new systemic quality that cannot be reduced to the elements of the system. So this quality is irreducible and it is also to a certain extent unpredictable, i.e. time, form and result of the process of emergence cannot be fully forecasted by taking a look at the elements and their interactions. Structures also influence individual actions and thinking. They constrain and enable actions. This is a process of top-down emergence where new individual and group properties can emerge. The whole cycle is the basic process of systemic societal self-organization that can also be called re-creation because by permanent processes of agency and constraining/enabling a system can maintain and reproduce itself (see fig. 1). It again and again creates its own unity and maintains itself. Societal structures enable and constrain actions as well as individuality and are a result of actions (which are a correlation of mutual individuality that results in sociality).
Re-creation denotes that individuals that are parts of a system permanently change their environment. This enables the system to change, maintain, adapt and reproduce itself. What is important is that the term re-creation also refers to the ability of all humans to consciously shape and create systems and structures, an ability that is based on self-consciousness and, in Anthony Giddens' terminology, the reflexive monitoring of action. Societal systems are re-creative ones because they can create new reality, the socio-cultural human being has the ability to create the conditions for his further evolution all by himself. Creativity means the ability to create something new that seems desirable and helps to achieve defined goals, it's a central feature of communicative action.

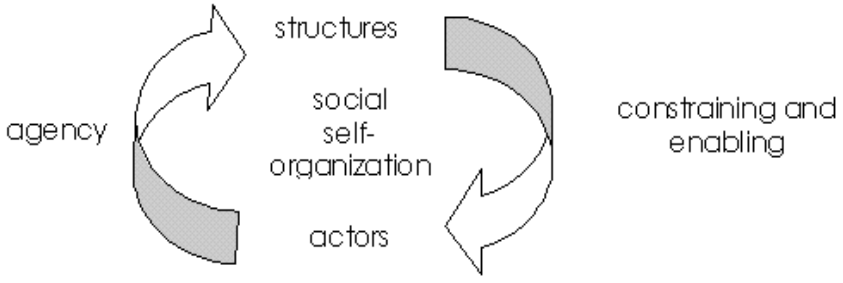

Fig. 1.: The self-organization/re-creation of societal systems

Terming the self-organization of society re-creation acknowledges as outlined by Giddens the importance of the human being as a reasonable and knowledgeable actor in sociology. Giddens himself has stressed that the duality of structure has to do with re-creation: "Human social activities, like some self-reproducing items in na-

[3] For a more detailed discussion of the foundations of a theory of social self-organization see Fuchs (2002, 2003a-g).

ture, are recursive. That is to say, they are not brought into being by social actors but continually *recreated* by them via the very means whereby they express themselves as actors“ (Giddens 1984: 2). Saying that society is a re-creative or self-organising system the way we do corresponds to Giddens' notion of the duality of structure[4] because the structural properties of societal systems are both medium and outcome of the practices they recursively organize and both enable and constrain actions (for the relationship of Giddens' theory of structuration and social self-organization see Fuchs 2003e).

A medium is a structural entity that helps organizing a relationship between two entities in a self-organizing system. Via a medium a relationship between parts of a system and/or system and environment is produced in order to enable the self-organization of the whole system. Etymologically the term medium stems from the Latin *medius* which means in the *middle*, the *middle one*. Media have to do with mediation. Social media mediate the social relationships of human being. They are employed in social relationships of living, social actors.

Social structures can be found in all societal areas: in technology, ecology, economy, politics and culture. *Tools* are means employed for reaching defined goals, *natural resources* organised by humans are necessary in order to reach these goals, *property* enables the production of use values and the satisfaction of needs. *Decision power* is necessary in order to orient processes and achieve decision-based results, *definitions* (norms, values) serve as means of reflection and assessment of the concrete human existence. Hence in society we find technological, ecological, economic, political and cultural structures that mediate the relationships of human beings and hence the reproduction of social systems. They are both medium and outcome of social actions, they constrain practice, but also enable practices that result in new structures and the differentiation of already existing ones. We argue in favour of a broad concept of the media that is neither confined to the technological realm nor solely to social systems. Media can be found with different characteristics in all complex, self-organizing systems (cf. Fuchs/Hofkirchner 2003), here we focus on the basic characteristics of social media:

- Media store and fix knowledge about society and simplify human action because due to their existence certain foundations of actions don't have to be permanently (re)produced, but can be accomplished by making use of media. Media reduce the complexity of society. They are carriers of knowledge and a foundation of the spatial and temporal extension of social systems. Social media are storage capacities in society which enable the existence of institutional forms which persists across generations and shape past experiences that date back well beyond the life of any particular individual. Not only technological systems form social media, but also markets, money, commodities, power, laws, rules, values, traditions, and norms.
- Media enable the continuity of social reproduction over space and time, they result in a spatial and temporal distanciation of social relationships without loss

[4] “According to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organise” (Giddens 1984: 25) and they both enable and constrain actions (ibid.: 26).

of continuity. But media also produce special modes of proximity and hence sublate distance by reembedding spatio-temporally disembedded relationships.

- Media are a foundation of practice and enable a certain mobility
- Media mediate, organize and co-ordinate social relationships, communication, knowledge management, production, co-operation, competition, domination, decision processes, the discursive establishment of norms and values, and the production and materialization of ideologies
- Media connect actors, individuals and groups.
- Special skills, rules, organizational forms and norms are necessary for using media (media literacy). Media put forward certain forms of usage and exclude others.
- Media mediate and change human perception.
- Media are symbolic systems and referential systems (e.g. technologies refer to purposes, property refers to material possibilities and positions, power to decisions, definitions to life-styles and taste).
- Media have material-substantial and ideational aspects. E.g. in computer mediated communication (CMC) the technological distribution as well as the produced content are important.
- Media enable new experiences that transcend the immediate experience of corporeal presence.
- Media dissolve on the one hand temporalities and spaces, but on the other hand also produce new spaces and temporalities.
- Media don't come into existence by chance, but in certain historical situations and due to certain social and cultural needs and interests. Media have their own history.
- Media are referring to objective reality, but these references are not simply reflections and mappings of reality, but also contain new meanings and contents. Media unite different contexts, e.g. different subjective value schemes in face-to-face communication or different cultural contexts in virtual discussion boards. Mediation means frequently that realities are disembedded from their context of production and reembedded into new contexts. E.g. in the Internet and in a film-montage elements that stem from different contexts can be embedded into a new context that contains new, emergent meanings that can't be found in one of the single elements.
- Media employ principles of order. E.g. linearity is a principle of order of the book, networking and linking are order principles of hypertext, and precision is an order principle of the medium money.
- Media contain certain meanings, ideologies, myths and worldviews.

In modern society, the development of technological media, i.e. tools and machinery, has been advanced in order to organize economic production more efficiently. The history of modern society is also the history of technologies that have become continuously more rapid and have increasingly enabled the disembedding of social relationships. Due to the enlargement of the scope of technological media (railway, telegraph, public transport, mass transport, telephone, radio, automobile, airplane, TV, fax, computer etc.) the flexibility of social relationship increases.

During the Fordist mode of societal development that was based on mass production and mass consumption the mass media have emerged as a relatively autonomous and functionally differentiated subsystem of society. The beginnings can be found earlier with the establishment of the press; radio, film and television have propelled the development of the system of the mass media. In this system, ideologies are produced and distributed, it is a diffusion channel of knowledge, news, ideologies and views. The mass media form an autopoietic or self-organizing system that is organized around the permanent production of topical news about the state of the world. The mass media don't map objective reality exactly, they construct social realities that distort objective reality due to the subjective views, interests and complex relationships that are contained in this system. The system of the mass media produces imaginary representations of reality, it doesn't simply construct one of many legitimate realities as claimed by constructivist sociologists like Niklas Luhmann (1996), it rather produces and distributes various views of objective reality that are different from reality as such to certain degrees. This system can be considered a subsystem of the cultural subsystem of society. Mass media are organized around certain technological media (printing press, radio technology, television, computer etc.) that are embedded into social institutions. Hence the term mass media doesn't simply denote certain technologies, but social relationships that make use of technological media in order to organize themselves and to reach certain goals. The mass media are closely structurally coupled with the economic, political and technological subsystems of society, they can achieve their goals only by making use of technological, economic, political and cultural media. Institutions of the mass media frequently (especially within deregulated social and institutional settings) also pursue economic interests and make use of technological media in order to achieve these aims, i.e. they sell knowledge and news as commodities.

We should employ the term *mass* media because technologies are used in order to reach a large number of people. Audience ratings are an important economic aspect of the mass media. A central characteristic of the existing organization of the mass media is that the main contents are controlled and produced by a relatively small number of people and groups, whereas the number of recipients is much larger. It does no longer make sense to distinguish subsystems of the mass media such as printed media, film, radio, TV because the convergence of technologies and media institutions takes place. Due to digitization and technological networks it is possible to digitally unite several classical media. Such a combination of scripture, audio, images, video, music, communication and body enables a multimodal dimension of the mass media. The technological structure of the Internet as a new technological medium is a typical expression of the convergence of technological media. Media organizations make use of technological convergence in order to expand the scope and distribution of their contents.

Social media don't operate fully separated from each other. Human beings make permanently use of different media (also at the same time) in order to organize their daily life and reach certain goals. Technologies, organized natural resources, property, decision power and definitions don't exist fully autonomous from each other, they rather as a totality constitute the structural characteristics of all social systems. In order to exist, the human being must make use of different media: technological ones (language, scripture, computer etc.), ecological ones (natural resources), eco-

nomic ones (goods, money, etc.), political ones (laws, elections, rules etc.), and cultural ones (norms, values, traditions). The system of the mass media embeds technological media institutionally, but it is also based on economic, political and cultural media. Its aim is the production and distribution of knowledge and topical news that frequently take on ideological and economic forms.

3. The Internet as a Self-Organizing System

Based on such a concept of social self-organization, a definition of the Internet that is non-technicistic can be given. The Internet is a global socio-technological system that is based on a technological structure consisting of networked computer networks that works with the help of the TCP/IP protocol and stores objectified human knowledge, human actors permanently re-create this global knowledge storage mechanism by producing new informational content, communicating in the system, and consuming existing informational content in the system; the technological infrastructure enables and constrains human communication. The self-organization of the Internet is based on a self-referential loop of self-organization (see fig. 2): In a top-down process the existing technological structure that stores objective human knowledge enables human activity, i.e. there is the subjectification of objective knowledge in human brains when one consumes knowledge that is represented in the Internet or communicates with other human beings via the Internet. In this sense the technological structure mediates human activities and results in emergent aspects of thinking and action. In a bottom-up-process human beings communicate and act in such a way that the knowledge stored by the technological structure changes, is actualized and extended. Here objective knowledge emerges from the co-operation of human actors, the actors co-ordinate their communication in such a way that parts of their subjective knowledge are synergetically shared and co-ordinated in such a way that new embedded and objectified emergent knowledge that is stored in the technological structure appears. This double process of bottom-up-emergence of objective knowledge and top-down-emergence of subjective knowledge constitutes the basic productive loop that is characteristic for the self-organization of the Internet system. The Internet consists of both a technological infrastructure and communicating human actors. The technical structure is medium and outcome of human agency, it enables and constrains human activity and thinking and is the result of productive social communication processes. The technological structure/part of the Internet enables and constrains human communication and is itself produced and permanently reproduced by the human communicative part of the Internet. The Internet consists of a technological and a social part that both have a networked character. Together these two parts form a socio-technological system, the technological structure functions as a structural mass medium that produces and reproduces networked communicative actions and is itself produced and reproduced by communicative actions. Not the Internet is a mass medium, only its technological part functions as a reflexive communication medium.

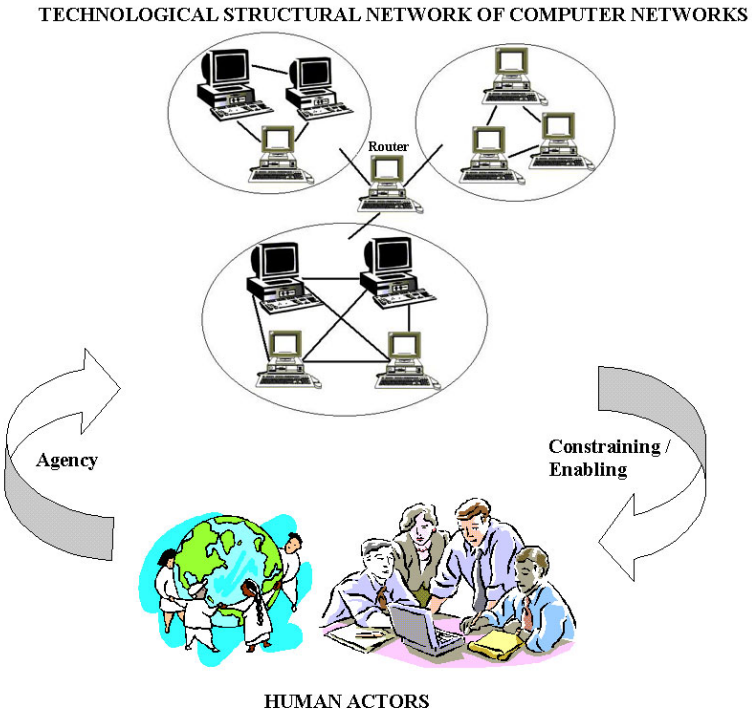

Fig.2: The Self-Organization of the Internet as a Socio-Technological System

Emergence in the WWW means emergence of new websites. The structure of the Web changes dynamically, pages disappear, reappear in alternative forms, are mirrored on other servers, new pages appear, etc. The detailed structure of the Web can't be known, predicted, and controlled to a full extent, its complexity steadily increases with its growth. This complexity can be measured by the number of websites and links in the WWW. When a new website is introduced, it is embedded into the existing Web and extends the latter. In order for a web page to be "visible" in the Net, links must be created that lead from and to this web page. Hence each web page is based on other websites, search engines, link lists, etc., but it can't be reduced to them (except in the case when one page is an exact mirror of another) because it has its own specific content and structure. Hence one can say that in the self-organization of the WWW, new web pages emerge out of other web pages. The Web "is continuously expanding, moving, and transforming itself. The World Wide Web is a flux" (Lévy 2001: 140). But this emergence and self-organization of the WWW is not a purely technological process, it is in need of active, knowledgeable human actors who create the structure of the WWW, links, new websites, etc. and browse the web. Without human beings, the Web is a dead mechanical entity that is non-self-organizing. One can only speak of the self-organization of the WWW when one considers the WWW not a technological system, but a socio-technological system where human beings make use of a technological medium in order to communicate. The Web grows and self-organizes only through human activity. The metaphor of the Internet as a carpet that is woven and permanently re-woven by millions of people that are distributed all over the world describes Cyberspace's dynamic nature. It is a carpet of networked, shared meaningful information that permanently re-creates itself and permanently re-emerges.

Websites are written in a specific language, the Hypertext Markup Language (HTML). Users make use of tools like Dreamweaver, FrontPage, Homesite, etc. in order to produce HTML-code. A hypertext is a network of informational nodes that contain informational pieces (texts, images, sounds, videos, animations) and are interlinked. The hypertext has a distributed nature, it can consist of texts, images, sounds, videos, animations, etc. (hence one also speaks of hypermedia) that are not necessarily stored on one computer, but all over the WWW, and of links to web pages that are distributed over the WWW. Links from all over the WWW lead to a hypertext, it can be produced jointly and at a distance by making use of co-operative work systems, it can be used and maybe extended or changed by people who are distributed all over the world. The hypertext is essentially dynamic, fluid, transitory, it has no fixed place. A specific hypertext forms a node in the Web that develops dynamically in such a way that links from and to this hypertext frequently appear and disappear.

Creating links is the essential operation of networking. The WWW is a self-referential medium in the sense that when a new link is created the system refers to itself by actualizing its content. Each web-page refers to a number of other web-pages that again refer to other web-pages etc. Self-referentiality is the essential nature of the hypertext, by creating links a hypertext is connected to a hypertext, the hypertext system of the WWW is referring to itself. This self-referentiality is based on human activities, i.e. on the creation of new hypertexts that are embedded into the existing system. The interlinked structure of the WWW defines possible paths that are discovered by active human beings that browse the Web and create their own personal path. “A hypertext is a matrix of potential texts, only some of which will be realized through interaction with a user” (Lévy 1998: 52). A hypertext system reproduces itself by the permanent self-reference of the category text.

Designing a web page is an essentially human creative, not only a technological, activity. Not only the production of new web sites is a central feature of the self-reproduction of the Internet, also its permanent usage as well as computer-mediated human communication are very important. Certain subsystems of the Internet like specific chats, bulletin board systems, newsgroups, mailing lists, etc. can maintain themselves only due to the fact that human actors make use of the technological structure as a medium of their symbolic exchange. As long as they communicate, the Internet is alive and organizes itself. The order of the system emerges due to communicative synergies. As soon as they stop using it, the specific self-organizing subsystem of the Internet breaks down. It might still be available technologically, but without meaningful communicated information it is not self-organizing. There is also the possibility that the self-organization of such a subsystem ends because it is technologically disconnected from the Internet. The Internet and the WWW consist of many different self-organizing spaces that are organized around special interests. Many of these subsystems are interlinked, they are not fully communicatively autonomous.

Due to its globally distributed, decentralized technical structure, small causes can have large effects in the Internet and can amplify themselves through the Net. Probably the best examples are computer viruses that spread over the Internet. These small pieces of code can do hardly any damage in a non-networked, local computer environment, but it can cause a lot of damage at distant places when it

enters the Internet. The same is true for communication, communicating specific information over the Internet can under certain circumstances cause social transformation in many distant places. The Internet enables action- and communication-at-a-distance. An example (Lubbers 1997): When in 1995 Steven Fishman published data and a declaration in lieu of oath on the Dutch server Xs4all.nl that documented the dubious tactics of Scientology, the sect threatened to prosecute Fishman and the Internet Service Provider (ISP). It aimed at censoring how former members felt about the praxis of Scientology. After Scientology effected a search warrant of Xs4all's headquarter, a global campaign was started by making use of the Internet. People all over the world joined the coalition and mirrored the incriminated data. Hence Scientology was unable to sue all of these individuals and ISPs and finally had to abandon the lawsuit against Xs4all. This example shows that small events or pieces of data (like a single web page about Scientology) can spread over the Internet and cause large effects like a protest campaign that transforms society.
Some parts of the WWW remain stable for many years, whereas others change dynamically (e.g. databases – like a search-engine – available on the Internet that contain dynamic information)

4. Central Aspects of the Internet as a Socio-Technological System

Important qualities that are connected with the Internet as a socio-technological system are Open Source, Virtual Reality, globalization, and many-to-many dialogue.

4.1. Internet and Open Source

In the Internet each consumer of information is also a potential producer and vice versa, with the Internet we see the emergence of the prosumer. Also each receiver is a potential sender and vice versa; and each reader a potential writer and vice versa. The traditional relationship of the author and the reader is broken up. The Internet is closely connected to concepts like Open Source, Open Content, Open Theory, etc. It fosters the networked, co-operative production of information, you can download existing code, data, images etc., reuse and improve it. The open source standards of the Internet software have in fact been one of the factors that have fostered its rapid growth. "The openness of the Internet's architecture was the source of its main strength: its self-evolving development, as users became producers of the technology, and shapers of the whole network" (Castells 2001: 27). Open source software is one of the key features of the Internet's evolution.

4.2. Internet and Virtual Reality

Virtual Reality (VR) means a space where information is not stored in the human brain, but in computer networks, that enables human communication and activity at a distance. VR is an extension of human reality in the sense that is based on human beings, their actions and interactions, it is a socially created space that has a techno-

logical substratum and is inhabited by human beings. VR is not the opposite of reality and it doesn't abandon reality. The experiences and practices we have through VR are real, hence Castells (1996) speaks of "real virtuality". The culture of real virtuality would be "virtual because it is constructed primarily through electronically based, virtual processes of communication. It is real (and not imaginary) because it is our fundamental reality, the material basis on which we live our existence, construct our systems or representation, practice our work, link up with other people, retrieve information, practice our work, link up with other people, retrieve information, form our opinions, act in politics, and nurture our dreams. This virtuality is our reality" (Castells 2001: 203). VR means a technological multiplication of reality, a simulation that constructs a new level of imagination and reality (Poster 1995). VR is characterized by three Is: immersion, interactivity, information intensity (Heim 1998). Immersion means that virtual reality creates new human experiences, interaction means that the state of an application changes according to changes of the human body that are feed as an input into the technical system, information intensity means that a virtual world can offer special qualities like telepresence that show a certain degree of intelligent behaviour.

When we browse the WWW, we are immersed into an artificial space that we navigate by clicking links and entering commands with the help of interaction devices such as the mouse and the keyboard. Certain human senses are observed by the system in order to gather input and change the state of the system, the output that the system produces appeals at least to our eyes and ears, the computer digitally combines data that can appeal to several of our senses and it digitally converts input of multiple senses into data that is used for changing the system's state. Hence the computer is a multi-medium. Digitization allows the convergence of text, sound, images, videos, animations, etc. Human-Computer-Interaction (HCI) involves a potentially endless feedback loop between the human user and the computer where the activity of a human being's sense organs changes the system's output and the output changes sensual human experiences. This process is the basic loop involved in interactivity. The WWW is not a fully immersive medium because our senses are not fully concentrated on interaction with the technology, you can see, hear, feel, smell, and taste stimuli that are not produced by the WWW while you are browsing. The Internet is a partly immersive system.

Full immersion can be achieved in a virtual reality system that makes use of 3D graphics, a data glove or data suit, and a head-mounted display. A fully immersive virtual reality system isolates the human senses totally from the outside environment, they are fully concentrated on interaction with the technology, the only sensual input into the body during the time of virtual experience is produced by the technology. The system exactly measures the user's position and movements and hence allows the user's control of artificial agents that move in a world that is presented to the user via the head-mounted display. The only thing he sees is the virtual world, it is not possible to observe the outside environment as it is when you surf the WWW. Frequently the virtual worlds are not purely artificial, but a simplified representation of reality. Examples are the virtual operating room and the virtual cockpit of a warplane. Midlevel immersion can be provided by the simulation of 3D spaces on a 2D monitor. This is e.g. the case in 3D arcade games like Duke Nukem

or Silent and VRML (Virtual Reality Modelling Language) spaces like cybertown.com.
Pierre Lévy (1998, 2001) argues that the virtual is not the opposite of the real, philosophically it would mean that which exists potentially rather than actually, a field of forces and problems that is resolved through actualization. Hence one can consider VR systems as objective systems that contain a mass of human knowledge that can be potentially actualized as subjective human knowledge. When one reads a piece of information in the WWW, objective knowledge is transformed into subjective knowledge, potential subjective reality is actualized into actual subjective reality.

4.3. Internet and Globalization

Networked computer usage has resulted in a real-time globalization of social relationships, knowledge flows today transcend national borders, they result in the globalization, intensification, time-space-distanciation of social relationships and establish a more intensive and extensive interconnection of humans, they cause a sort of supraterritoriality, time-space compression, action at a distance, and accelerating interdependence (Giddens 1990, Harvey 1990, Held/McGrew/Goldblatt/Perraton 1999, Robertson 1992, Scholte 1999). Knowledge is today quite substantially detached from territorial space, it cannot be situated at a fixed and limited territorial location, it operates largely without regard to territorial distance, it transcends territorial space. New knowledge-based technologies like the computer facilitate the de-localisation and disembedding of communication in the sense of the generation of spatial and temporal distance. One of the main characteristics of knowledge-based technologies is that they increase the speed of delivery of data massively and hence are a medium of the time-space distanciation of communication. They contribute to the disembedding and delocalization of social systems and relationships and hence reshape society. But they also further the reembedding and localization of disembedded social relationships, e.g. the globally available information on the Internet is embedded into local cultural contexts of action by the recipients. Globalization and localization are intrinsically coupled, Roland Robertson (1992) has suggested the term glocalization for this phenomenon.
The 20th century has seen an unprecedented increase in intensity, extensity, and velocity of global communication that is closely related to the rise of radio, television, satellite transmission, the microelectronic revolution and digital fibre-optic cable networks/digital data processing. The transatlantic cable of 1866 reduced the time of transmission of information between London and New York by over a week, the telephone increased the velocity of messages by a few minutes, the Internet reduced it not much at all in comparison to the telephone (Keohane/Nye 2000: 80). This doesn't imply that technological globalization is a myth, but that we should also stress qualitative aspects such as the reduction of the costs of information transport and new qualities of communication such as many-to-many-communication, interactivity, hyperlinking, digital compression, multimedia, conversion, simulated virtual realities, the decontextualisation and derealisation of communication, implications of computer mediated communicated for the formation of identities, etc.

The common theme underlying Giddens' concept of disembedding (Giddens 1990), Castells' concepts of timeless time and spaceless space (Castells 1989, 1996, 1997, 1998, 2001), and Harvey's (1990) concept of time-space compression is that modern technologies such as the computer accelerate and flexiblize social relationships. The history of modern society is a history of globalization and of the technological acceleration of transportation (of data, capital, commodities, people) that makes the world a smaller place in the sense that it increasingly mediates social relationships more efficiently so that it appears like distances are disappearing. Technological progress has resulted in an increasing separation of the movements of information from those of its carriers, the movement of information gathered speed on a pace much faster than the travel of bodies (Bauman 1998: 14). Especially transportation and communication technologies (railway, telegraph, broadcasting, automobile, TV, aviation, digital computer-based communication technology, and most recently digital network technology) have increased the speed of global flows of capital, commodities, power, communication, and information. The Earth has been increasingly transformed into a global communication network that affects all realms of society.

4.4. Internet and Many-to-Many-Dialogue

The WWW is a system that requires human activity, active human browsing, and active human knowledge creation for its existence and permanent reproduction. Each receiver is a possible transmitter. Nonetheless the Internet today is more a space of commerce and passive information consumption, but it has the potential to become a space of active, mutual, co-operative, inclusive information production. The Web is a space suited for "nomadic co-operation" (Lévy 1997).

The Internet is technologically based on a decentralized network that forms a polydirectional medium of interaction where many-to-many-communication can take place. In comparison to traditional media that were based on one-to-many communication this is a new quality that has a fundamental political potential. Traditional media such as television, radio or printed media have a one-dimensional character, they only work in one direction from the sender to the receiver without possibilities for mutual interaction. The interactivity of the Internet can extenuate the elitist character of traditional media, there is a shift from one-to-many- to many-to-many- and all-to-all-communication. The technological networking of the world pits forward a new principle: all-embracing, participative, networked co-operation (cf. Fuchs 2003a) and direct democracy in all realms of society. It is up to the human beings to change society in such a way that it can make full use of and realize the opportunities the Internet poses. Internet communication can support the emergence of a global public sphere and a global civil society.

Vilém Flusser (1996a, b) has distinguished between dialogic and discursive forms of communication. Dialogue would mean exchanging and sharing information in order to produce new information jointly and co-operatively, discourse would mean the distribution of existing information. Dialogues would be conservative and totalitarian because they would try to conserve and distribute existing information. The traditional media would operate in the form of amphitheatre discourses where there is one sending centre that functions as a channel that transmits information to the

mass of passive receivers. Another form of communication would be network discourses that could mainly be found in daily life as gossip and spreading rumours. The existing communication structure would be dominated by a combination and synchronization of the amphitheatre discourses of the mass media and gossiping network dialogue. The amphitheatre discourses would program unambitious, manipulating information in the form of techno images (symbolic patterns that signify linear texts that signify pictures that signify parts of the world, images that signify concepts/texts) that would be realized by the gossiping network dialogues in the life world. The character of network dialogue would be shaped and dominated by discourses.

In the times of the new media, there would not only be a potential for a new totalitarianism, but also one for a new level of human communication (1996b: 50) that means real human communication (ibid.: 157). The TV could easily be transformed into a dialogic medium that functions like a telephone (ibid.: 203) and enables a democratic cosmic village (ibid.: 204). Adding feedback structures to existing mass media wouldn't be a technological problem (ibid.: 226), doing so could open up new possibilities for a cosmic creative dialogue (ibid.: 228). Computer-based technologies would have the potential for transforming society into a new dialogic polis (ibid.: 286-299). Telematics (telecommunication+informatics) would have a democratic potential for helping to realize a fully dialogic society, a "telematic society" (Flusser 1996a) that is not based on intercourse between techno images and human beings, but on intercourse between human beings that is mediated by techno images that enable democratic dialogue (ibid.).

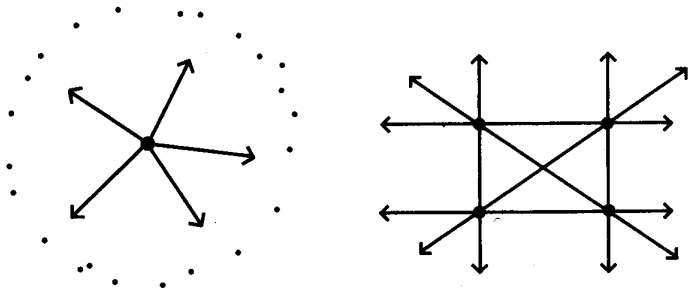

Fig. 3: Amphitheatre discourse and network dialogue as two forms of communication (from: Flusser 1996b, pp. 27+32)

Flusser died in 1991, he didn't live long enough to see and describe the emergence of the Internet as a mass phenomenon. But he has clearly seen that computer-based networks pose both new opportunities and risks. The Internet forms on its technological level a system of networked dialogue, but on the social level society doesn't make adequate use of this potential because it is dominated by discourses in all realms of social life. Realizing the democratic potential of the Internet would mean that a technological system of network dialogue is coupled to a social system of network dialogue. The old system of amphitheatre discourse that still dominates society in all of its realms would be replaced by a democratic form of network dialogue. The form of network dialogue that Flusser describes as simplistic gossip and the spreading of "false consciousness" in the life world would be transformed into a form of network dialogue that is participatory, co-operative, inclusive, and direct democratic. Human beings would be enabled to shape their lives and decisions all

by themselves, self-determination, permanent dialogical decisions and consensus democracy would become central aspects of the dialogical society. Social network dialogues would no longer be dominated by discourses, but would be fully dialogic and supported in their democratic character by a technological infrastructure that is organized itself as network dialogue.

Gilles Deleuze and Félix Guattari (1987) have introduced the concept of the rhizome. One of my hypothesis is that only a fully democratic, dialogic Internet forms a rhizome. Most authors who have analyzed parallels between the Internet and the concept of the rhizome have argued that due to its decentralized, networked technological structure the Internet is a rhizome (Burnett 1993, Hamman 1996, Koh 1997). My argument is that one must also take a look at the social usage of the Internet, at the immanent social systems, in order to analyse whether the Internet is or is not or can be a rhizome. Considering the Internet as a purely technological system doesn't satisfy the quality of the rhizome that it is open and connected.

Principles of a rhizome are: the principle of connection and heterogeneity (i), the principle of multiplicity (ii), the principle of asignifying rupture (iii), and the principle of cartography and decalcomania (iv).

Principle (i) means that any point of a rhizome can be connected to anything other, and must be. This is a description of a network structure as it can be found in the Internet. But a fully networked character of the Internet would have to include the inclusion of the excluded, i.e. the provision of free access for all and the dissolution of the digital divide. The hypertext structure of the WWW that is based on the principle of hyperlinking is a technological embodiment of the principle of connection. But the Net in its current form is not fully connective, it involves hierarchic dominating points and stratifying social hierarchies. A Net where all points are fully connected would be one without social hierarchies.

Principle (ii) means that there are no points or positions in a rhizome, only lines and that multiplicities are defined by the outside according to which they change in nature and connect with other multiplicities. This can be interpreted in such a way that the Internet can only be considered a rhizome if it is not seen as a closed technological system, but as an open system where technological structures are connected to social structures and the virtual subsystems and communities are all interconnected. The principle of multiplicity also implies that there should be no social hierarchies immanent in a rhizome, hence there would have to be free acces to and free participation in the Internet for all in order to consider it as a rhizome. Today in the Internet there is not only the hierarchy of the digital divide constituted around the dichotomy of access/no access, there is also a hierarchy stratified around the dichotomy importance/unimportance that privileges commercial sites and disprivileges political, philosophical, cultural, social, communicative, etc. web sites. Hence for becoming a rhizome, the Internet would have to become more ambitious and pretentious and would have to abandon the domination of commercialized knowledge and contents in favour of more communicative action.

Principle (iii) means that rhizomes tend to deterritorialize lines of segmentarity, i.e. a rhizome constitutes lines of flight down which it constantly flees. This principle reminds us of the fact that the Internet is a segmented space that is hierarchically organized according to lines of income, origin, gender, age, education, etc. It reflects the existing asymmetrical distribution of power in society and is a space of

social conflict. Alternative movements like the Open Source movement or new protest movements make use of the Internet in order to constitute lines of social flight and to challenge mainstream segmentary lines. In order to become a rhizome, the segmentary lines of the Internet would have to be broken up, i.e. it would have to develop into an inclusive, co-operative, participatory agora. Principle (iii) also means that a rhizome may be broken shattered at a given spot, but will start up again. This reminds us of the fact that the Internet can't be controlled or censored by single systems, such attempts are today continuously made economically and politically, but also continuously challenged.

Principle (iv) means that a rhizome is a map and not a tracing. A map is not an image from which reality can be traced, it is a changing flux that is permanently reconstructed. A map is oriented toward experimentation, in contact with the real, it fosters connections, removes blockages, advances maximum opening, is open, connectable, detachable, reversible, susceptible to constant modification, and it has multiple entryways. This reminds us of the fact that the Internet is still dominated by the traditional discursive character of the mass media where there is a lack of possibilities for democratic participation, co-operation, and dialogical mutual interaction. The open standards (of e.g. TCP/IP), the Open Source movement, and a grassroots community with libertarian values have formed important parts of the history of the Internet. Hence openness is a fundamental value of the Internet, but this value has not been fully realized and there is a tendency to close off the Internet commercially. The Internet is embedded into societal systems of discourse, but puts forward the idea of many-to-many-dialogue. In order for the Internet to become a rhizomatic map, society and technology would have to strengthen their dialogic character. Dialogue means permanent change by co-operation and participation, it forms a map. Discourse means conservative stabilization and distribution of information, it forms a tracing where there is a lack of openness, modification, and connectedness. Moving from discourse to dialogue, from the tracing to map, from the segmented Internet to the rhizomatic Internet, from the segmented society to the rhizomatic society, means to realize the inclusive, co-operative, participatory, direct democratic potential that is immanent in the new media and to move from the conservative distribution model of information to the progressive model of the participatory constitution of information. The Internet has a rhizomatic potential, the human being can realize and build the rhizome.

5. Conclusion

The Internet is not a technological system or mass medium. It requires human activity and communication in order to self-organize. It forms a socio-technological system where a technological structural network of computer networks that is based on the TCP/IP protocol functions as a mass medium of social activity and networked communication. This mass medium is a carrier of objective social knowledge that is permanently reproduced and reactualized through networked human communication.

The Internet is based on open source knowledge and constitutes a partly immersive form of Virtual Reality. It is interactive and advances the globalization of social

relationships. Considering it as a human system has ethical implications: The possibility of many-to-many communication puts forward the principle of co-operative, participatory democracy. Realizing this potential could strengthen the dialogic character of society.

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Otherland Revisited
Philosophical Implications of Artificial Worlds

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2

River of Blue Fire
or the Epistemology of Artificial Worlds

A

Hardware vs. Software

1 The Problem

In the first part of this paper we have essentially dealt with the ontological aspects of the Otherland project.[6] We come now in the following to the more epistemological aspects. The first of these is related to the problem of hardware vs. software: In other words, the question is how we can discuss artificial worlds while knowing that physics guarantees the consistency of *this one world* which we call actuality. That is, we obviously can program software which is representing worlds which are not consistent as compared with our actual world, but nevertheless they must be compatible with it, because otherwise we would nt be able to program it in the first place. In fact, hardware appears to us as the physical realm of energy while software appears to us as the non-physical realm of information instead. The former is coupled to the laws of conservation and creates a sort of conservation causality, the latter is coupled to the laws of logic and creates a sort of logic causality. Both of them can differ considerably after all.
On the other hand, recently it has been shown that information is physical (and viceversa, physics is informational). Hence, there must be some sort of compatibility criterion in order to relate the one to the other. One could suppose that this can be clarified when modeling the processes in question in front of the quantum mechanical background in physics. But in epistemological terms, the problem is more subtle: „There is no quantum world. There is only an abstract quantum physical descrip-

[5] Permanent Address. Also: Clare Hall, UK – Cambridge CB3 9AL / Present Address: Lehrgebiet Philosophie, FB 13 AW, FH, Lothstr.34, D – 80335 München.
[6] See part I: City of Golden Shadow or the Ontology of Artificial Worlds. In: I. Dobronravova, W. Hofkirchner (eds.), Science of Self-Organization and Self-Organization of Science, INTAS volume of collected essays 2, Abris, Kyiv, 2004, 86-116.

tion. It is wrong to think that the task of physics is to find out how nature *is*. Physics concerns what we can *say* about nature."[7]
So what we will do is to have a look into the hardware first and to show then what quantum physics really means (in epistemological terms) and what the logical implications of all that may be. In the second part of this present paper we will discuss the spatial nature of logic itself in more detail.

2 The Schroedinger Theory of Semi-conductors

Essentially, in physical terms, computers are systems of semi-conductors, and as such their hardware theory deals with solid state bodies, or in other words: with crystals in motion. Until today, this theory is being governed by the Schroedinger equation. In fact, the abstract version of the initial problem is defined by the time-dependent problem (of motion) which gives a standard form of the Schroedinger equation, of the kind

$$i\hbar\, \partial\Psi/\partial t = H\, \Psi.$$

The solution of this well-known equation is equivalent to that of the eigenvalue problem for the Hamiltonian (which is time-independent):

$$H\, \Psi = E\, \Psi.$$

And we have to add the appropriate normalization of the wave function, of the form

$$<\Psi|\Psi> := \int_G d^3x_1 \ldots d^3x_N\, d^3X_1 \ldots d^3X_j\, |\Psi|^2 = 1,$$

taken over a fundamental region G such that

$$\Psi = \Psi\,(x_1 \ldots x_N; X_1 \ldots X_j; t),$$

where the first part of the bracket denotes the valence electrons and the second part the atomic trunks which are being visualized in terms of a simple lattice structure of the respective crystal such that primitive lattice vectors reproduce the geometrical form:

$$\Psi = \Psi\,(x_1 + G\, a_j, \ldots, x_N + G\, a_j; X_1 + G\, a_j, \ldots, X_j + G\, a_j; t).$$

The Hamiltonian components themselves consist of three parts

$$H = T_R + T_e + V,$$

[7] This is what Jeffrey Bub tells us in his: Interpreting the Quantum World. Cambridge University Press, 1997, 11. He is quoting here Aage Petersen who himself quotes Nils Bohr. (1963)

where $T_R = \sum \mathfrak{p}^2/2\ M$ is the sum over the trunk momenta (index j) and $T_e = \sum \mathfrak{p}^2/2\ m$ is the sum over the electron momenta (index i). Also, the potential is given by

$$V = V_{ee} + V_{eR} + V_{RR},$$

where the components give the respective interactions (such as the first term e.g. which gives the Coulomb interaction).
Now, it is not possible in principle to practically solve the resulting equation in any straightforward manner. Hence, it is an approximate solution which is being looked for. Essentially, there are two such approximations which facilitate the solution, the *adiabatic approximation* and the *one-electron-approximation*. The first assumes that quantum-mechanical transitions can be neglected. The second assumes that trunks move much slower so that some separation of terms is possible.
Starting with re-writing the eigenvalue ansatz we have

$$H\ \psi\ (x, X)\ \varphi\ (X) = E\ \psi\ (x, X)\ \varphi\ (X),$$

where the small Greek characters reflect the separation terms of the wave function. We have the simplified form of the Schroedinger equation for the electrons and trunks, respectively, then by substituting terms:

$$(T_e + V_{ee} + V_{eR})\ \psi = U\ \psi,$$

$$(T_R + V_{RR} + U)\ \varphi = E\ \varphi.$$

Note that the runks here denote what is called elements of structure, while the expression of the form $<\varphi|X|\varphi>$ denotes the elements of motion which are actually called *phonons*.[8]
In a crystal, rotations, reflexions, and rotational reflexions of the point group of directions transform axes into equivalent ones. These properties characterize the potential V. Hence, after the mentioned above, the Schroedinger equation itself gains symmetry properties. Call the translation operator t_R and collect all other symmetry operators in the symbol α, then we have

$$[t_R, H] = [\alpha, H] = 0.$$

A well-known example for all of this is the (somewhat elaborated) unipolar field-effect transistor (MOSFET) which utilizes pn-transitions of a two-shift system of isolator and semi-conductor. The solution of the respective equations being quite involved, one is usually satisfied with the approximate envelope equations of the conduction band and the valence band, respectively. The former is of the type

$$[\ -\ ½\ \mathfrak{h}^2/m_c^*\ d^2/dx^2 + E_c - e\ \varphi(x)]\ X_c(x) = E\ X_c(x)$$

[8] We do not deal with technical details here. For them, see the very illuminating standard text book: R. Enderlein, A. Schenk: Grundlagen der Halbleiterphysik, Akademie, Berlin, 1992. Here, in particular, chapter 2.

with an associated electron density of $n = n_c \exp - (E_c - E_F)/kT$,
the latter being

$$[- \tfrac{1}{2} \hbar^2/m_v^* \, d^2/dx^2 + e \, \varphi(x)] \, X_v(x) = E \, X_v(x)$$

with an associated hole density of $p = n_v \exp (E_F - E_v)/kT$. Note that $E_F := \tfrac{1}{2} \hbar^2/m \, k_F^2$ is the Fermi energy and $\mathfrak{p} = \hbar \, k$ the Fermi momentum (describing the radius of the Fermi ball in k-space). The indexed quantities give the values with a view to the lower bound of the valence and conduction bands, respectively.[9]
For us here, it is the interpretation of what is going on in Schroedinger theory which is of particular interest: Thinking of the fact that in principle, the theory of computer hardware is nothing but classical (solid state) physics, we meet the „interpretational knot“ when having a short look as to the original derivation of the Schroedinger equation itself. Because essentially, the idea was to deal with matter waves which are not very different as compared to classical waves. Hence, according to the standard treatises of Schoredinger himself, and of Dirac, and Landau-Lifshitz we have the following: Choose a wave ansatz and include time dependence by means of a periodical term. Then

$$\partial^2/\partial t^2 \, \Psi = u^2 \, \partial^2/\partial x^2 \, \Psi; \; \Psi = A \sin \omega \, (t - x/\lambda\nu);$$

with the periodical term of the form $\exp (- i\omega t)$. Here, u is the phase velocity, $h\nu/mv$. And in fact, we notice that the whole derivation is nothing than a rephrasing of the energy conservation law, because after separation we have

$$d^2/dx^2 \, \psi + 4 \, \pi^2 \, \nu^2/u^2 \, \psi = 0,$$

so that $\nu^2/u^2 = 2m/h^2 \, (E - U)$, and thus $E = h\nu = T + U$! And, of course, $\Psi = \psi \, \varphi$. (But, alas, the question is whether this can be visualized as a legitimate approach to something which as compared to classical physics is comparatively weird, to say the least.) Hence, we arrive at the time-dependent form of the Schroedinger equation in its standard representation:

$$\nabla^2 \, \Psi + 4\pi i m/h \, \partial/\partial t \, \Psi - 8\pi^2 m/h^2 \, U \, \Psi = 0.$$

But the obvious discrepancy with classical physics is that the result, as we can clearly recognize, demonstrates that Ψ is a complex quantity rather than a real quantity as usual for physics. (This has led the inventors to interpreting $\Psi\Psi^* \in R$ as the probablity density of the states associated with the complex wave function. Hence, it would not be possible to actually measure this quantity directly, contrary to the common tradition in physics.)

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[9] The important operations which such a semi-conductor system can achieve, are, respectively differentiation and integration. In the book of Enderlein and Schenk one can find illustrating examples for closed circuits which generate the derivative or the integral of a given input voltage. See ibid. passim. For a first overview have a look into Horst Stoecker: Taschenbuch der Physik, Harri Deutsch, Thun, Frankfurt a.M., 2nd ed., 1994, 770 sq. As one can clearly recognize from the arguments about the Fermi energies, the trick is mostly in the appropriate Fourier transformations.

The idea was to re-arranging terms:

$$i\hbar\, \partial/\partial t\, \Psi = -\, \hbar^2/2m\, \nabla^2\, \Psi + U\, \Psi = H\, \Psi.$$

Choosing then $\Psi = a \exp i/\hbar\, S$, and ordering according to purely real and purely imaginary terms gives

$$(1) \quad \partial/\partial t\, S + 1/2m\, (\nabla S)^2 + U - \hbar^2/2ma\, \nabla^2 a = 0,$$

$$(2) \quad \partial/\partial t\, a + a/2m\, \nabla^2 S + 1/m\, \nabla S\, \nabla a = 0.$$

If we neglect in equation (1) all terms of the order $O(\hbar^2)$, then we have

$$\partial/\partial t\, S + 1/2m\, (\nabla S)^2 + U = 0$$

which is the classical Hamilton-Jacobi equation for the action S of a particle. Multiplying equation (2) by 2a gives

$$\partial/\partial t\, a^2 + \nabla\, (a^2/m\, \nabla S) = 0$$

which is the expression that shows how the probability density $a^2 = |\Psi|^2$ moves with a velocity of $v = 1/m\, \nabla S$.

3 Bohm-Hiley Theory

The significant difference of the Bohm-Hiley interpretation of quantum theory is that here the terms of order $O(\hbar^2)$ in the above equation are not being neglected. Define then $Q := -\, \hbar^2/2ma\, \nabla^2\, a$ to be an appropriate *quantum potential*, then we can re-write:

$$\partial/\partial t\, S + (\nabla S)^2/2m + U + Q = 0.$$

Bohm and Hiley introduce in that manner a kind of *active information* which is thought of as being independent of the state of observation. Hence, they speak of *beables* rather than of observables. Consequently, there are two sorts of order, and the complete order is compared with a *hologram*: The order in the hologram is said to be *implicate* (implicit order), while the order in the object is said to be *explicate*. Therefore, their idea is that the wave function (or the density matrix, accordingly) does not give any complete description of reality. (A point to which Gell-Mann and Hartle agree, by the way.) Also, the classical world as we know it is visualized as being *emergent* with respect to the quantum world. (This is a point which sounds very familiar to us after all what we said before.) Finally, non-locality is not visualized as a contradiction to physics, because the idea is that it acts on another level of fundamentality. In particular, the hologram picture indicates that there is a relation between the wave function at one time and at another, given by the propagator (or Green's function):

$$\Psi(x, t) = \int K\,(x - x', t - t')\,\Psi(x', t')\,dx'.$$

In other words, the sum of the contributions from the whole of x‘ at an earlier t‘ weighted by some suitable K is characterizing the state of the function at the given x and t. Hence, we can say that x *unfolds* contributions from all over space at other times. (Obviously, this is a holistic viewpoint, and, similar to the approach of Feynman’s, time becomes a degree of implication. Here also greets Barbour.)[10]

4 Logical Implications

Jeffrey Bub, in his book of 1997[11], pursues a somewhat more algebraic approach: He defines a classical state of a particle as one which selects a subset of the elements in a Boolean algebra. And a property of a system is given by the characteristic function which in turn takes on the value of 1 for a corresponding subset. A possible world then, is an *ultrafilter*, i.e. a maximal such set of true propositions.[12]
And it is exactly here, where we have arrived at the point which is interesting for us, given our original problem: We are on the boundary here between possible and impossible worlds. Roger Penrose has discussed this point in some detail.[13] He puts forward that Escher’s impossible worlds as deformed polyhedra can be interpreted as an imaginative depiction of different Boolean perspectives pasted together such as to form a structure that cannot be embedded into a single Boolean framework, with an encoding of the Hilbert space directions that generate a proof of non-embeddability. Equivalently, one can define an interpretation of the propositional variables in a classical tautology under which the tautology turns out to be false. As Bub states: This is the way in which a quantum world is non-classical.[14]
What we see here is how representations of space are related to each other: Because in principle, we deal all the time with various representations of space, visualized under more concrete or under more abstract aspects. In fact, as it turns out, the problem we had with the Otherland project in epistemological terms – bringing classical causality of the physical hardware together with non-causality of the informational software – can be understood as a re-phrasing of the anscient problem of substance and attribute: Quantum theory shows up here as a means of representing the fundamental level of physics *as far as one can speak about it*. And classical physics (constituting the world of our daily experience) being emergent with respect to quantum physics means that the former is to the latter what the attribute is to substance.

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[10] Usually, the problem of time is a very intricate one in quantum theory and in fact rarely discussed in detail. An impressing presentation is given by Thirring in: Lehrbuch der Mathematischen Physik, Springer, Wien, New York, 2nd edition, 1994, vol. 3, section 3.3.
[11] Op. cit.
[12] Remember that a filter in a Boolean algebra corresponds to a set of true propositions conatining all conjunctions of propositions in the set and all propositions implied by any proposition in the set.
[13] R. Penrose: On Bell Non-Locality Without Probabilities: Some Curious Geometry. In: J. Ellis, A. Amati (eds.), Quantum Reflexions, Cambridge University Press, 1994.
[14] Cf. Bub, op. cit., 94 sqq.

It is in a recent collection of essays dealing with these and similar questions that we can find the physical answer to our problem: Dyson e.g. states that the quantum mechanical language is necessarily incomplete (arguing that there is no complete description of a black hole including its environment).[15] And David Deutsch assists in stating that a quantum observable is neither a real variable (like a classical degree of freedom) nor a discretevariable (like a cbit), but one with *both* aspects. Bits, Boolean variables and classical computation are all emergent properties of qubits due to decoherence. In a larger reality, the answer to a yes-no-question is never just yes or no, nor even both yes and no in parallel, but a quantum observable which can be represented by a large Hermitian matrix.[16] Very much on the same line of argument we find Linde: Let us remember that our knowledge of the world begins not with matter but with perceptions.[17] And finally Ellis: The causal hierarchy rests in metaphysical ultimate reality. Metaphysics precedes the TOE.[18] This is a very adequate closing word.

B

The Spatial Logic of Representation
Drafting a Master Programme

Die Kunst muß nun zur Natur zurückkehren,
um dort mehr Kraft und neues Leben zu schöpfen.[19]

In the following a systematic framework is given for a number of projects of ongoing research primarily related to the INTAS co-operation project. It is shown that the human strategies in complexity structurally depend on the onto-epistemic relationship between perceiving and modeling the world on the one hand, and that it is the concept of space which serves as the prime mediator of representation on the other. By serving its purpose, space exhibits its own generic logic which turns out to be essentially a logic of game semantics thus determining most of the characteristic aspects of the social system.

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[15] J. D. Barrow, P. C. W. Davies, C. L. Harper jr. (eds.): Science and Ultimate Reality. Quantum Theory, Cosmology, and Complexity. Cambridge University Press, 2004. Here F.J.Dyson: Thought-experiments in honor of J.A.Wheeler, 72-89 (87).
[16] D. Deutsch: It from qubit. Ibid., 90-102 (93, 100).
[17] A complicated statement which should be discussed in further detail at another occasion. Cf. A. Linde: Inflation, quantum cosmology, and the anthropic principle. Ibid., 426-458 (451).
[18] G. F. R. Ellis: True complexity and its associated ontology. Ibid., 607-636 (634).
[19] Xavier Tilliette on Schelling's *Akademierede* (inuagural speech for the academy of arts): „Über das Verhältniß der bildenden Künste zu der Natur", Munich, 12th October 1807. [Art has to return to Nature in order to gain more force and life there.] In: id.: Schelling. Klett-Cotta, Stuttgart, 2004, 191. (Calmann-Lévy, Paris, 1999.)

1 The Concept of Space

The initial introduction of a conceptual rôle of space dates back to Spinoza who defines matter (as *res extensa*) as one of the attributes of substance. This establishes the conceptual equivalence of matter and space on the one hand, and gives space a central position within the system of attributes on the other.[20] Space becomes here *the principle of the extension of things*, although it is not spatial itself, but simply some *decree of order* (Rombach). It is a multitude (diversity) which *plays itself* in a combinatorial way and can thus be visualized as having an interior life of dynamical inherence.[21] Hence, it implies a concept of system, but as a system it is explication rather than predication.[22] In fact, it is the relationship between inherence and subsistence which tells us a lot about the nature of space within the system of attributes expressing substance: Substance precedes subsistently inherence and needs the latter in order to be able to explicate itself. Subsistence in turn unifies the modi of substance within the latter's essence. Under this perspective, the attribute is the system of the modi. Hence, space is the system of spatial modi. In other words: the mode of human being is essentially spatial.[23] (And also: the modi inhere in subsisting substance.[24]) Being connected with the mode of human being, the concept of space gains therefore anthropological relevance: That is: cosmology, physics, and logic are the basic fields which constitute anthropology.[25] Nature becomes thus the explicit *form of mediation* within which it can be said that substance „acts" onto the world, as seen under the human perspective. (Quicquid est, in Deo est.) Hence, utilizing the terminology of Spinoza's, the potential of humans is their existence, as the potential of substance is ist essence. (Dei potentia est ipsa ipsius essentia. Humani potentia est ipsa ipsius existentia.)[26] In the case of Spinoza, it is this basic aspect which relates theoretical concepts and fields of research as well as practical implications: Ethics becomes here a physics which is a metaphysics. (Albiac) And the onto-theology becomes ethico-political. (Tosel) That is, as to the latter, „Deus" (i.e. the law & order of immanent nature) translates itself in a human manner into the immanence of a rationally constituted society. On the other hand, the ethico-political is also ontological: Free humans are a possibility of anonymous nature.[27] These aspects have been taken into account while developing modern idealism within the late 18th century and the early 19th century. Schelling is one of the leading protagonists who re-translate Spinoza's concepts into a modern language which already points towards a consequent materialism of transcendental kind.[28] Schelling keeps two attributes which are unified within the absolute, a developed version of substance: It is not me who knows, but *only the Universe knows* within me ... this

[20] I have discussed these aspects at various places. See more recently my: System des transzendentalen Materialismus (System of transcendental materialism), Mentis, Paderborn, 2004, 242. I refer here to Bennett, cf. ibid., 225.
[21] Ibid., 243 sq.
[22] Ibid., 244.
[23] Ibid., 245.
[24] According to Wetz. Cf. ibid., 214.
[25] Ibid., 224 sq.
[26] Ibid., 221, 220.
[27] Ibid., 222, 224.
[28] In so far, a transcendental materialism is also a dialectical materialism, but the converse is not true.

one knowledge however that *knows* is at the same time what *is truly known*.[29] For Schelling, nature is originally identity, and the difference of the attributes initiates and expresses a permanent tendency (back) towards identity. The former is the condition of the latter. But at the same time, this duplicity within the worldly structure is also the condition of nature's productivity.[30] Nowadays, while keeping only one of the attributes (space-time-matter expressed as geometry of space), these consequences of a modern re-interpretation of substance remain basically untouched.[31]
It has been primarily Henri Lefebvre who applied the materialistically interpreted insight into the nature of space to the social field.[32] He notes that there is no obvious isomorphism between social and physical energies, but that nevertheless, human societies cannot be conceived of independently of the Universe. Hence, he also notes an abstract universality of the concepts of production (which is already implied by the yet idealistic discussion).[33] He derives the fact that the rôle of space (namely to produce the human mode of being while being produced in turn by the latter) is being concealed by two illusions governing social systems: by the illusion of transparency of design as a mediator (bringing the non-communicable into the realm of the communicable) and by the illusion of the realistic (bringing assurance and pleasure to the naif). Both types of illusion prevent insight into the three qualitative types of space which govern the human mode of being: the spatial practice of production and re-production, the representations of space, and the representational spaces.[34] Hence, Lefebvre couples the concept of social space to hermeneutic aspects of communication. In other words: Abstract space presupposes the existence of a spatial economy of denotative discourses.[35] For Lefebvre therefore, there arises a twofold logic of space: a metonymic logic between part and whole (we will discuss this aspect later on under the heading of „location"), and a logic of metaphor.[36] On the other hand, there is a history of space between anthropology and political economy.[37] For us, in the past, this has led towards lines of research which characterize the relationship between human perception and cognition on the one hand, and the human activity of modeling the world, on the other. One practical result was the modeling project of the historical centre of Bologna.[38]

[29] Ibid., 215. (Referring to SW II, 140: Schelling 1804.)
[30] Ibid., 218. (Referring to SW III, 309, 288.)
[31] Note that even in the theory of Einstein, the ancient concept of space in the sense of Spinoza is well-kept though not always correctly understood. The point is however that the relation between (physical) space and (physical) matter is still the same, and that recent (mathematical) theories of topoi re-introduce the explicit psycho-physical parallelism introduced in Spinoza's identity theorem E2p7. See op. cit., 500, 613 sqq.
[32] Henri Lefebvre: The Production of Space. Blackwell, Oxford, 1991. (Anthropos, Paris, 1974, 1984.)
[33] Ibid., 13 sq., 15.
[34] Ibid., 27 sqq., 33.
[35] Ibid., 56.
[36] Ibid., 98.
[37] Ibid., 116.
[38] There are essentially four interrelated lines of research: The Bologna project, cf. more recently my: Decentralization as Organizing Principle of Emergent Urban Structures. In: V. Arshinov, C. Fuchs (eds.), Causality, Emergence, Self-Organization, INTAS Volume of Collected Essays, Russian Academy of Sciences, NIA-Priroda, Moscow, 2003, 36-55. See also together with Anna Soci: The Emergence of Bologna and its Future Consequences. Decentralization as Cohesion Catalyst in Guild Dominated Urban Networks. In: The Information Society, EAEPE, Maastricht, 2003, 181-182. – The Glass Bead Game project, cf. more recently: The Modeling of Nature as a Glass Bead Game. Conference on Human Approaches to the Universe, Helsinki, 2003. (To be published) See also my: System des transzendentalen Materialismus, op. cit. – The Otherland Revisited project (2004) of the INTAS co-operation to be published under the same title. See more re-

For Lefebvre himself, his approach implies a concept of society which makes it into a space and an architecture of concepts, forms, and laws whose abstract truth is imposed on the reality of the senses, of bodies, of wishes and desires.[39] Bodies themselves *generate spaces* which are produced by and for their gestures.[40] Space so conceived might well be called „organic", in the systematic tradition of Schelling.[41] Hence, social space shows up as one that is among the forces of production and can be thus consumed, is politically instrumental, underpins the concepts of production and re-production as well as property relations, is equivalent to a set of institutional (and thus ideological) superstructures that are not presented for what they actually are, contains potentialities (of works and re-appropriation).[42] In an effort to find an appropriate classification of spaces, Lefebvre speaks here of „isotopias" (analogous spaces), „heterotopias" (mutually repellent spaces), and „utopias" (spaces occupied by the symbolic and imaginary).[43] We will see later how to utilize these classificatory aspects.

2 The Logic of Space

Following the insight provided for by Lefebvre, the political economy of space has evolved somewhat in recent years. Hillier and Hanson presented a concise study of what they called the „social logic of space" (though without mentioning Lefebvre) in 1984.[44] Their field is that of theoretical architecture, and therefore, they start from an architect's perspective: For them, it is architecture which structures the system of space by giving shape and form to the material world. As such it has direct relations to the patterns of movement, encounter and avoidance which are generator as well as expression of social relations.[45] Hillier and Hanson set out to develop some kind of „architectural programme" reflecting the logic inherent to (social) space by means of what they call „morphic language", a semi-formalized language of shape comparable to the computational methods of simulation common to recent space research.[46] In this manner, reality turns out to be its own programme.[47] In a more recent book[48], Hillier explicates the various characteristics of architectural space in more detail concentrating on its intelligibility and combining the structural

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cently: Metopien in Anderland. Ansätze zu einer experimentellen Philosophie. Bloch-Jahrbuch 2004, in press. – The Wallenstein space project (of which the Bologna project turns out to be a part): Sartres „Das Sein und das Nichts" als moderne Poetik. Sartre-Gesellschaft Berlin, 2004, in press.

[39] The Production of Space, op. cit., 139.

[40] Ibid., 216. – This conception of approach has been re-discovered recently in ongoing research. See Ed Casey: Smooth Spaces and Rough-Edged Places: The Hidden History of Place. www.sunysb.edu/philosophy/new/research/casey_2.html

[41] Ibid., 228.

[42] Ibid., 348 sq.

[43] Ibid., 366.

[44] B. Hillier, J. Hanson: The Social Logic of Space. Cambridge University Press, 1984.

[45] Ibid., ix.

[46] There are various discussions of these methods of Hillier and Hanson. See e.g. R. E. Zimmermann, A. Soci, G. Colacchio: Re-constructing Bologna. The City as an Emergent Computational System. (Part I) www.arXiv.org/pdf/nlin.AO/0109025 More recently: Signaturen. NaturZeichen & DenkZettel. Zur morphischen Sprache welthafter Aktualität. System & Struktur X 1, 2004, 18-66.

[47] The Social Logic of Space, op. cit., 44.

[48] B. Hillier: Space is the machine. A configurational theory of architecture. Cambridge University Press, 1996.

aspects of spatial connectivity (such as the permeability, integration, axiality of space and so forth).[49]
The important point in all of this is that it becomes quite obvious that space is not being produced at random and under arbitrary criteria (as one could suppose when observing the evolution of a settlement), but that instead it is following its own logic such that the evolutionary outcome can be visualized as a necessary result indeed. Note that this logic of social space is certainly different from the logic of physical space as we commonly encounter it in daily life. But the crucial aspect is that *there is such a logic at all*. And this is in fact what connects the approach mentioned here to the concept of space as presented by Spinoza. (Though this is probably easier to recognize in the approach of Lefebvre who was himself a philosopher.) In the meantime, similar approches have been introduced behind the „front" of research in self-organized critical phenomena, especially in terms of the Santa-Fe school, with a view to computational economics and the study of urban systems. All of them reflect more or less clearly the insight gained in the above mentioned approaches. Hence, Krugman discusses percolation economics[50] (in fact, the problem of percolation turns out to be the most important problem within the discussion of communication in networks – and those are actually closely related to problems in the spatial structure of social systems) while Arthur concentrates on the concept of location in economic terms.[51] Arthur states that whether small events in history matter in determining the pattern of spatial or regional settlement in the economy reduces to a question of topology (namely as to whether the underlying structure of locational forces is convex or not).[52] This somewhat unexpected point is mirrored in the work of Darley and Stuart Kauffman who notice that a „natural" definition of *homo oeconomicus* might be one in which agent complexity, information use, forward-planning horizons, and recursive modeling depth are dynamically constrained within a finite „bubble" of activity, on average poised between the ordered and the chaotic regions of behaviour.[53]

3 Generic Space Types

While comparing the different aspects of the above discussion concerning physical space and social space, we notice that obviously, there are various types of space which ask for an appropriate classification. Within this framework it is *physical space* which takes the position of the concrete case of the underlying concept. On the other hand, *social space* belongs to the more abstract side. As it turns out, these categories are far too general for our purposes: Instead, *concrete spaces* should be classified according to their underlying conception in daily life. That is, the physical space of our daily perception is itself structured in various ways so that we are not really able to sort out all the time what is still physical and what is already social. Hence, we call *concrete* all such spaces which have a physical correlate, even if this

[49] Ibid., 126 sqq.
[50] P. Krugman: The Self-Organizing Economy. Blackwell, Malden, Oxford, 1996, 69 sq.
[51] W. B. Arthur: Urban Systems and Historical Path Dependence. In: id. (ed.), Increasing Returns and Path Dependence in the Economy. University of Michigan Press, Ann Arbor, 1994, 99-110.
[52] Ibid., 108.
[53] V. M. Darley, S. A. Kauffman: Natural Rationality. In: W. B. Arthur, op. cit., 45-80. Here: 48.

can only be represented in terms of abstract mappings. In this sense, the space depicted by diagrams representing the connections among airports as part of a programme of some airways company is a physical space, and so is the space of connections within the network of the world wide web. The degree of abstraction of such a physical space is nevertheless higher than that of a geographical space (consisting of streets on which we can actually walk, or rivers on which we can go by boat). Finally, the geographical space of a city is strongly influenced by social processes which themselves might settle within some other type of space. And as compared with concrete spaces of the physical type (though abtract by themselves), there are at least two types of concrete space which are not physical in the strict sense, though they are certainly produced and mapped (expressed) in physical terms: virtual spaces and symbolical spaces. The former are non-physical in the sense that they can be visualized as domains of the non-causal and imaginary, because what is being programmed into them is not necessarily what there is in physical modality as perceived by human beings. The latter are non-physical in the sense that the elements which constitute them are a sign for something else (such as propositions in a glass bead game). Consequently, the characteristic topologies and geometries of these spaces are always different and range from the continuous structure of Euclidean space up to the tree structure and taxa of propositional space.

Utilizing this sort of approach we can associate a specific space type with the parts of the projects in process, and we can visualize these as *generic* sorts of space types: Hence, the Otherland Revisited project dealing with experimental philosophy of cyberspaces is associated with virtual spaces. The Glass Bead Game project is associated with symbolical spaces. Internet-type spaces are associated with *abstract-concrete* spaces of physical type. The Wallenstein project (of the political control of European space) is associated with geographical spaces of which the Bologna project (a study of the urban space of the city's historical centre) turns out to be a special case. As the two latter projects are closely related to economic and political aspects of social life, they are also associated with aspects of (abstract-concrete) social spaces. Note however that due to the fact that one such aspect cannot be easily separated from the other, we do not leave the framework as it has been given by Lefebvre, in the first place. Note also that therefore, we can visualize spaces as means of mapping the world such as to follow a specific kind of epistemological logic which may be thought of as constituting an inherent human logic of representing the world as it is perceived. Hence, discussing a *spatial logic of representation* means to establish a general (master) framework for related sub-projects. On the other hand, this line of approach follows strictly the original space concept as put forward in the theory of Spinoza, so that this epistemological foundation can itself be founded on a substance metaphysics of ontological type – provided the line from Spinoza is being re-interpreted in the sense of recent insight.

4 Double Bookkeeping

The basic difference between virtual and symbolical spaces on the one hand and concrete spaces on the other is that the former are not necessarily subject to the causality of physical spaces. In other words: While in the latter the conservation theorems of physics are valid, this is not the case in the former. Which does not mean that those would be disconnected from the rest of the world. In fact, they also follow a set of laws implied however by a different kind of balance which is represented by the second law of thermodynamics (the entropy balance). Remember that conservation theorems are essentially sums over local balances of physical systems. That is, in general one has balance equations for various physical quantities such as mass (particle density), momentum, angular momentum, energy and so forth, with some sort of production or annihilation term on the right-hand-side. If we sum them over all possible (or relevant) systems, then we have the conservation theorems with a zero on their right-hand-side. Hence, the balance sum of the energy domain is zero. This is not the case with entropy, because usually, the entropy balance will be positive. And there is no conservation theorem. The point is that it is not the energy domain which is represented in terms of entropy, but the information domain instead. So what we need is a balance of some sort of *double bookkeeping* which comes to the same results, but on different routes of balancing quantities. This idea has been recently clarified (if not solved completely) by Duncan and Semura.[54] Hence, one side (of energy) could be visualized as the active part of the balance telling something about a system‘s potential and the associated energy costs (assets), while the other side (of entropy) could be visualized as the passive part of the balance telling something about the origin of invested means (the capital or liabilities, respectively). There would be respective energy accounts on the one hand and entropy accounts on the other with their own debit and credit sides (displaying the respective costs and the „income“ – which can also be an income of knowledge = information). In order to secure the equality of both sides of the balance (in terms of assets and liablities altogether) – which should obviously be zero – it is necessary then to introduce a new term on the entropy side which compensates the positive amount displayed in the entropy balance. This could be interpreted as a negative term which represents the amount of insight gained by information or the costs of actually erasing information, respectively.[55] A similar consideration can help to (metaphysically) solve the problem of physically implementing non-physical (= non-causal) phenomena into cyberspace (as it is actually the case in Grand’s *creatures* games).

5 Locational Logic

It is comparatively easy now to relate the above mentioned to the special case of *location*. Following Rebecca Bryant we can say that location is what has an

[54] Todd L. Duncan, Jack S. Semura: The Deep Physics Behind the Second Law: Information and Energy as Independent Forms of Bookkeeping. Entropy 6, 21-29, 2004.

[55] This depends on the convention finally chosen: namely whether the increase of entropy is associated with a loss of information (because of a reduction of system complexity) or with a gain of information. Note that the erasing of information (forgetting) is also costly and necessary, due to the finite capacity of memories.

address.[56] This is not only true for cyberspace. In fact, it is this concept of location which determines the local topography of a space. And in turn, it is the local topography that sets the boundaries of discourse (Guerin).[57] Hence, addresses are vertices within networks which represent the relevant type of space – this is the linguistic part of modeling the world (namely in terms of an adequate lexicology, syntax, and semantics). It is this aspect which connects the approaches of Barabási and Varzi with the social perspective of Bourdieu's theory.[58] In particular, within the view of Bourdieu's, the logic of spaces is closely related to the structure of social games being played in them. In other words, it is here where an explicit translation of abstract space forms into physical space can be given.[59] This reminds us strongly of the insight provided by Hillier and Hanson within an architectural framework of places and location. And this is also strongly reminiscent of the narrative properties of space as discussed by Sennett.[60] We find all these aspects within the study of the above mentioned Bologna project, because it is especially the urban quality that comes out through networks, boundaries, and differences whose mutual friction is expressed in recognition, acceptance, fertilization, and productive application, as Christiaanse says.[61]

We realize that a practical concept of location as it might be relevant within the framework of economic and/or social research (such as it is the case with urban structures) relies heavily on a theoretical (top-down) foundation of the concept of space in general. And the full implications of a locational situation cannot be accessed completely (or at least satisfactorily), if the classificatory line of derivation is not re-constructed starting from that conceptual foundation. In this sense, the recent result of Gastner and Newman[62], namely that the qualitative features of spatial networks can be well represented by a simple one-parameter family of networks balancing miles traveled with number of legs between vertex pairs – as to the structure of concrete spaces comparing abstract-concrete ones with geographical ones – is but a special instance of a whole spatial dynamic which shows up as the explicit result of an underlying logic of representation inherent to human thinking.

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[56] R. Bryant: What Kind of Space is Cyberspace? Minerva 5, 138-155, 2001.

[57] Topos, Logos, and Kosmos. www.fordham.edu/philosophy/fps/symposia/2001fall/guerin.htm

[58] See Achille C. Varzi: Philosophical Issues in Geography – An Introduction. Topoi 20 (2), 119-130, 2001. Also R. Albert, A.-L. Barabási: Topology of Evolving Networks: Local Events and Universality. Phys. Rev. Lett. 85 (24), 5234-5237, 2000. – A general review on networks gives T. S. Evans: Complex Networks, downloadable from www.arXiv.org/pdf/cond-mat/0405123 – As to Pierre Bourdieu: Meditationen. Zur Kritik der scholastischen Vernunft. Suhrkamp, Frankfurt a.M., 2001 (du Seuil, Paris, 1997).

[59] Bourdieu, op. cit., 102 sq., 106.

[60] Richard Sennett: Civitas. Die Großstadt und die Kultur des Unterschieds. Fischer, Frankfurt a.M., 1991, 119 (Knopf, New York, 1990).

[61] Kees Christiaanse: New urbanism in former harbours. In: www.topos.de/issues/ - See also the concept of space syntax: www.spacesyntax.com/publications/topos/topos.htm

[62] Michael T. Gastner, M. E. J. Newman: The spatial structure of networks. www.arXiv.org/pdf/cond-mat/0407680

6 Locational Game Semantics

The recent advent of an innovative and original (though somewhat cryptic) approach to logic by Jean-Yves Girard[63] has opened the lines to eventually extending the various aspects mentioned above to an abstract foundation which re-connects logic with games, games with perception, and the human mode of being with substance. This is so because Girard centres his approach around a concept of ethics and thus behaviour which is already implemented into a logic as characterizing a typical human *attitude* towards grasping the world. The starting point for this is proof theory in fact: The idea is to primarily work with *designs* which are essentially cut-free proofs of some formula when all of the logical information is being erased. Hence, only locations are being kept, and the location is what matters (locus solum). The situation is similar to a plug-in within the framework of online operations: Here, only the location of the plug-in is being kept without giving away its contents. This is what Girard calls *pitchforks*: namely what remains of a sequent when the formulae have been forgotten and only their locations remain. Note that the prime aspect of the procedure itself is *cut-elimination*, i.e. a result of a sequent calculus which is not made of formulae, but of sequents which are finite sequences of formulae together with a connective which replaces the usual *modus ponens* by the cut-rule (that is, a rule which expresses the transitivity of implication). Take then a set of numbers counting subformulae in a proof-tree and call them *bias*. A *locus* (or address!) is then a sequence of such biases. And the *parity* of a locus is the parity of its length. Hence, a design can be visualized as a proof-tree of pitchforks, and each such pitchfork is a conclusion of a rule. The tree structure connects the idea with the concept of a game (and thus with the concept of behaviour): Pitchforks have a polarity, namely such that a handless pitchfork (comb) is defined to be positive, a pitchfork with handle negative. Loci have the same parity which is the opposite of the handle's parity. Loci of the same parity have positive polarity, loci of different parity have negative polarity. Hence, the tree structure can be equivalently visualized as the successive *actions* undertaken by two players, called Even and Odd, essentially isomorphic, such that the rules displayed are the moves of the players. In this sense, ethics is a set of designs. And behaviour is being preceeded by an ethics. The procedural logic as put forward by Girard generalizes these aspects by introducing the concept of *bihavour* (and biethics) in the sense that a bihaviour is a behaviour plus a partial equivalence class on its partial designs. This is essentially what is behind the notion of game semantics (Abramsky and McCusker, 1999) and the geometry of interaction (Girard, 1989). In this type of logic, time becomes relevant and explicit, in terms of the alternating sequence of tokens placed by a proponent (first player or Even) and an opponent (second player or Odd), so that a sequence can be visualized as the trace of the interaction of some program with its environment. It is not the appropriate place here to discuss the complete implications of Girard's approach, but for our own approach which essentially reflects the fundamentals of a generalized dialectical approach to transcendental materialism, developed along the lines of

[63] J.-Y. Girard: Locus Solum. From the rules of logic to the logic of rules. [Taken from his web page, where a collection of papers can be found under http://iml.univ-mrs.fr/girard/Articles.html – There is also a group of logicians working on related topics in Padova, Italy, headed by Giovanni Sambin, and among others assisted by Claudia Faggian, presently in Cambridge – UK: www.math.unipd.it/~logic/rgl/frame.html .]

hermeneutic insight gained by philosophical models provided by a variety of philosophers in the first place (ranging from Spinoza to Schelling, Bloch and others), the methodology of what Girard calls *ludics* and which is essentially thought of as being a study of interaction „between syntax and syntax“ and thus something in between syntax and semantics implying that „logic reflects the hidden geometrical properties of something“, all these ideas are immediately plausible and turn out to be useful when relating their results to some of the projects mentioned above (e.g. the Glass Bead Game project).

Although not quite on the familiar route of main-stream research, this sort of approach has a lot to do with a re-formulation of the explicit inter-activities of social philosophy (with anthropology at its roots), the philosophy of nature, and aesthetics, respectively. It is this aspect which already Bense, a long while ago, has related to the concept of space (as is done in this very project presented here).[64] And more recently, it is Bachmann who in his discussion of a philosophy of nature *a priori* comes very much into our own direction.[65] In particular, Bachmann visualizes the scientific program as one which determines symmetries of nature. As such he visualizes this program itself as an application-oriented derivation of some symmetry principle *a priori* which emerges itself from the philosophy of nature. Hence, nature itself becomes a *meta-symmetry*. In other words: The formalization of the laws of nature assumes a principle of meta-symmetry in the first place.[66] Bachmann visualizes Schelling's approach with respect to his philosophy of nature as an earlier example for a theory of symmetry a priori.[67] This is obviously what we could agree with following the line of argument displayed in the above-mentioned. Starting from Schelling, Bachmann concludes that the world shows up therefore (within the framework of Schelling) as a permanent self-modification of productivity itself, as consequence of the fact that there is a crucial difference between real factors (laws of nature) which determine with reference to something else, while principles of nature determine with reference to themselves.[68]

Hence, we can observe the following: On the one hand, the concept of space as prime mediator of the process of perceiving and modeling the world can be founded on a modernized conception of substance metaphysics as derived within the framework of transcendental materialism. It is possible therefore, to find generic connections of the various space projects to a long metaphysical tradition originating (somehow) with Spinoza. On the other hand, the network of ongoing research projects mentioned here displays manifold possibilities for unifying different approaches on a suitable onto-epistemic background. This calls for further work in order to eventually establish some sort of *space paradigm*.

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[64] Max Bense: Raum und Ich. Eine Philosophie über den Raum. [Space and I. A Philosophy about Space.] 1934! In: Ausgewählte Schriften, Band 1 (Philosophie), Metzler, Stuttgart, Weimar, 1997, 7.

[65] Manuel Bachmann: Die Notwendigkeit einer Naturphilosophie a priori für die Naturwissenschaft. [The Necessity of a Philosophy of Nature a priori for science.] In: Karen Gloy (ed.), Natur- und Technikbegriffe. Bouvier, Bonn, 1996, 183-204.

[66] Ibid., 191.

[67] Ibid., 193.

[68] Ibid., 200, 195.

3
Niels Bohr's Complementarity – A Linguistic Tool for Transcending the Myths of Objectivity and Subjectivity

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Traditionally, physicists have not paid much attention to the language they use when investigating and describing reality. They have more or less consciously assumed that language reflects the structure of the world in an unproblematic manner, that it corresponds to reality. This kind of thinking was well suited to the objectifying approach taken by classical physics, but the results coming from modern physics appear to call for more careful consideration of the role played by language.

The basic presuppositions of the classical paradigm of science, the conception of reality formed at the beginning of the modern era, were confirmed the Newtonian approach to physics. The materialistic thinking of the antique Atomists was revived and for a long time, its methods also provided a model for other fields of study. It was taken for granted that everything in reality consisted of objectively-existing separate particles with certain objective properties such as size and weight and which, it was supposed, conformed to strict deterministic laws. Belief in the universal and objective structure of the world and confidence in the scientific method was ultimately based on use of the empirical method and the certainty provided by mathematics.

Nowadays, trust in any kind of eternal truth or certain knowledge is more often than not rejected. In philosophy, it is commonplace to argue that truth is relative, that it varies from person to person and from culture to culture. Arguments which refute the existence of fully-objective, unconditional or absolute truth cannot be accepted by many people raised in a scientific climate where such a goal is traditionally taken for granted. While scientists are confident in their indisputable knowledge concerning the facts of nature, many humanists argue that science is not able to address the most important issues in human life. Since objectivity which favours the abstract, the universal and the impersonal is forced to ignore our feelings, aesthetic sensibilities and moral practices, people who consider these human capabilities to be important see that science is of little value when it comes to the most significant things in our lives. Objectivism misses what is most relevant to us and what holds the greatest meaning for individuals. The gap between science and humanism has remained unbridged throughout the modern era. Too often, the only alternative to objectivism is taken to be radical subjectivity – you either believe in absolute truth or make your own image of the world.

In their well-known treatise *Metaphors we live by* (1980), George Lakoff and Mark Johnsson offer a third choice to the prevailing myths of objectivism and subjectiv-

ism by elaborating the concept of the metaphor. It is their opinion that any system of human concepts is basically metaphorical in nature. Metaphors are tools by which we try to comprehend reality. Everyday speech affects the ways in which we perceive, think, and act, and reality itself is thus defined by metaphor. Metaphors represent imaginative rationality, and as well as using them to approach reality we are also able to employ them in approaching our feelings, our aesthetic experiences and our moral practices. Metaphor unites reason and imagination: our ordinary rationality becomes imaginative by its very nature. Truth becomes relative to our understanding and our conceptual system as there is no absolute standpoint for it. Lakoff and Johnsson do not, however, abandon the concept of truth. It is constantly being tested by our experiences and interactions with other people and through our physical and cultural environments.[69]

This kind of linguistic approach to reality has close similarities to the ideas of Niels Bohr, who, on the basis of modern physics, came to reconsider the deep metaphysical assumptions of the classical paradigm of science. In his complementarity, Bohr abandoned the idea that the common classical language used by physicists (and people in general) corresponds to reality. It was his view that while our common language, conditioned as it is by everyday experience, can be used to describe the macroscopic world, it is unsuitable for all levels of reality. It cannot offer a ”correct” visualisation of the microscopic world or the strange phenomena encountered in connection with quantum physics. In his complementarity, Bohr in a way “relativised” classical language. It did not inevitably “correspond” to all of reality. Language thus became metaphorical and conditioned by human experience. Unlike Lakoff and Johnson, Bohr however tied the metaphors of our everyday language to a universal mathematical theory, namely quantum mechanics. This empirically-verified mathematical formalism is capable of reflecting the structure of our multi-dimensional and complex reality in a more complete manner than either ordinary language or Newtonian physics. It is able to express delicate relationships which cannot be reached or visualised using ordinary language.

Bohr’s approach allows him to reconcile the myths of objectivism and subjectivism in a more satisfying way than Lakoff and Johnson. It is their view[70] that the myths of objectivism and subjectivism both miss the point, i.e. that we understand the world through our interactions with it, and Bohr does the same, using his complementarity to tie the foundations for describing reality to the interaction between man and nature and the intersubjective descriptiveness of experience. The detached observer becomes an active operator in evolution, interacting with the surrounding environment and shaping it through the choices made. Natural laws became laws invented by humans, but not in a subjective sense. We are only urged to see that both our objective manner of describing reality and the language we use are metaphorical, familiar ways of perceiving the world.[71]

This kind of approach did not demand that Bohr deviate greatly from the traditional objectivity of science. Complementary descriptions can be based on universal mathematical theory, which even if it can also be seen as an abstract conceptual system, also provides a durable foundation independent of the beliefs of individuals.

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[69] Lakoff and Johnson 1980, 193.
[70] Lakoff and Johnson 1980, 194.
[71] Gregory 1988, 96.

By dismissing the objectivity and universality of physics, humanists often surrender a valuable tool. Attaching too low a value to physics usually results in an inability to appreciate that the abstract theories of modern physics are not committed to the metaphysical presuppositions of classical physics. Quite the reverse, quantum physics actually provides the most powerful, empirically-verified evidence for disputing the mechanical and reductionist paradigm of classical science. At the some time it also provides new kinds of tools to deal with possibilities and individual, context-dependent phenomena.

1. Myths, metaphors and the conception of reality

The origins of the classical paradigm of science as well as the myths of objectivism and subjectivism can be traced back to the fundamental division made by Rene Descartes at the beginning of modern era. In order to make room for the new secular research concerning nature he separated the mechanical world of matter, *res extensa*, from the subjective domain of thought, *res cogitans*. Ever since, the myth of objectivism has held that the world is made up of extended objects which have properties independent of anyone who experiences them. Subjective reason or rationality was stripped from the remainder of reality and became a human capability. Because of it, we are supposed to be able to understand objects in terms of categories and concepts which correspond to properties that the objects themselves possess.

Opposition between the scientific and humanistic approaches is deep, even if in western culture as a whole, objectivism is by far the greater potentate. It rules, at least in nominal terms, realms such as science, law, government and economics even if, as Lakoff and Johnson argue, it is a myth. Something that is a myth should not be belittled or scorned even if, according to the objectivist myth, myths and metaphors cannot be taken seriously because they are not objectively true. Lakoff and Johnson see, as is generally seen in anthropological studies, that myths give order to people's lives. Myths and metaphors provide ways of comprehending experience and are unavoidable. While it is easy for us to spot the relative nature of foreign belief systems, we nevertheless tend to consider the myths and metaphors of our own culture to be truths.[72]

It appears quite plausible that our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature. As our conceptual system plays a central role in defining our everyday approach to reality, it does not seem very far-fetched to argue, as Lakoff and Johnson do, that our world-view is also based on metaphors.[73] A quick examination of cultures documented by anthropologists as well as the history of philosophy reveals that metaphors and analogies have been, and are being, continuously employed when conceiving reality. In antiquity, the whole *universum* was seen as a rational macrocosm analogous to the human microcosm. At the beginning of the modern era, the organic view of reality was replaced by the idea of a mechanical clockwork mechanism. These types of metaphors naturally – even if often unconsciously – guide our thinking. They define

[72] Lakoff and Johnsson 1980, 185-186.
[73] Lakoff and Johnson 1980, 3, 157.

the boundaries of what is credible or can happen in the world. We simply think and act more or less automatically along particular lines provided by the customary framework. For example, the modelling of mental phenomena as analogous to the software in computers demands acceptance of the basic metaphors in our culture.
The idea of a clockwork reality is strongly stamped on modernity. It is certainly not an unfruitful metaphor. For centuries, science was able to progress within the mechanical and reductionistic paradigm. Natural laws and facts concerning the constitution of material reality could not be ignored by theologians or philosophers. Many of them were busy keeping the myth of subjectivity alive, but the myth of objectivity could only be overcome by improved scientific research. Only on the basis of modern physics it is really possible to question the basic metaphysical assumptions that underlie the classical paradigm of science. In the 1920s, quantum mechanics entailed a radical shift of paradigm in physics. As Newtonian mechanics had done in its time, quantum mechanics now offered the same kind of broad and universally-applicable theoretical framework that was capable of leading modern research. Even though the interpretation of this abstract theory is still a matter for discussion, it is evident that many typical quantum characteristics such as superposition and non-locality, entanglement, or statistical predictions, all of which are indispensable in modern theories and provide the basis for modern technology, cannot be understood within the currently generally-accepted particle-mechanistic and deterministic framework of classical physics.

2. The breakdown of the classical paradigm of science

The conception of reality offered by classical physics appeared rational as long as research could be conducted within the framework it provided, but the difficulty of interpreting quantum physics forced us to become conscious of the fundamental presuppositions which are part of the classical paradigm of physics. A major part of the development of quantum theory and the interpretation of quantum physics was out in Niels Bohr's Institute for Theorethical Physics in Copenhagen. The extraordinary results achieved made the physicists who were involved realise that the question of the fundamental nature of reality could no longer be taken as being given *a priori.* The illusion of a totally-predictable and autonomous external world broke down at the microscopic level. Bohr remarked that they could not know in advance what kind of reality they were investigating.
The world-view of classical physics was based on the idealised use of well-defined and familiar concepts from everyday life, but modern physics extended the use of these concepts well beyond the region in which they were born and where their application could be observed. Modern theories deal with areas which are not touched by our everyday experience and direct observation. In such investigations, we encounter severe problems if we attempt to maintain that our language "corresponds to reality" as was believed in the circles of classical physics. The theory of relativity tackled inadequacies in classical language by revealing structures in the world that "common" language could not address. Bohr highlighted the fact that coverage of certain concepts turned out to be limited, for example the theory of relativity gave new content to concepts such as "space" or "time" and classical concepts were

found to be suitable only for the portrayal of a world in which speeds are small compared to the velocity of light. At the same time, the discovery of quanta revealed that the theories of classical physics were idealisations, useful only at the macroscopic level where effects are so large that quanta can be ignored.[74]

The physicists of the Copenhagen group focused their attention on the fact that a notable feature of physics at the beginning of the twentieth century was the increasingly-abstract nature of theories. The usefulness of quantum formalism was clear before it could be interpreted in everyday language. Everything that measurement could acquire from a system being investigated was contained within the complex wave- or state-function, but this mathematical construction did not itself appear to have any clear counterpart in observable reality. The inadequacy of classical language in explaining new observable phenomena was clearly revealed to the Copenhagen Group in discussion concerning the nature of the uncertainty relationships discovered by Heisenberg. In contrast to classical mechanics, quantum theory does not permit the establishment of both position and momentum with unlimited precision. It only proved possible to speak about the exact position and momentum (or path) of a particle at the macroscopic level.[75] In quantum mechanics, even if the variables *p* and *x* are termed ”momentum” and ”position”, the words are being employed in an unusual sense. Bohr and Heisenberg stressed that the uncertainty relationship set up a limit beyond which our classical concepts simply do not work. The familiar concepts lose their accurate meaning in the microscopic world. By attempting to define both of them with complete accuracy at the same moment, we are trying to get hold of something which does not exist.

At the same time as the significance of abstract mathematics increased, the concept of matter became more vague and impossible to describe. Elementary particles proved to not be eternal and unchanging. Mass changed to energy in collisions and kinetic energy became mass in pair formation. The form of allowable material structures appeared to be specified on the basis of laws of conservation and fundamental symmetries in nature. The Copenhagen Group concluded that the increased immateriality (*entstofflichung*) of elementary particles meant that the concept of dead matter in the prevailing world-view was replaced by a kind of play of forms. The first step in this direction, equivalence between mass and energy, had already been taken by the theory of relativity.[76] The Copenhagen interpretation implied both a radical reconsideration of classical metaphysics and a re-evaluation of the role played by human beings.

Werner Heisenberg suggested that the world was going through the same type of change that took place in antique times when the Atomist teachings of Leucippus and Democritus were replaced by the ways of thinking employed by Pythagoras and Plato, in which form was a more important factor than fabric. Even though the final shaping of a situation could not yet be achieved, Heisenberg felt able to express his belief that Plato’s philosophical concepts were more suitable for addressing reality than proposals made by the antique Materialists. Also, the Aristotlean terms ‘form and content’ or ‘form and substance’ were given new meaning since the elementary particles of modern physics were neither eternal or unchanging particles of matter,

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[74] Bohr 1939, 25, Bohr 1958, 69-70, and Bohr 1963, 59.
[75] Nagel 1961, 301.
[76] March 1957, 117-122.

but abstractions in the same way as Plato's regular elements which consisted of triangles. In Heisenberg's view, elementary particles were the different forms in which energy could be manifested. The result of a collision was not an object but a form which energy could adopt and which we then observed as being a material object. In this way, the most important aspect of research into nature ceased to be material objects and became mathematical symmetry. Energy was not just the force which kept everything moving, it was like fire in the philosophy of Heraclitus – the fundamental substance out of which the world is made.[77]
Max Born also emphasised mathematical forms or structures: in his opinion, particles were not something that could be thought of as having substance in the manner of Kant. Erwin Schrödinger, who considered waves to be more important than particles, also joined this discussion. He thought of the accurately-specified masses and charges of particles as nothing more than gestalt elements that were specified by wave equations. Individual particles were of no significance. They were not identifiable as individuals since the same particle could never be observed twice, nor could a specific electron, even in principle, be considered to be labelled without consequent errors in calculation. On the other hand, it was easy to leave a permanent trace in wave structures which could be observed more than once.[78] Heisenberg also linked mathematical constructions to the world lying behind human experience. He thought of quantum formalism as portraying some kind of world of possibilities. Laws of nature were no longer absolutely deterministic, they rather specified the possibility that events might take place, the probabilities that something could happen. Possibility or tendency existed as some kind of intermediate layer behind the world as it appears to us.[79]

3. The superiority of mathematics over classical language

In modern physics, the illusion of the objective reality of elementary particles in a peculiar way disappeared, but did not vanish into some unclear and misty reality: it lost out to the transparency of mathematical clarity.[80] But how should these evermore-important mathematical structures and symbols then be understood? Max Born believed that symbols were not just a convenient way of shortening presentations, but an essential component of the method of penetrating the physical reality which lies behind phenomena. Through its increasingly-mathematical methods and by abandoning observable models, physics had gained the ability to handle an even larger collection of real phenomena. Mathematical constructions give humans the ability to achieve a better understanding of reality, since physics is the link between observable phenomena and the hidden structures of pure thought. A mathematical formula is a symbol of some kind of reality behind everyday experience. Born has no hesitation in identifying these well-specified constructions as Kantian things "as such". They are images of the world behind phenomena, pure forms. Nevertheless, the structures referred to are in no way empty or pallid abstractions separated from

[77] Heisenberg 1958, 15-19, 31.
[78] Schrödinger 1961, 53-56.
[79] Heisenberg 1958, 10.
[80] Heisenberg 1955, 12.

the world, as can be concluded from both their utility and their many concrete adaptations.[81]

No-one will certainly wish to dispute that mathematics holds a position of fundamental significance in modern physics. In spite of the powerful development of mathematical theories, our conception of the reasons for the usefulness of mathematics has not actually progressed since antique times. The ontological and epistemological problems of mathematics are foreground topics in the philosophy of mathematics. It is by no means clear what mathematics is about. What is the nature of the objects that it studies? Are its concepts and methods discovered or invented? And what kind of knowledge does mathematics provide? Even in the 17th century, mathematical certainty was of the utmost importance to both Thomas Hobbes, a famous Materialist and Rene Descartes, a famous Rationalist. For Hobbes, mathematics essentially represented an instrument but Descartes believed that via mathematics, reason has direct access to reality. Both of these views still live. In physics, the nature of mathematics has not been clearly questioned. Is it, as for example Bohr maintained, primarily a tool for humans to use in description, or is it something ontologically more concrete, something with which the human intellect can directly reveal the structure of reality?

At least in the beginning, Heisenberg believed that the consistent mathematical formalism of quantum mechanics was adequate for the explanation of atomic phenomena. The theory provided limits on what could be observed, and since classical concepts such as position and momentum could no longer be handled precisely, it was only necessary to accept that classical concepts were no longer applicable at the atomic level.[82] Bohr paid considerable attention to the extent to which humans are bound to classical language in their search for knowledge. He stressed that we do not understand reality solely on the basis of a mathematical model. Even though mathematics also can be seen as a language, mathematics alone will not do. Pure mathematics is not physics, which is able to tell us something about reality. Both the theory of relativity and quantum mechanics are based on comparison of the results of measurements, and the use of classical language when handling this material is essential, even though, in principle, it is unable to deal with the revelations brought both by relativity theory and quantum mechanics.[83] Without a common language, one already employed in classical physics, research would lack a common foundation according to which everyone would comprehend, for example the experimental equipment being used or the results obtained, in a similar way.

Bohr did not doubt that the mathematical and symbolic language of quantum theory addressed microscopic reality better than the classical language suitable for the macroscopic world, but even so, mathematical symbols cannot be used to refer to what is experienced in the absence of classical concepts. Even if the area of applicability of classical concepts had been shown to be limited, we are tied to both our classical language and our classical methods of description if we are to maintain objective or common intersubjective description. Only the use of classical language guarantees consistent intersubjective communication. Communication has to be

[81] Born 1968, 179-186.
[82] Heisenberg when interwieved by T. Kuhn. See Folse 1985, 95.
[83] Bohr 1939, 25.

based on meanings which we can understand, and classical language is required to connect the symbols of quantum theory to the contents of our experiences.[84]
Bohr aimed to achieve a deeper understanding of the uncertainty relationship and wave-particle dualism which he believed in some manner reflected the structure of reality. Since physical theories have penetrated far beyond our normal observational world, they could not as such, without clear interpretation, increase our understanding of reality. In particular, Bohr searched for an answer to the question of why describing observed phenomena using classical concepts[85] led to the use of descriptions which seemed contradictory. In specific experimental situations, atomic objects have to be represented in the form of waves, in others they have to be represented as being particles. Although elementary objects sometimes behaved like waves and sometimes like particles, the consistency of the mathematical theory guaranteed that no real incompatibility could in fact exist.

4. Bohr's complementarity

Bohr accepted the undisputable fact that, depending on the context, microscopic objects must sometimes be described as waves and sometimes as particles. Within a particle-mechanistic world-view this kind of strange behaviour is not understandable, no object cannot be both a wave and a particle. Quantum theory, however, went far beyond the customary domain of classical physics. The simple and visualisable particle-mechanistic model proved to be suitable only for macroscopic objects, and contrary to all expectations, intricate investigations in the microscopic world revealed restrictions on the ideas of divisibility and space-time description that are typical in classical physics. In quantum theory, state description was no longer based on the positions and velocities of particles in space-time. The abstract wave-function represented a new kind of wholeness in nature that remained outside the scope of traditional space-time description. This led Bohr to a more general framework, the framework of complementarity.
Bohr concluded that it is not necessary for atomic objects or the target of a particular investigation to be either a particle or a wave, even though these are the only familiar images at the macroscopic level which we can adapt to phenomena observed in different experimental situations. By interpreting our experiences of atomic objects with the help of natural language, we unavoidably end up with descriptions which appear incompatible, but it must be remembered that the information yielded by different experimental situations and portrayals also includes the influence of the whole experimental setup. Our observations do not have to concern what we suppose to be independent properties of microscopic objects, but rather phenomena which appear as result of their interaction. We may only be able to observe some limited complementary aspects of a complex reality which ultimately is an undivided whole. The classical idea of an external observer who can take a God's eye view of reality turned out to be applicable only in the macroscopic world when we observe phenomena which are not directly related to us. In quantum real-

[84] Bohr 1958, 67, Bohr 1967, 19.
[85] By 'classical concepts', Bohr means the intuitively-understandable concepts of natural language which also were used in classical physics.

ity, the observer belongs to the reality that is being investigated and only receives information when interfering with that reality by participating in its processes. In an interactive situation, Bohr considered the observer to be an extension of the equipment being used. The observer is tied to a certain context and cannot obtain an overall objective view of how all the process actually proceed. Quantum mechanics does not allow for the possibility of making observations without reference to the observer or to the means of observation.[86]

In this kind of situation, Bohr viewed his complementarity as the only possible way of achieving an objective approach, one in which apparently contradictory phenomena could co-exist within a consistent framework. He saw description as a consequence of an experiment and bound to it. Information obtained from two complementary systems of investigation cannot be combined in a single portrayal by using common images and concepts. The familiar space-time description failed and the meaning of fundamental concepts such as ”particle”, ”property” or ”being” became obscure. Even so, our intersubjective observations and descriptions represent essential aspects of the information concerning that object. Complementary phenomena represent regularities which the classical approach does not reach. They appear to be mutually exclusive but at the same time complete each other. Together, they provide all the knowledge of atomic objects that is available from the experimental system being employed. Complementarity does not therefore in any way indicate a limitation on quantum-mechanical descriptions, it should be taken as a rational generalisation of the idea of causality.[87]

The basis of classical description failed when as a result of the discovery of quantum of action, it become obvious that nature has set limits on our possibilities of speaking about independent phenomena.[88] Complementarity descriptions can be thought of as complementing each other in order to provide a better understanding of complex reality. Although our descriptions are coloured by our observations and language, they are not imaginary constructions, they refer to real phenomena. Complementary phenomena or descriptions cannot be directly internally contradictory for the simple reason that experimental systems always require that the other be excluded. Using the viewpoint of complementarity, apparently-contradictory results can be reconciled and the apparent contradictions are completely removed.[89] In complementarity, the question is not one of any contradictions in reality, only of the inadequacy of the mechanical model and classical language.

Bohr’s view of complementarity permits a traditional deterministic portrayal when the phenomena being observed are at the macroscopic level and independent of the observer. At the microscopic level, this qualification does not apply. When examining the portrayal of context-dependent and indivisible pheonomena by quantum theory, the behaviour of objects is not independent of the observer. We cannot fully isolate ourselves at an ontological level from the world we are investigating. Indeterminism cannot therefore be avoided and physical description is returned to a more-general portrayal using complementarity.[90] The mechanical models of classi-

[86] For example Werner Heisenberg stated that natural science describes nature as exposed to our method of questioning, Heisenberg 1962, 81.
[87] Bohr 1958, 25- 26.
[88] Bohr 1939, 25 and Bohr 1967, 91.
[89] Bohr 1958 s.59.
[90] Bohr 1958, 41 and Bohr 1939, 25

cal physics, in which all events can be incorporated within observer-independent objects moving in space-time, are only capable of addressing idealisations useful at the macroscopic level. Portrayals involving classical determinism can only be employed as long as the behaviour of an object is independent of the observer. The indivisible or individual features connected with quantum theory are not therefore just alien to classical theory, they are incompatible with the traditional concept of causality.[91]

Complementarity generalises our earlier frame of reference by noting that humans are also an inseparable component of the world, and that our concepts are tools that we use in describing our experiences in different interactive situations. All our knowledge of the microscopic world is based on mathematical models and indirect descriptions in which we apply concepts that are familiar at the macroscopic level. The abstract and symbolic depiction given by quantum theory is neither visualisable or directly understandable and thus we are forced to reflect the formalism by using concepts and analogies based on direct experience that is appropriate at the macroscopic level. Bohr's approach did not therefore completely satisfy the ideals of classical physics regarding description and he came to suggest that quantum theory required generalisation of the whole of the earlier framework of description, the classical space-time model familiar since Newton. For example, H. Folse and C. Hooker have argued that with his concept of complementarity, Bohr was striving to discover an internally-consistent and understandable "rational generalisation" of classical physics.[92] Bohr himself most clearly emphasised his goal with uttearances such as "classical physical description is an idealisation of limited applicability" and "the notion of complementarity is called for to provide a frame wide enough to embrace the account of fundamental regularities of nature which cannot be comprehended within a single picture".[93]

Bohr considered the uncertainty relationship to be a mainstay of the doctrine of complementarity, and believed that in the same way that descriptions of position and momentum in quantum mechanics are complete in themselves and modifiable to each other by employing Fourier transforms, classical images and concepts such as the particles and waves employed in describing atomic systems are perfectly suitable in specific experimental situations. The simultaneous employment of such complementary-type descriptions was not however possible since the theory did not permit experimental situations in which both aspects of such systems could be defined at exactly the same time. In this sense, complementarity has a clear physical meaning. By employing the idea of complementarity, Bohr attempted to hold on to classical concepts while he searched for new connections between them and reality.

Bohr's claim that we must also hold on to classical language when depicting the new areas revealed by quantum theory was not immediately accepted even in Copenhagen circles. Wolfgang Pauli believed that the problems of interpretation would be solved if inadequate concepts were replaced by new ones that could be used to create a new visualisable model of reality. It was Werner Heisenberg's opinion that we no longer knew the meaning of "wave" or "particle" and that like heat or pressure, "space" and "time" were only of significance when handling large numbers of

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[91] Bohr 1948, 313.
[92] Folse 1985, 222., Hooker 1991, 499, 502.
[93] Bohr 1958, 85 and Bohr 1963, 12.

particles.[94] Bohr understood language as a means of approaching and analysing nature and our experiences concerning it which had evolved over time. With the help of language, we are able to orient ourselves to our environment.[95] Although words entrap us, they are at the same time a network with whose help we can aim at achieving an ever-clearer picture of the world and our place in it. When creating visualisible models concerning reality Bohr strove to keep in mind both the limitations and the deceptive nature of all types of descriptive and analogous models. For example, according to Bohr, portrayal of the wave function, even though it was real, meant that the act of visualisation had to be abandoned. He did not believe that any single visualisable model should be given more realistic status than that of abstract mathematical formalism.

Bohr drew a clear distinction between a theory's mathematical formalism (symbolic scheme) and the intuitive description offered by classical concepts. It is my opinion that language can, according to Bohr, also be considered as a kind of theory of the world. It works because it is anchored to our everyday experience. On the other hand, the language we use also implies the familiar macroscopic world. It incorporates everyday assumptions about the nature of the world which suit the environment we live in, such as, for example, the assumption that the world consists of isolated objects, and the drawing of a clear distinction between subject and object. These kinds of prejudice can be overcome by mathematical language. Because mathematics avoids the references to conscious subjects which slip through in everyday language, it is well suited to objective description and consistent definitions. It is appropriate for expressing relationships where verbal communication is unclear or clumsy. It should be remembered that definition of the symbols and operations in mathematics is however based on the simple and logical use of normal everyday language.[96]

In essence, the idea of replacing traditional objective approaches with a complementary description is linked to a new conception of the relationship between subject and object. It was not Bohr's principal wish to say that classical language does not address the whole truth of reality as this is better accessible to mathematics, he rather wanted to challenge the traditional assumption that humans are able to examine natural events in an objective manner from an external viewpoint. He thus rejected, for example, the traditional Kantian division according to which science investigated the world of phenomena in an objective manner, while religion was linked to the subjective domain. According to Bohr, the relationship between science and religion could not be examined on the basis of objective and subjective experience:

> "Religion uses language in quite different way from science but I myself find the division of the world into objective and subjective side much too arbitary. The fact that religions through the ages have spoken in images, parables and paradoxes means simply that there are no other ways of grasping the reality to which they refer. But this does not mean that it is not a genuine reality."[97]

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[94] Hendry 1984, 64, 114.
[95] Bohr 1948, 88.
[96] Bohr 1963, .60
[97] In discussion quoted by Heisenberg 1971, 87-89.

Developments in physics which showed how problematic concepts such as 'objective' and 'subjective' are, represented, for Bohr, a great liberation of thought. He said that even if we have to distinguish between the objective and subjective side, even the location of such a division may depend on the way things are looked at and to a certain extent can be chosen at will. Thus science and religion could be seen as different forms of complementary description which although they excluded one another, were both needed to convey the rich possibilities flowing from within the principal order in reality.

5. Conclusion

Bohr realised that both classical mechanics and the world-view accompanying it are constructions of the human mind. He did not, however, mean that the shaping of a model of reality was somehow arbitrary or subjective. In describing reality, Bohr placed his trust in the extensive mathematical theories that physics can offer, but his principle of complementarity states that we are not able to take a God's eye-view. Neither in our everyday experience, nor in our natural language, do we have concepts, descriptions or models able to catch the truth as such. Every honest trial, however, may pick up a part of the truth, and wider models or theories provide us with perspectives that can unite circumstances previously seen as separate and distinct.

Complementarity is closely connected with a change in the position of the observer. Classical physics adopted the viewpoint of Cartesian dualism in which an immaterial knowing subject investigated events in the material world as if it were completely isolated. To Bohr, the observer was quite clearly a part of reality. He was the first physicist who truly immersed human beings in the same system as the rest of the universe. Immersed in the world, people do not have complete knowledge of the fundamental nature of reality or a comprehensive external view of its full extent. We can only strive to participate and understand the phenomena we encounter to the best of our ability.

While complementarity makes it possible to move beyond the myths of subjectivity and objectivity, it does not require that we abandon the scientific method. Bohr's complementarity uses the idea of metaphorical language and description to give space for human activity in reality. By ontologically locating human beings within reality, it succeeds in going beyond the myths of subjectivity and objectivity. In Bohr's interpretation, the detached observer of classical physics can be seen as a constructive evolutionary agent. Strict dualism between subject and object is rejected. Reality appears as an evolving entity that can be divided and described in different ways. Human actions and choices may direct development in nature, and what have been called our 'subjective' aspects - our knowledge, our values and our goals - may also play a notable part in shaping natural processes. All our delicate capabilities belong to the dynamic web of reality.[98]

[98] See Kallio-Tamminen 2004

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Dialectical Materialism and the Self-organisation of Matter

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Abstract

The aim of this paper is to show that the theory of self-organisation in some respect proves the topicality of dialectical materialism and that an alternative concept of substance makes sense within the framework of dialectical materialism. The first part of the paper shows that Marx, Engels opposed the notion of substance because for them this notion was connected with the assumption of mechanical materialism that there is an eternal, unchanging stuff in the world to which all existence can be reduced. An alternative concept of substance is implicitly present in Engels' works because he says that the eternal aspect of the world is that matter is permanently changing and moving and producing new organisational forms of matter. Ernst Bloch has explicitly formulated this concept of process-substance within the framework of dialectical materialism and in opposition to mechanical materialism. Such an alternative conception of substance can as the second part of this paper shows also be expressed as the permanent and eternal self-organisation of matter. Concepts from self-organisation theory such as control parameters, critical values, bifurcation points, phase transitions, non-linearity, selection, fluctuation and intensification in self-organisation theory correspond to the dialectical principle of transition from quantity to quality. What is called emergence of order, production of information or symmetry breaking in self-organisation theory corresponds to Hegel's notions of sublation (Aufhebung) and negation of the negation. Self-organisation theory shows that Engels' *Dialectics of Nature* is still very topical and that dialectical materialism contrary to mechanical materialism and idealism hasn't been invalidated, it rather seems to be confirmed that dialectics is the general principle of nature and society.

1. Matter and Substance in Dialectical Materialism

Friedrich Engels has formulated some theses of a dialectical philosophy of nature that have remained very topical until today:

- The real unity of the world consists in its materiality (1878: 41)
- The basic forms of all being are space and time, and there is no being out of space and time (1878: 48).

- Motion is the mode of existence of matter. There is no matter without motion and no motion without matter. Both are uncreatable and indestructible (1878: 55)
- The human mind is the highest product of organic matter (1886a: 313; 1886b: 341).
- Nature does not just exist, but comes into being and passes away (1886a: 317), it has its existence in eternal coming into being and passing away, in ceaseless flux, in un-resting motion and change (ibid.: 320).
- Matter is eternally changing and moving, "we have the certainty that matter remains eternally the same in all its transformations, that none of its attributes can ever be lost, and therefore, also, that with the same iron necessity that it will exterminate on the earth its highest creation, the thinking mind, it must somewhere else and at another time again produce it" (1886a: 327).
- Nature forms a system, an interconnected totality of bodies which react on one another, this mutual reaction constitutes motion (1886a: 355)
- The basic form of all motion is approximation and separation, contraction and expansion – *attraction* and *repulsion* which are dialectical poles of movement (1886a: 356f).
- Matter is the totality of matters from which this concepts abstracts. Words like matter and motion are abbreviations[99], which combine many different, sensually perceivable things according to their common properties (1886a: 503). Matter is an abstraction in the sense that we abstract from the qualitative differences of things and combine them as physically existing in the concept of matter (ibid.: 519).

Matter is the totality of objects that constitute reality and is itself constituted in space and time by an interconnected totality of bodies which react on one another (motion), i.e. they repulse and attract each other. Motion is the mode of existence of matter in space-time. Matter is an eternal process of becoming and passing away, a ceaseless flux, it is uncreatable and indestructible. Matter is the totality of objective, really existing systems that are interconnected and accord to different physical laws. The material unity of the world means that the motion of matter results in a natural hierarchy of relatively autonomous forms of movement of matter where each level has new, emergent qualities that can't be reduced to lower levels or an assumed "materia prima".
Attraction and repulsion are the essence of matter (Hegel 1874: §§97f)[100], as polar opposites they are "determined by the mutual action of the two opposite poles on

[99] Also for Hegel, matter is an abstraction. He defines the Thing as the determined and concrete unity of Ground and Existence. It consists of matters or materials which are themselves partly things, which in that way may be once more reduced to more abstract matters. Numerous diverse matters coalesce into the one Matter. "Thus Matter is the mere abstract or indeterminate reflection-into-something-else, or reflection-into-self at the same time as determinate; it is consequently Thinghood which then and there is the subsistence of the thing. By this means the thing has on the part of the matters its reflection-into-self [...]; it subsists not on its own part, but consists of the matters, and is only a superficial association between them, an external combination of them" (Hegel 1874: §127).

[100] "The One, as already remarked, just is self-exclusion and explicit putting itself as the Many. Each of the Many however is itself a One, and in virtue of its so behaving, this all rounded repulsion is by one stroke converted into its opposite — Attraction [...].But the Many are one the same as another: each is One, or even one of the Many; they are consequently one and the same. Or when we study all that Repulsion involves, we see that as a negative attitude of many Ones to one another, it is just as essentially a connective reference of

one another, [...] the separation and opposition of these poles exists only within their unity and inter-connection, and, conversely, [...] their inter-connection exists only in their separation and their unity only in their opposition“ (Engels 1886a: 357). Energy is repulsion as one form of motion of matter, it is mass in movement. The unity of attraction and repulsion forms a field that surrounds and influences particles. Matter and energy are two forms of one and the same thing, matter is condensed energy and energy radiated matter. Einstein has shown that energy and mass are equivalent, hence energy has mass and mass energy. Energy is produced and transmitted from one atom to another only in portions of a certain extent (quanta, Max Planck). The atom emits (or gains) energy as it moves from one stationary state to another. Energy is not emitted or absorbed in a continuous manner, but rather in small packets of energy called quanta. An atom moves from one energy state to another state in steps. The energy of a quantum depends on the frequency of radiation and Planck's constant ($E = f \times h$), or expressed another way the frequency of radiation can be described as $f = (M \times c^2)/h$. This also means that particles are fields and that a particle with a mass M is connected with a field of frequency $(M \times c^2)/h$. The complementarity relation says that for each type of particle there is a corresponding wave-field.

Bohr and Rutherford have shown that atoms are not the smallest parts of the world. In it we find electrons circling around the nucleus which consists of protons and neutrons which are themselves no elementary particles, but consist of quarks. Elementary particles (6 types of quarks, 6 types of leptones) are not an immovable substance, they are transforming themselves. The stuff our world is made of are atoms, pure materials or elements. We know 118 pure materials (periodic table). They combine and form molecules which have new qualities. Radioactivity and quantum theory don't mean the "disappearance of matter". Particles and energy are both structural forms of matter. Elementary particles seem to disappear and reappear, they can't be considered as changeless substance, but as Erwin Schrödinger said they are "more or less temporary entities within the wave field whose form and general behaviour are nevertheless so clearly and sharply determined by the laws of waves that many processes take place as if these temporary entities were substantial permanent beings“ (Schrödinger 1953: 16).

These new physical conceptions such as Heisenberg's conception of the field as the source of particles, the assumption of quarks as elementary particles etc. show that the source of existing forms of matter is itself material and that the unity of the world is its materiality (Hörz 1976). Mechanical materialism has been invalidated by modern physics, but not so dialectical materialism. The latter's assumption that the world is in constant flux and process-like has been asserted. Engels basic hypotheses about the dialectics of matter still remain topical.

Information is a relationship that exists as a relationship between specific organisational units of matter. Reflection (Widerspiegelung) means reproduction of and reaction as inner system-changes to influences from the outside of a system. There is a causal relationship between the result of reflection and the reflected. The reflected

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them to each other; and as those to which the One is related in its act of repulsion are ones, it is in them thrown into relation with itself. The repulsion therefore has an equal right to be called Attraction**;** and the exclusive One, or Being-for-self, suppresses itself. The qualitative character, which in the One or unit has reached the extreme point of its characterisation, has thus passed over into determinateness (quality) suppressed, i.e. into Being as Quantity“ (Hegel 1874: §97f).

causes structural changes, but doesn't mechanically determinate them. There is a certain, relative autonomy of the system which can be described as a degree of freedom from perturbations. On the different organisation-levels of matter we find different degrees of freedom. This degree increases along with complexity if we go up the hierarchy from physical-chemical to living and finally social systems. The causal relationship between the reflected and the result of reflection is a dialectic of freedom and necessity. Information is an objective relationship between the reflected, the result of reflection inside the system's structure and the realisation of functions of the system within the reflected environment of the system (see Hörz/Röseberg 1981: 273ff). This means that information is a relationship of reflection between a system and its environment, to be more precise between units of organised matter. Information is not a structure given in advance, it is produced within material relationships. "Information is a physical structure and at the same time a structure which dominates the physical forces. […] Information is not a physical substance, it is instead temporarily 'attached' to it. Information must be understood as a specific effect and as a relationship" (Fuchs-Kittowski 1997: 559f).

Already Lenin pointed out that reflection is a quality of matter (Lenin 1952: 82) and his definition of matter is connected to this notion of reflection: "Matter is a philosophical category denoting the objective reality which is given to mall by his sensations, and which is copied, photographed and reflected by our sensations, while existing independently of them" (ibid.: 118f). But this notion of reflection is a mechanic-deterministic one because it assumes that there is a linear, fully determined reflection of outside reality within a material system. No autonomy and degree of freedom is granted to the category that is considered as the one being determined by a determining instance. Mechanistic determinism argues that causes and effects can be mapped linearly: each cause has one and only one effect, similar causes have similar effects, different causes have different effects; one assumes that small changes of causes necessarily have small effects and large changes of causes necessarily have large effects. Meanwhile the sciences of complexity have shown that similar causes can have different effects and different causes similar effects; small changes of causes can have large effects whereas large changes can also only result in small effects (but nonetheless it can also be the case that small causes have small effects and large causes large effects). Thinking the relationship of a system and its environment dialectically and in terms of the modern sciences of complexity, the notion of reflection shouldn't be defined in a strictly deterministic manner, there should be room for a dialectic of chance and necessity. Lenin's conception of matter is a dualistic one because it doesn't consider consciousness as a specific organisational form of matter, but sees it as something external to matter (that nonetheless depends on the latter). This definition suggests that subjectivity is not material, idealists or spiritualists could agree with it. E.g. Aristotle or Thomas d'Aquin said that God is an extra-mental, immaterial reality.

Energy and information don't exist outside of or external to matter, they are specific aspects of the movement and development of matter and as such are integral aspects of the world.

In Ionian philosophy there was the idea of prime matter. For Thales the prime matter (Urstoff) was water, for Anaximander "apeiron", for Anaximenes air, for Heraklit fire. The Atomists Demokrit and Leukipp reduced all being to smallest parts of

the world that are not dividable, move spontaneously and join or repel when colliding. There are eternal and indestructible corpuscles. The cosmos is seen as a system that is structured by the collision of atoms, the atoms themselves are considered as substance that doesn't change. These early positions can be considered as materialist monism.

Aristotle who tried to combine Ionian materialism and Elatic idealism postulated that substance always remains the same, nothing becomes or passes away, the same nature always maintains itself. For Aristotle there is substance (essence) and accident (contingency), hyle (substance) and eidos (form). Form and substance are two aspects of a thing that can't be divided, the only form without substance would be God. His position is one of ontological dualism, besides material being there is immaterial being.

The Middle ages were dominated by a religious conception that considered matter as a creation of God. This was questioned by Pantheistic conceptions such as the one of Giordanno Bruno that considered God as an eternal force that is immanent in nature. The Newtonian world-view was characterised by its believe in absolute immutability of nature and a reductionistic methodology. Nature was considered as conservative systems that remains stabile from its beginning until its end, organic matter was reduced to mechanics. French materialism of the 18th century (LaMettrie, Holbach, Diderot, Helvétius, Condillac, Alembert, Condorcet, Bonnet, Robinet, Laplace) as well as the "mechanical materialists" (Engels 1886b: 342) of the 19th century (Moleschott, Büchner, Vogt) were influenced by this worldview. The human being was considered a machine and the universe wasn't comprehended "as a process, as matter undergoing uninterrupted historical development" (Engels 1886b: 342). Relatively autonomous objective systems with higher forms of motion were reduced to mechanical ones.

Marx and Engels opposed the idea of substance (an endless, changeless carrier of changing qualities[101]) as materia prima because they considered such positions as mechanical and undialectical, neglecting that matter is always in motion and in its dialectical process of becoming develops higher organisational levels. Hence if one takes a look at the history of dialectical materialism one will find an animosity towards the notion of substance. E.g. Lenin wrote: "The recognition of immutable elements, "of the immutable substance of things," and so forth, is not materialism, but *metaphysical, i.e.,* anti-dialectical, materialism" (Lenin 1952: 251). Herbert Hörz (1976: 222ff), one of the main philosophers of the GDR, argued that due to field physics, the discovery of radioactivity, relativity theory and quantum theory, the notion of substance has become untenable. Modern physics has shown that elementary particles are transformed into other ones, the existence and maintenance of a particle is only possible in relationship to other particles and the latter's qualities. Hence the idea of an unchangeable carrier of qualities seems no longer to be valid. "Whereas the notion of substance presupposes a changeless carrier, […] modern physics conceives material events primarily as change, interaction and searches for the structural laws of this change" (Hörz 1976: 225). The notion of substance wouldn't be able to show the dialectical relationship of particle and field that was

[101] Also Kant assumed a permanence of substance and said that "throughout all changes in the world *substance* remains, and that only the *accidents* change" (Kant 1787: 214)

introduced by quantum theory. Field and elementary particles wouldn't be substance because they aren't changeless.
Hegel opposed the notion of substance for other reasons: Spinoza sees substance as causa sui, it is its own reason, Hegel says that such an assumption would exclude the creation of the world by God that he believed in. "A deeper insight into nature reveals God as creating the world out of nothing. And that teaches two things. On the one hand it enunciates that matter, as such, has no independent subsistence, and on the other that the form does not supervene upon matter from without, but as a totality involves the principle of matter in itself" (Hegel 1874: §128, see also §§150f)
Due to modern physics a mechanistic and reductionistic conception of substance must be repudiated. Nonetheless there seems to be an alternative conception of substance immanent in Engels' works on nature themselves: The substance of the world, i.e. that which exists permanently and endlessly, is the process-structure of matter. Matter is unresting, in permanent motion, in ceasless flux and a self-producing entity. In its dialectical movement it produces different organisational levels that have higher, emergent qualities which can't be reduced to older qualities.
Rainer Zimmermann (1999) shows that such an alternative conception of substance can be traced back to the line of thought constituted by Benedictus de Spinoza – Friedrich Wilhelm Schelling – Ernst Bloch. And it seems apparent that also Karl Marx and Frederick Engels seem to fit into this line as is e.g. shown by Engels' assumption that matter is a producing entity and through its permanent flux and motion "remains eternally the same in all its transformations".
Other than in the reductionistic worldview which saw nature as enemy and tried to reduce all forms of being to a stabile and unmoving matter, Giordano Bruno, Spinoza and Schelling considered nature as a producing and process-like entity. Ernst Bloch sees this line as a historical alternative to the "block"-matter and the "root-thinking" of mechanistic materialism (Bloch 2000: 166ff). Spinoza differs between natura naturans (the actively creating nature producing things) and natura naturata (the passively produced nature). Substance does not need other concepts to be explained, it is its own reason (causa sui), its essence involves its own existence. For Schelling, nature "has its reality in itself (and) is its own product, a Whole which is organised out of itself, and is organising itself" (Schelling, Sämtliche Werke, III: 17, cited from Zimmermann 1999). Schelling explains nature by principles which lie in itself, productivity is the main one of it. In opposition to the standard-assumption of their times that matter was created by God, these philosophers insisted that nature has its own reason and is producing itself. This means that in nature and matter as self-producing systems there is no place for a first mover that is not moved itself and for creatio-ex-nihilo. Schelling and Spinoza anticipated the assumption of dialectical materialism that matter is in permanent flux and produces different, and ever higher organisation-levels of matter.
The Marxist philosopher Ernst Bloch worked out an alternative conception of substance and matter within the framework of dialectical materialism (for details see Zeilinger 2002). In opposition to mechanical materialism[102] Bloch argues that matter is process-like, it is not a "dead block, moved only by pressure and push and re-

[102] Bloch says that mechanical materialism has a concept of matter that is only analytical and static, it doesn't know history, perspective and horizons of transformation (Bloch 1963: 208).

maining itself all the time" (Bloch 1963: 230), but nonetheless he doesn't give up the notion of substance. Matter for Bloch is fermenting and process-like (Bloch 1963: 203), it is a process-being, being-in-possibility (dynamei on; 1963: 207) and has a historical-dialectical character (1963: 209). Matter would be potentiality, and as such kata to dynaton (being-after-possibility) and dynamei on[103]. The former as that which can appear historically according to the conditions given, the latter as the correlate of the objectively real possible or the substrate of possibility within the dialectical process (1963: 233). The kata to dynaton is the historically possible, it conditions, i.e. it enables and constrains future possibilities: "These are not only the disturbing, thwarting, but also the material conditions assisting in the appearance of form" (Bloch 1975: 140). Matter as clade would be the fermenting sapling (gärender Schoss) of a substance that is bearing, developing, clarifying, qualifying itself (Bloch 2000: 173). Motion in its full extent would be the form of existence of matter: motion, change, production, tendency and latency (2000: 176).

As past potentialities matter conditions the future, but it nonetheless also involves aspects of openness and of the Not-Yet. Matter would be the world substrate in the sense that it opens up possibilities that can be realised (1963: 209). Matter is the existence-form (Daseinsform) of possibility (Bloch 2000: 119ff). Hence matter would also be utopian matter. Not-Yet characterises the tendency of material processes, as the origin that is processually emerging and tending towards the manifestation of its content (1963: 219). Matter is the "possibility-substratum which is fermenting in Nothingness, bearing in the Not-Yet and guaranteeing the novum" (1963: 227). The Novum (see Bloch 1963: 227ff; 1975: 141ff) is grounded in the real possibility of a Not-Yet-Having-Become, it is the land of perspectives of the process itself, something that has never been and is real future. As such, it is never completely new. The novum opens up the possibility of "active hope", but it is not necessarily "a good one", it can cause "fear as well as hope", it includes the "double-possibility of crash and rise". It is a "moment of could-become-other" (Anderswerdenkönnen) in objective-real possibilities, one could say one of relative chance. Matter both contains tendency and latency (Bloch 1975: 144ff). Tendency means relative determination and necessity in the development-process of the world, latency is a force which drives the process towards a goal and forms spontaneously new structures. Latency drives towards a novum. Tendency in contrast to laws is undecided, for its decision it is in need of a "subjective factor", it has room for chance and the novum. Latency means an open, broad plurality. In latency, tendency has its pre-existence of its direction and its anticipation.

Bloch's concept of matter anticipated the modern theories of self-organisation which also stress the productivity of matter that results in different organisational forms and hierarchical levels of matter and the self-reproduction and re-creativity of self-organising units. Nature is for Bloch a producing subject, he says it is forming itself, forming out of itself (1963: 234). In this context Bloch takes up Spinoza's concept of natura naturans in order to stress that nature is not only passively produced, it is also itself an actively producing system. The relationship of tendency and latency in matter also reappears as a dialectic of chance and necessity in self-organisation theory (the concepts of relative chance by Kolmogorow and Chaitin and of incomplete determinism). What Bloch calls a novum is called emergent

qualities in the sciences of complexity. Bloch used the term "emergence" himself by stressing that all gestalt figures *emerge* from the dialectical process and from matter as developing, producing (ausgebären[104]) substance immanently as well as speculatively (Bloch 1975: 165). For Bloch matter is a dialectically developing, producing substance.

Substance for Bloch is *process-substance* (1975: 246), it opens up possibilities, is fermenting and actively producing. It is "germ and utopian totum of the materia ultima in the laboratory of the world" (ibid.). Such a concept of substance seems to be an alternative to the "passive block-" and "root-"substance of mechanical materialism. Bloch explicates such an understanding, whereas it was implicitly present in Engels' works who didn't speak of substance, but about the eternal self-transformation and dialectical movement of matter.

Bloch stresses the important role of the human being in the self-transformation of matter. An organisational form of matter that would guarantee freedom and happiness would ultimately depend on human activities. Also Marx was interested in the relationship of man and nature and like Bloch considered the man-nature-totality as a self-organising system. In his *Economic-Philosophical Manuscripts* he stresses that in the production of his life which includes the metabolism between society and nature and social reciprocity, man as the universal, objective species-being produces an objective world (gegenständliche Welt) and reproduces nature and his species according to his purposes. He says that "nature is man's inorganic body – that is to say, nature insofar as it is not the human body. Man lives from nature – i.e., nature is his body – and he must maintain a continuing dialogue with it is he is not to die. To say that man's physical and mental life is linked to nature simply means that nature is linked to itself, for man is a part of nature" (Marx 1844: 515f). Marx says that animals only produce their immediate needs, whereas man as the universal, objective species-being through production and the dialogue with nature not only produces himself, he also "reproduces the whole of nature" (ibid.: 516). So also for Marx human activity is decisive for the self-reproduction and self-transformation of the man-nature-system. Exploitation and estrangement in capitalism would result in a destruction of this system and hence Marx argues (just like Bloch did 100 years later) that the sublation of this social formation is a necessary condition for the true appropriation of man's nature. "This communism, as fully developed naturalism, equals humanism, and as fully developed humanism equals naturalism" (Marx 1844: 536). Bloch adds that a "good novum" would mean "materialisation of the human being, humanisation of matter" (Bloch 2000: 176).

2. Self-organisation and Dialectics

Saying the substance of the world is the permanent dialectical movement of matter and its self-productivity, corresponds to saying that matter organises itself and nature is a self-organising system.

The theory of self-organisation has lead to a change of scientific paradigms: from the Newtonian paradigm to the approaches of complexity. There is a shift from pre-

[104] the German term used by Bloch is "ausgebären" which corresponds on the one hand to "bearing", but not only points at an active production, it also refers to a developing process

dictability to non-predictability, from order and stability to instability, chaos and dynamics; from certainty and determination to risk, ambiguity and uncertainty; from the control and steering to the self-organisation of systems, from linearity to complexity and multidimensional causality; from reductionism to emergentism, from being to becoming and from fragmentation to interdisciplinarity. This has been interpreted as a shift from modern to post-modern knowledge (Best/Kellner 1997).

Concepts of physical self-organisation have been put forward by Ilya Prigogine's theory of dissipative systems (Nicolis/Prigogine 1989, Prigogine 1980), Hermann Haken's (1978, 1983) synergetics and Manfred Eigen's hypercycle-theory (Eigen/Schuster 1979).

Principles of physical self-organisation are (see Fuchs 2001, Ebeling/Feistel 1994):

1. *control parameters*: a set a parameters influences the state and behaviour of the system
2. *critical values*: if certain critical values of the control parameters are reached, structural change takes place, the system enters a phase of instability/criticality
3. *fluctuation and intensification*: small disturbances from inside the system intensify themselves and initiate the formation of order
4. *feedback loops, circular causality*: there are feedback loops within a self-organising system; circular causality involves a number of processes p_1, p_2, …., p_n ($n \geq 1$) and p_1 results in p_2, p_2 in p_3, …. , p_{n-1} in p_n and p_n in p_1.
5. *non-linearity*: in a critical phase of a self-organising systems, causes and effects can't be mapped linearly: similar causes can have different effects and different causes similar effects; small changes of causes can have large effects whereas large changes can also only result in small effects (but nonetheless it can also be the case that small causes have small effects and large causes large effects).
6. *bifurcation points*: once a fluctuation intensifies itself, the system enters a critical phase where its development is relatively open, certain possible paths of development emerge and the system has to make a choice. This means a dialectic of necessity and chance. Bifurcation means a phase transition from stability to instability.
7. *selection*: in a critical phase which can also be called point of bifurcation, a selection is made between one of several alternative paths of development
8. *emergence of order*: in a critical phase, new qualities of a self-organising system emerge; this principle is also called order from chaos or order through fluctuation. A self-organising system is more than the sum of its parts. The qualities that result from temporal and spatial differentiation of a system are not reduceable to the properties of the components of the systems, interactions between the components result in new properties of the system that can't be fully predicted and can't be found in the qualities of the components. Microscopic interactions result in new qualities on the macroscopic level of the system. Checkland (1981: 314) defines an emergent quality in similar terms "as a whole entity which derives from its component activities and their structure, but cannot be reduced to them".
9. *information production*: new qualities of a self-organising system emerge and have certain effects, i.e. a complex reflective relationships is established between the trigger of self-organisation (the reflected), the emergent qualities (the result of reflection) and the function the new qualities fulfil for the system in its

adaptation to its environment. We have defined this relationship as information, self-organising systems are information-producing systems, information is not a pre-existing, stabile property of a complex system

10. *fault tolerance*: outside a critical phase, the structure of the system is relatively stable concerning local disturbances and a change of boundary conditions
11. *openness*: self-organisation can only take place if the system imports entropy which is transformed, as a result energy is exported or as Prigogine says dissipated
12. *symmetry breaking*: the emerging structures have less symmetry than the foundational laws of the system
13. *inner conditionality*: self-organising systems are influenced by their inner conditions and the boundary conditions from their environment
14. *relative chance*: there is a dialectic of chance and necessity in self-organising systems; certain aspects are determined, whereas others are relatively open and according to chance
15. *complexity*: the complexity of a system depends on the number of its elements and connections between the elements (the system's structure). There are three levels of complexity: 1. there is self-organisation and emergence in complex systems, 2. complex systems are not organised centrally, but in a distributed manner; there are many connections between the system's parts, 3. it is difficult to model complex systems and to predict their behaviour even if one knows to a large extent the parts of such systems and the connections between the parts

One example of physical self-organisation are the Bénard-cells: A special liquid is heated at a certain temperature t2 from beneath and cooled down at a certain temperature t1 from above. So there is a temperature-difference $\Delta t = t2 - t1$ which develops and is the control parameter of the system (principle 1). At $\Delta t = 0$ the system is in equilibrium, the temperature gradient rises and at a certain critical value (p2), a new pattern emerges in the liquid that looks like honeycombs (p8, p9). The liquid particles are located in layers, lower layers are due to the temperature warmer than upper ones, they expand and their density decreases. At the beginning of the critical phase, a first small fluctuation is caused which means that a particle is thrown out of its position in a certain layer and enters an upper or lower layer (p3). It is not predetermined in which layer this fluctuation will occur. Fluctuations only take place if a certain threshold of the control parameter Δt is crossed. The fluctuation intensifies itself (p3), more and more liquid particles are detached from their stationary position , disorder, chaos and motion shows up (p6). The liquid particles arrange in cells which have different forms (round, square, broad, thin, large, small etc.). These forms are dependent on modes, which are elementary forms of motion. At a certain point of time, several types of cells exist. Finally one type can assert itself, there is one dominant form due to a selection process within the system (p7). As a result of the superimposition of many of the same form, a pattern emerges that looks like a honeycomb (p8, p9). So from an initial chaos of particles, order has emerged. At a certain value of the temperature gradient, this order disappears. In this process, it is determined that order will emerge, that there will be initial fluctuations which spread out and that one of several types of roles will be selected. But it is not determined in which layer the fluctuation will be caused, how the cell-types will exactly

look like and which one will be selected (p14). This experiment will only be successful if energy in the form of a temperature difference will be applied to the system (p11).
Another example that is frequently used in order to explain self-organisation, is the functioning of a laser (see Haken 1987). A laser consists of an active medium that is situated between two mirrors. This medium is either a gas that is radiating due to the discharge caused by current entry or a crystal that is pumped through a flash lamp. E.g. a ruby with crome iones can be used. The atoms of the crystal are stimulated by the flashes and an electron changes its trajectory, it jumps from an inner trajectory to an outer one and takes up energy from the flash lamp. It spontaneously returns to its former trajectory and emits energy in the form of a light wave. So due to the stimulation of the atoms caused by the flash lamp, the atoms emit light waves. The two mirrors again and again reflect the light. First there is a chaos of light waves. A light wave can hit other atoms and force them to intensify its own light. By such processes, the light waves reach certain amplitudes. Hermann Haken says that one light wave "enslaves" the others, this means that it becomes dominant and orders the system. As a result an ordered light wave, the laser beam, emerges. From a chaos of light waves, an ordered pattern emerges (p8, p9). The decisive control parameter is current supply (p1, p11), the system can only enter criticality if the current reaches a certain threshold (p2). A light wave is caused by a fluctuation, i.e. an electron returns to its inner trajectory and emits energy; a light wave can intensify itself by "enslaving" electrons (p3). Such an intensification always means circular causality, because an entity causes the behaviour of another entity and this behaviour results in a transformation of the first entity (p4). Due to such intensifications, the system enters a state of chaos/instability/bifurcation (p5, p6). A certain light wave is selected (p7) and determines the emergence of the laser beam (p8, p9). It is determined that a laser beam will emerge, that fluctuations and intensification will be caused; but it is not determined how this exactly takes place and which light wave will order the system (p14).
Georg Wilhelm Friedrich Hegel has outlined that the purpose of dialectics is "to study things in their own being and movement and thus to demonstrate the finitude of the partial categories of understanding" (Hegel 1874: Note to §81). Self-organisation refers to the forms of movement of matter and hence is connected to dialectics. What is called control parameters, critical values, bifurcation points, phase transitions, non-linearity, selection, fluctuation and intensification in self-organisation theory (principles 1, 2, 3, 5, 6, 7) corresponds to the dialectical principle of transition from quantity to quality. This is what Hegel has discussed as the Measure (Hegel 1874: §§107ff): The measure is the qualitative quantum, the quantum is the existence of quantity. "The identity between quantity and quality, which is found in Measure, is at first only implicit, and not yet explicitly realised. In other words, these two categories, which unite in Measure, each claim an independent authority. On the one hand, the quantitative features of existence may be altered, without affecting its quality. On the other hand, this increase and diminution, immaterial though it be, has its limit, by exceeding which the quality suffers change. [...] But if the quantity present in measure exceeds a certain limit, the quality corresponding to it is also put in abeyance. This however is not a negation of quality altogether, but only of this definite quality, the place of which is at once occupied by

another. This process of measure, which appears alternately as a mere change in quantity, and then as a sudden revulsion of quantity into quality, may be envisaged under the figure of a nodal (knotted) line“ (ibid.: §§108f).
What is called emergence of order, production of information or symmetry breaking in self-organisation theory (principles 8, 9, 12) corresponds to Hegel's notions of sublation (Aufhebung) and negation of the negation. Something is only what it is in its relationship to another, but by the negation of the negation this something incorporates the other into itself. The dialectical movement involves two moments that negate each other, a somewhat and an another. As a result of the negation of the negation, “something becomes an other; this other is itself somewhat; therefore it likewise becomes an other, and so on ad infinitum” (Hegel 1874: §93). Being-for-self or the negation of the negation means that somewhat becomes an other, but this again is a new somewhat that is opposed to an other and as a synthesis results again in an other and therefore it follows that something in its passage into other only joins with itself, it is *self-related* (§95). In becoming there are two moments (Hegel 1812: §176-179): coming-to-be and ceasing-to-be: by sublation, i.e. negation of the negation, being passes over into nothing, it ceases to be, but something new shows up, is coming to be. What is sublated (aufgehoben) is on the one hand ceases to be and is put to an end, but on the other hand it is preserved and maintained (ibid.: §185). In dialectics, a totality transform itself, it is self-related. This corresponds to the notions of self-production and circular causality. The negation of the negation has positive results, i.e. in a self-organising system the negation of elements results in positive new qualities.
The two examples mentioned above in fact are examples of the dialectical development of matter. When the control parameters reach a certain threshold, a point of bifuraction or criticality, Hegel says a nodal-line, shows up. The quantities that are increased and transform into quality are the temperature gradient and electric current. The emergence of a pattern of honeycombs and of the laser beam means sublation and the negation of the negation. The old state of the systems is eliminated, but nonetheless preserved in new qualities. New qualities show up and hence the systems reach a higher level.
The principle of relative chance which is typical for self-organising systems had already been considered as dialectic of chance and necessity by Hegel, Marx and Engels (Hegel 1874: §§144ff, Engels 1886a: 486-491). Engels has stressed that the dialectic of attraction and repulsion is an aspect of matter and its movement. Both elements are also described by self-organisation theory: Chaos, noise or instability is described as disordered movement of the elements of a complex system. One can also say that the elements are repulsing each other. But this repulsion is one that turns into attraction, because the elements interact, there are processes of ordering and selection, i.e. attraction takes place as the emergence of a coherent whole and new qualities.
As an example for the transition from quantitiy to quality Engels mentions the homologous series of carbon compounds:
“Here therefore we have a whole series of qualitatively different bodies, formed by the simple quantitative addition of elements, and in fact always in the same proportion. This is most clearly evident in cases where the quantity of all the elements of the compound changes in the same proportion. Thus, in the normal paraffins

C_nH_{2n+2}, the lowest is methane, CH4, a gas; the highest known, hexadecane, $C_{16}H_{34}$, is a solid body forming colourless crystals which melts at 21° and boils only at 278°. Each new member of both series comes into existence through the addition of CH2, one atom of carbon and two atoms of hydrogen, to the molecular formula of the preceding member, and this quantitative change in the molecular formula produces each time a qualitatively different body“ (Engels 1878: 119).

Almost everywhere in chemistry one can find examples for the transition from quantity to quality, therefore Engels speaks of chemistry as “science of the qualitative changes of bodies as a result of changed quantitative composition“ (Engels 1886a: 351). This transition is what today is called in self-organisation theory emergence. In a self-organising system, a certain threshold of a control paramteter is crossed and order emerges. What is today called a point of bifurcation, instability of criticality, Engels refers to as “Hegelian nodal line of measure relations – in which quantitative change suddenly passes at certain points into qualitative transformation“ (Engels 1878: 117) or even directly anticipating the modern terminology he speaks of “critical points“ (Engels 1886a: 351). As other examples for nodal lines Engels mentions e.g. a certain current strength that is required to cause the platinum wire of an electric incandescent lamp to glow, the temperature of incandescence and fusion of metals, the freezing and boiling points of liquids, the critical point at which a gas can be liquefied by pressure and cooling (Engels 1886a: 351). The transition from quantity to quality that occurs e.g. in the homologous series of carbon compounds when certain atoms are added can also be termed the emergence of a qualitatively different body.

Other examples that Engels mentioned for the transition from quantity to quality and that could equally be described as the emergence of new qualities in a critical situation after a threshold of a certain control parameter has been crossed, include:

- change of form of motion and energy: “All qualitative differences in nature rest on differences of chemical composition or on different quantities or forms of motion (energy) or, as is almost always the case, on both. Hence it is impossible to alter the quality of a body without addition or subtraction of matter or motion, i.e. without quantitative alteration of the body concerned. [...] Change of form of motion is always a process that takes place between at least two bodies, of which one loses a definite quantity of motion of one quality (e.g. heat), while the other gains a corresponding quantity of motion of another quality (mechanical motion, electricity, chemical decomposition). Here, therefore, quantity and quality mutually correspond to each other“ (Engels 1886a: 349)
- Engels refers to Hegel’s example of the states of aggregation of water (Engels 1886a: 351): “Thus the temperature of water is, in the first place, a point of no consequence in respect of its liquidity: still with the increase of diminution of the temperature of the liquid water, there comes a point where this state of cohesion suffers a qualitative change, and the water is converted into steam or ice“ (Hegel 1874: §108). As other examples Hegel mentions the reaching of a point where a single additional grain makes a heap of wheat; or where the bald-tail is produced, if we continue plucking out single hairs.

For Engels “the negation of the negation is an extremely general […] law of development of nature, history, and thought; a law which, as we have seen, holds good in

the animal and plant kingdoms, in geology, in mathematics, in history and in philosophy“ (Engels 1878: 131).
As an example from nature he mentions the development process of a grain of barley: “Billions of such grains of barley are milled, boiled and brewed and then consumed. But if such a grain of barley meets with conditions which are normal for it, if it falls on suitable soil, then under the influence of heat and moisture it undergoes a specific change, it germinates; the grain as such ceases to exist, it is negated, and in its place appears the plant which has arisen from it, the negation of the grain. But what is the normal life-process of this plant? It grows, flowers, is fertilised and finally once more produces grains of barley, and as soon as these have ripened the stalk dies, is in its turn negated. As a result of this negation of the negation we have once again the original grain of barley, but not as a single unit, but ten-, twenty- or thirtyfold“ (Engels 1878: 126). As similar examples he mentions the development process of insects, geology as a series of negated negations, a series of successive chatterings of old and deposits of new rock formations, differential and integral calculus, the development of philosophy and society.
These development processes can also be described in the terms of physical self-organisation: the control parameters that influence the development of the grain are time and natural conditions such as heat and moisture. During this development new seeds will show up. At a specific point of time, a critical point is reached and the grain ceases to exist. But at the same time new grains emerge.
Dialectical processes and negation of the negation not just only mean the emergence of other, new qualities, it also includes a development process that results in *higher* qualities and other structural levels. Dialectical development is not just change or self-transformation and self-reproduction, it is also the emergence of higher levels of organisation (Hörz 1976: 311ff). Hence dialectical thinking assumes an immanent hierarchy in nature and evolutionary leaps.
This was also considered by Engels: “the transition from one form of motion to another always remains a leap, a decisive change. This is true of the transition from the mechanics of celestial bodies to that of smaller masses on a particular celestial body; it is equally true of the transition from the mechanics of masses to the mechanics of molecules – including the forms of motion investigated in physics proper: heat, light, electricity, magnetism. In the same way, the transition from the physics of molecules to the physics of atoms – chemistry – in turn involves a decided leap; and this is even more clearly the case in the transition from ordinary chemical action to the chemism of albumen which we call life. Then within the sphere of life the leaps become ever more infrequent and imperceptible“ (Engels 1878: 61).
Self-organisation theory is also dialectical in the respect that it frequently considers self-organisation as emergent evolution. This means that there are different hierarchical organisational levels of self-organisation which differ in complexity and where new qualities of organisation emerge on upper levels. In self-organisation theory e.g. Ervin Laszlo (1987) argues that evolution does not take place continuously, but in sudden, discontinuous leaps. After a phase of stability a system would enter a phase instability, fluctuations intensify and spread out. In this chaotic state, the development of the system is not determined, it is only determined that one of several possible alternatives will be realised. Laszlo says that evolution takes place

in such a way that new organisational levels emerge and identifies the successive steps of evolution.

Biology has long struggled for finding a consistent definition of life. Such definitions normally include a list of properties such as movement, metabolism, replication, sensation, reaction to stimuli, growth, ageing, disease, death, reproduction, regulation, inheritance. The problem is that there always examples can be found that don't seem to fit the definition. Humberto Maturana and Francisco Varela (1992) have tried to find a consistent definition of life, they say that living systems are biologically self-organising ones, i.e. the permanently produce themselves. They call such self-producing systems autopoietic (autos=self, poiein=to make something). Autopoietic systems or biological self-organisation can be characterised by the following items:

1. They permanently produce their parts and their unity themselves
2. An autopoietic organisation is characterised by relations between its parts
3. These relations result in a dynamic network of interactions
4. Autopoietic systems are operationally closed: the effects of the network of interactions don't go beyond the network itself
5. The autopoietic unit forms its own border, it delimits its structure from its environment. In a cell the membrane is such a border.
6. The production of the system's components enables the forming of a border, a border is a precondition for a dynamic that is needed for the self-production of the system (circular causality)
7. Living systems constitute themselves as different from their environment, they are autonomous units.
8. Structural coupling: Perturbations from the environment can influence an autopoietic unit, but it can't fully determine changes of the system's structure

The main characteristics of an autopoietic system are self-maintenance, self-production and production of its own border.

In his *Anti-Dühring* and his *Dialectics of Nature*, Friedrich Engels pointed out the problem of defining life and intuitively anticipated the theory of autopoiesis. Of course today we know a whole lot more about life than Engels did, especially since the discovery of the double helix. But what's important is that Engels anticipated the idea of autopoiesis, he says that life exists in the "constant self-renewal of the chemical constituents" it has (Engels 1878: 75), life is a "self-implementing process" (ibid.: 76), albumen would not only permanently decompose itself, it would also permanently produce itself from its components (Engels 1876a: 558f).

3. Conclusion: Science, Materialism and Religion

As Engels implicitly pointed out, the substance of the world is its process-character, the permanent dialectical movement of matter and the productivity of matter that results in self-reproduction and the emergence of new, higher qualities and organisational forms of matter. This corresponds to saying that the substance of the world is the permanent self-organisation of matter. As has been shown, processes of physical self-organisation can be described in dialectical terms. Control parameters, critical values, bifurcation points, phase transitions, non-linearity, selection, fluctua-

tion and intensification in self-organisation theory correspond to the dialectical principle of transition from quantity to quality. What is called emergence of order, production of information or symmetry breaking in self-organisation theory corresponds to Hegel's notions of sublation (Aufhebung) and negation of the negation. The concept of emergent evolution corresponds to the principle of dialectical development, the dialectics of chance and necessity as well as of attraction and repulsion that have been described by Hegel, Engels and Marx are constitutive for processes of self-organisation. The other way round, the examples Engels gave for the dialectics of nature can also be seen as examples of self-organisation of matter.

Self-organisation theory shows that Engels' *Dialectics of Nature* is still very topical and that dialectical materialism contrary to mechanical materialism hasn't been invalidated, it rather seems to be confirmed that dialectics is the general principle of nature and society. Self-organisation theory lines out Engels' assumptions that the real unity of the world consists in its materiality, that matter is process-like and in constant flux, that it is a producing entity that is uncreateable and indestructible. That the substance of the world is self-organisation of matter which results in higher organisational forms of matter, thus far the highest organisation form is human society, means that God doesn't exist, that there is no creatio-ex-nihilo and no first mover that isn't moved itself. Hence religion and esoteric thinking are mere ideology, false consciousness. Dialectical materialism seems be confirmed by modern science, whereas serious problems arise for idealistic worldviews. "The conceptions of self-organisation, the conceptions that assign a determining role to the activity of inner factors instead of outer, are new scientific affirmations of the old dialectical theses, as well as the conceptions of the general connection of all things and appearances" (Steigerwald 2000). Self-organisation theory is indeed a dialectical materialist-theory, but unfortunately its representatives not all to often realises this and don't acknowledge the dialectical tradition and heritage of the philosophy of nature in the line of Friedrich Engels.

The natural sciences that emerged during the last century such as quantum theory, quantum mechanics, first and second order cybernetics, general system theory, non-equiblibrium thermodynamics, synergetics, dissipative systems theory, autopoietic systems theory, catastrophe theory, hypercycle theory, string theory, loop theory etc. deal with the ontology of the material world. Hence there seems to be scientific evidence that nature is a self-organising totality and is its own cause. This seems to confirm the materialist notion that matter is uncreateable and indestructible.

It is quite common today in idealistic thinking to interpret the big bang as the creation of the world by God where nothing turns into something. But if before the big bang there was nothing except God, what is the foundation of God? There has never been scientific evidence that God could really exists as an eternal substance outside of material existence and that he is his own reason, whereas modern science has produced evidence that matter is causa sui, organises itself and hasn't been created by an external first mover out of nothing. It is not reasonable to assume that the world has been created out of nothing, that God exists eternally and has no created origin. In such arguments a causal principle is applied to matter, but the same causal principle is declared as not holding for God. There are no rational reasons why this should be the case. Talking about God and the origin of the world means talking

about universality, its unreasonable to apply a form of universal causality to one universal phenomenon, but to simply ignore it for another one.
Philosophy deals with explanations of how single aspects of the world and single sciences are connected. It is the science of universality. Philosophy is the thinking study of material reality and the things that comprise reality. Philosophy works out notions and categories in order to describe and explain the total world process on a general level. Various idealistic, religious and esoteric theories explain the world as being created by God as an external first mover who is not moved himself. This violates fundamental philosophical theorems such as Occam's Razor: if the material world can be explained as its own reason as can be done by philosophically generalising theories of self-organisation, referring to an external creator is an unnecessary over-specification and multiplication. The theorem of foundation holds that everything that is or can be has some foundation/ground. By starting to tell the history of the cosmos from physics, matter can be conceived as its own reason and as the self-referential foundation of the world. Philosophy actually must explain the development of the universe and must start from physics as the fundamental natural science, idealistic conceptions that stresses spirit will fail to find a sufficient ground of the universe (Zimmermann 1999). If Spirit and God are conceived as eternal entities that are their own reason, irrational categories are simply defined tautologically and without reference to the really existing, material world that can be rationally explained by the natural and social sciences. Idealism can't provide a reasonable foundation of the world.
The existence of God has never been proved scientifically, but there is all reason to assume that matter is organising itself and that this is a universal phenomenon. The theory of the hypercycle by Manfred Eigen provides an explanation of the origin of life and the human being that is in no need for an argument that assumes divine creation because the emergence of life is explained as a qualitative leap in the self-organisation of matter that results in a new organisation level within an evolutionary hierarchy. Life is the result of a cross-catalysis between auto-creative nucleic acids and proteins. "There is no need for a miracle, for a divine, supernatural act to explain biological development. The only possibility of avoiding this conclusion would be the statement that the laws ruling it have been created together with the world by an extrahuman force. But then reasonable arguments for the possibility and necessity of this extranatural power must be found, and that cannot be established by scientific means" (Steigerwald 2000). The existence of life is due to self-reproducing molecules, there is no scientific evidence for a creation of life and the human being by God.
With the breakdown of Fordist capitalism in the sixties, the capitalist world system entered a permanent crisis and ever since the global groblems have quickly worsened. A new Postfordist mode of capitalist development emerged and individualisation has shown up as a new phenomenon that serves dominating interests and results in the erosion of collective institutions that formerly seemed to give sense to the human being. Such institutions are traditional religions, unions, associations, families etc. Capitalism is now based on a deregularised and flexible institutional setting and people throughout the world are faced with the dangers of precariousness and extinction that is due to the development of the internal antagonisms of the capitalist world system. With the breakdown of the Soviet Union, an ideological

vacancy showed up and the former Eastern European states have been fully included into the global capitalist dynamics.
In ideology and science, the emptiness and helplessness that is felt by many and that is due to the antagonisms of the capitalist world system has resulted in a search for new transcendental and mystical explanations and salvations. As a result there is a boom of various forms of mysticism, esotericism and spiritualism. People are looking for irrational guidelines, instead of looking for the foundations of problems and developments within the real world. The new irrationalism is a result of the increased complexity of the world that people can't cope with.
These irrational tendencies can also be found within the self-organisation paradigm which has by some been interpreted as holistic spiritualism.
E.g. for the Austrian systems philosopher Erich Jantsch spirit is the guiding force of evolution, its self-organisation results in organisational levels. For him, history is history of the spirit and he says that the materialistic argument that humanity can be described by material processes is reductionistic (Jantsch 1979: 252, 330, 346). He considers the history of nature as the evolution of consciousness and spirit (1979: 411) and suggests that spirit is a god-like principle. God is considered as the evolving spirit of the universe.
Jantsch suggest that there is a hierarchy of natural systems (Jantsch 1975: 72) which stretches from physical to biological, social and finally spiritual systems. Very similar to the world model of Karl Popper (see Eccles/Popper 1977: 38) where world three corresponds to the products of human mind, spirit seems to be some upper guiding principle of evolution for Jantsch. Hence the upper system in his hierarchy is not society – that includes material processes as well as human ideas –, but spirit. This again outlines Jantsch's idealistic view of the world. Jantsch (1979: 243) says that it is the neural spirit that steers the evolution of the human world.
Jantsch (1975) refers positively to Henri Bergsons's eschatological and metaphysical concept of élan vital, a life force that (as is assumed) drives evolution toward higher forms of organisation. Jantsch himself says that the formation of life should not be explained by random fluctuations, but by special, attractive, higher force toward a finality which was called entelechy by Hans Driesch and élan vital by Bergson. Self-organisation theory puts forward the idea that life has come into existence by the self-organisation of matter without an external creator (God) or a metaphysical force at work. Although Jantsch is into this theory and tries to apply it to society, he is explaining life metaphysically. For Jantsch evolution does not take place randomly, he sees some finalistic, teleological principle at work. Jantsch's view is a monistic idealism, he says that all human systems – organisations, institutions, cultures, and so forth – are alive (Jantsch 1975: 50) and that self-organisation on all evolutionary levels means the unfolding of spirit (Geist). Jantsch's view is that spirit is everywhere dissipative self-organisation takes place, especially in all areas of life (Jantsch 1979: 227). For Jantsch, spirit is also in society, eco-systems, the "gaia"-system or in the insect world.
Similar arguments can be found in the works of Fritjof Capra who considers the total dynamics of self-organisation in the cosmos as cosmic mind and regards self-organisation as a mental process. "In the stratified order of nature, individual human minds are embedded in the larger minds of social and ecological systems, and these are integrated into the planetary mental system - the mind of Gaia-which in turn

must participate in some kind of universal or cosmic mind. The conceptual framework of the new systems approach is in no way restricted by associating this cosmic mind with the traditional idea of God. In the words of Jantsch, "God is not the creator, but the mind of the universe." In this view the deity is, of course, neither male or female, nor manifest in any personal form, but represents nothing less than the self-organizing dynamics of the entire cosmos“ (Capra 1982).
In such mystical views, the universe is seen as one large living totality that consists of a network of equal parts. There is no hierarchy in nature in such conceptions and hence also no qualitative differences between systems, they are all considered as an expression of spirit. Based on the Gaia hypothesis, biologistic and eco-fascistic arguments frequently are employed.
In such new mystifications and irrationalisations of science, God is not necessarily considered as an eternal creator, but there is an eternal principle that exists externally to matter. Capra stresses the similarities between his systems view and mystics. Consciousness is regarded as the primary reality and the ground of all being. “In its purest form, consciousness, according to this view, is non-material, formless, and void of all content; it is often described as "pure consciousness", "ultimate reality", "suchness" and the like. This manifestation of pure consciousness is associated with the Divine in many spritual tradions. It is said to be the essence of the universe and to manifest itself in all things; all forms of matter and all living beings are seen as forms of divine consciousness“ (Capra 1982). Capra doesn’t consider material structures as primary reality, all structures of the universe from particles to galaxies and from bacteria to human being are considered as manifestations of the cosmic mind. “But this is almost the mystical view“ (Capra 1982). Capra says that both the ideas of the the universal interconnectedness and interdependence of all phenomena and the intrinsically dynamic nature of reality can be found in science and mystical traditions.
Arshinov and Voitshekovich (1999) argue that theology and mysticism are important aspects of the new synergetic paradigm. Silent prayer (isichast) is considered as an interaction between God and man where a union with “God’s enery“ is reached that can be considered as synergetic order. They argue that at the philosophical level of synergetic knowledge “the elements of science are mixed with the elements of belief. Such knowledge can not be falsified“. The philosophical level would cover world outlooks such as Taoism, Buddhism, Hinuduism, Christianity, esoterics and classical philosophical systems. It is suggested that God is the highest level of existence and that “bio-fields“, “universal field“, silent prayer etc. are concepts of self-organisation theory.
Philosophy is not an area of belief, belief belongs to religion which is not a part of science and philosophy. Values and norms are part of ethics, which comprises one part of philosophy. The other ones are ontology (What is the world and all being like?) and epistemology (How do we perceive the world?). Philosophoy is not an area where “anything goes“ in the sense of an radical constructivist or anarchistic epistemology of science as e.g. put forward by Paul Feyerabend. Philosophy instead tries to connect, to generalise and to unify single sciences. It produces interrelationships between single sciences on a more general meta-level. Hence it is based on the natural and social sciences, philosophical categories are related to the single sci-

ences. E.g. categories like reason, love, human being are related to the humanities, categories like nature, space, time, matter are related to physics etc.
Categories like God and spirit that are conceived as the Absolute, as something infinite and unquestionable and as absolute truth are not at all connected to the single sciences. This results in isolated doctrines that can't be analysed, questioned and examined scientifically. There is e.g. no proof for the claim that man occupies some lower steps in a universal field where God means the Absolute. Religion, mysticism, spiritualism and esotericism is where science ends and pure ideology starts.
Hegel said that "what is reasonable is actual and what is actual is reasonable". Actuality means materiality, hence putting Hegel from head to toe means that only material reality can be reasonable, and that something that is conceived as existing prior or external to matter is unreasonable. Areas such as religion and esotericism are unscientific and irrational, they proclaim absolute truths that can't be researched or contested. Irrational arguments avoid objectiveness, exactness, logic, verifiability and falsifiablity. Pseudo-sciences use strategies of immunisation in order to avoid criticism. If pseudo-sciences like creationism, spiritualism, mysticism, parapsychology and astrology were right, this would mean that the modern sciences are all wrong. Hence isolationism is typical for such areas of thinking.
There are no scientific grounds for religion and other irrationalisms. Religions might include some elements that are interesting for science and philosophy, but one has to deal with these topics scientifically, not religiously and in terms of absolute truths. Religion and esoterics are
a "universal basis of consolation and justification. Religious suffering is, at one and the same time, the expression of real suffering and a protest against real suffering. Religion is the sigh of the oppressed creature, the heart of a heartless world, and the soul of soulless conditions. It is the opium of the people" (Marx 1844: 378).
There is no need to refer to mystic forces for explaining the self-organisation of the universe and society. New properties simply emerge due to the complex interactions of the parts of a system, not because there would be some external holistic force at play. Already the founders of the Philosophy of Emergentism, Conwy Llord Morgan and Samuel Alexander saw emergence as something mystically, and so they introduced spiritual forces (known as "Nisus") as the driving principle. Such forces lack an understanding of the dialectical relationship of quality and quantity and the whole and its parts. The emergence of order doesn't need to be explained metaphysically because new qualities of the whole are solely constituted by interactions of its parts. The philosophical mistake of over-specification that is grasped by Occam's razor is made by holistic thinkers such as Jantsch and Capra. This opens the way for irrationalism and esotericism, which belong to the scope of ideology rather than to science.

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5
The Self-Organisation of Society[105]

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Abstract

The aim of this paper is to outline some aspects of the self-organisation of society based on a dialectical methodology. On a very general level, society can be characterised as a re-creative system: By mutual productive relationships of social structures and actors, society can based on human activity and creativity reproduce itself. Social structures are medium and outcome of social actions. This is a synchronous description. Describing society in a diachronic way, one can say that new order emerges in phases of instability and crisis. Society can also be described as the unity of different qualitative moments such as production, consumption, distribution, politics and culture because human activity results in more permanent qualitative moments. A dialectical analysis of society means to consider societal existence as a development process. Dialectics means concretisation and speculation. Hence by ascending from the abstract to the concrete (from the logic of essence to the logic of notion), we discuss the economic self-organisation cycle of capitalism. This process of capital accumulation results in the estrangement and exploitation of the human being by the human being. Capitalist society is not a naturally given pattern, but a historical system. The human being has the ability to consciously behave towards the world, hence it's possible to change the societal conditions in such a way that true, well-rounded individuality can fully unfold.

1. Introduction

In the older natural sciences one can still ignore that the topic are not only some things "on the outside", but things in "a world for us". All objects are objects of human practice. In quantum theory the neglect of the human being had to be given up and also in the concept of self-organisation humans can't simply be considered as outside observers, they must be considered as participants in the process.

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Even more obvious is the fact of participation, the impossibility of only an external position, in the scientific analysis of the societal[106] being of humans. If we took the position of only an external observer in sociology, we wouldn't be able to explain human behaviour adequately – but we also don't assume that human behaviour can only be understood by a single actor, not by others. Human life is free – but always also limited in its possibilities. There is neither absolute arbitrariness of behaviour nor absolute arbitrary interpretation of human behaviour – but the comprehension of society can't simply copy methods from the natural sciences. Also an adoption of modern concepts from the natural and general sciences which include the subject of cognition is not sufficient.
In this work we will use different approaches to the problem. The chapters 2 and 3 vary in the way that we describe society, this is done in chapter 2 according to rather traditional sociological analysis as we consider society and the relationships of individuals as object of analysis. In chapter 3 we acknowledge that also another approach is needed for the subject as an object of cognition. We accept both approaches and point out their mutual complementation. In chapter 2 we point out two possibilities of subdividing the total system of society. On the one hand society is considered as the unity of human beings or their actions (empirical concept of society in chapter 2.1) and on the other hand society is considered as the unity of different qualitative moments (society as category in chapter 2.2.). The two conceptions are connected by the fact that qualitative moments of society such as the economy, politics and culture are based on human actions and social relationships. The second conception shows that the specific definiteness of quality (that changes historically) must result in a concretisation of the various societal formations. This dialectical way of cognition "from the abstract to the concrete" opens the way to a historical approach and justifies the synchronous (systematic) and diachronic (historical) descriptions of the structure of societal systems in the subchapters 2.1.2. and 2.1.3.

2. Society as a Dialectical System

2.1. Human Action Systems – The Relationship of Society and Individuals

2.1.1 What is Society?

Various meanings can be employed for the term "society". We use it in a specific way that shall be outlined. We consider society the characterisation that delimits that which is specifically human from other organic modes of organisation. All other characteristics of the human being such as consciousness, labour as the foundation of reproduction etc. are bound to sociality. Hence we also distinguish social

[106] In this paper we make a terminological differentiation between 'social' and 'societal'. There are social animals that act instinctively together in order to achieve something, but there are no animal societies. With the term societal we refer to the (necessary) existence of the human being in society. Humans are social just like certain animals are. But they are even more than that, they are societal beings, i.e. they have the ability to consciously behave towards the world, to select from different alternative actions and to actively change the conditions of their existence which enable and constrain their choices and actions.

from societal. Social relationships and communities (Gemeinschaft) can already be found in the world of animals – but no societies in the way we employ the term.
A more specific definition of what societal being is can be given if we compare it to historically older forms of sociality which have resulted in society. We can't cover anthropogenesis in depth here (see Schlemm 2001a for more details), but we want to summarise some important points:

- Although the emergence of the human being from the animal world took many hundred thousands or million years ("animal-man-transition field"), human beings differ from their animal ancestors and other animals qualitatively. An appreciation of those qualities and abilities that animals don't have, is not a negation of the intrinsic value of other life-forms.
- Constitutive for the qualitative difference of the way of organising life has been that human beings e.g. for scavenging no longer simply used means (stick) for achieving immediately given ends (catching of a fruit on a tree), but that they also produce and preserve the means independent from immediate means, i.e. indirect precaution, production and preservation (for details on this reversal of ends and means see Holzkamp 1985, p. 173 and Zukunftswerkstatt 2002, see also Leontjew 1985, pp. 149ff[107]). Such a reversal of ends and means has (thus far?) only taken place once on planet earth, namely by the pre-human becoming human. Humans begin to distinguish themselves from animals by starting to produce their means of subsistence by which they are indirectly producing their actual material life (Marx/Engels 1846: 21).
- Marx pointed out that man like animals lives from inorganic nature, he must remain in a continuing physical dialogue with nature in order to survive. Nature can be considered as man's inorganic body in the sense that nature is "a direct means of life" and "the matter, the object, and the tool of his [man's] life activity" (Marx 1844: 516). Animals produce only their own immediate needs, "animals produce one-sidedly, whereas man produces *universally*; they produce only when immediate physical need compels them to do so, while man produces even when he is free from physical need and truly produces only in freedom from such need; they produce only themselves, while man reproduces the whole of nature; their products belong immediately to their physical bodies, while man freely confronts his own product. Animals produce only according to the standards and needs of the species to which they belong, while man is capable of producing according to the standards of every species and of applying to each object its inherent standard; hence, man also produces in accordance with the laws of beauty" (Marx 1844: 517). In the production of his life which includes the metabolism between society and nature and societal reciprocity, man as the universal, objective species-being produces an objective world (gegenständliche Welt) and reproduces nature and his species according to his purposes. "The activity of the animal is not *directed at the totality of these conditions* [of a situation], but only at certain objects of its biological needs. This is different with the human being"[108] (Leontjew 1985: 163, emphasis added). With the human being,

[107] "The animal merely *uses* external nature, and brings about changes in it simply by his presence; man by his changes makes it serve his ends, *masters* it. This is the final, essential distinction between man and other animals, and once again it is labour that brings about this distinction" (Engels 1876: 452).
[108] Translation from German

history emerges: “the more that human beings become removed from animals in the narrower sense of the word, the more they make their own history consciously, the less becomes the influence of unforeseen effects and uncontrolled forces of this history, and the more accurately does the historical result correspond to the aim laid down in advance“ (Engels 1875: 323).

- All generally known specific characteristics of the human being such as consciousness (based on a “Gnostic distance”, Holzkamp 1985: 236, towards the given), language and labour are based on this “breakage of immediacy” (“Durchbrechung der Unmittelbarkeit”; Leontjew 1987: 126; Holzkamp 1985: 193).
- With the “breakage of immediacy” emerged a new form of socially mediated activities, *the societal form of mediation of the life process*. This means for the single individual that the maintenance and development of his/her life is no longer only confined to biological processes (including the ones of societal realms), but takes place within societal structures. No human being can live without this mediation by society because his/her individual-cognitive abilities can only develop in mutual relationship with societal conditions.
- As Friedrich Engels (1875, 1876) has shown, this breakage of immediacy started with the erect posture in walking which resulted in the specialisation of the hand which implies tools, tools imply production as human activities that transform nature. A differentiation of certain bodily forms can result in other organic differentiations. The specialisation of the hand resulted in labour and the utilisation of nature. The emergence of labour and production resulted in a co-evolution of society and consciousness. The genesis of man is due to a dialectic of labour and human capabilities (hand, language, increase of brain volume, consciousnes etc.) which have resulted in developments such as hunting, stock farming, agriculture, metal processing, navigation, pottery, art, science, legislation, politics etc. Idealistic conceptions of the development of man argue that consciousness existed prior to human, societal beings, that’s e.g. the case in traditional philosophy of consciousness. Symbolic interactionism (e.g. George Herbert Mead) on the other hand has pointed out that the development of consciousness can only be explained by assuming societal interactions mediated by the usage of symbols. Both explanations are reductionistic, they assume either consciousness or society as determining the historical process. The emergence of the individual as a societal being can only be explained adequately by a dialectical co-evolution of society (especially categories such as labour and production) and human abilities.
- The specific characteristic of life maintenance in society is the “conscious, precautious disposal over common conditions of life by collective labour etc.” (Holzkamp 1985: 184)[109]. The existence of society is not an end in itself, but the maintenance of the existence of the individuals is the only sense of society.
- Society exists mediated by the activities of human beings (where it doesn’t definitely and fully determine thinking and actions – for more details see chapter 3 of this essay and Fuchs 2002a, b; Schlemm 2001c), and constitutes its own sphere that has its own logic of development (among other things by the means gaining their societal meaning independent from the single human being). This sphere can no longer be changed by the actions of single individuals directly.

[109] Translated from German

Society exist always when human beings exist, also for those and in those who don't participate in its reproduction. One can say that society reproduces itself and differs in this type of independence from immediate human actions in co-operations. Co-operations only exist as long as the process lasts and only for the participants. Part of a co-operation are only the participants, whereas part of society are also those who don't actively participate. Co-operations are a different type of emergence than society. Co-operation is always goal-directed, in society as such there is not a goal. Not only the capitalistic valorisation-machine does have a systemic character, all types of society have.

- On the societal level the fundamental possibilities of human actions and the goals of interactions and co-operation are determined – fundamental societal change can only be achieved on this level. On the societal level, human beings can consciously influence and change the conditions of their own being and development.
- The necessity of integrating individual reproduction into societal processes results in the fact that each human being itself is a *societal* individual ("societal nature of the human being", see Schlemm 2001b). There are no "humans without sociality" who are later socialised. Even the existence as single producers of commodities and as egoistic competitors is their specific societal way of existing. Individualisation does not firstly show up when individuals enter market relationships, it is a societal process (and doesn't correspond to the "nature of the human being"). Hence Marx says that societal analysis has to begin with "individuals producing in a society" (Marx 1857: 615), these individuals are "dependent and [...] belong to a larger whole" (616). He considers man as a zoon politikon (political animal) that is not only a societal animal, but an animal that can be individualised only within society. Man would be a societal being, the concept of a "solitary individual outside society" would be preposterous.
- The sociality of the human being is not a causal or functional determination, it enables and restrains his/her individuality.

Each single individual can only become a subject of its life by having possibilities of acting from which he can select certain alternatives. These *possibilities of actions are enabled by the societal form of life processes*. "From the outside" the structures and functions of society can be described just like any other system, but then one can't explain why it is not just "a large community or co-operation" or the "sum of its individuals". From the point of view of the subject the difference becomes clear: A large community or co-operation, a set of individuals, can produce synergies and if necessary it can change scopes of action – but the *existence of specific human (individual) possibilities* is due to the *societal mediation* of human life (and the communities embedded in it). Without societal embedding also an arbitrary sum of organisms couldn't live in a human way.

With this characterisation of the human being and society we deepen the understanding of what should be considered as "natural". For human beings their sociality is natural. All human beings are "naturally societal" (see Schlemm 2001b). Within the relationship unnatural/supernatural – natural the societal is part of the natural. But within nature there are qualitative differences levels which allow us a division into levels such as physical-chemical, the living and societal. In this relationship

frequently only the physical-chemical and biologically living is seen as "nature" opposed to human society. We – as dialecticians – stress the unity in which the diversity is sublated, hence also preserved. Societality is our nature. There can be no "back to nature without sociality". The mode of our sociality, the mode of the treatment of the non-societal natural "environment" can be designed in different ways. Sociality has its own momentum that is relatively autonomous from the other moments of nature. Also the other moments are in constant movement and change. "Nature is not the past"[110] (Bloch 1985: 807).
We have to take into account that the capitalistic societal formation results in a destruction of natural resources that shouldn't be tolerated. The solution to this problem is not the abandonment of appropriating nature because this would be the end of human life.
It is true for society that the single individual can only develop itself freely if all others can also develop themselves freely (although this is harmed in *certain* societal formations). This is also true for the relationship of society and nature: Society can only develop if it reasonably develops its relationship to nature – nature can only prosper if it is enriched by the forms produced in society (so called cultural landscapes).

2.1.2 The Synchronous Description of Society

There is a difference between employing words for a curtate description of empirically given phenomena and employing words as a sort of "glasses" for viewing the world (categories).
The notion of "society" first of all means thinking about human beings and imagining "all human beings together" as society. This is the empirical concept of society. Unity here is considered as a unity of many human beings and can be described in two different ways: on the one hand in its systematic structure (synchronous) and on the other hand as temporal process (diachronic). Concerning the philosophical concept of dialectic we employ, the first approach refers to the dialectical logic (logical relationships of categories) and the second to the historical logic (temporal evolution) – here still within the logic of essence[111]. We first deal with the synchronous description of society.
Sociological theories can be categorised by the way they relate structures and actors (see Fuchs/Hofkirchner/Klauninger 2002). Individualistic and subjectivistic theories consider the human being as an atom of society and society as the pure agglomeration of individual existences. Structuralistic and functionalistic theories stress the influence and constraints of societal structures on the individual and actions. Dualistic sociological theories conceive the relationship of actors and structures as independent, arguing that actors are psychological systems that don't belong to societal systems. Finally, dialectical approaches try to avoid one-sided solutions of this foundational problem of sociology and conceive the relationship of actors and structures as a mutual one.

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[110] Translated from German. „Die Natur ist kein Vorbei".
[111] For the relationship of logic of being, essence and notion see Hegel 1830I/1986, p. 179 (§83), pp. 304ff (§159); see also Schlemm 2002

Functionalist and structuralistic positions are unable to see human beings as reasoning, knowledgeable agents with practical consciousness and argue that society and institutions as subjects have needs and fulfil certain functions. This sometimes results in views of a subjectless history which is driven by forces outside the actors' existence that they are wholly unaware of. The reproduction of society is seen as something happening with mechanical inevitability through processes of which societal actors are ignorant. Functionalism and structuralism both express a naturalistic and objectivistic standpoint and emphasise the pre-eminence of the societal whole over its individual, human parts. Mechanistic forms of stucturalism reduce history to a process without a subject and historical agents to the role of supports of the structure and unconscious bearers of objective structures (Althusser).

In individualistic social theories structural concepts and constraints are rather unimportant and quite frequently sociality is reduced to individuality. There is a belief in fully autonomous consciousness without inertia. E.g. methodological individualists such as von Mises, Schumpeter and von Hayek claim that societal categories can be reduced to descriptions of the individual. "If interpretative sociologies are founded, as it were, upon an imperialism of the subject, functionalism and structuralism propose an imperialism of the social object" (Giddens 1984: 2).

In Hegelian terms, individualism reduces society to individual being-in-itself or abstract, pure-being, whereas structuralism and functionalism consider the role of the human being in society merely as being-for-another and determinate-being. Only dialectical approaches to society consider the importance of both aspects, unity as being-in-and-for-itself. Already Hegel criticised atomistic philosophies (Hegel 1830I: §§ 97, 98) by saying that they fix the One as One, the Absolute is formulated as Being-for-self, as One, and many ones. They don't see that the One and the Many are dialectically connected: the One is being-for-itself and related to itself, but this relationship only exist in relationship to others (being-for-another) and hence it is one of the Many and repulses itself. But the Many are one the same as another: each is One, or even one of the Many; they are consequently one and the same. As those to which the One is related in its act of repulsion are ones, it is in them thrown into relation with itself and hence repulsion also means attraction.

Also Marx criticised the reductionism of individualism in his critique of Max Stirner (Marx/Engels 1846: 101-438) and put against this the notion of the individual that is estranged in capitalism and that can only become a well-rounded individual in communism. Stirner says that the individual can only be free if it gets rid of dominating forces such as religion, state, and even society and humankind. He argued in favour of a "union of egoists" and stressed the superiority of the individual and the uniqueness of the ego. Societal forces would be despotic, they would limit and subordinate the ego of the individual.

Marx interposes that: 1. individualism doesn't see the necessarily societal and material interdependence of individuals and doesn't grasp their process of development because it limits itself to advise them that they should proceed from themselves. "Individuals have always and in all circumstances "proceeded *from themselves*", but since they were not *unique* in the sense of not needing any connections with one another, and since their *needs*, consequently their nature, and the method of satisfying their needs, connected them with one another (relations between the sexes, ex-

change, division of labour), they *had to* enter into relations with one another“ (Marx/Engels 1846: 423).
2. Individualism wouldn't adequately reflect the real conflicts in the world and due to an idealistic inversion of the world it would replace political praxis by moralism. Stirner wants do away with the “private individual” for the sake of the “general”, selfless man, but consciousness is separated from the individual and its existence in the real, material world. “It depends not on *consciousness,* but on *being*; not on thought, but on life; it depends on the individual's empirical development and manifestation of life, which in turn depends on the conditions obtaining in the world. If the circumstances in which the individual lives allow him only the [one]-sided development of one quality at the expense of all the rest, [If] they give him the material and time to develop only that one quality, then this individual achieves only a one-sided, crippled development. No moral preaching avails here“ (Marx/Engels 1846: 245f).
In medieval thinking individual meant inseparability and identity, it was a concept that denoted the relationship of a private human being to God (mediated by the church). An individual was defined as a fixed member of a certain group, as inseparable from its social role. The possibility of becoming something else was very limited in medieval times. The term individual was connected to the religious idea of the unity and indivisibility of the Trinity (God, Jesus, Holy Ghost). Until the 18th century the term individual was rarely used without explicit relation to the group of which it was the ultimate indivisible division. With the rise of capitalism mobility increased, at least some men could change their status. The understanding of the term individual changed and the individual was considered as being separable from its social role. With the movement against feudalism and traditional religion there was a stress on a man's personal existence over and above society. Individualism has had its rise with the emergence of modern, i.e. capitalist society and is related to ideas that have been developed during the course of the enlightenment such as a free will as well as rationally and responsible acting subjects. The enlightenment formed an integral element of the process of establishing modern society. The concept of the modern individual is also one that has been made possible by questioning religious eschatologies of an unalterable and God-given fate of humankind. The rise of this modern notion of the individual has also been interrelated with the rise of the idea of “free” entrepreneurship in market society. Freedom has been conceived in this sense as an important quality and essence of the modern individual. The idea of the modern individual can be seen as a logical consequence of the liberal-capitalist economy. According to this concept, morally responsible and autonomous personalities can develop on the basis of economical and political freedom that is guaranteed by modern society and trade is considered in a model which postulates separate individuals who decide, at some starting point, to enter economic relationships and produces a collective result due to their egoistic interests (theorem of the invisible hand). It also stresses that society guarantees individuality by removing obstacles to individual freedom and to rational and reasonable actions. In the ideology of individualism, individuality is clearly identified with following self-interest economically. Egoism and selfishness are often fetishised by assuming that they are natural characteristics of all individuals and that they emerge from rational and autonomous thinking. But it can also be argued that our modern society is

not reasonable because it does not guarantee happiness and satisfaction of all human beings, in fact these categories are only achievable for a small privileged elite.
Nowadays individuals are not only seen as owners of a free will, it is also generally assumed that this free will can be applied in order to gain ownership of material resources and capital which make it possible to realise individual freedom. So freedom is seen as something that can be gained individually by striving towards individual control of material resources. This shows that the concept of the modern individual is unseparably connected with the idea of private property. The idea of the individual as an owner has dominated the philosophical tradition from Hobbes to Hegel and still dominates philosophical ideas about the essence of mankind. But this concept could never be applied to all humans that are part of society because the majority of the world population still does not possess all these idealistically constructed aspects of freedom and autonomy, this majority is rather confronted with alienation and the disciplinary mechanisms of compulsions, coercion and domination. Hence the modern idea of the individual can be seen as an ideology that helps to legitimate modern society. The idea of already existing autonomous individuals may be a nice ideal, but nonetheless it can today be seen as nothing more than imagination and self-deception.
Besides individualism and structuralism, there is also dualism. In sociology, the main representative of the sciences of complexity is Niklas Luhmann. Luhmann argues that action-based conceptions of society are reductionistic because they reduce societal order to rational human beings and that they can't adequately explain the increasing complexity of modern society as well as emergent properties of societal systems (Luhmann 1984: 347). Luhmann wrongly infers from this that the explanation of societal relationships should neglect acting subjects. This results in a dualistic theory that due to the neglect of human subjects itself can't adequately explain the bottom-up-emergence of societal structures and the top-down-emergence of actions and behaviour.
Luhmann's theory has been criticised as deterministic one because he doesn't adequately reflect the wide contingency of societal systems that is due to the fact that action involves the realisation of one of several possibilities in a specific societal situation. Luhmann argues that self-reproduction is a necessity of a societal system that is not based on human actions (Luhmann 1984: 395, 655), conceives society in functional terms, applies Maturana's and Varela's autopoiesis-concept sociologically and sees society as a self-referential system with communications as its elements. He argues that individuals are (re)produced biologically, not permanently by the societal systems. If one wants to consider a societal system as autopoietic or self-referential, the permanent (re)production of the elements by the system is a necessary condition. Hence Luhmann says that not individuals, but communications are the elements of a societal system. A communication results in a further communication, by the permanent (re)production of communications a societal system can maintain and reproduce itself.
Luhmann can't explain how one communication can exactly produce other communications without individuals being part of the system. An autopoietic conception of society must show consistently that and how society produces its elements itself. Luhmann does not show how communications are produced, he only mentions that communications *result* in further communications. He can explain that society is

self-referential in the sense that one communication is linked to other ones, but he can't adequately explain that it is self-producing or autopoietic.
Luhmann's abandonment of the human subject in society results in functionalist descriptions that have no room for critical considerations of how society could or should be in. He says himself that he does not have an agenda of a societal problems-approach and it has been criticised that he wants to deny critical and oppositional thinking their legitimacy. Things only have to function, Luhmann sees the task of sociology in locating disfunctionalities and eliminating them. This theory is only critical in the sense that it is critical against all oppositional movements and of opposition. Warnke (1977) argues that with relativism and perspectivism Luhmann and other system theorists try to eliminate the philosophical categories totality, concrete-universal and essence and replace the dialectical-materialist demand for concretness by an abstract philosophical body. Contrary to pausing at the abstract thing-in-itself or the abstract being-for-another dialectical philosophy would be in a mediation of both in the being-in-and-for-itself which means concretisation. Luhmann's concept of a system would see a whole as something complete and finished, whereas the dialectical concept of totality would consider a whole as developing and becoming as well as an endless process of parts and wholes sublating their difference by each moment passing over into the other and again composing their difference through unity.
A consistent alternative that bridges the shortcomings of individualism, structuralism and dualism is a dialectical theory of society. By saying that societal self-organisation means the self-reproduction of a societal system, one must specify what is being reproduced. Applying the idea of self-(re)production to society means that one must explain how society produces its elements permanently. By saying that the elements are communications and not individuals as Luhmann does, one can't explain self-reproduction consistently because not communications, but human beings produce communications. One major problem of applying autopoiesis to society is that one cannot consider the individuals as components of a societal system if the latter is autopoietic. Applying autopoiesis nonetheless to society will result in subject-less theories such as the one of Luhmann that can not explain how individuals (re)produce societal structures and how their sociality is (re)produced by these structures. Another alternative would be to argue that society can reproduce itself by the biological reproduction of the individuals, but doing so will result in the neglect of the differentia specifica of society.
Neither assuming society is a self-referential communication system, nor describing society in terms of biological reproduction provides us with an adequate idea of how the self-reproduction of society takes place. Society can only be explained consistently as self-reproducing if one argues that man is a societal being and has central importance in the reproduction-process. Society reproduces man as a societal being and man produces society by socially co-ordinating human actions. Man is creator and created result of society, society and humans produce each other mutually. Such a conception of societal self-organisation acknowledges the importance of human actors in societal systems. Saying that man is creator and created result of society corresponds to Giddens' formulation that in and through their activities agents reproduce the conditions that make these activities possible (Giddens 1984: 2).

The individual is a societal, self-conscious, creative, reflective, cultural, symbols- and language-using, active natural, labouring, producing, objective, corporeal, living, real, sensuous, anticipating, visionary, imaginative, expecting, designing, cooperative, wishful, hopeful being that makes its own history and can strive towards freedom and autonomy (see Fuchs 2002f).

In the societal production of their existence, men inevitably enter into definite relations, which are partly dependent and partly independent of their will. By societal actions, societal structures are constituted and differentiated. The structure of society or a societal system is the totality of behaviours. A specific structure involves a certain regularity of societal relationships which make use of artefacts. Societal structures don't exist externally to, but only in and through agency. In societal formations such as capitalism societal structures are alienated from the human being and the human being estranges itself from the societal structures because certain groups determine the constitution and development process of these structures and exploit others for facilitating these processes. Alienated societal structures still exist only in and through agency, but some groups have privileged access to and control of these structures, whereas it is much harder for others to influence them according to their own needs and interests. Societal structures in alienated societies are an object and realm of societal struggle.

By societal interaction, new qualities and structures can emerge that cannot be reduced to the individual level. This is a process of bottom-up emergence that is called agency. Emergence in this context means the appearance of at least one new systemic quality that can not be reduced to the elements of the systems. So this quality is irreducible and it is also to a certain extent unpredictable, i.e. time, form and result of the process of emergence cannot be fully forecasted by taking a look at the elements and their interactions. Societal structures also influence individual actions and thinking. They constrain and enable actions. This is a process of top-down emergence where new individual and group properties can emerge. The whole cycle is the basic process of systemic societal self-organisation that can also be called re-creation because by permanent processes of agency and constraining/enabling a societal system can maintain and reproduce itself. It again and again creates its own unity and maintains itself. Societal structures enable and constrain societal actions as well as individuality and are a result of societal actions (which are a correlation of mutual individuality that results in sociality).

Re-creation denotes that individuals that are parts of a societal system permanently change their environment. This enables the societal system to change, maintain, adapt and reproduce itself. What is important is that the term re-creation also refers to the ability of all humans to consciously shape and create societal systems and structures, an ability that is based on self-consciousness and, in Giddens' terminology, the reflexive monitoring of action. Societal systems are re-creative ones because they can create new reality, the socio-cultural human being has the ability to create the conditions for his further evolution all by himself. Creativity means the ability to create something new that seems desirable and helps to achieve defined goals, it's a central feature of communicative action (see Fuchs/Stockinger 2002). Man can create images of the future and actively strive to make these images become societal reality. Individuals can anticipate possible future states of the world, society as it could be or as one would like it to become; and they can act according

to these anticipations. Man has ideals, visions, dreams, hopes and expectations which are based on the ability of imagination which helps him to go beyond existing society and to create alternatives for future actions. Based on creativity, man designs society: Design is a future-creating human activity that goes beyond facticity, creates visions of a desirable future and looks for a solution to existing problems. Design creates new knowledge and findings. Man designs machines, tools, theories, societal systems, physical entities, nature, organisations etc. within societal processes. Such an understanding of design as a fundamental human capability takes into account man's ability to have visions and utopias and to actively shape society according to these anticipated (possible) states of the world. It is opposed to an understanding of design as a hierarchical process and as the expert-led generation of knowledge about the world and solutions to problems. As Ernst Bloch (1986) pointed out, desires, wishes, anxieties, hopes, fantasies, imaginations play an important role in society and hence one should also stress the subjective, creative dimension in the constitution of human and societal experience. Bloch has shown that hopes and utopias are fundamental motives in all human actions and thinking. These are also important differences between animals and humans.

Terming the self-organisation of society re-creation acknowledges as outlined by Giddens the importance of the human being as a reasonable and knowledgeable actor in sociology. Giddens himself has stressed that the duality of structure has to do with re-creation: "Human social activities, like some self-reproducing items in nature, are recursive. That is to say, they are not brought into being by social actors but continually *recreated* by them via the very means whereby they express themselves as actors" (Giddens 1984: 2). Saying that society is a re-creative or self-organising system the way we do corresponds to Giddens' notion of the duality of structure[112] because the structural properties of societal systems are both medium and outcome of the practices they recursively organise and both enable and constrain actions. Societal systems and their reproduction involve conscious, creative, intentional, planned activities as well as unconscious, unintentional and unplanned consequences of activities. Both together are aspects, conditions as well as outcomes of the overall re-creation/self-reproduction of societal systems.

The mutual relationship of actions and structures is mediated by the habitus, a category that describes the totality of behaviour and thoughts of a societal group (for the importance of Pierre Bourdieu's conceptions such as the habitus for a theory of societal self-organisation see Fuchs 2002b). The habitus is neither a pure objective, nor a pure subjective structure, it means *invention* (Bourdieu 1977: 95, 1990b: 55). In society, creativity and invention always have to do with relative chance and incomplete determinism. Societal practices, interactions and relationships are very complex. The complex group behaviour of human beings is another reason why there is a degree of uncertainty of human behaviour (Bourdieu 1977: 9, 1990a: 8). Habitus *both* enables the creativity of actors and constrains ways of acting. The habitus gives orientations and limits (Bourdieu 1977: 95), it neither results in unpredictable novelty nor in a simple mechanical reproduction of initial conditionings (ibid.: 95). The habitus provides conditioned and conditional freedom (ibid.: 95),

[112] "According to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organise" (Giddens 1984: 25) and they both enable and constrain actions (26).

i.e. it is a condition for freedom, but it also conditions and limits full freedom of action. This is equal to saying that structures are medium and outcome of societal actions. Very much like Giddens, Pierre Bourdieu suggests a mutual relationship of structures and actions as the core feature of societal systems. The habitus is a property "for which and through which there is a social world" (Bourdieu 1990b: 140). This formulation is similar to saying that habitus is medium and outcome of the societal world. The habitus has to do with societal practices, it not only constrains practices, it is also a result of the creative relationships of human beings. This means that the habitus is both opus operatum (result of practices) and modus operandi (mode of practices) (Bourdieu 1977: 18, 72ff; 1990b: 52).
In the Liberal-individualistic tradition (e.g. Hobbes, Locke) the individual was postulated as an axiom and society derived from it. In the collectivist tradition (e.g. Rousseau, Hegel) one starts from society or the State and derives the individual from it. The founder of Cultural Materialism Raymond Williams (1961) says that there must be mediating terms between individual and society such as relationships, class, association or community in order to avoid reductionism. Erich Fromm suggested the mediating term 'social character', in anthropology one speaks of a 'pattern of culture'. Bourdieu's concept of the habitus is also a mediating category, Williams already pointed out implicitly the necessity of the notion of the habitus at the beginning of the 1960ies. Williams wants to avoid both an absolute totalisation of society and the individual. He considers the individual as a societal being and each individual as unique. "The conscious differences between individuals arise in the social process. To begin with, individuals have varying innate potentialities, and thus receive social influence in varying ways. Further, even if there is a common 'social character' or 'culture pattern', each individual's social history, his actual network of relationships, is in fact unique" (Williams 1961: 74). The individual is unique for Williams due to a particular heredity expressed in a particular history. Society is not a uniform object, individuals enter various groups and hence Williams says that due to the fact that the individual encounters tensions, conflict as well as co-operation in these relationships and as a result of the interactions in groups and between them, new directions emerge in society. Williams distinguishes several types of individuals: members, subjects, servants, rebels/revolutionaries, reformers, critics, exiles, vagrants and self-exiles/internal émigre[113]. We would need such descriptions in order to get past the impasse of the simple distinction between conformity and non-conformity. For Williams these forms are forms of active organisation (action, interaction), he considers the relationship of the individual and society as a complicated embodiment of a wide area of real relationships where certain forms may be more influencing than others. Society would not just act upon the individual, but also many unique individuals through a process of communication create the organisation by which they will continue to be shaped. The uniqueness of the individual is "creative as well as created: new forms can flow from this particular form, and extend in the whole organization, which is in any case being constantly renewed and changed as unique individuals inherit and continue it" (Wil-

[113] "To the member, society is his own community. […] To the servant, society is an establishment, in which he finds his place. To the subject, society is an imposed system, in which his place is determined. To the rebel. a particular society is a tyranny; the alternative for which he fights is a new and better society. To the exile, society is beyond him, but may change. To the vagrant, society is a name for other people, who are in his way or who can be used" (Williams 1961: 81).

liams 1961: 82). The relationships individuals enter are creative, social change and emergent properties result from it, and these resultant patterns create, i.e. enable and constrains, the individual's history of thinking and actions. Williams' concepts corresponds to (and in fact anticipated) the reflexive categories of Giddens and Bourdieu. Saying that the uniqueness of the individual is creative and created complies with Giddens' formulation that in and through their activities agents reproduce the conditions that make these activities possible as well as to Bourdieu's formulation that habitus provides conditioned and conditional freedom and is a property for which and through which there is a social world. "If man is essentially a learning, creating and communicating being, the only social organization adequate to his nature is a participatory democracy, in which all of us, as unique individuals, learn, communicate and control. Any lesser, restrictive system is simply wasteful of our true resources; in wasting individuals, by shutting them out from effective participation, it is damaging our true common process" (Williams 1961: 83).

In modern sociology, Pierre Bourdieu and Anthony Giddens have devoted their work to bridging the traditional, strict oppositions between subjectivity/objectivity, society/individual, structures/action and consciousness/unconsciousness dialectically. They both want to solve the problem of relating societal structures and actions dialectically. Bourdieu has introduced the dialectical concept of the habitus that mediates between objective structures and subjective, practical aspects of existence. The habitus secures conditioned and conditional freedom, it is a structured and structuring structure that mediates the dialectical relationship of the individual and society. For Bourdieu, in the societal world we find dialectical relationships of objective structures and the cognitive/motivational structures, of objectification and embodiment, of incorporation of externalities and externalisation of internalities, of diversity and homogeneity, of society and the individual and of chance and necessity. Bourdieu's suggestion that the habitus is a property for which and through which there is a social world means that habitus is medium and outcome of the societal world and that societal structures can only exist in and through practices. Such formulations very much remind us of Giddens' main hypothesis that the structural properties of societal systems are both the medium and the outcome of the practices that constitute those systems. Although Bourdieu's theory might be considered a more "structuralistic" conception than Giddens', the similarities concerning aims and certain theoretical contents are very striking and aspects from both theories can enhance a theory of societal self-organisation (see Fuchs 2002a, b).

The notion of the re-creation of society suggest a *dialectical* relationship of structures and actors. Saying this, one should clarify why exactly this is a dialectical relationship. Georg Wilhelm Friedrich Hegel has outlined that the purpose of dialectics is "to study things in their own being and movement and thus to demonstrate the finitude of the partial categories of understanding" (Hegel 1830I: Note to §81). The dialectical method "serves to show that every abstract proposition of understanding, taken precisely as it is given, naturally veers round its opposite" (ibid.). The negative constitutes the genuine dialectical moment (Hegel 1830I: §68), "opposites [...] contain contradiction in so far as they are, in the same respect, negatively related to one another or *sublate each other* and are *indifferent* to one another" (ibid.: §960) Opposites, therefore, contain contradiction in so far as they are, in the same respect, negatively related to one another or *sublate each other* and are *indif-*

ferent to one another. But the negative is just as much positive (§62). The result of Dialectic is positive, it has a definite content as the negation of certain specific propositions which are contained in the result (§82).
An entity as pure being is an identity, an abstract empty being. Being is dialectically opposed to Nothing, the unity of the two is Becoming. In Becoming, Being and Nothing are sublated into a unity. This unity as result is Determinate Being which can be characterised by quality and reality. Quality is Being-for-another because in determinate being there is an element of negation involved that is at first wrapped up and only comes to the front in Being-for-self. Something is only what it is in its relationship to another, but by the negation of the negation this something incorporates the other into itself. The dialectical movement involves two moments that negate each other, a somewhat and an another. As a result of the negation of the negation, "Something becomes an other; this other is itself somewhat; therefore it likewise becomes an other, and so on ad infinitum" (§93). Being-for-self or the negation of the negation means that somewhat becomes an other, but this again is a new somewhat that is opposed to an other and as a synthesis results again in an other and therefore it follows that something in its passage into other only joins with itself, it is *self-related* (§95). In becoming there are two moments (Hegel 1812: §176-179): coming-to-be and ceasing-to-be: by sublation, i.e. negation of the negation, being passes over into nothing, it ceases to be, but something new shows up, is coming to be. What is sublated (aufgehoben) is on the one hand ceases to be and is put to an end, but on the other hand it is preserved and maintained (ibid.: §185).
In society, structures and actors are two opposing moments: a structure is a somewhat opposed to an other, i.e. actors; and an actor is also a somewhat opposed to an other, i.e. structures. The becoming[114] of society is its permanent dialectical movement, the re-creation or self-reproduction of society. The Being-for-self or negation of the negation in society means that something societal becomes an other societal which is again a societal somewhat and it likewise becomes an other societal, and so an ad infinitum. Something societal refers to aspects of a societal system such as structures or actions, in the dialectical movement these two societal moments in their passage become an other societal moment and therefore join with themselves, they are self-related. The permanent collapse and fusion of the relationship of structures and actors results in new, *emergent* properties or qualities of society that can't be reduced to the underlying moments. In the re-creation-process of society, there is coming-to-be of new structural and individual properties and ceasing-to-be of certain old properties. "Becoming is an unstable unrest which settles into a stable result" (Hegel 1812: §180). Such stable results are the emergent properties of society.
In respect to Hegel, the term *societal self-organisation* also gains meaning in the sense that by the dialectical process where structures are medium and outcome of societal actions a societal somewhat is self-related or self-referential in the sense of joining with itself or producing itself. By dialectical movement, societal categories opposing each other (structures and actions) produce new societal categories. A societal something is opposed to an societal other and by sublation they both fuse into a unity with emergent societal properties. This unity is again a societal somewhat opposed to a societal other etc. By coming-to-be and ceasing-to-be of societal entities, new societal entities are produced in the dialectical societal process.

[114] We don't mean the temporal becoming, but the systematic-logic one.

For Marx the individual is of great importance in his social analysis, not as an isolated atom, but as a societal being that is the constitutive part of qualitative moments of society and has a concrete and historical existence. “The first premise of all human history is, of course, the existence of living human individuals“ (Marx/Engels 1846: 20). He considers the individual in its abstract being-for-self, its connectedness to others and its estrangement in modern, capitalist society. The individual as a societal, producing being (“individuals co-operating in definite kinds of labour“) results in phenomena such as modes of life, increase of population (family), forms of intercourse (Verkehrsformen), separation of town and country, forms of politics (nation state), division of labour, forms of ownership (tribal ownership, ancient communal and State ownership, feudal or estate property (feudal landed property, corporative movable property, capital invested in manufacture), capital as pure private property), production of ideas, notions and consciousness. For Marx, a certain mode of production is combined with a certain mode of co-operation (ibid.: 30) and the history of humanity is closely connected to the history of the economy. Opposing the atomism of Max Stirner and Bruno Bauer, Marx writes that the “individuals certainly make one another, physically and mentally, but do not make themselves“ (ibid.: 37).

In the *German Ideology* (Marx/Engels 1846), Marx speaks of societal relationships as forms of intercourse, whereas he later replaced this term by the one of relationships of production. He says that with the development of the productive forces, the form of intercourse becomes a fetter and in place of it a new one is put which corresponds to the more developed productive forces and hence “to the advanced mode of the self-activity of individuals” – a form which in its turn becomes a fetter and is then replaced by another etc. The history of the forms of intercourse would be the history of the productive forces and hence the history of the development of the forces of the individuals themselves (ibid.: 72).

Marx considers man in the *Economic and Philosophical Manuscripts* (Marx 1844) as an universal, objective species-being that produces and objective world and reproduces nature and his species according to his purposes. Human beings are societal beings, they enter societal relationships which are mutually dependent actions that make sense for the acting subjects. Individual being is only possible as societal being, societal being (the species-life of man) is only possible as a relationship of individual existences. This dialectic of individual and societal being (which roughly corresponds to the one of individual and societal existence or of actors and structures) was already pointed out by Marx: “The individual *is the social being.* His manifestations of life – even if they may not appear in the direct form of communal manifestations of life carried out in association with others – are therefore an expression and confirmation of *social life.* Man's individual and species-life are not *different,* however much – and this is inevitable – the mode of existence of the individual is a more *particular* or more general mode of the life of the species, or the life of the species is a more *particular* or more general individual life“ (Marx 1844: 538f). Marx said one must avoid postulating society again as an abstraction *vis-à-vis* the individual as e.g. today individual/society-dualism does. “Man, much as he may therefore be a *particular* individual (and it is precisely his particularity which makes him an individual, and a real *individual* social being), is just as much the *totality* – the ideal totality – the subjective existence of imagined and experienced society for

itself; just as he exists also in the real world both as awareness and real enjoyment of social existence, and as a totality of human manifestation of life“ (ibid.). Saying that man is creator and created result of society as well as that in and through their activities agents reproduce the conditions that make these activities possible, corresponds to Marx' formulation that “the social character is the general character of the whole movement: just as society itself produces man as man, so is society produced by him“ (ibid.: 537).

Up until now we have only considered the systematic aspect of the self-reproduction of society as a whole towards its parts. It is also an important question how these systematic relationships develop temporally. We will have different results depending on which approach we choose: one that is based on concepts of self-organisation and systems theory, or one that is based on a historical-concrete analysis of societal forms.

2.1.3 The Diachronic Description of Society

Society is not a static state, but a permanently self-maintaining and self-renewing process. In a first approximation, a living organism can be used as an analogy for this process. The living is characterised by self-maintenance: “We recognise that a dispensing order has the power to maintain itself and to produce ordered processes”[115] (Schrödinger 1987: 74). The individuals however are in this concept only indifferent against each other, the parts are not defined as inner qualitative difference to each other (Hegel 1830II/1986: 373, § 343 corollary). Such a neglect of the individual distinctiveness as subjects of society is connected to the point of view which tries to primarily describe the identical self-reproduction of society. Such descriptions can mainly be found in old systems theory (1st order cybernetics) which are based on equilibrium theories (e.g. the social systems theory of Talcott Parsons). The concept of autopoiesis, which not accidentally stems from biology, is transferred by one of its main proponents, Humberto Maturana, to society, whereas Francisco Varela opposes such an application. Also the newer concepts of self-organisation stress first the emergence of systematic wholes from interactions of their parts. Self-organisation as “irreversible process which results from the co-operative interaction of subsystems in complex structures of the whole system”[116] (Ebeling/Feistel 1986) or as synergetics where a “cyclical causality” (Haken) between whole and parts is assumed, correspond to this idea. However the concepts of self-organisation have new potentialities: they refer to qualitative changes. As “new systems theory” they also refer to the unpredictability of structural breaks. Maybe not accidentally this thinking has become modern at the time when the limits of steering in the manner of the “welfare state” first showed up (see Müller 1992: 343). These concepts which are based on non-equilibrium, non-linearity and the existence of fluctuations, show at least the inappropriateness of the old equilibrium models and are meanwhile also used in economics and management theory. However, most of the existing concepts of economic self-organisation legitimise neo-liberal politics by arguing that human beings can't at all intervene into the capitalist economy in

[115] Translated from German
[116] Translated from German

order to solve social problems and that hence market-based regulation will do best (see Fuchs 2002g). That this is not the case is clear due to the worsening of the global problems in the last two decades of neo-liberal politics in the world system.
A number of authors have tried to conceive sociological models in analogy to Ilya Prigogine's abstract principle of order through fluctuation. They see society as a system where not equilibrium and stability is the normal state, but non-equilibrium and instability. Modern society is described as process-like and evolving through phases of crisis and instability.
Ervin Laszlo (1987) argues that Prigogine's principle is a general one that applies for the evolution of all complex systems, also for society. According to this hypothesis systems do not remain stabile, if certain parameters are crossed, instabilities emerge. These are phases of transition where the system shows high entropy and high degrees of indetermination, chance and chaos. Evolution does not take place continuously, but in sudden, discontinuous leaps. After a phase of stability a system enters a phase of instability, fluctuations intensify and spread out. In this chaotic state, the development of the system is not determined, it is only determined that one of several possible alternatives will be realised. Such points in evolution are called catastrophic bifurcation (Laszlo 1987, Schlemm 1999, Fuchs 2002c, d). In a very abstact form we can say: It is determined that this evolutionary process will sooner or later result in a large societal crisis, but it is not fully determined which antagonisms will cause the crisis and how the result of the crisis will look like. There can be no certainty, the sciences and hence also the social sciences are confronted with an end of certainties (Wallerstein 1997). There could e.g. be the emergence of a new mode of development, the ultimate breakdown of society due to destructive forces or the emergence of a new formation of society caused by social agency of intervening subjects. If a certain threshold in the development of concretely existing antagonisms is crossed, a new, not pre-determined quality will emerge. This is what Hegel has discussed as the measure or the turn from quantity into quality (Hegel 1830I: §§107f).
Arguing only abstractly doesn't take into account the different qualities of societal formations[117]. In one or the other manner the first humans organised themselves and this organisation dissolved, somehow large city states, the Greek republic, Asiatic nomads, capitalism, actually existing "socialism" organised themselves. We need also more concrete analyses which are not only abstract-general, but also don't simply list the sum of all observations and singular phenomena.

2.2 Society as the Unity of Different Qualitative Systems

For such an approach dialectical-speculative thinking is needed[118]. Whereas in usual thinking (within the logic of essence) a starting point is considered as being already given/posited and further implications are deduced, in dialectical-speculative thinking (within the logic of notion) the posited (das Gesetzte) must be given grounds for

[117] Concerning the critique of an absolutised abstract view see Schlemm (1999: 25f), Schlemm (2001d: 17f).
[118] Whereas the "pure" dialectical is the transition of one moment into its opposed moment and the other way round, i.e. it creates nothing new (Hegel 1830I/1986: 172 (§81)), the "speculative-dialectical" in Hegel's philosophy means that this movement leads to a higher unity (Hegel 1830I/1986: 176 (§82)).

and hence all thinking must be integrated into a context of justification and mediation.

We distinguish an abstract generality ("humanity") from a concrete generality[119] where we are referring to concrete societal formations. On such a concrete level, one can qualitatively describe the mediations which determine the development of the societal formation in question. We want to outline this shortly for the concrete-historical societal formation of capitalism:

First we have to distinguish different societal spheres, such as production, consumption, distribution, politics, culture, etc. In society all spheres are mediated – in order to know later what is concretely mediated with each other, the single moments must also be analysed separately. We here concentrate on the capitalist economy. Like in all societal formations, goods are produced in capitalism that satisfy human needs. The specific ways this is done distinguish different societal formation. In capitalism the production process is based on the fact that single economic actors produce goods which are sold on the market after their production in order to achieve a profit that allows re-investment, more production, more selling, again more profit etc. Marx called this process the accumulation of (money and commodity) capital. Capitalist production doesn't satisfy immediate needs (as was e.g. the case in the production of the medieval craftsman), but each capitalist is in need of the so-called "anonymous market" for the socialisation of the products. That the single capitalist enterprise produces in an isolated way, is of course not something biologically given, but a societal relationship. Marx is speaking of private labour that produces commodities. Another foundation of capitalism has been the detachment of the means of production from the workers. Marx is speaking of "double free wage-labour", the workers don't own the means of production and the produced goods and they are forced to sell their labour power (Marx 1867: 181-183). Wage labour and the industrial division of labour (which has been enabled by machine technologies, Marx speaks of machine-systems, large industry or the co-operation of many similar machines that are powered by a motor mechanism such as the steam engine, see Marx 1867: chapter 13) are necessary conditions for the full development of capital accumulation.

On this foundation a functional circle takes place (according to Fuchs 2000): The capitalist buys with his money (M) the commodities (C) labour power (L) and means of production (Mp) (these two commodity types are separated – in another societal formation without the same base the cycle of production takes place in another way). The means of production are considered in their value form as constant capital (c) and can be subdivided into circulating constant capital (the value of the utilised raw materials, auxiliary materials, operating supply items and semi-finished products) and fixed constant capital (the value of the utilised machines, buildings and equipment) (Marx 1885: chapter 8). The value of the employed labour power is termed variable capital (v). Constant capital is transfused to the product, but it doesn't create new value. Only living labour increases value – labour produces more value than it needs for its own reproduction. In production due to the effects of living labour onto the object of labour surplus value (s) is produced. The value of a produced commodity C' = c + v + m, this value is larger than the value of the in-

[119] See Schlemm (1997/1998)

vested capital (C = c + v). The difference of C' and C (Δw) can exist due to the production of surplus value and is itself surplus value. Surplus value is transformed into profit (surplus value is "realised") and value into money capital by selling the produced commodities on the market. It is not sure if all produced commodities can be sold, hence not all surplus value is necessarily transformed into profit. But normally after the whole process there is more money capital than has been invested into production, and such "surplus value generating money" is termed "capital" and is partly re-invested into new production (accumulation).

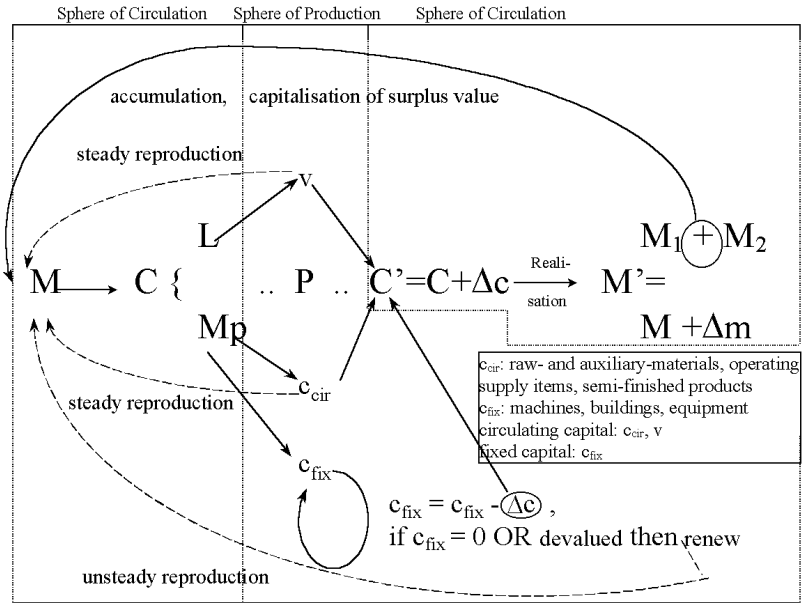

Fig. 1.: The economic self-organisation of capital: The expanded reproduction cycle of capital

Whereas in all societies humans produce, the way they do this is typically different in different societal formations. It's a false inference to generalise the form of production just described as something that is typical for all types of societies. In reality this is not and doesn't have to be the case. There are again at least two approaches: We can positively describe how the expanded reproduction of capital (and the reproduction of the economic base of society) takes place. This would mean to assume the positing of its moments (e.g. labour as private labour of isolated producers that is socialised by the market after production and the separation of the main means of production and labour power) and to not further question the moments. There would simply be capital, the production of commodities, the selling of labour power etc., but it wouldn't be argued why that's historically the case and how this capitalist situation could change or be overcome. Or we can question from where these moments come from, whether they can be changed, i.e. if they have developed historically and can be sublated. Or we analyse the foundations of the existence of these conditions and hence also the possibility of changing these conditions.
Both approaches are scientific – the first form corresponds to a positive science of the given (e.g. of the political economy of capitalism), the second is critique (e.g. as the critique of the political economy of capitalism). These forms represent typical

examples for Hegel's logic of essence and logic of notion. In capitalism these relationships are especially confusing: The driving power of production are not the needs of the humans, but the "need of capital" to increase itself ("Everything must be profitable!", "Capital is shy like a roe deer – where it can't make profit, it won't invest"). In capitalism goods are only produced because they are a means to generate surplus value and profit – and possibilities to avoid production and to increase capital nonetheless are welcome (stock-market!). It seems like capital is the "subject of development" itself, it turns itself loose and dominates and coins all human relationships. In its different forms such as money it becomes a fetish which can't simply be shrug off as an illusion, but exists as "necessary appearance" as long as the foundations which can only be recognised by the second form of thinking (critique, logic of notion) are given. Something abstract, not concrete needs and concrete actions determine social life! Such a "real abstraction" can induce one to use as methodology an abstract level such as systems theories that remain purely abstract. Such theories in fact map real relationships (the "necessary appearance") of this society, that's why they are very convincing. Theories of self-organisation even map the internal states of crisis and hence can be used to avert and abandon political and political-economical intervention that is necessary for realising social and ecological interests. An analysis whether crises are only crises of renewal or which perspectives of sublation there are, is only possible in a concrete-general manner by researching the concrete qualitative moments of capitalist development (for the relationship of crisis theory and self-organisation theory and a concrete analysis of Fordist and post-Fordist capitalism as well as the societal crisis of Fordism see Fuchs 2002g).

3. Human Individuality in Society

3.1 Particularities of Human Society

The reproduction of society – due to its systemic character – as a whole is independent from the contributions of single individuals. The system, society, is in need of enough active human actions, this mass of actions depends on the human being as such, but not on any particular individual. Its open for the single individual, if, how and to which extent s/he takes concretely part in the reproduction of society. The human individual is not an "element functioning in order to keep up the self-maintenance of the system", the system can exist independently from the contribution of each special individual, but not independently from the contributions of a certain mass of human beings.

We have to change our perspective here. Seen from the point of view of society, there must somehow be enough contribution from the human beings. From the point of view of the individual, it is not necessary to do specific things now and today. What is *necessary* for the system as a whole, is only a *possibility* of action for the individual. The individuals doesn't have to "function" for the whole, s/he rather can *consciously* behave towards the possibilities.

This conscious behaviour towards something means that he can recognise that he is not just a powerless gear-wheel of a large gear unit, but that he can disassociate

himself from the immediate at least in his thoughts. He can recognise that society as a whole must reproduce itself through the contributions of all humans, but that his own contribution is at his own discretion. That he can do that doesn't man that each human being is doing or should do that all the time. Human beings have the capabilities and possibilities for doing so. And that is indeed very much. In each concrete society, certain options are suggested to the individual, such suggestions can more or less be connected with coercion. Nonetheless the human being has the possibility to dissociate from the given at least notionally.
Each human being is born into a historical situation and social structures which have their own laws. That s/he is human means that s/he doesn't simply have to obey these conditions blindly, but that s/he can consciously relate to these conditions. Hence s/he is always one step ahead of all determinateness (see Holzkamp 1985: 355). Human freedom is not only characterised by the decline of conditionality, such a definition of freedom would be a pure negative one. "Conscious behaviour towards the world" unfolds its own *justifications* that can't be explained by external conditions, but originate subjectively. Free action is not determined by external conditions – but is also not arbitrary. The reasons are only subjectively insightful and can never be observed "from the outside".

3.2 Sociology as Science of the Subject

There are different approaches for analysing individuality in society. One of them is Critical Psychology that is a "Marxistically based science of the subject" (Holzkamp). Its scope includes

a. Methodological foundations for an integration of the individual into social thinking, connectivity to Marxism
b. Knowledge from the science of the individual

Conscious action is in need of the analysis of given conditions and possibilities as well as the development of its own goals. Due to the fact that each individual and the whole human civilisation are embedded into an environment, one must take a closer look at the mutual relationships. Frequently the relationships are reduced to one level or one direction. One has always to take into account the plurality of mediations. "Because the dialectical totalisation must comprise the actions, passions, labour and needs, it must at the same time integrate the actor as well as the event into the historical context, define him in relationship to the direction of becoming and must exactly determine the meaning of the presence"[120] (Sartre 1999: 144).
Very problematically is the fact that human beings produce their conditions of life and at the same time exist under these conditions. This mutuality complicates all methods which aim at understanding and influencing human behaviour (ones own behaviour or the behaviour of others). Also Karl Marx deal with this dialectic.
Marx has shown that the analysis of the individual must be one of the analysis of its historical and present conditions of life. So e.g. in the *German Ideology* and the *Economic and Philosophical Manuscripts* which are important works for the Marxist concept of the individual, Marx speaks on the one hand generally about the individual (as a producing, societal being etc.), and on the other hand takes a look at the

[120] Translated from German.

qualitative moments of society that at present influence the life of the individuals. In this analysis the concept of the alienation of the individual in modern society is important. So Marx on the one hand is interested in the general reproduction of society, on the other he describes the capitalist mode of reproduction as one that is based on alienation, exploitation, heteronomy and a lack of self-determination of the human being.

Marx points out that with the division of labour a contradiction between the interest of the separate individual and the communal interest of all individuals who have intercourse with one another emerged. As long activity is not voluntarily, but naturally, divided, man's own deed would become an alien power opposed to him, which enslaves him instead of being controlled by him (Marx/Engels 1846: 33f). Heteronomy for Marx means that there are forces such as the state, labour relationships or the world market which are imposed on the individuals as an interest "alien" to them and are independent of them. This would result in an illusionary representations of “general“ interest as in the form of the state. Thus far during history, the individuals would have become more and more enslaved under a power alien to them (ibid.: 37). Capitalism means the subsuming of the single individuals under the division of labour (ibid.: 54). Estranged labour would “turns man’s species-being [...]into a being alien to him and a means of his individual existence. It estranges man from his own body, from nature as it exists outside him, from his spiritual essence, his human existence“ (Marx 1844: 517). Man’s estrangement from the product of his labour, his life activity and his species-being, would result in the estrangement of man from man.

Also the productive forces would be a world for themselves, independent and divorced from the individuals because the individuals would exist in class opposition to each other and these forces would no longer be the forces of the individuals but of private property and of the individuals only insofar as they are owners of private property (Marx/Engels 1846: 67). The individuals robbed of these forces would only be abstract individuals. In capitalism the individual is not a real individual, but only a *class individual* (ibid.: 76) subsumed under exploitative and alienating forces.

A true appropriation of the forces of production would be the development of the individual capacities corresponding to the material instruments of production and the development of a totality of capacities in the individuals themselves (ibid.: 67f). This would mean the development of individuals into complete individuals and the transformation of labour into self-activity which corresponds to the transformation of the earlier limited intercourse into the intercourse of individuals as such (ibid.: 68). Individuals would have to subject the material powers to themselves and abolish the division of labour in order to be free individuals. This personal freedom would only be possible in the community, in capitalism the individual wouldn’t have been part of a real community, only of illusionary communities existing outside of them and enslaving them. “In a real community the individuals obtain their freedom in and through their association“ (ibid.: 74). This real community would be the “reintegration or return of man to himself, the transcendence of human self-estrangement“, “the *positive* transcendence of *private property* as *human self-estrangement,* and therefore as the real *appropriation* of the *human* essence by and

for man“ and “the complete return of man to himself as a *social* (i.e., human) being“ (Marx 1844: 536).

Thus far we have not accomplished to transcend the current societal order that is built upon heteronomy, estrangement and exploitation in order to ascend towards the highest form of societal self-organisation that is based on self-determination, inclusion, co-operation and participation. As Marcuse pointed out, a society that allows true individuality to be established in a free manner can only be established by self-determined individuals: ”The individuals who shall live in the *Great Society* must be the ones who build it up – they must be free for it, before they can be free in it. No other power can impose or force their society upon them” (Marcuse 1966: 187). In a free society the individuals’ consciousness of their mutual relations will have completely changed.

A self-determined society would be one in which consists of structures which allow all individuals which are effected by a problem to have the same power to determine and design the occurrence, form, course and results of the constitution and differentiation of societal structures. A symmetric distribution of power in terms of resources and access to information, co-operation, inclusiveness, solidarity instead of competition and as well as a form of socialisation that enables individuals to establish a form of compatibility and satisfaction of their own interests and collective, societal ones would be necessary. Under radically changes societal conditions, collective societal intelligence (Fuchs/Stockinger 2002) could emerge. Compatibility of individual and collective interests means that each individual on the one side has a maximum of freedom that does not influence the freedom of others as well as collective societal interests negatively. Free development of everyone is a necessary condition for the free development of all as well as freedom of all is a necessary condition for freedom of the individual.

Individual and collective interests could be compatible without interfering negatively, egoism is not a "natural" pattern of behaviour that is given by birth or encoded in the genes, it rather comes into existence by processes of socialisation in a heteronomous system.

In a free type of society, there would be another type of individuality. This his been pointed out by Marx and Engels with their concept of the comprehensive and well-rounded individual (in German *allseitiges Individuum*) that is free and has enough free time in order to pursue different activities. They thought that in another society the free development of individual abilities will replace the submission of the individual to the division of labour. So individuals would be free to choose between different non-alienating activities they want to perform.

”People will no longer be, as they are today, subordinated to a single branch of production, bound to it, exploited by it; they will no longer develop one of their faculties at the expense of all others; they will no longer know only one branch, or one branch of a single branch, of production as a whole. [...] Industry controlled by society as a whole, and operated according to a plan, presupposes well-rounded human beings, their faculties developed in balanced fashion, able to see the system of production in its entirety. The form of the division of labour which makes one a peasant, another a cobbler, a third a factory worker, a fourth a stock-market operator, has already been underminded by machinery and will completely disappear. Education will enable young people quickly to familiarize themselves with the

whole system of production and to pass from one branch of production to another in response to the needs of society or their own inclinations. It will, therefore, free them from the one-sided character which the present-day division of labor impresses upon every individual. Communist society will, in this way, make it possible for its members to put their comprehensively developed faculties to full use" (Engels 1847). In the German Ideology Marx mentions that "private property can be abolished only on condition of an all-round development of individuals, precisely because the existing form of intercourse and the existing productive forces are all-embracing and only individuals that are developing in an all-round fashion can appropriate them, i.e., can turn them into free manifestations of their lives" (Marx/Engels 1846: 424).
A well-rounded individual no longer has a particular, exclusive sphere of activity, which is forced upon him and from which he can't escape. In a free association "nobody has one exclusive sphere of activity but each can become accomplished in any branch he wishes, society regulates the general production and thus makes it possible for me to do one thing today and another tomorrow, to hunt in the morning, fish in the afternoon, rear cattle in the evening, criticise after dinner, just as I have a mind, without ever becoming hunter, fisherman, herdsman or critic" (ibid.: 33).

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6
Different types of thinking about different things
- Part I -

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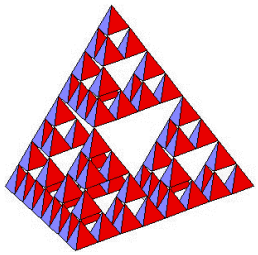
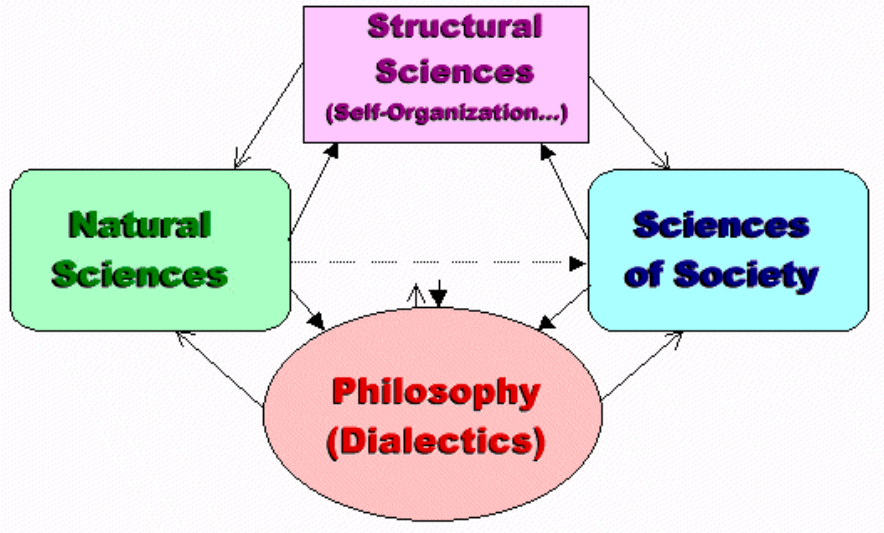


1. Introduction

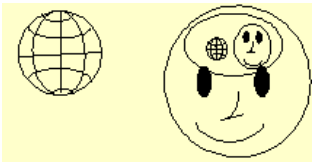
I have worked with the problem of self-organization for more than 15 years. I came from the philosophy of physics and found that the concept of self-organization could be useful for the philosophy of society, too. I found that the abstract form of the conceptions of self-organization allows finding many parallels between different real objects and their connections and evolution. But I also found that such a parallel, such an analogy is not enough to explain something in its own connections. I saw that the abstract thinking in concept of self-organization helps to find new ideas. But I know that the meaning of philosophy is not to find more and more abstract concepts.

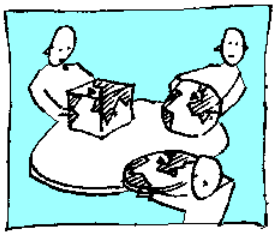


It took a long time for me to get a sense, in which way philosophy differs from other abstract theories. I began to get an idea of the special quality of philosophy by reading Fichte, Schelling and Hegel.
Now I know that it is a philosophical tradition to differentiate between several types of thinking (abstract and concrete, understanding="Verstand" and reason="Vernunft" and so on) and I would like to represent typical types which may be useful for our project.

2. The Onto-Epistemic precondition

We are parts of an infinite totality. We can't grasp it in its infinity; we can't even grasp the whole totality of one thing. Therefore our cognition depends on abstractions. We have the ability to abstract in several forms (Schlemm 2000). We can take out something which is invariant in changes, we can go from Particular to Universals, and we can take out essential characteristics and so on.
Therefore all our cognition is not a "copy of the whole world", it differs from the world, because it is OUR cognition. The philosophy of science has known the active role of the subject since Hume and Kant.



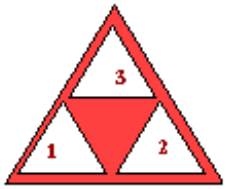


But I think, radical constructivists carry this role too far. If all reality would be only an individual subjective construction, we couldn't live in the same world. Today a modern, maybe better post-modern tolerance wants to prevent us from searching such a "totalitarian" thing like truth. Yes, there is no "absolute truth", the absolute identity of thoughts and world. But we are not imprisoned in a "brain in a tank", we have the possibility to recognize the world, to see its phenomena, to interact with its processes and to understand their structures and laws better and better.

Because there is no reliable ground for a conditionless beginning, neither in an external world itself nor in our thinking, we have to use a system of concepts, which justify themselves in a specific way.

3. Hegel's System

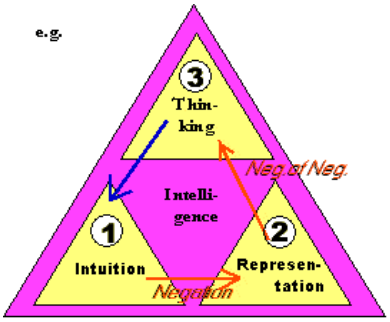
Hegel determines all the concepts, the notions by their relations to each other. Therefore there are no "first definitions", "first axioms" or so on. No concept is the basis – all concepts need all the other concepts to understand their meaning. If we begin with the concept "Being" like Hegel in its Logic, we need to know the whole system to understand, why the development of the concept "Being" goes further through "Nothing" to "Becoming" and so on. Each concept turns out to be the whole process of its development.
It is very hard to grasp, but we can make some hints for understanding. I found such a hint in the Websites "www.hegel-system.de" and will use it in this essay.



We can look at the development of one concept (or notion, or category): It begins with the simple identity of a thought. This simple identity will be the number "1" in our triangle. We will get the determination of "1" if we ask: "What is it?".

But when we want to ask "Why is it?" we get the answer: Its characteristics are given by other things in its environment – Or: Its characteristics are given by the parts (or the relations of the parts) of the whole. Or: At first we see the immediate appearances (what?) and search the essence (why?) of them. Now we have the Identity *and* the Others – and the Others are in difference or contradiction to the simple identity. Now we get the difference, the "Other" in the inner triangle number "2". It is the *negation* of "1". But the "1" and the "2" cannot stay in eternal contradiction. The contradiction means, that they have something common (otherwise the "2" would not be the Other of the "1" – they would have nothing to do with each other). There is some unity of 1 and 2 – it is their Identity 3. In Identity 3 the Identity 1 founds itself negated twice (*Negation of Negation*). The identiy (3) contains *its* contradiction now and is more developed, *more concrete* then the simple identity. It is the famous *"Identity of the Identity and Difference".* It is typical for the state "3", that it never is a static thing, but it is always a developing process. There is an interesting difference between 2 and 3. 2 and 3 are different answers of the question "Why is 1?". They are different types of "grounds" of 1. One ground is the stable essence (its "laws") and the other, the deeper and more concrete ground is its evolution-coherence (the connection/Context of its evolution). 1,2 and 3 are now moments of a higher process.
The transition to 3 can be justified only by solving contradictions in a right way (whatever this "right" means) and the possibility to deduce all determinations of 2 and 1 from 3 (this is related with the problem of validity in philosophy of science).

I want to show one example of such a development:



If we analyse the concept "intelligence" (=theoretical mind), we have to take into consideration the three moments "Intuition /Intelligent Perception" (="Anschauung"), "Representation /Mental Idea" (="Vorstellung") and "Thinking" (=Denken). Intelligent Perception is the immediate feeling mind, the cognition of forms like the mind perceives them in their objective form.

In our Mental Idea we can imagine several connections between the forms, but they are only subjective imaginations. If the mind recognises the "right" connections, the real inner connections of the object, it reaches the Thought. (We know that Hegel's objects were only "Sachen", and "Sachen" are objects, which are not differing from their notions.) In thoughts objectivity and subjectivity are united. And now we can come back to other Intelligent Perceptions but they will change with our thoughts. Hegel said:

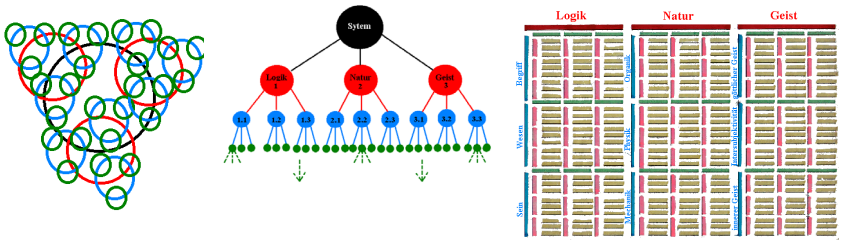
> "Only by education the mind attention will gain strength and fulfilment… A highly educated person immediately has a complete notion of anything presented…" (Hegel Enc.III, S. 250, § 448 n). („Erst durch die Bildung des Geistes bekommt die Aufmerksamkeit Stärke und Erfüllung... Ein Mensch von ... großer Bildung hat sogleich eine vollständige Anschauung des Vorliegenden...")

Or:

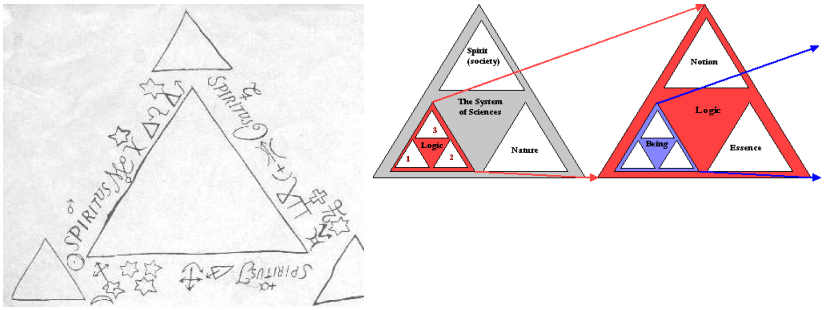
> "In Experience everything depends upon the mind we bring to bear upon actuality. A great mind is great in its experience; and in the motley play of phenomena at once perceives the point of real significance. The genius of a Goethe, for example, looking into nature or history, has great experiences, catches sight of the living principle, and gives expression to it."
> (Bei der Erfahrung kommt es darauf an, mit welchem Sinn man an die Wirklichkeit geht. Ein großer Sinn macht große Erfahrungen und erblickt in dem bunten Spiel der Erscheinung das, worauf es ankommt. Die Idee ist vorhanden und wirklich, nicht etwas da drüben und hinten. Der große Sinn, wie z. B. der eines Goethe, der in die Natur oder in die Geschichte blickt, macht große Erfahrungen, erblickt das Vernünftige und spricht es aus. (Enz. I, § 24, Zusatz 3, 3. Satz))

This *onto-epistemic circularity* is never abolished (although Hegel's linear writing needs a beginning point).

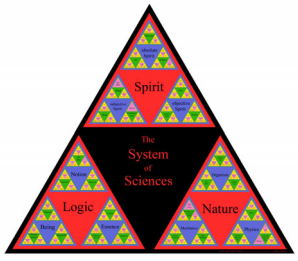
In this way (determined negation and negation of negation) Hegel develops all concepts of philosophy. Hegel speaks about the "rhythm" of the spirit (Hegel VLRel, S. 65). And as we know: If one used one simple rule to develop her/his thing in a non-linear process- she/he will get a fractal. Therefore the system of Hegelian categories looks like fractals:



Hegel himself used the figure of a triangle and therefore I will use it to explain one of the most important aspects of Hegelian thinking. Hegel himself spoke about „circle of circles" (Hegel, WdL II, S. 570-571; Enz. I S. 59, § 15) and a "diamond-like net" (Hegel Enz.II, S. 20, § 246 Zusatz). Bloch spoke about a "World-net", a "weaved-weavening plan of the world" (SO, S. 173). Bloch also remarked, that Hegel's System is an En-kyklo-paidia ("In-Kreis-Lehre" / "within-circle-doctrine") it its best sense (SO, S. 184). This System is an "In-one-another (Ineinander) of dynamics and static at least", which is grounded in the "In-one-another of capitalism and feudal standstill" in the days of Hegel (ebd.). Incidentally: Hegel wasn't successful in doing the system. With his fire he could not built a sphere – as Bloch said (ebd., S. 187) …



4. The three logics of Hegel



If we look at the first triangle in his whole system, we will find the "Logic". Here Hegel models a theory of recognition; he makes models of typical forms of thinking. (It is not fully correct: Hegel himself worked out that the development of thinking is identical with the process of the things, of the "Sachen" their selves).

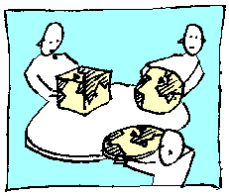
I think, to know the forms if thinking is useful for us to access in which form of "logic" we are in certain moments of our work. Sometimes we misinterpret each other, because one's thinking is located in one logic but the other in another logic.
Hegel distinguished three types of logical objects: Objects of Being, Objects of Essence and Objects of Notion. These objects require different types of thinking: the Logic of Being, the Logic of Essence and the Logic of Notion.
At first I will tell you a story I think, you might already know:

4.1.I Logic of Being

Some blind people meet and speak about their perceptions. One of them says: I feel a long hose with grooves. The other says: But I feel a cord with tassels. But the third insists that he feels a wall. They are within the logic of Being.

- *single, isolated phenomenon*
- *simple identity in its immediacy*

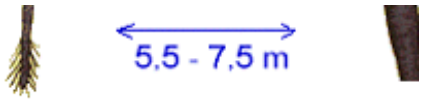
→ Quarrell of opinions



In this logic the object is given as a single, isolated phenomenon. We see its simple identity in its immediacy. We get the answer of the question: "What is it?"- but the answer will not be a qualitative determination yet. In our immediate perception we merely feel an "It" without enough qualitative determination.
Many people can exchange their opinions (doxa) about their perceptions in this logic. But it is a meaningless quarrel. The best way within this logic is the tolerant indifference…
But our thinking doesn't want do stay at this point. We ask, in which way the perceptions are connected. This is a first form of asking, "*Why* is it?"
(I want to remark that the relation between "What" and "Why" in this sense is kindred with the relation of "daß" and "was" in Bloch's Experimentum Mundi.)

4.2.I Logic of Essence

The question about the connection of the perceptions leads us to the next type of logic, the logic of essence. The simple identity is situated among other objects and within relations to them. It turns out to have an inner structure.
In our example the three people find out, that the hose and the cord are located always in a distance of 5.50 to 7.5 metres. Other people tell them, that their hoses and cords have other distances. And our people notice, that much things change – the location of their objects and so on, but the distance is always the same. They recognise, that the distance of 5.5 to 7.5 metres is essentially for their object and the connection of their object.



- *abstract laws of essential connections*

It depends on an inner structure of their connection. Maybe they invent a new science of hoses and cords and walls and they are able to find laws. If the law will be: "The distance of cord and hose is always 5.5 to 7.5 metres" and if they know the location of one object, they can explain it and predict the location of the other object.
The philosophy of sciences has a problem now: How can such laws be justified? Are laws the sum of all immediate perceptions (within the Logic of Being)? If we assume, that laws are simple generalisations of "facts", we get the problem of induction. We know, that the generalisation of scientific laws need a type of necessity, but no philosopher of science knows, what type of necessity it is. Formal necessity is not enough, now they are speaking about: "natural necessity", but this doesn't solve the problem.
I think, we can understand what a scientific law is only, if we understand the distinction between the logic of being and the logic of essence. Essence is not only "more inductive generalisation", it is another qualitative level of cognition. And essence has no own existence outside the appearances – it is a special (namely a necessary) universal *within* the things of the world.
We have to remember that essence in Hegel's Logic is not the stable, eternal "substance" ore the middle-age-"essence". Essence is determined as "ground for existence" and in relation to its appearance. In comparison to the "concrete phenomenon" as appearance the essence is a very abstract entity.
Okay, now we have reached the most important content of science. Maybe this is the end. Is it the end of cognition, when we know the abstract laws of essential connections?

4.3.I Logic of Notion

It is very useful, to go from the abstract "back" to the concrete. We have now to understand the concrete object in its necessary connections and to build upon this knowledge its right notion. The three blind people detect, that they spoke about an "elephant" all the time. The Notion unites the essence and the appearance. We can't grasp the notion abstractly! We need an other form of concreteness, we can't speak about "animals", but a concrete-universal "Elephant".

"I am an elephant!"

If we got the notion, we understand the phenomena's in a new way. We know the meaning of them. We know, that the hose is the trunk of the elephant, that the wall is its body and the cord is the tail. The knowledge of the right notion allows us to explain the function of the parts of the whole, to deduce more about them. We get a new type of answer to our question: "Why is it?". The answer is not an abstract law, but the understanding of concrete connections.
We get a new "concrete", which is different from the fist concrete isolated appearances in the logic of Being. It is a universal-concrete, a totality.
Okay, this was our first circle through the rhythm of Hegel's Logic.
The next circle uses the given explanations and goes deeper in our understanding.

4.1.II Logic of Being

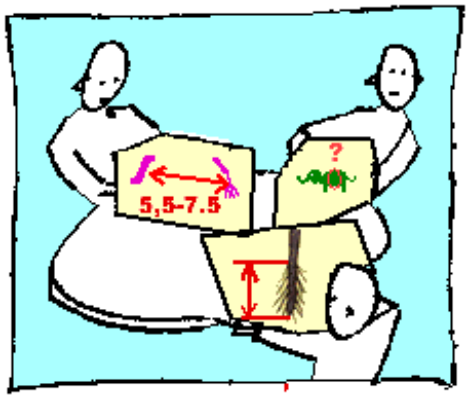
The Logic of Being is the dominant logic in all positivistic models of science. The positivistic science tries to begin with immediate given particulars and to stay within the Logic of Being. Positivist scientists refuse the "metaphysics of essence". Also in positive political economy and in "vulgar Marxism" dominates the "simple acceptation of the immediately given (that is to say: empirical) social structure" (Lukács 1923/2000, S. 176). Other scientists try to criticise such a "dogma of the given" and remind of Kant's emphasizing of the spontaneity of the mind (Mc Dowell 2000). But they have no notion of the logic of essence.
Hegel resolves (sublates) this logic in the further argumentation, but it is also preserved. He discusses this phase of cognition in his work "Phenomenology of Mind" it its transition to the understanding of the essence. At first the perception gets abstract information about sensation. The perception doesn't know, "what" was the cause of the sensations. It is an abstract "It" ("Es", see Bloch EM, S. 39). But we can distinguish several things (Ding) with several characteristics. Such a thing contains a contradiction: The thing is an Identity against its environment or against its parts. But in its characteristics it is diversity at the same time. One thing has many qualitative determinations. What is the identity of them?

We can see now, how the essence of the thing produces all appearing characteristics - No, we can not "see" it !- this identity in the essence only can be thought, the essence is not an object of perception.

4.2.II Logic of Essence

At a deeper level of cognition we find the logic of essence. This level is connected with the activity of the understanding (Verstand).
The understanding (Verstand) is able to abstract from appearances and to reconstruct the essential inner relations of the object in a way that no formal contradiction obstructs the scientific work. Within different qualities some qualities, which can be taken as equivalent, are selected. In physics Newton defined mass, velocity and other measuring values ("Meßgrößen") in such a way that the dialectic contradiction

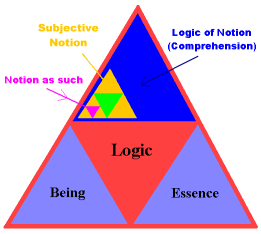
of motion is prevented (Wahsner 1993/1996). Different moments of motion have to be separated in such a way that measurement and physical experience become possible. The understanding (Verstand) has the tendency to make things from relations (reification =”Verdinglichung”) and to separate the abstract essence and their appearances. Understanding (Verstand) tries to imagine the connections. We remember: In Logic of being the Intelligent Perception (Anschauung) dominates, in Logic of essence the Representation (or Mental Idea) (Vorstellung) dominates. Thinking in this logic is mainly positing and external reflection. This two forms are within the Logic of Essence – they have an relationship of exteriority (Äußerlichkeit), not yet mediation (Vermittlung).



Therefore in this logic there are interchangeable *models* from different perspectives. One emphasizes the relation of the distance of trunk and tail, the other emphasizes the girth of the body and others the length of the legs and other laws. But they don’t speak about the foundation of all their laws.

If we want to understand the logic of essence in a better way, it may be useful to look at the logic of notion. Later we will see the differences and understand both in a better way.

4.3.II Logic of Notion



I read Ernst Bloch’s Experimentum Mundi and compared it with Hegel’s Logic of notion. In Hegels Logic the “notion” exists twice. At first it exists as the “notion as such” (Hegel WdL II, S. 345) or the “abstract notion” (Blunden 2001) and secondly as the whole notion. I think the first “notion” corresponds to Bloch’s precept (“Ergriff”). Such a notion is a single determined notion (WdL II, S. 273). The “notion as such” *is not yet* the whole notion!

Maybe the translation “comprehension” for this “whole notion” is better – I found it in on translation of Hegel into English in the Internet.

Hegel wrote:

> “Now although it is true that the Notion is to be regarded, not merely as a subjective presupposition but as the absolute foundation, yet it can be so only in so far as it has made itself the foundation. Abstract immediacy is no doubt a first; yet in so far as it is abstract it is, on the contrary mediated, and therefore if it is to be grasped in its truth its foundation must be first sought.” (German: WdL II, S. 245, Translation from Internet)
> (Ob nun wohl der Begriff nicht nur als eine subjektive Voraussetzung, sondern als absolute Grundlage anzusehen ist, so kann er dies doch nicht sein, als insofern er sich zur Grundlage gemacht hat. Das abstrakt Unmittelbare ist wohl ein Erstes; als dies Abstrakte ist es aber vielmehr ein Vermitteltes, von dem also, wenn es in seiner Wahrheit gefasst werden soll, seine Grundlage erst zu suchen ist.“)

This foundation will be the whole Notion. The first, single determined notion turns out to be merely an issue of the Logic of notion, the part “subjective notion”, in which judgements and conclusions take place. The “whole” Notion is the Totality, which results from the interactions (through mediation) from the sphere of essence (WdL II, S. 251). The Essence turns out to be the (relative stable) manifestation of the Notion and the notion generates its own logic, which differs form the logic of the essence.

“**notion** as such”	(Logic of) **notion**
• A single determined notion (within subjective logic)	• Totality, which results from the interactions from the sphere of essence and sets its own moments

Because Hegel took the way through his circles before he wrote his books, he knew the way. In principle the way can be thought as open.

Now to some characteristics of a whole notion, of the logic of notion. The most important difference to the logic of essence is the

- Concreteness and the
- (logical) Historicity, or better: the connection of (logical) development. (We have to distinguish between logical and historical development, see Schlemm 2002).

Here the famous *“ascending from the abstract to the historical-concrete whole/universal”* has to take place. The highest notion it the system of Hegel is the absolute spirit, given in the philosophy of Hegel. I think, this doesn’t say that all

development is ready, the system is closed. If we pay enough attention to the notion of the notion we know that each notion is development itself. But it is not a random development, it needs relative destinations like “Heimat”, “Utopia” or “hope” and I think that the meaning of an Hegelian notion can be understood as equivalent to draft (“Entwurf”).
To think the notion as an evolving concrete-universal totality we need our reason (Vernunft), which is not identical with understanding (Verstand).
I want to say more about these characteristics later (Part II).
I’m interested in different ways of thinking, in types of thinking, which we often use, without knowing that the used type may look up us within a limited area. To go beyond the pure logic of essence corresponds for instance with the principle of the Existentialists, that the existence will be *before* essence. I think, they do not mean that immediate, isolated existence is the very first – but the existence of a developing coherence/connection is the deeper reality (“Vermittlung” said Sartre) against the pure essence.
I want to remind that the differentiation of three types of logic corresponds to different types of reflection. Christian used the first two in his papers about society.

<table>
<tr><td colspan="2">Logic of Essence

external reflection:

Universal/whole (found)

Particular/parts (given)

reflektierende Urteilskraft

positing reflection:

Universal/whole (is given)

Particular/parts (subordinated)

(Kant:
- bestimmende Urteilskraft)</td><td>Transition to → Logic of Notion
Hegel:
Unity of external and positing reflection:
→ determining reflection (bestimmende Reflexion)
Contradiction:
To have the Being in an Other
→ notion as evolving</td></tr>
<tr><td>Luhmann</td><td>Habermas</td><td>Hegel, Marx</td></tr>
<tr><td>simple form of value

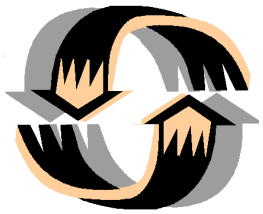
World of Commodities
Acts of Exchanche</td><td>unfold form of value

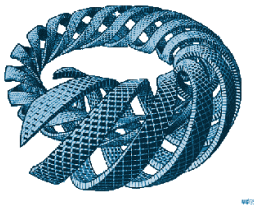
Value Magnitude
Exchange</td><td>universal form of value
Capital + Surplus Value
Capital
Commodity</td></tr>
</table>

	→ **Capital** is the right notion to explain bourgeois society and its evolution.

If we deduce the universal from the particular or the particular from the universal – we are still in the logic of essence. Both are in a relation of exteriority. The relation is a stable one. But if we take into account evolution, the emergence of New, we need another logic, a logic of mediation.
If we explain the world with systems, which are reproduce itself in an eternal Autopoiesis, we use the logic of essence – but if we are interested in Self-Organization of Emergence, we need the logic of Notion. Otherwise we don't may be very useful.

Logic of Essence	**Logic of Notion**
stable selfreproduction of systems Autopoiesis	evolution of systems Self-Organization with Emergence





I think this is enough for today. I will continue with the distinction of different types of systems (within the three logics) and some application in several sciences.

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7
Remarks on:
The Post-non-classical Paradigm: Overcoming the Science/Humanities Dichotomy
(by Yuriy Myelkow)

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I would like to add some remarks, which are derived from my works about philosophy of science. You can read about it (Schlemm 2004a).
Yuriy and me, we have different starting points. Yuriy emphasises the differences of classical and non-classical/post-non-classical sciences. But I'm working on more general features of all single sciences (and than we may ask, if sciences like self organisation or synergetics differ or not). Differences between them become later important, but I think we need a basic understanding what means "science" before.

1.

I try to differ between "world view" (Weltanschauung) and science at all. It is not the purpose of the science, to show us the world "like it really is". Each science has its objects. All objects are not really parts of our world. All objects are more or less idealised ("more or less" distinguishes different forms of science like classical – non-classical and post-non-classical). But even objects of post-non-classical science are not the real things of our world!

2. What is the difference?

In the real world there are dialectical contradictions. The world is a unity of contradicting parts. (I use a dialectical world view, not an analytic one, which is based on Bertrand Russells refusal of dialectics! see Russell 1992 and Russell 2001).

2.1. Science doesn't catch the real dialectic

In one question Russell is right: All our sciences don't deal with dialectical contradictions! Boiling of water is not a really dialectical contradiction (because its source is not in itself). Duality of particle and wave aspects of quantum objects is not a dialectical contradiction, too (because it is the consequence of the impossibility to describe quantum objects with classical terms, not a contradiction in the quantum object itself. It is an antinomy of problems in the evolution of science (Narski 1973), but not an objective dialectic contradiction. You can see this easily if you take into consideration that dialectic contradictions are sources of development, but where is

development in particle-wave-dualism?). Yes, our sciences approach dialectical behaviour of objects more and more. But we may never say: Now our science reaches the real dialectics! Maybe you can say: post-non-classical sciences are more dialectical than classical or non-classical. But nevertheless they are not the world itself, they are models of the world, which necessarily reduce dialectics in a certain way.
An important question is, how we may describe dialectics or "tracks" of it with our scientific means. Normally our mathematics excludes to describe dialectics. Mathematics is based on nondialectic identities". To include "tracks" of dialectics by means of differential calculus does not mean, that we got complete dialectics within mathematics and science! Maybe new mathematical means like theory of graphs or mathematics of new mathematic objects like "categories" (Zimmermann 2004) may change this situation.

2.2. Means of cognition

Mathematics is only one of our means of cognition. If we consider science we have to take into consideration that cognition is not only a relationship between subjects and objects but that it is mediated by means of cognition. It becomes more clear it you consider cognition as one form of working. Work needs subjects of work, objects of work and means of work. In the same way cognition needs and uses means of cognition. Not only scientific devices are such means of cognition, but also our mathematical knowledge, our models of space and time and so on. No scientific theory is based only on "events". Each theory is based on and uses certain means of cognition too. In my paper (Schlemm 2004a) I quoted your sentence: "The way we see reality is the way *we see* reality" (Myelkow 2003: 82). This is a consequence of using means of cognition like the discussed epistemological presuppositions.
More about the science-immanent dualism of objects and means of cognition and the consequences about measurable quantities you can read in my paper.
Because of these immanent limitations of science it is different to "world views" themselves. If we want a dialectic world view, we may use a non-dialectic science, we don't need a "dialectic science"! To understand the dialectic of the world we have to take into consideration our acting as human beings into our worldview! Dialectic is not inside the formulas of scientific laws, it is in the scientific acting of human beings!

3. What is the purpose of science?

The purpose of science is to show us, how to act in the world. It shows as the *possibilities* to act. Therefore science is interested more in possibilities (and in actuality, which contains its possibilities) than in reality of events. Scientific *laws* don't describe the factual world, how it is, but give us an overview about *possibilities* (or capacities, see Cartwright 1989, Laitko 1979: 84). The object of sciences is the changeability of parts of the worlds in our practice.
In our practice there are different spheres. In some spheres it is sufficient to use classical mechanics to act within possibilities of mechanical moving. Than also

"classical" science is dialectical enough for our acting. In other spheres it will be helpful to use other theories or sciences. Maybe universal properties are more interesting, like treated in theory of self-organisation – we can describe more complex behaviour, but now we lose the concrete sources of evolution… (see Schlemm 2004a). We see once more: Science outside of our concrete acting is neither dialectic nor non-dialectic. Neither classical, nor non-classical, nor post-non-classical.

*

And now to your paper about Overcoming the Science-Humanity-Dichotomy:

a) You wrote that "under the contemporary scientific paradigm,… the classical dichotomy of science and humanities becomes obsolete" (p.1). I think it was obsolete all the time. It was an inappropriate view on relationship of science and mankind.
Your sentence means that under the classical scientific paradigm the dichotomy was right. But I don't think so. Also famous "classical mechanics" is a right model of our world, if we take into consideration the legitimacy of its limitations. Only when we forget the limitations and make this model to an absolute world view (like Voltaire did), we produce problems which lead to such an dichotomy (incidentally: If we forget the limitations of our new sciences we will produce the same problems!).
I would like to suggest a differentiation in the formulation (maybe in a footnote with quotation):
If we speak about paradigm, we have to differ between the scientific theory which is necessarily based on certain epistemological presuppositions (like the Newtonian theory of classical mechanics) and a world view, which is derived from that theory (like the Voltairian generalisation of that theory to a universal world view) (see Schlemm 2004a).

b) "The truth… had to be objective, that is, independent of anything human." (p.1). Already Kant knew that this is a misconception. I think our new answer has to deal with the means of cognition. And than we can assess, how in formerly times people took this into consideration or not. I think, the assessment of non-classical and post-non-classical sciences (p.2) will fit to such a consideration: cognition is a relationship with objects, subjects and means. If one moment is changed, all moments will change (because of the dialectic of the process). Other objects need other means (and abilities and so on of subjects), new means approach new objects by changed subjects and so on. For each stage of science (classical, non-classical, post-non-classical) we can discuss the relationship of all moments and their mutually changeability. Of course in development the relationship becomes more and more complicated and the dialectic in formerly stages is more hidden, but never abandoned.

c) I'm glad that you are so near to my own opinion about science as work/practice (p.3). I think, all considerations with synergy and so on (p.3) may win if we take into consideration the means of cognition. There is no immediate connection of subjects and objects. V. Ivanov wrote about "sensual objective activity". In German I would use "gegenständlich" (maybe "bodily")[121]. In science we don't deal with in-

[121] or objective sensuousness (gegenständliche Sinnlichkeit)

dividual senses - but with a bodily practice. Maybe it is important to add that subject of cognition is not an individual but humankind. And individuals as societal[122] beings.
The means of cognitions are the mediation between subjects and objects: They are consciously developed by subjects on the basis of the possibilities (capacities) of nature.
All quarrel between idealists and naïve realists comes from a confusion. Idealists/subjectivists knock the means of cognition down to subjects and forget the limitations of nature and naïve realists knock the means of cognition down to the objects and forget the activity of subjects.

d) The problem of "objectivity". I think we have to differ between "reality" and "actuality". "Reality" means given facts (without changeability) – but "actuality" is more interested in possibilities of change. In political sciences the difference in the interests is obviously! In think, in natural sciences the difference is not so obviously. But we can differ between merely instrumental changeability or a conscious co-evolution of non-alienated humankind an nature (the "Naturallianz" of Ernst Bloch!, see Schlemm 2004b).

e) The Circle of M. Boulatov: I would suggest to add, that these model is only an analytical one, not a reconstruction of a real process of cognition.
I would begin with another point: the world an me united – than differentiation: me as subject and world, which I (not as isolated individual, but as part of mankind) want to recognize and than: how I'm building means of cognition to do that…. All parts of these process are "objective" in a certain sense…

f) "subjectivity" (p.6) – Do you know the dissertation of Karl Marx? There he deals with the "subjectivity" in the work of Epicurus (who tried to grasp self-consciousness as subjectivity and to find it also in nature as "declination").

g) "Science is now to study the singular as well as the general." (p.8). The dialectic unity of singular and general is the concrete-universal in Hegelian terms! I found that in GDR Camilla Warnke (Warnke 1977) used that notion in theory of society. And than I asked why it wasn't used in philosophy of nature. I got no answer. I found that philosophy of nature remained in "logic of essence" (Hegel, see Schlemm 2002). Now our task is: to develop a philosophy of nature in a "logic of notion". (Hegel tried it, but he didn't know enough about natural science, esp. its foundation in epistemological presuppositions). I think such a philosophy of nature will be united with philosophy of society, because it deals with sciences of nature as human practice.

h) Absolutizing universality by Hegel (p.10).

[122] „There are social animals that act instinctively together in order to achieve something, but there are no animal societies. With the term societal we refer to the (necessary) existence of the human being in society. Humans are social just like certain animals are. But they are even more than that, they are societal beings, i.e. they have the ability to consciously behave towards the world, to select from different alternative actions and to actively change the conditions of their existence which enable and constrain their choices and actions." (Fuchs, Schlemm 2003)

1. I don't think that Hegel himself absolutesed the universality. His notion of universality was a unity of a manifold of contradicting, different moments (in difference to Schelling, who underestimated the differences!).

2. Yes, "abstract/concrete are not features of correspondingly thinking/perception" – and Hegel didn't think so! Hegel saw abstract and concrete moments in all forms of recognition… (see esp. his "phenomenology").
"Hegelian universal …is the only real, and the singular is just its self-alienation" – yes, if the singular is absolutised!, but NO, if the singular is a moment of the universal. In Hegelian terms the concrete-universal is more real than the abstract-general! I don't see any difference to Hegel himself! The interpretation of "pan-logical system" is not adequate to Hegel himself! (There are a lot of discussions among Hegelians about this topic. Mostly of them who studied Hegel (and not only his critics are interpreting the "totality" of Hegel in such a sense like your quotation of Ilyenkow. All of the Hegelian work was to overcome the merely "Verstand", "Wesenslogik", "abstract universal" and so on, therefore it is nonsense to interpret his work as merely such an universal.
Maybe we can reduce the assessment of Hegel by a limitation of "some interpretations of the Hegelian system" with a footnote which explains, that there are different interpretations…

i) Absolutizing singularity (p.11)
The most modern people who absolutise singularity are the "post-modern" people, I assume. existentialists like Sartre are not necessary such absolutisers. It is an old-marxist critic on existentialism, but it doesn't get the point! As far as I know Sartre, he developed a very complex theory of relationships between individuals and groups and society at all (Sartre 1980). In his biographical work about Flaubert he showed that dialectic (Sartre 1979).
Here also a footnote may help to overcome one-sidedness with respect to Sartre. Maybe it is better to refer to contemporary post-modernists.

j) "inner feelings and beliefs" (p.15)
I assume, we have to take into consideration that these inner feelings and beliefs are also (not only) depending on societal relationships. If society is alienated, our feelings and beliefs are alienated too! And it needs hard work (but it is possible!) to overcome this alienation by consciousness! (and organising other social relationships to strengthen our experience with non-alienated relationships).

And last but not least:
I think, the unity of science and humanities will not be found in a new science or in a new paradigm. It will be found in a certain practice (or: in a science *as* practice…). (It leads to practical philosophy: A united practice needs non-alienated conditions and relations, needs another form of society!… And this society will need and produce new forms of science and paradigms…Maybe we can built germs of them (society and science and paradigm…).

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8
Overcoming Classical Dichotomies of Science vs. Humanities

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§1. Synergetic Bridge between Science and Humanities

Modern scientific revolution, connected with becoming of non-linear science, is estimated as one of four global scientific revolutions of New Time (Stepin, 1989). Globality of the revolution changes presuggests revision of the whole system of foundations of science. It means that the philosophical foundations of scientific world picture and methodological norms of scientific investigations undergo essential changes.

In contrast to previous scientific world pictures the initial points of synergetic (nonlinear) world picture are processes, changes, emergence of new wholes – all that characterizes the self-organization in nonlinear non-equilibrium mediums. Stability, which was a base of foregoing scientific world pictures, is also present in the synergetic world picture. However, here it is relative dynamic stability of dissipative structures or transitive stability of complex fractal systems, forming in frontier areas, where different attractors of deterministic chaos concur. In any case the stability connects with cooperative coordinated motion of plenty elements of medium. This motion can be characterized with a few parameters of order. Even if behavior of such parameter becomes chaotic, collective motion, coupled with it, preserves the coordination of elements (Haken, 2000). Nonlinear dynamic of parameters of order regularly can be described by simple iteration formulas, which often represent the solutions of nonlinear equations.

In such a way the remarkable option originates for relatively simple scientific description of systems, which are complex in principle. Together with it the computer revolution creates powerful means for realization of computative methods to solve the nonlinear equations, for computational experiments and computer simulation as methods to describe the complex systems of different nature.

How much different the nature of such complex systems could be? In other words, how much different could be the subject areas of synergetic investigations? So much, that they leave the frames of traditional subjects of natural scientific disciplines and the natural science at all.

This way a gap between sciences and humanities is overcoming, so as a gap between science of the animate and science of inanimate nature. It is happening due to emergence of general scientific methods for description of peculiarities seemed to be typical only for the alive and for the human beings and their societies. We mean the ability for self-organization and self-development for irreversible choice of alternates in bifurcation points on the evolution ways, the becoming of a new whole. Synergetics regards such properties as typical for all of self-organizing systems, even if they are the inanimate objects, natural or technical.

The importance of such overcoming shows itself not only as a progression of scientific understanding of life and society. There are the systems, for which the very division of the human, natural, artificial is rather problematic. They are so called human-dimensional systems: ecological, technical, economical and the most human-dimensional of all – the human being her/himself in all variety of her/his attributes: anthropological, psychological, cognitive. Many disciplines are needed for investigations of such systems; so far cooperation of specialists requests the coordination of different disciplinary methodological approaches. It is not so simple oftentimes. Transdisciplinary synergetic approach avoids these difficulties. The very possibility to come from the same philosophical foundations and methodological norms is hard to overestimate here. These foundations of non-linear science have, however, to be clarified to serve as a bridge, not as a barrier.

In fact, traditional epistemological opposition of essence and existence does not work in post-nonclassical science anymore, so as the identification of essence with set of linear laws. It changes the understanding of many methodological norms, in particular, of description, explanation and prediction as functions of theoretical knowledge in its relation with empirical data. (Dobronravova, 2004)

However, the changes in philosophical foundations of science not always have only cognitive importance. Some of them have the great practical consequences, taking into account that human actions depend on the knowledge of their circumstances so far as on moral values of actors. And here could be a place for one more use of synergetic bridge between science and humanities. We mean especially synergetic changes in the understanding of such important idea for human activity as causality.

In non-linear area Laplasian determinism does not work anymore. It means, the avoiding of a threat of fatalism. In nonlinear area human actions, which are negligible by energetic consumption, but take place in right time and right place, can define the choice of further way of complex systems, which existence is set up by giant flows of energy and matter. It extends the human abilities, but the responsibility for wrong choice increases. That why the right understanding of causality in special points of nonlinear processes is heuristic so much.

Consideration of bifurcation points in nonlinear dynamics as situations of emergence of effective causes (Dobronravova, 1990) gives the opportunity to comprehend a role of human actions in such situations. Effective causes emerge in bifurcation points on the ground of non-linearity due to choice by chance one of alternate variants. The set of the variants is pre-suggested by the whole situation of nonlinear dynamic. So far as this situation of choice is very non-equilibrium and sensitive to small influences, such influences are the conditions defined one or other variant of self-organization.

Thus the role of human action is to create the conditions for choice of the favorable alternative. If favorable alternative is absent, people must try to avoid the non-linearity as ground of self-organization (in chemical industry, for example, it is enough to limit size of reservoirs sometimes) or to avoid the worst consequences of self-organization (to warn the possible victims of avalanches in mountains, for instance).

In nonlinear area moral choice often come from the practical domain of choice of actions in situation clarified by cognitive efforts, in cognitive field itself. Live organisms, ecological systems, social situations are typical objects of postnonclassical nonlinear science. They are far-from-equilibrium open sensitive systems, the influence on which with the aim of the scientific researches can change their further destiny. The well known instances are medical diagnostic methods, dangerous for human health: X-rays, nuclear tomography and so on. Publication of sociological data can define results of elections, wrong methods of calculation of rare animals can destroy their population. So moral choice became the part of cognitive practices. It was admitted by few philosophers of science (Putnam, 1990, Stepin, 1989).

Once again synergetics became a bridge between theoretical knowledge of nature (including the human nature) and practical philosophy. Application of synergetic methods for understanding of human actions in complex interfacing of cognition and self-cognition, education and manipulation, objectivity and subjectivity makes the opportunity to interpret the cognitive process as a process of self-organization. It could be regarded in objective way as in evolutionary epistemology (Knyazeva, Kurdyumov, 1994) or from the point of view of transcendental empiricism (Svirsky, 2004). In the last case becoming of transcendental foundations of experience is regarded in the process of its unfolding in computational experiment. Then instead of contradiction of subject and object the becoming of observer is considered and the description of self-organizing reality itself regards as a result of the process of self-organization.

Certainly, the above mentioned approaches do not exhaust the ways to comprehend the synergetic strategies of human activity, including the cognitive one. Surely, synergetics does not give the ready-made formula for all the cases, it does not exist at all in area of moral choice and moral responsibility. But nowadays, when collective responsibility is actualized, a good will must be completed for rational discussing of complex problems by the type of rationality, adequate to their complexity. It is postnonclassical type of rationality, elaborated mostly on the base of synergetic methodology.

However, there is a kind of paradoxical circle in attempts to use the postnonclassical rationality as a base for moral choice in situation of collective responsibility. Vyacheslav Stepin showed (Stepin, 1989), that objective knowledge in postnonclassical science is relative to values of cognizing subjects, like it is relative to means of observation in nonclassical science. It is especially understandable for such objects of postnonclassical science, as human-dimensional systems: social, ecological, psychological.

Synergetic models, elaborated for self-organizing natural systems, can serve as a good base for rational scientific description of the self-organizing human-dimensional systems. However the application of synergetic models in humanitarian

area does not guarantee the overcoming of traditional dichotomy between sciences and humanities. Such overcoming requires clarifications of some foundations for the dichotomy in question. Those foundations are divided into three groups: ontological (and epistemological), methodological, and axiological foundations for strict categorial distinction between science and humanities in their classically acclaimed opposition.

§2. Onto-epistemological Foundations. Human vs. Nature.

The first major point for opposing science to humanities is based on ontological considerations as for their *object* of study. Sciences are natural sciences, while humanities (or humanitarian sciences), as it is evident already from their naming, are sciences that have human as their prime and sole object of interest. The human / nature (or culture / nature) opposition not only implied ontological distinction of the two worlds, but was also reflected in the epistemological area as the opposition of subject and object. In turn, that constituted the ideal of classical science. Everything related to subject (to human) was to be exterminated out of scientific knowledge. The Truth, as the main goal of scientific activity, had to be *objective*, that is, independent of anything human or humane. The science was to cognize the nature in its own being-in-itself, undisturbed by any notion or activity related to subject.

That classical ideal is being somewhat changed already in the beginning of the 20th c., when the non-classical science develops itself in the form of quantum mechanics and the theory of relativity. Micro-objects, objects of quantum-mechanical studies are different in that way, so "to 'look' at them, i.e. to direct electromagnetic radiation at them, means to exert influence that is capable of affecting the results of measurement" (Dobronravova, 1999. – P. 89). That is, the non-classical notion stated that human while being an observer, already influences the object. And the norms of non-classical science supposed introduction of observation means into the epistemic ideal of that science, as demonstrated by Vyacheslav Stepin. The post-non-classical science, while turning to even new type of objects – complex self-organization systems, which also turn to be those of human-dimension, leads to the subject's own inclusion into the ideal of scientific knowledge (Stepin, 1989).

Arguably the major reason for that kind of 'subjectivization' of scientific norms and ideals is but another change of the subject's position as for objects of his scientific investigations. In case of complex self-developing systems, the subject founds himself, in our opinion, to be not just an observer, but also *a participant* of the system's development. And that is true not only in case of human-dimensioned systems, like social systems, where the observer's primary position lies inside that very system, and not outside it in the infinite classical realm of 'God's eyes' view'. In that case, of course, the human subject is obviously the participant of the development processes. That was always so in humanities and social sciences, where the ideal of scientific objectivity had never been characterized by strict classical rules of eliminating the subjective.

The subject is found to be an active participant also in relation to complex natural systems, as well. The dichotomy of subject / object becomes obsolete under contemporary scientific paradigm, as the co-evolution conception is being developed in relation to human and nature. Even in his purely theoretical activity, including scientific knowledge, the subject cannot retain any kind of *completely* 'independent' 'outsider's' position as for the object of investigations being conducted. The cognition itself is found to be based on practical activity, it is implanted into practical Weltanschauung of the human being.

We will try to demonstrate that feature of contemporary science basing on ideas of practical philosophy, or rather philosophy of practice. According to that tradition, it is practice where subject and object appear in their unity, in their intertransition, that is, in their synergy. According to Kiev philosopher of the 20th c. Vadim Ivanov, practice as embodiment of the unity of subject and object appears on the one hand as sensual objective activity in its unity with material processes of nature; on the other hand, practice is found to be manifestation of subject. "Thus, practice includes subjective moment, and not as alien content for the world, but as subjective *act* that is able to produce real palpable changes, and being thus of the same level with natural determination forms. In practice the subject objectivates himself as natural force, while natural reality in turn from something just indifferently existing is transformed into fixed manifestation of human subjectivity" (Ivanov, 1977. – P. 54). In terms of dialectical philosophy, in the course of practice the essential is being formed as that of human, and human's is being confirmed as the real.

Such state of affairs allows to draw the conception of human interrelation with the natural world: human appears as the product of self-organization of nature, and the world of nature turns to be objective embodiment of human activity. That's why it is incorrect to consider philosophy of practice in the sense of classical anthropocentric activism, as 'free' transformation of the world by human. First of all, the nature itself could not be considered here as something exterior to human being, and reasonable practical activity of human defines not only the way of human relation to the world, but also "the immanent principle of self-organization of the latter" (Ivanov, 1977. – P. 14).

In other words, human and nature (both as phenomena and as the fields of studies conducted by respectively traditionally denoted 'science' and 'humanities') are no longer considered to be parts of the dichotomy. And as Karl Marx wrote in his Economic and Philosophical Manuscripts of 1844, as we "gain an understanding of the human essence of nature or the natural essence of man", we proceed to that stage of the development of science when "natural science will in time incorporate into itself the science of man, just as the science of man will incorporate into itself natural science: there will be one science", because, in fact, "human natural science, or the natural science of man, are identical terms" (Marx, 1974. – Pp. 542–544).

However, upon admitting the ongoing elimination of the ontological distinction between human and nature, as both those system are now being considered as parts of another more complex self-organizing system that now already becomes the subject of new inter- and meta-disciplinary research programs, – upon admitting that ontological presumptions there are still several serious problems left for philosophy and methodology of science. The first of them concerns the problem of *objectivity* as the ideal of scientific activity. If human not only observes, but also par-

ticipates in the life of natural systems, if he transforms those natural systems in his practical activity (for now let alone the question of *how* he transforms them) – then how is it possible to obtain the objective scientific truth, i.e., how the science could be able to present in knowledge the real world in its own being?

I think that objectivity itself as the ideal of science does not retain its motionless classical form under the paradigm of post-non-classical science. Objectivity here is to be understood not as the picture of dehumanized natural world, but as the world in its essential characteristics. Objectivity must be now considered as *a process*, and not as a given static quality of 'world-in-itself' in principle lacking any human dimension and any human, or cultural, reference. It is a developing phenomenon. We shall provide as an evidence and an example for such position a dialectical objectivity conception elaborated by Kiev philosopher Mikhail Boulatov that gives an answer for the question.

The first stage of objectivity process, according to M. Boulatov, is objectivity as 'thing-in-itself', as such part of the world that is completely independent from human's both practical and theoretical activity. However, such objectivity is not what was meant by classical scientific ideal – such thing is not even an object yet – it becomes an object only while being correlated with the acting and cognizing subject. And that's the second 'objectivity level', the proper objectivity of that natural thing, which is discovered as the thing's relation to human practice. In other words, "the objectivity of the object got involved into the sphere of human activity consists in its *resistibility* to the transformation" (Boulatov, 1976. – P. 165). The object reveals its very existence (and its very objectivity) to human when the latter in the course of his practical activity faces sudden unexpected resistance from 'the material' he directs his actions to.

I have to comment here that such objective resistibility of the object toward its transformation by human is not necessarily resistibility to *any* transformation, but to transformation that is *inadequate*, transformation by means that appear to be irrelevant to the nature of the object being transformed. And the primary, pre-theoretical practice is, as a rule, just such inadequate influence over natural objects. Thus, the objectivity of the next, higher stage of knowledge appears as a certain kind of 'instructions' issued by the object of cognition and/or transformation as for the necessity of adequate means of its transformation, "the necessity for human in his practical activity to move by the object's dimensions, its connections, excluding arbitrary, subjective manipulation with things" (Boulatov, 1976. – P. 177). The category of 'subjective' here means voluntary activity of human, which is not based on objective knowledge of the object of activity.

The achievement of high level of objectivity and of practice – when human, having once tried to influence the natural object out of his own subjective free will, faces the resistibility of the object, so that he is forced to follow the object itself for its *effective* transformation – appears at a next stage of objectivity process in a form of *intertransition* of subjective and objective. The knowledge obtained by the subject in his theoretical studies is being then *objectified* in human practical activity. Finally, having passed over all stages of its dialectical expression in thinking and consciousness, the processual objectivity, as it is shown by M. Boulatov, returns again to the objectivity of 'thing-in-itself', which is presented by objects created in human practice and then isolated themselves from human will and consciousness.

Thus, it can be concluded that the science is able to achieve objectivity only *due to* (and *not in spite of*) human subject being participant in the life of natural systems, due to his practical activity with natural objects that helps to reveal objectivity (the essence) of those objects. In our opinion, 'objectivity' describes essential side of natural world, and not its 'out-of-human' state; 'subjectivity' is not anything that is related to human, but it (in its 'negative' sense) rather means features that refer to human *not* following the objective logic of natural world in his human activity. That is, it is not that objectivity as the epistemic ideal of science loses its importance and its prime position – it attains new meaning that is itself more adequate to the contemporary scientific Weltanschauung.

§3. Methodological Foundations. The General vs. the Specific.

Other important aspect of the classical dichotomy of science and humanities is based on the distinction of methods that were said to be peculiar to those two types of knowledge activity. We mean the tradition of demarcating 'sciences of nature' and 'sciences of spirit' elaborated in Baden school of Neo-kantian philosophy and the 'philosophy of life' tradition. As stressed on by Wilhelm Windelband, those two types of science differ by methods rather than by subjects: natural sciences are 'sciences about laws', while humanities deal with events; first ones study something that happens and must happen all the time, while second types of science are interested in comprehending something that happened only once.

That idea had been developed by Heinrich Rickert. Describing the natural-scientific way of thinking, Rickert points out that logical structure of natural sciences does not allow them to comprehend natural reality in its actual way: in his opinion, natural sciences are aimed only at attaining the knowledge of general obligatory notions, and not that of events or facts. Humanities, 'sciences of spirit', or historical sciences, as Rickert names them, have their attention focused on individuality, on singularity of event. Indeed, the reality serves as the object of study for both kinds of sciences, transmuting itself depending on cognition methods applied. That is, the reality "becomes nature as soon as we consider it in the way so that the general is being meant; it becomes history as soon as we consider it in the way so that the particular is being meant" (Rickert, 1903. – P. 223). The particular here is *valued* just because it *differs* from the general, it is something that falls out of general scheme, and that's why it is being of interest to 'sciences of spirit'.

Pavel Florenskiy at the beginning of the 20th c., in order to explain the difference between those two types of science in a popular way, used such an example. The acceleration of Kant thrown from the tower of Pisa would – from physics' point of view – be equal to 9.8 m/s², but – from the point of view of historical science – it is not that that we would find to be most interesting in Kant studies. The given methodological dichotomy characterizes the classical natural science, which since the 17th c. was a model for all forms of cognitive activity. Ideas presented by Baden neo-kantians and other thinkers from the beginning of the 20th c. in their criticism of natural-scientific way of thinking – and that was criticism not so of natural science itself, but criticism of it being an ideal model for all sciences – served to affirmation of the specifics of humanities that now were to be considered as separate type of

sciences with different methodology, which is not to be reduced to that of natural science.

However, at the beginning of the 21st c. we have another turn in understanding the scientific methodology. The classical science that had to be methodologically distinguished from specificity-oriented humanities is replaced by the paradigm of post-non-classical science that founds itself to be more close to humanities that to its own natural predecessor in this question. Natural science in its post-non-classical vision, as it discovers its objects being complex self-developing – and thus, as a rule, *unique* – systems, achieves corresponding changes in investigation norms: it is no longer of no difference for the natural science what its object is – Kant or inanimate stone.

It is important to note that this new feature does not really mean dissolution of natural sciences in humanities, nor any kind of negating of the general law of gravitation formulated in classical science. In similar way, the development of non-classical scientific theories – theory of relativity and quantum mechanics – had not 'cancelled' the laws of Newton, but specified them, limited their application sphere. And certain area of objects of investigations just leaves, so to say, the front-line of science while remaining the ground for construction of new knowledge.

Science is now to study the singular as well as the general. As explained by I. Prigogine and I. Stengers, "upon transition from equilibrium conditions to strongly non-equilibrium ones, we pass from the general and the repeating to the unique and the specific" (Prigogine, Stengers, 1986. – P. 54). Speaking the language of dialectics, that turn in scientific methodology could be presented as a movement *from the abstract to the concrete*. The abstract means simple, unilateral way to consider an object, like the way to see Kant *only* as a carrier of gravity to be thrown from the tower[123]. The concrete is a singularity considered from all (or most) its sides, it is the way to represent an event or a singular object in all variety of its features.

There could be pointed out a scheme of such movement of science from abstract to concrete. The classical science dealt with the general (laws); the non-classical science (and 'science of spirit' in neo-kantian conception) was interested rather in the singular (events). The post-non-classical science, as it could be concluded, turns to *the particular*. And the particular as the concrete is not a simple binary opposition to the general (or abstract). The particular is not singular, not just unique; it is more than that – it is the general revealed itself in the singular. The concrete is not just either unity or diversity, it is dialectical "unity in diversity", as shown by Evald Ilyenkov (Ilyenkov, 1960. – P. 6). The concrete is discovered as the unity of differences, the unity of variety of irreducible objective features, as opposed to the abstract unity based on reduction of all variety of qualities to one denominator, on understanding object as a representation of one artificially chosen quality.

It can be stated that overcoming the 'dichotomy' of general / singular as conditional aims of classical / non-classical science correspondingly could be presented

[123] Of course, scientific investigations are impossible without construction of such abstract 'idealized objects', in Stepin's term, to be used in experimental situations; but it is not individual scientific experiments that we are talking about now, but the former general way of thinking and representation of the world heavily inspired by that scientific approach.

(with certain clauses) as overcoming the mentioned classical dichotomy of natural sciences and humanities (or, sciences of spirit). The ideal of the knowledge of the concrete is what can unite again those two kinds of cognitive activity, for the natural science, due to change of its prime objects of interest, is no longer aimed at the general only; similarly, humanities could not be satisfied just with obtaining the knowledge of the singular. In other case, history would not differ from historiography, being a mere (very long and very useless) list of all individual events that happened that or other time.

And it also must be noted here, that aiming at the concrete does not cancel the necessity of the abstract knowledge; the achievement of the level of concrete in scientific cognition of objects of reality is made possible only by means of the preceding level of abstracting. Under abstraction there happens a division of one – syncretically 'unified' – singular object into many features, each of them being considered in an abstract, unilateral way. Only under such abstraction the extraction and comprehending of *the essential* in object is possible. But at the same time such comprehension is not complete, it is abstract in relation to real object, for it takes place in thinking only (Zlotina, 2004. – P. 241–242). It is the concrete as the unity of universality (attained due to abstraction and analysis on the previous stage of cognition) and singularity (on the base of addressing the real, not the ideal, object of the immediate reality) that presents itself as the goal of scientific knowledge, either that of natural science, or that of humanities.

Such dialectical interpretation of contemporary scientific methodology opposes the two extreme positions absolutizing one of its aspects – either universality or singularity. In classical philosophy the first position is presented in the most clear way by Hegel. First difference from that system is that abstract / concrete are not features of correspondingly thinking / perception. Concreteness is an object's feature that exist independently from subject, and it is being shown to subject only in practice. Abstract (unilateral) could also be a characteristic of real object. However, the most radical difference is the role of the singular. Hegelian universal – the Notion – is the only real, and the singular is just its self-alienation. As for objective dialectics, it considers the *result* of the transition process from abstract to concrete being the specific as such singular that embodies the universal (the all-general). The all-general (the concrete-universal, not the abstract-general), according to E. Ilyenkov, "stands opposed to the sensuously given variety of separate individuals primarily not as a mental abstraction but as their own *substance,* as a concrete form of their interaction. As such it also *embodies* or includes the whole wealth of the particular and individual in its concrete determinateness and that not simply as the possibility of development but as its necessity" (Ilyenkov, 1974. – P. 262).

In other words, the singular really can become the universal, more exactly, it can reveal the presence of such substantial universal in itself. The universal exists as objective necessity of the development, and not as immutable absolute law, but as a tendency that can assume different concrete forms depending on circumstances and activity of subject. That's why the concrete object can obtain the universality while not losing its singularity, which is the main point for criticizing Hegel's pan-logical system from the position of dialectics and post-non-classical science.

The opposite extreme of understanding practice is presented in philosophy by *existentialist* (and post-modernist) tradition that absolutized not the universal, but

the singular, and denied the possibility of the universal to reveal itself in immediate reality. For example, J.-P. Sartre turns to 'praxis quotidienne' while trying to 'detotalize' practice in its Marxist understanding (Sartre, 1960. – S. 182). Such turn to everyday practice is explained by the search for the concrete and the fear of the absolutized (totalitarian) pseudo-universal, including that of classical natural science. However, the absolitization of pluralism, the irreducible set of individualities deprived of any universality surely leads to relativism in theory and pessimism in practice.

The aspiration for the concrete is the moving force of the whole knowledge and the whole practice; but the aspiration we observe here (existentialism, especially postmodern, etc.) is the aspiration for *pre-abstract* concrete (and that does not require any special practical or cognitive efforts, neither). Such pre-abstract concrete, being not based on any theoretical foundations (like astrology, for example, or most of other 'alternative sciences'), being rather identical to elementary sensual and visual, appears as pseudo-concrete (the term used by Czech philosopher K. Kosik (Kosik, 1963. – P. 11)). The real concrete, it can be concluded, provides the basis for philosophical conceptualization of overcoming classical dichotomies like science vs. humanities, unity vs. variety, fundamentalism vs. anti-fundamentalism from the methodological side of their consideration. Both extreme parts are already discredited enough. The real alternative to fundamentalism – not anti-fundamentalism, but poly-fundamentalism; real unity of the general could be developed from nothing but variety, and real objective variety of singularities could exist only on the base of inner essential unity.

§4. Axiological Foundations. Facts vs. Values.

The next source of strict differentiation between science and humanities arises out of consideration of values. That problem originates in fact from same premises as methodological distinction formulated by Baden Neo-kantian school of philosophy. The unique as the object of 'sciences of spirit' due to its very uniqueness becomes valuable for the science, while objects of natural sciences due to its generality and its repeatability appear to have no values. There is a fact / values dichotomy being grounded here, and not just in its logical form of 'is / ought' opposition peculiar to analytical tradition, but rather as the opposition of 'units' of respectively nature and culture.

Heinrich Rickert even constructs a whole system of 'philosophy of values' basing on that distinction. The essence of values lies, in his opinion, in their importance (significance), and not in their factuality. That is, we cannot even say that the value *is*; it indeed represents a separate world, says Rickert, which is completely independent from participation not only in any object or subject, but in the very being itself. Value is "a sense that lies above any being" (Rickert, 1913. – P. 46). The sphere of values opposes the sphere of being, the sphere of reality; and it is the contradiction between the two spheres that defines, in Rickert's opinion, the main problem of philosophy – the problem of correlation and possible unity of those two worlds.

In correspondence to what have been already said in previous paragraph, when in natural science we proceed to unique human-dimensioned system, the knowledge of those systems loses any principal methodological difference from the knowledge obtained by 'sciences of spirit'. That is, that knowledge also acquires the feature of value. That could happen because of two reasons. First, the uniqueness of the new object of post-non-classical natural science leads us to considering them being of value to us: such objects are no longer just common and general, obeying the ceteris paribus principle. Non-linearity of development of those complex systems supposes 'rises' and 'falls' happening in their course of development, so that we can definitely *lose* some of those systems under certain circumstances – like that happens with natural systems during ecological crisis, with its ever-growing loss of bio-diversity.

Then, there is another aspect of evaluating both the natural-scientific knowledge and its objects under the post-non-classical paradigm. As it was already mentioned, human is no longer just an observer of processes involved in the cognition sphere, but their active participant as well. In that case, the loss of bio-diversity and endangerment to ecosystems' existence is not just 'a foreign event' to human 'observer', who only may or may not feel some sort of regret as for that loss happening in the natural world. It is human himself that is being endangered as a result of that loss. And it is still human who appears as the prime originator of that loss. In both cases, we believe, values are not some 'essences above any being' – they are characteristics of being itself.

In other words, similar to other pairs of 'human' / 'world' and 'the general' / 'the specific', 'facts' and 'values' are no longer parts of a dichotomy. Facts are not 'desubjectified' units of scientific knowledge, as they are no longer 'units of reality', synonyms to events they were once believed to be. Facts turn out to be events in the context of human Weltanschauung, and not only in the context of a device situation (as in non-classical scientific paradigm), facts have a component of *sense* in their structure, and not of *being* only (see: Myelkov, 2003). Only upon consideration of any event within the frames of human world-outlook, human history and human practice, that event could become a fact, can take its place in the system of scientific knowledge. That is, facts are products of *culture* in the same measure they are products of *nature*, if they are not rather products of culture than nature.

One can still argue whether the natural world 'in itself', with all human and subjective features eliminated once and forever, possesses the true objectivity of the scientific knowledge? But that question is to remain rhetorical. *We* are not able – neither practically, nor even theoretically – to perceive and cognize the world *in a non-human way*, outside our human culture, without the heritage of our historical development. And contemporary post-non-classical science, in our opinion, does not see its task in fruitless attempts of achieving such absolutely abstract and useless out-of-subject knowledge of the natural world that surrounds us and which we are being parts of.

So, facts could not be presented as something completely out of culture, something totally lacking any values. Natural sciences depend on cultural values nearly in the same way humanities do. But, at the same time, *values* themselves are not only of cultural and subjective character. Values also do possess objective qualities in them. As explained by Russian philosopher Ghenrikh Batishchev, specific

feature of values is that they cannot become ‘a property’ of an individual subject, values are always ‘non-subjective’ in their nature (Batishchev, 1997. – P. 347). And non-classical pluralism from this point of view is nothing but relativization of values that leads to complete chaotic disorder, to ‘bad infinity’ of atomic individuals.

The task for our scientific and philosophical knowledge is to show, in Batishchev words, “strictly *objective* way, on which our human criterial-valuable judgements, and the content of our values in general (including also nature-loving, and, more broad, ecological reciprocity), would not appear in collectively subjective antropocentric isolation from their roots – from the boundless objective dialectics of the Universe” (Batishchev, 1986. – P. 180). Inter-subjectivity locked within the limits of human collective, even within the limits of humanity in general, remains subjective in correspondence to the objectivity of the world. It is very difficult for human *to be objective in values*, Batishchev admits, but it is still the main task of our knowledge sphere (humanities and natural sciences united) to reach the state of objective dialectics and objective values that would embrace both culture and nature.

The aspiration for following the objective logic supposes obtaining a deep feeling of love for the natural world and its objects. That’s another point of intersection of former ‘sciences of spirit’ and ‘sciences of nature’. Not only observing devices, but inner feelings and beliefs of the scientists are now said to play a certain role in determining results of scientific investigations. And that role lies not in blacking out the objectivity of the world; on the contrary, it must be founded on human loving and understanding nature, not on violating it as something alien and inanimate. Only in that case human theoretical and practical activity could become fruitful and effective, not leading to the last ecological and anthropological catastrophe. And, in our opinion, although natural values could be disclosed and spoken out only by means of human own activity while refracting in human cultural values, they really and objectively exist as the criterion for that human activity and the base for both nature and culture, both science and humanities. Of course, such statements certainly require much more philosophical investigation.

But as a conclusion of this paper, it could be stated that the foundations for strict classical opposition of science and humanities, or ‘sciences of nature’ and ‘sciences of spirit’, are over. All existing fundamentals for that dichotomy are no longer proved. Ontologically, human and nature are no longer opposed one to another, both those system are now being considered in their co-evolution, as parts of another more complex self-organizing system. Epistemologically, human can only cognize and transform nature out of his own human position. Objectivity of scientific knowledge is thus transformed to a task of following the logic of its objects for their adequate comprehension and practical transformation; the science is able to achieve objectivity only due to human subject being participant in the life of natural systems, due to his practical activity revealing objectivity (the essence) of objects of that activity. Methodologically, post-non-classical science turns to studies of objects – complex self-developing systems, that force the science to consider them from the position of their uniqueness and specificity, as it used to be earlier with humanities only. Axiologically, such unique systems are themselves of value to human; facts as units of knowledge of natural sciences no longer stand opposed to cultural values, but do suppose those values and are based on them. The post-non-classical paradigm of science could lead to establishment and development of new scientific ap-

proaches focusing on the human-world unity and based on mentioned philosophical premises.

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9
Mission Impossible?
Wolfgang Pauli's Idea of a Neutral Language

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Introduction

To be a scientist is to devote oneself to a mission in life. This was how Wolfgang Pauli, physicist and Nobel prize winner, viewed his profession. Science, said Pauli, is of no avail, if the scientist does not engage himself wholeheartedly. Science is a mission and is therefore deeply intertwined with existential issues. It may seem that developments in the sciences take place along certain paths of objective goal-directed activities. But even so, each particular discovery of standing is nevertheless intermingled with the life of the scientist. According to Pauli, the scientific method requires years of energetic work. The scientist has a fated relationship with the problems in question, always having to keep them in mind and with this attitude stir the unconscious to co-operation. Only in this fashion can creativity, knowledge, and solutions emerge from the unconscious to become manifested in our world.
This somehow unusual viewpoint for a physicist like Pauli was to set ablaze a veritable firework of new perspectives on the nature of science and scientific language. Over the years, reflexions on these issues led Pauli to suggest an ontology which claims that reality as such is of a symbolic nature. In one of his numerous letters we find the following short, but precise statement of this profound idea: "Für mich ist *jede Wirklichkeit symbolisch*, konkretistisch sind nur die Phänomene, aber *nie* die Wirklichkeit!"[125] Pauli found that reality as such is beyond our reach. The only way we can approach the deeper dimensions of reality is through an interpretation of its symbolic nature. From this perspective the psychic and the physical world are but two different dimensions of the same reality. Only in our everyday human world psyche and matter seem to be opposed. In connection to this basic idea Pauli sketched other far-reaching viewpoints. However, all these reflexions were never advanced into a systematized formal body, but instead Pauli introduced and discussed his thoughts in letters to friends and colleagues.[126] Although Pauli had theo-

[124] Also: Clare Hall, UK – Cambridge. Presently on leave of absence at the Istituto di Studi Avanzati, University of Bologna, Villa Gandolfi Pallavicini, Via Martelli 22/24, I – 40138 Bologna.
[125] In 1979 the Spinger Verlag started to publish Pauli's scientific correspondence of 1919-58. The letters are edited by A. Hermann, K. v. Meyenn und V. F. Weisskopf. References to Pauli's correspondence with the exception of his correspondence with Carl Gustav Jung refer to the numbers, marked in brackets, in „Wolfgang Pauli, Wissenschaftliche Korrespondenz mit Bohr, Einstein, Heisenberg u.a." The quotation here is from Pauli to Fierz [1507] 19/1/53. See also Pauli to Fierz [971] 12/8/48.
[126] Not all letters are published. However, the published corpus counts about some 7.000 pages including introductions, notes, and indexes.

retical ambitions concerning his philosophical interests, it would, nevertheless, be erroneous to speak about theories in a strict sense. Pauli's passionate and persistent occupation with the themes in question should rather be valued as provisional fragments. As such, Pauli's philosophical work canvasses new points of departures which might, over time, widen, change, or open new outlooks to our understanding of reality.
In the following section we shall take a closer look of one of Pauli's favourite hobby horses. Pauli wanted to revolutionize the language used for scientific description so that the psychic and the physical dimension would be treated equally. The name of this hobby horse was *neutral language*.

The Idea of a Neutral Language

The ambition to work out a new mode of scientific description was primarily inspired by a number of recurring dreams. In these Pauli was exposed to inner figures who insisted on using a special kind of language in which the gap between the psychic and the physical world had vanished. Physical objects were used as expressions of psychic content and vice versa. Moreover, physical concepts and images could be used in a symbolic fashion to illuminate not yet understood physical facts.[127]
Thus the dream language referred to a past, or historical epoch before soul and matter were divorced. The dream figures embodied a world view which was not yet stigmatized by the results which became manifest in the wake of Descartes' dissociation of the world into two domains, leaving nature void of soul. Hence, depriving nature of soul indeed paved the way for the spiritualization of the idea of soul beyond this world. Soul, then, disappeared into spirit, or became identified with spirit, the result of which was a dualistic world view with dead matter and spirit creating two opposing levels.
Pauli became more and more puzzled by the phenomenon that his unconscious kept producing a particular language of its own that was so different from the language of physics and the language of Jungian psychology. The style of language in his dreams had a characteristic quality and tone in that it claimed the identity of consciousness even as the dream dealt with two different matters of fact such as a physical and a psychic situation. Hence, two different situations had to be understood as an expression of the same archetypal image. Only as to their appearances in the conscious mind do they seem to be different. In essence they are not: "Der Traum bringt *deshalb* zwei Aspekte der Wirklichkeit zusammen – er behauptet sogar ihre "Identitaet", weil sie *eigentlich zusammen bestehen sollen*."[128]
In 1948 Pauli writes to Pascual Jordan that he has started to work on his own theory of dreams. Furthermore, the idea of developing a neutral language began to take form. Pauli introduced his idea to Carl Gustav Jung who, according to Pauli, urgend him to develop the idea. Later, Pauli writes to Markus Fierz that Jung had emphasized that a neutral language would in fact be the future goal of a new science in which physics and psychology might be united. Hence, this kind of language would

[127] Cf. Pauli to Jordan [942] 23/3/48
[128] Pauli to von Franz [1848] 23/7/54

then embody the language of nature.[129] In 1948 this is all still in the making, and Pauli writes to Fierz that he is hopeful over time to be able to develop a proper theory on neutral language. Later, again in a letter to Fierz from 1950, Pauli refers to the development of the idea in the unpublished essay "Background Physics".[130]
Over the years he arrived at the conclusion that the inner dream figures represented a deeper message. Pauli felt that they somehow wanted to be redeemed. However, there redemption seemed always to be only partial, or temporary. About a figure called Stranger, Pauli says: "[E]r stellt ein kontinuierliches, niemals endendes Experimentieren mit dem (oder den) Menschen an, und er liebt es, sie in Spannung und Konflikt zu halten."[131] Thus the character of the Stranger embodies the good, but also a potential evil. He is, says Pauli, like a father who takes an interest in his tasks being carried on, but who does not quite understand the way in which the offspring accomplishes this.
In addition, Pauli also found that the messages represented by these inner figures reached far beyond him as an individual being. The recurring redemption requested by a figure like the Stranger and others, Pauli interpreted as powerful forces to be grasped and brought to manifestation in the outer world. Hence, the general, cultural meaning hidden in the dreams was seen by Pauli as their most crucial function: "Ich bin davon überzeugt, dass diese sich mit Variationen über viele Jahre erstreckenden Traummotive nicht mit meiner persönlichen Stagnation zu tun haben, sondern auch objektiv mit den tieferen Gründen der Stagnation der Physik. Leider bin ich auch davon überzeugt, dass die Aufgabe, solche Träume zu verstehen und zu deuten, die Fähigkeiten sämtlicher Psychologen unserer Zeit bei weitem übersteigt."[132] We shall later discuss Pauli's almost hostile approach to psychologists and therapy. Here, we want to stress how Pauli linked his inner experiences with the essential problem in modern science. According to Pauli, the established paradigm of scientific description by definition pays service to the God of one-sidedness, which is too narrow a concept of reality.
The opposite of the objective is not the personal, but the private. The private is not of any interest, but the personal dimension is. Pauli says that this insight was what inspired him to write the Kepler study to which we will return in a moment.
Therefore, the archetypal dreams the personal level corresponds to, or participates in a kind of objectivity although appearing in an irrational frame. With a sharp distinction between the private and the personal Pauli wanted to emphasize that the dimension of feelings, the atmosphere in which dreams present themselves, does indeed embody a kind of objectivity: "Es scheint mir nun, dass im allgemeinen Fall das *Gefühl wesentlich sein wird, um die 'Gestalt' überhaupt erkennen zu können*, und dass *hier* das Gefühl mit *Er-kenntnis-Fragen* zusammenhängt. Es ist dieser Zusammenhang, den 'der Fremde' betont, und der im Weltbild der Kollektivmeinung (d.h. auch im wissenschaftlichen Weltbild unserer Zeit) keinen Platz gefunden hat."[133] The point that we want to emphasize here is that Pauli wanted to treat the experience of feeling on the same level as the experience of intellect but without

[129] Pauli to Fierz [971] 12/8/48
[130] Posthumously published in „Atom and Archetype", The Pauli-Jung Letters 1932-1958. Edited by C. A. Meier with a preface by Beverly Zabriskie. London and New York 2001, p. 179 sqq.
[131] Pauli to Jaffé [1350] 23/1/52
[132] Pauli to Fierz [1507] 19/1/53
[133] Pauli to von Franz [1227] 18/4/51

being caught up in private problems and therapy. Hence, Pauli liked to view his inner life under this highly objective perspective.
In brief, these were some of the main reflexions which led Pauli to the idea of a neutral language. Ideally, scientific description should cater to the outer world as well as to the inner world, to the objective observation and to the inner, psychological situation which is always at the root of events and approaches, sustaining the initiative to pursue scientific discoveries and obtain scientific results. Pauli's essay on Kepler is a most successful and admired piece of work in this vein, demonstrating how Kepler's scientific concepts are deeply linked with and rooted in the inner, spiritual life of Kepler.
Finally, it is crucial to emphasize again that by neutral language Pauli understood a language which should be neutral in the sense that it equalizes the level of the objective, intellectual observation with the emotional, biased, psychological situation, in which scientific discovery takes place.

Critique

Although Pauli devoted much energy to his reflexions on a neutral language, it remained one of his most vulnerable projects. From his letters, which cover an abundance of topics, we know that he was very alert and eager to trace the historical and philosophical traditions of issues introduced to him through discussions with Markus Fierz, Carl Gustav Jung, Marie-Louise von Franz, Erwin Panofsky and others. For example, reading Jung's book "Answer to Job" took Pauli into extensive philosophical and theological inquiries and discussions of the origin of the *privatio boni*, that is, the idea that evil is a lack of the good. However, as to the nature of language, Pauli took a rather naive stance, and did not consider how words and language are intertwined with our existence as such. But Pauli was not a naive person. In fact, he deliberately chose to exclude all linguistic and epistemologic speculation. In a dispute with Niels Bohr about the "detached observer" in quantum physics he stated the following: "I confess that very different from you, I do find sometimes scientific inspiration in mysticism (if you believe I am in danger, please let me know), but this is counterbalanced by an immediate sense for mathematics. The result of both seems to be my kind of physics, whilst I consider epistemology merely as a logical comment to the application of mathematics in physics."[134] We shall have more to say about Pauli's mystical approach in a moment.
Although the idea of a neutral language was inspired by the sophisticated imaginations in his dreams, Pauli, nevertheless, transformed this inspiration into a square, rational construction which did not take him anywhere. In short, the idea of a neutral language may be characterized as a relative of the paradigm of objective language, which has been celebrated in science and philosophy since the dawn of the Enlightenment. However, the idea of a neutral language is more problematic than the concept of a universal objective language. Historically, objective language has been opposed to the language of feelings, but in principle, an objective language can very well be used to describe the level of feelings. In comparison, the word "neutral" originates from the Latin word "neutralis" which refers to something not gen-

[134] Pauli to Bohr [2041] 11/3/55

dered, and the common use of "neutral" refers to something towards which we are indifferent and detacted. In any case, we are never outside the world, but in it. Therefore Pauli's choice of the world "neutral" is dubious and obscure. In principle, we are by necessity fated to be partial and biased, and this fact is reflected in language itself.

To summarize, we may say that Pauli's idea of a neutral language was too rigid a construction, and further, a *contradictio in adjecto*. Another sign pointing to the same conclusion is a certain inconsistency in the way Pauli described what he intended neutral language to be. In some of his reflexions he speaks about a standard language. At other times he is referring to a sort of a monistic, unifying language which seems much more in line with his basic idea that reality is of a symbolic nature. Finally, in a letter to Aniéla Jaffé, Pauli compared neutral language with the Eastern symbol of Emptiness, a comparison which shows how strained and farfetched Pauli's idea was. Pauli's reflexions on emptiness run along these lines: "Die Leere ist nicht 'nichts', sondern eben das aeusserst Wirkungsvolle. Aber sie ist die Leere, weil sie sich der Veranschaulichung durch Bilder und auch durch Worte entzieht. Die Leere ist auch synonym mit einer tieferen *Einheit* von physischem und psychischem Geschehen ('neutrale Sprache!')."[135] Although the comparison between the symbol of emptiness and neutral language is just added and not developed in the letter, it shows the sort of difficulties Pauli had plunged himself into. The symbol of emptiness is developed in Eastern thinking in particular. In this tradition emptiness denotes the divine. But unlike Western symbolizations of the divine it does not lead to world attraction, but to the opposite. The Eastern conceptualization of the divine is supposed –to pave the way for mystic experiences beyond human imagination and beyond human language. It is an approach that leaves the outer behind, and which, historically, did not result in taking the lead in producing scientific knowledge.

Pauli did not succeed in finding a satisfying solution of revolutionizing and improving scientific language, and why he compared neutral language with the Eastern symbol of emptiness remains a paradox. If we should take this reflexion into further consideration, the idea of neutral language ends up being an obscure phantom language. In antiquity it was believed that even the language of the gods had some resonance in human language. In comparison, what Pauli wanted to establish is a non-divine and non-human language which ideally could transgress any reference of words referring to the natural habitat to which we are linked through sensations and feelings. It is also somehow puzzling that Pauli, who boldly claimed the view that reality as such is of a symbolic nature, should advocate a firm belief in the possibility of establishing a neutral language. Yet, for unknown reasons, he turned his back on the intrinsic problems hidden in language itself. As I shall argue next, words are in themselves prominent pointers to life, existence, and myth itself.

Language is deeply intertwined with our mode of being and our way of existence in a specific cosmic environment. A few perspectives on the nature of words and myth may be introduced.

To find the language which would please the gods most was for centuries a serious concern of sages, poets, philosophers, and scientists. The inclination towards epiphanic description is richly stated in the pre-modern cosmogonies, cosmologies,

[135] Pauli to Jaffé [1284] 25/9/51

ontologies, and in theoretical thinking. To a certain extent we still find this attitude in modern everyday language, while scientific language, ideally, is supposed to be free of any emotionally tainted expressions, but hardly ever is. But unlike our conscious efforts to avoid passionate expressions in our present day scientific and academic style, the ancient philosophers did not shed the style of praise, and yet they displayed a modest and humble attitude as to whether their language actually hit upon the level of absolute truth or not.

In Plato's dialogue "Kratylos", Sokrates becomes entangled in a long-winded discussion on the nature of words and language. At the start the discussion fluctuates between two positions: 1) Words are natural and do denote a fragment of truth about absolute reality. 2) Names and words are conventional, and their origin is rooted in human habits and cultural differences, the latter position paying homage to Heraclitus whom Sokrates compares to persons who have "fallen into a kind of vortex and are whirled around in it, dragging us with them." (Krat. 439c)[136] Although the discussion leaves the question open, Sokrates seems in favour of a view which emphasizes that language, names, and words refer back to the basic experience of the world. By referring to our basic experiences in general, Sokrates tries to put a stop to dwindling into pure relativity: "But if there is always that which knows and that which is known, if there are such things as the beautiful, the good, and each one of things that are, it doesn't appear to me that these things can be at all like flowings or motions, as we were saying just now they were." (Krat. 440b) To accept Heraclitus' claim wholeheartedly would, according to Sokrates, leave the problem and even humans themselves in an unsound state of unreality. (Cf. Krat. 440c) Hence, in Greek philosophy, there is a pious belief that words somehow denote and refer back to an ontological level, and therefore also contain the divine in some form.

To pursue this issue in its most general perspective we may next turn to discuss the status of words in myth. According to Walter F. Otto, a German scholar in mythology, verbal expression is just one of the many forms in which myth manifests itself. Every word, says Otto, is originally a living myth in the sense that "der Name ... der erste Mythos [ist]."[137] Further, Otto emphasizes that "[d]as Rationale selbst ... gar nicht ohne den Mythos [ist]. Unsere Sprache (und das heißt: unser Denken), wenn wir ihr auf den Grund gehen, ist durchaus mythisch."[138] Language itself is genuinely mythical, meaning that no area, not rational thinking, logic, nor scientific language, or any other kind of language can escape the mythical dimension. However, nowadays this fact has become unconscious. In Otto's words: "In Wahrheit steht ... überall ein Mythos im Hintergrund."[139] Behind any logic, rational, or clever thinking, behind any word, we will find myth to be the final axiomatic level. And finally, says Otto, the true myth is always a myth containing the divine in some form, which is to say that myth is also deeply linked to the notion of beauty.

Historically, the linking of beauty and myth has until recently been a feature of ambitious speculation. Grand theories like cosmogonies, cosmologies, and ontologies especially in one way or another, nearly always pay tribute to beauty. In the end, such systems, whether they are mythological, philosophical, theological, or even

[136] Quotations are from Plato: Complete Works. Edited by John M. Cooper, Indianapolis, 1997.
[137] W. F. Otto: Der ursprüngliche Mythos im Lichte der Sympathie von Mensch und Welt. Eranos-Jahrbuch 1955 (vol. XXIV). Zürich 1956, p. 306.
[138] Ibid., pp. 336-337.
[139] Ibid., p. 334.

scientific, do found themselves on various forms of axiomatic premises in which beauty comes to the fore. In general, basic terms in grand systems will denote aspects of beauty which again link to both myth and the divine. The proper term for such a style of description is "epiphany", and it can be traced through a long-standing tradition. Even Gnostic cosmologies which do represent a special, interesting case, are related to the Western epiphanic tradition, but in a negative manner. Gnostic thinking, in its detailed elaboration of evil powers, develops a twisted and reversed image of a beautiful Universe. However, philosophically, the tormented image of an evil, but still exquisite order is indeed linked to the image of the beautiful cosmos.[140]

The articulation of ephemeral intuitions and experiences of the divine manifesting itself in forms of beauty may lead one astray, but there are numerous examples which testify the opposite. And, basically, it remains an open question whether cosmogonical and cosmological thought can escape the aesthetic dimension at all. The following narrative from an ancient Egyptian creation myth embodies the problem:

> *In the beginning, the world has nothing at all*
> *heaven was not, nor earth, nor space.*
> *Because it was not, it bethought itself:*
> *I will be. It emitted heat.*[141]

Even in this simple yet sophisticated version of a cosmogony we notice that the aesthetical dimension emerges along with the appearance of creation itself. In this narrative the key word "heat" implies energy and light, but also aesthetic splendour which is on the breaking point of becoming. Finally, the very moment of creation is shrouded in myth itself. The last phrase: "I will be. It emitted heat." contains an enigma.

From the historical point of view, Pauli's extensive quotations of Johannes Kepler and Robert Fludd, Kepler's opponent, further add to the examples of the use of a magical-symbolical language, saturated with words of praise. We cannot here analyze Fludd's and Kepler's world views in detail. However, it is well-known that Kepler honoured the principles of classical aesthetics and especially of Pythagorean philosophy. Most famous is Kepler's statement that *geometria est archetypus pulchritudinis mundi* – geometry is the archetype of the beauty of the Universe. The alchemist Robert Fludd, for his part, also turns to praise when he writes about the quaternity number which he associates with dignity, wonder, beauty, and the divine.[142]

Thus, the idea echoes through the centuries that only to the extent that one can find the *mot juste*, or a beautiful language in which to express one's theory, can one hope

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[140] For a comprehensive analysis of Gnostic cosmological thought see Hans Jonas: The Gnostic Religion. The Message of the Alien God and the Beginnings of Christianity. Boston 1958. See in particular Part III: Gnosticism and the Classical Mind, pp. 239-265.

[141] Quoted from John D. Barrow and Frank J. Tipler: The Anthropic Cosmological Principle, Oxford 1996 (1986), p. 440.

[142] Pauli's essay „The influence of archetypal ideas on the scientific theories of Kepler" is published in id.: Writings on Physics and Philosophy. Edited by Charles P. Enz and Karl von Meyenn. Berlin, Heidelberg, 1994.

to say something of importance, which participates in or relates to truth. In "Harmonice Mundi" Kepler starts one of his chapters with a long prayer to God that he, Kepler, will not express anything which is not in accord with the glory of God.[143] The examples mentioned above, which could be multiplied in legion, show that the inclination towards epiphanic viewpoints certainly opens doors of perceptions in the processes of producing knowledge.

A description may be balanced in terms of the focus and energy being devoted to the various contents, but since language itself originates in myth, that is, the reference back to a reality which is unknown to us in its deeper aspects, words are in themselves heavily biased and loaded. In short, language itself points to myth. We may for example think of words like freedom, justice, love, faith, and so forth.[144]

As mentioned earlier, Pauli's own world view contains the thesis that reality is of a symbolic nature. As concerns the aesthetically biased perspective, this ontology is no exception to the conceptualizations mentioned above. Pauli had a strong taste for order and symmetry, and this disposition coloured his scientific and philosophical ideas down to the most minute detail. Pauli believed in cosmic order[145], and his ambition for a neutral language was that it should be able to account for this cosmic order.

However, as we have examined, tradition in general, and also the sources from which Pauli himself was deeply inspired, undertook the task of describing the world not in the fashion of a neutral language but in a style which can be characterized as the opposite, that is the use of epiphanic expressions. Through his study of Kepler and Fludd, Pauli was familiar with a magical-symbolic language saturated with epiphanic expressions, and he was deeply fascinated by it. The language of Kepler, Fludd, the natural philosophers and others such as the Renaissance philosopher Leone Ebreo[146] in whom Pauli found a deep source of inspiration, employed a rhetoric which allowed their feelings to be expressed as well. Their scientific discoveries on various forms of cosmic order were enveloped in a rhetoric interwoven with hymnal phrasings and words of praise.

The emotional energy behind the style of epiphany is strong and persistent, and it was exactly this psychological background Pauli found very important to analyze, and of which the Kepler study is a brilliant example. In this study Pauli shows how scientific thinking and the development of concepts are rooted in the inner life of the scientist. But Pauli himself did not succeed in transforming this inspiration into his own work. Or, to be more precise, he did not allow himself to advance in the footsteps of those he sincerely admired. In the next section we will take a closer look at this struggle which had deep roots in Pauli's personality.

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[143] Joh. Kepler: Harmonice Mundi. Edited by Max Caspar. Collected Works, vol. VI, Munich 1940, Nachbericht, p. 500.

[144] See e.g. George Lakoff and Mark Johnson: Metaphors We Live By. Chicago and London, 1981.

[145] See his „Matter", in: Writings on Physics and Philosophy, op. cit., p. 34.

[146] Cf. also Pauli to Kronig [1067] 22/12/49

Symbolic Language

Pauli's ontological statement that reality is of a symbolic nature invites a focus on all kinds of symbolic activity from the mathematician's use of abstract symbols to the symbolic language in dreams and imagination.

A huge number of Pauli's dreams are published either in Jung's writings[147] or in Pauli's own writings. From the very beginning of his therapeutic sessions in the early 1930s Pauli had many dreams with clear archetypal structures and rather sophisticated archetypal images. The fact that Pauli, after having finished his therapy, continued to keep a record of his most important dreams allows us to observe how dreams, over a long period of time, are very persistent in their mirroring of problems which the dreamer has not yet solved. The early dreams as well as those coming later more or less wrestle with the same problem, namely Pauli's conflict between the inner, emotional propensity towards a unified world view, and his status as a physicist, engaged in objective science dealing with confined and restricted areas.

The troubled balance between feeling and intellect was felt very strongly by Pauli, and he worked hard to understand and overcome this historically conditioned discord of the soul. To Marie-Louise von Franz he writes: "An dem Problem, dem Fühlen hier einen *objektiven* Platz im Kosmos zu *finden*, laviere ich sehr herum."[148] Since soul is an all-embracing entity, Pauli wanted to re-establish the validity of its emotional dimension, but as he carefully emphasizes, on an objective level. Behind the apparently subjective psychological problems is hidden an objective, more general problem. Hence, the discord between feeling and intellect as it was delinated in his own personality, was seen by Pauli as a characteristic of modern Western culture in general.

Pauli fully realized that rational thinking as such is unable to move things ahead: "Das Bewusstsein allein kann offenbar keine Loesing ergeben, dazu braucht es die 'goettliche Gnade'. (Deo concedente) Diese beruht darauf, dass die Ganzheit im Unbewussten praeexistiert und von sich aus Wirkungen hervorruft."[149] Pauli saw the level of dreams, visions, and imaginations as a particular domain in which solutions are offered to our problems, but these solutions are coded, that is, they appear in a symbolic language. If humans can work out the message hidden in the symbolic language, they will be able to connect to the hidden dimension of wholeness and unity. Next, we shall examine one of Pauli's own dreams and discuss how he relates to its message.

The following dream from 1951 does not enjoy the attention that has been given to others in the vast corpus of Pauli's dreams. Other dreams might have been chosen instead to bring home a similar argument to the one we will establish. However, the dream dates back to February 3rd, 1951, which adds a certain perspective to its interpretation. In February 1951, Pauli's impressive Kepler study of how archetypal images are embedded in scientific theory and in its concepts was almost ready for

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[147] Pauli had recorded over 1000 dreams and visions which were made available to Jung for scientific purposes. From this material Jung chose 400 dreams for further analysis. A selection of this material is published in C.G.Jung's „Psychologie und Alchemie", GW 12.

[148] Pauli to von Franz [1205] 22/2/51

[149] Ibid. [1281] 19/9/51

publication.[150] The essay had already been introduced as a lecture and had even been a success. But in spite of this victory, including much approval from Jung, Fierz, Panofsky and others[151], Pauli was still insecure and hesitated to proceed in his chosen direction. He somehow felt trapped in a painful conflict with himself. The dream, analyzed below, relates to this situation:

Ich sehe grosse gestreifte *Gegenstände am Boden liegen, die aehnlich aussehen wie Kokosnuesse, aber etwas laenglicher und von grau-gruenlicher Farbe sind.*
Nun kommt der "Fremde" mit einem grossen Hammer und zertruemmert einen nach dem anderen damit. Dabei verschwinden die Streifen. Dann nimmt er die aufgebrochenen Truemmer in die Hand, die Truemmer sind wie schalenfoermige Gefaesse, und zu meiner Ueberraschung sehe *ich, dass sie eine wasserklare Fluessigkeit enthalten. Diese trinkt der "Fremde", und in* dem *Moment wird er jedesmal juenger, seine grauen Haare werden immer dunkler und zuletzt braun dabei. Nun sage* ich: *"Es ist wichtig, dass die Gegenstaende keinen Antrieb haben. Der Saft scheint ja heilende Wirkung zu haben." Er nickt bejahend und fuegt hinzu: "Wenn ich* diese *Fluessigkeit trinke, brauche* ich nicht *in den Krieg zu gehen. Kepler hat es auch so gemacht!"*[152]

The immediate impression of the dream is a positive one. Its atmosphere is adventurous and optimistic. Further, the plot even suggests an approach or strategy which would greatly improve everything, especially in terms of renewed energy, but also in terms of gaining knowledge: In the dream Pauli shows himself that nature contains the kind of nourishment he needs in order to prosper, but this growth will only materialize, if he adapts himself to a new approach, preventing him from dissociating into conflict and destruction. Next, we shall take a closer look at the sequences of the dream in its progression from Pauli as the onlooker to his engagement in a dialogue with the dream figure.
The opening of the dream presents a striking atmosphere of aesthetic fascination and attraction. Pauli discovers some beautiful, elongated fruits with magical stripes. With their shape, interesting decoration and greyish-greenish colour, these fruits attract the eye. But they are like coconuts, that is, precious nourishment which is hard to reach. Already at this point Pauli is confronted with a troublesome problem. Nourishment and liquid may come in many forms such as finding a well, enjoying the experience of falling rain or morning dew, bt Pauli finds nourishment which is encapsulated in a hard shell. In the traditional language of symbols the greyish-greenish fruit lying on the ground is a symbol of the Great Mother and of *prima materia*.
However, before Pauli has truly faced his problem, the dream elegantly introduces a magical turn. The encounter has been revealed, but aesthetic fascination alone does not suffice, but must be followed up by energetic action. This is symbolized by a

[150] Pauli to Panofsky [1206] 22/2/51
[151] When Werner Heisenberg was later introduced to this study, he was also very enthusiastic about it. See Pauli to Jaffé [1664] 28/10/53.
[152] Pauli to Jung [1200] 2/2/51. See the enclosure: To the dream a small sketch of the fruit is added. In the same enclosure, another earlier and quite remarkable dream is recorded from Dezember 11th, 1947. For an analysis of this see Herbert van Erkelens: Wolfgang Pauli and the Chinese Anima Figure. Erasmos Yearbook 1999, Ascona.

recurrent inner figure in Pauli's dreams, a figure whom Pauli called Stranger. Now this inner figure suddenly appears to set in motion. The Stranger acts in a systematic, potentially scientific fashion, cracking one fruit after the other with a sledge hammer. Traditionally, the hammer is an attribute of thunder gods, the tool symbolizing a formative and active force. During the act of transformation, the fruits lose their fascinating stripes. But the disappearance of all the wonder and magic is only temporary. As their content is released, the liquid has a magical effect. By drinking the liquid the Stranger undergoes a transformation himself, symbolized by an enhanced appearance. He is rejuvenated, and his grey hair darkens again. He has renewed *his* energy.

Until now Pauli has been an amazed onlooker, first dazzled by the aesthetics of it all, then by the action, and finally by the transforming powers of the liquid. But now Pauli himself changes his attitude from being the onlooker to someone who participates in a dialogue. In speech Pauli affirms his understanding of the demonstration. The nourishment from the fruit does not come from its outer appearance, but is only accessible through its content which possesses a life-sustaining power. The liquid represents refreshment, regeneration, rebirth, and transformation from a state of low energy to a state of renewal and fertility. Then, after Pauli has demonstrated some level of understanding, the Stranger greatly affirms Pauli's remarks. Not all dreams come to a conclusion, but in this case the dream does come to a close and builds up to a *grande finale*. First the Stranger approves of Pauli's understanding by a gesture of agreement, then he proceeds by amplifying the message, not only with one but with two remarks. First, drinking the liquid, he says, prevents him from going to war. War is an act of desintegration, disorder, and a waste of precious energy, and perhaps even of life itself. Second, the basic message is exposed in the Stranger's final remark: "Kepler hat es auch so gemacht!" With this remark the dream comes to an impressive and crystal-clear conclusion. Kepler allowed himself to act upon his intuition in following his inner imagination. Indeed, this is something which Pauli knows very well since he had just finished his work on Kepler.

Viewed from the outside, in retrospect, and from a rational point of view, the reader may be puzzled about why Pauli had to host such a dream, repeating, although in a fancy way, what he already knew, and had known for quite some time. In attempting to understand this situation we may refer to Jung's remark that life itself will always produce new situations with which the individual must wrestle. Pauli was hesitant. Therefore, he found himself in a situation in which he needed to find the courage to proceed in the direction he had been working. According to Jung, archetypal dreams like the one above will naturally focus on issues most arduous to the dreamer. Pauli was depressed at the time. Since finishing the Kepler essay he had not made further progress in that direction, but had instead fallen victim to doubts about what he was doing. The dream may be seen as a response to his depressed mood, encouraging him to proceed and develop his reflexions and writings along the lines outlined in the Kepler study. To conclude our analysis of –Pauli's dream we may say that it, in symbolic language, strikes a level of subtle wit, consolation, and a strategy of competent, decisive action.

To launch a complete interpretation of Pauli's dream is beyond our reach, since a dream can only be considered interpreted to a sufficient conclusion when the dreamer himself can identify with the interpretation. While respecting this condi-

tion, we do however, insist on the meaning that we have argued above. The dream even suggests a way out of the dark through its witty and persuasive images. Pauli was an eminent interpreter of dreams, and there can be no doubt that he himself must have grasped its meaning.

As a motto for his chapter on the history of ideas in alchemy, Jung uses a phrase from Mylius' "Philosophia reformata": "Habentibus symbolum facilis est transitus."[153] With this quote the meaning of which can be translated as: "He who is in possession of the symbol, will easily succeed in transition", Jung underlines the august importance of symbols as they embody the opportunity of gaining a new or renewed perspective on a critical situation. Jung found that a symbol is "the best possible expression for a complex fact not yet clearly apprehended by consciousness."[154] Besides being vessels of great emotional energy, symbols are also carriers of a state of knowledge which has not yet been integrated by the dreamer, or, as in the case of Pauli, contents which had been rejected by the dreamer.

With this background we may say that Pauli was in possession of both the symbol and adequate inner emotional readiness. The fact that the dream develops into a dialogue shows that Pauli had an inner urge to carry out a materialization of its content, that is, to transfer its meaning to scientific research and into his scientific-philosophical writings. But inner readiness has to be married to energetic action, placing doubts and heavy criticism aside for a time. This was indeed the test which Pauli did not pass. In his younger days he was already known as a severe ionoclast, equally feared by students and colleagues who often found themselves targets for Pauli's witty sarcasm. For example, he would verbally tease colleagues by suggesting to them that they put on what he called their "thinking cap". In his later years, it seemed that he himself became a victim of this ionoclastic attitude.

The dream is a very intense symbolic expression of this problem. The Stranger explicitly refers to something that Kepler was also doing. Kepler, and Fludd, allowed themselves to be carried along by their feelings and intuitions. Pauli felt a strong desire to follow a similar tendency, but the impulse to do so was held back, hampered by Pauli's overly critical approach which in the end drained him of the energy he needed to undertake the task he had set for himself.

At several occasions the inner conflict in Pauli's personality became a subject of discussion between Jung and himself. In a letter from March 1953 Jung expresses his gratitude that Pauli has commented in detail on Jung's publication of "Answer to Job". But the reflexions presented by Pauli also prompt Jung to suggest that Pauli himself should start lecturing, or continue writing on his viewpoints. Jung writes: "It seems to me that you have done a great deal of thinking and have covered a lot of ground, which would give you quite a lot to tell the *strangers* about. If one moves too far forward, it is often impossible to remember the thoughts one had before, and then the public finds one incomprehensible."[155] Again, in May 1953, Jung actually nails down the problem which held Pauli in a straight-jacket: "With the perception of the archetypal prerequ-isites in Kepler's astronomy and the compari-

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[153] C.G.Jung: Psychologie und Alchemie, GW 12, op. cit., ch. III. (Olten, Freiburg i. Br., 1972)

[154] C.G.Jung: The Structure and Dynamics of Psyche. GW 8, p. 148. (Collected Works edition by Herbert Read et al., London and Henley, 1957, 2nd ed. 1970.)

[155] Atom and Archetype, op. cit., p. 101.

son with Fludd's philosophy, you have taken two steps, and now you seem to be at the third one – namely, the question of *what Pauli says about it*."[156]
Jung urged Pauli to reveal his reflexions to a wider audience, but besides the Kepler study and two later essays, Pauli continued the established habit of pouring his reflexive energy into his correspondance. In these letters, Pauli could discuss all kinds of issues without being straight-jacketed into an objective language. Furthermore, he never even brought the idea of neutral language into the equation. He could allow himself expressions of emotions, and, as he said, to let the unconscious have its say. Pauli was well aware that the extended use of letters was a means of realizing himself of the burdens of a rigid scientific attitude. But it remains a question whether he also realized that the extensive use of letters in the end became an escape route, preventing him from taking theoretical responsibility for his thoughts and pinning them down in a coherent, systematic manner.
In the writings about Pauli there has been much speculation as to why he lost his inner drive and fell into a depressed state. For one, Herbert van Erkelens has argued that Pauli's inner journey came to a dead end, because at the end of the day he did not really dare to trust in Eros and to act according to his impulse.[157] To further illuminate this point it should be noted that Pauli took a rather unusual stand on Jungian psychology.

Pauli's View on Psychology

Pauli benefited tremendously from being introduced to Jungian psychology, from his discussions with Jung, and from his friendships with scholars from the Jungian institute. But in spite of that, Pauli was also a heavy critic of Jungian psychology. A recurrent –topic in Pauli's letters is the critique of Jungian theory, and especially of the Jungians who were regularly the target of his critique. They, says Pauli, do not have the proper respect towards what might count as scientific work. Neither are they in a position to have a proper concept of scientific work.[158]
One of the more intense arguments Pauli had with Jung dealt with the future status of Jungian psychology, which, according to Pauli, would in the future blossom not in the field of therapy, but rather in the frame of natural philosophy. In this matter, Pauli was remarkably partial, and even obstinate to the point where he seems to misinterpret Jung. Pauli writes to Fierz that "... scheinen wir beide [Jung and Pauli] darin uebereinzustimmen, dass die Zukunft von Jungs Ideen gar nicht bei der Therapie liegt (die mich uebrigens nicht primaer interessiert), sondern in einer einheitlichen, ganzheitlichen Auffassung der Natur und der Stellung des Menschen in ihr."[159] Of course, no one can know exactly what words were exchanged between Pauli and Jung at a certain moment in time, but compared to Jung's approach in general and to the argument quoted below, Pauli does indeed suggest a development which runs counter to the central core in Jungian psychology. To cut off the link to the inner life of the individual and his personal life in time and place is actually to

[156] Ibid., p. 114.
[157] Herbert van Erkelens: Wolfgang Pauli and the Chinese Anima Figure, op. cit.
[158] Cf. Pauli to Meier [1535] 16/3/53
[159] Pauli to Fierz [1188] 25/12/50

throw out the baby with the bath water. To neglect the personal dimension is to take a short cut into a field where such an approach does not work. To grasp the subtle and profound insights of soul does not take place on the main road, but rather is enabled through patience and understanding of apparently irrational whims, strange sympathies, views, and imaginations. Pauli wanted to cut off the very source from which Jungian psychology originated.

When Pauli first analytically encountered his dreams in the context of Jungian therapy, he showed himself to be a skillful interpreter of his dreams, and he was very agile at catching their deeper aspects. But later he insisted on characterizing himself in a highly generalized manner. He admitted that his stagnation or depression was a signal that his personal life and his scientific-spiritual life suffered from a deep discord. To Marie-Louise von Franz he wrote that his personal problems were only part of a much broader and deeper cultural problem, and in order to solve private problems the general cultural problems must be addressed first. "Die geistige Stagnation ist bei mir verknuepft mit einer Hemmung des Gefuehls (bzw. Angst vor dem Fuehlen). Meine Traeume stellen das aber nicht als persoenliches Problem dar, sondern als ein *allgemeines*, das in der Welt des Mannes diskutiert werden sollte. (Z.B. traeume ich von wissenschaftlichen Kongressen, die in Russland unter Polizeidruck stattfinden, und wo niemand reden darf, was er wirklich denkt.)"[160] In this matter, Pauli anchored his problems to a general level. In contrast, Jungian psychology will normally argue the other way round, and as a starting point begin with the personal and existential experiences of pain, suffering, and desorientation. It is one of the basic points in Jungian psychology that one cannot solve general problems without first going through personal individuation.

In fact, Jung, at one point, warned Pauli not to insist too strongly on dealing with only the objective level of situations, phenomena, and things. Jung writes: "However important and interesting it may be to deal with the non-psychic – especially with its archetypal stage – there is nevertheless the risk that one may lose oneself in the notion itself. But then the creative tension disappears, for it comes into being only when the acknowledgement of the non-psychic is brought into relation with the observer."[161] And Jung adds: "In physics this means the determination of the role of the observer or the psychological prerequisites of a theory." These remarks may indeed serve as a quite precise description of Pauli's problem. Pauli wanted to bring together feeling and intellect, soul and matter, psychology and physics, in a language which, at the same time, could cater to psyche as well as to physics. But the tool which Pauli constructed, namely the concept of neutral language, did not work. And the reason why it did not do so was that the concept itself demanded an extinction of exactly what Jung refers to as "creative tension."

Final Remarks

Pauli believed that the task of a scientist is his vocation, and he truly accepted this as being his particular destiny. He devoted much energy and reflexion to finding ways which could widen the horizon of our understanding of reality, and conse-

[160] Pauli to von Franz [1227] 18/9/51

[161] Atom and Archetype, op. cit., p. 114.

quently lead to a new scientific method and way of scientific description. However, his ambitions of launching a new scientific language remained unfulfilled. And, as has been argued here, the idea itself was revealed to be a paradox. Nevertheless, Pauli did in fact introduce a very crucial perspective on scientific research which should not be forgotten. In his own words, the ideal is to find a "future description of nature that uniformly comprises physics and psyche, a form of description that at the moment we are experiencing only in a prescientific phase. To achieve such a uniform description of nature, it appears to be essential to have *recourse* to the archetypal *background of the scientific terms and concepts*."[162] The world of physics and the world of psychology are indeed linked. It was one of Pauli's lasting contributions to point this out to the scientific community.

In Jung's view a defeat can sometimes also be a victory, in the sense that a person with all he/she is, wrestles persistently with a problem. As it appears, these words are very illuminating in this context. Pauli had great skills in pinning down the problems connected with a narrow scientific world view, and he wanted to revolutionize the language of the sciences to cater to the reality of feelings and intuitions as well as to the reality of intellect.

Creativity may manifest itself in many ways and on many levels, but the roots of creativity originate in a desire, a need, or a longing. In short, creativity springs from an emotion. Pauli was well aware of this, and he liked to say that the Cartesian dictum *Cogito, ergo sum* should rather be replaced by *Amo, ergo sum*. Pauli died suddenly in 1958, but the problems with which he struggled remains unsolved.

[162] Ibid., p. 180.

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Cognitive foundations of synergetic

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Instead of the preface

First, a few words about our understanding of the term "cognitive foundations", which is put into the title of our article. We have chosen it to emphasize from the very start the fact that our discourse will be about interdisciplinary basis of synergetic, and not about its philosophical, methodological, gnoseological, ideological premises taken isolated and traditionally lined up as a hierarchically regulated system of logical levels. We proceed from the assumption that synergetic, being a rather interdisciplinary post-non-classical current of explorations can be thoroughly grounded only in such an interdisciplinary context which is primarily coherent to it. And first of all in the context caused by the contemporary cognitive science, which is a new interdisciplinary trend in the study of intellect and perception. This trend represents a circularly organized correlative combination of such sciences as linguistics, neurobiology, psychology, anthropology and philosophy. At that, investigations in the field of artificial intellect, communicativistics, computer networks, in particular Internet environment, as well as the theory of autopoesis, generally associated with the names of the Chilean neurobiologists Francisco Varella and Umberto Maturana, take on an important sense-forming significance for the cognitive science. As far as philosophy is concerned, we concentrate our attention on the researches in the sphere of quantum mechanics philosophy, biosocial cultural evolution, and investigations in the field of philosophy of science, oriented onto the ideas of M. Polany's personal knowledge and phenomenology of Gusserl and Merlo-Ponty, as well. Thus, the problem of cognitive basis of synergetic transforms into the totality of problems concerning the process of its validating which is understood as the formation of multidimensional structural conjugation of synergetic and its environment represented by variety of subjective and inter-subjective experience, its modeling and corresponding communicative technologies.

The same problem of interdisciplinary founding of synergetic can be formulated in a little bit different way. Namely as a problem of the observer and the process of observation. One of the best cognitive formulations of this problem belongs to M. K. Mamardashvilly. This especially post non-classical formulation, as we'd call it, is represented in the very beginning of his famous work "Classical and non-classical ideals of rationality", first issued in 1984. "Combination of various problems and sciences, - Mamardashvilly wrote, - resulted in the appearance of the utmost necessity to find more or less precise definition for the *notion "observation*" (underlined by us – V.A., V. B.), at least as much precise that it would approach, in its accuracy and explanation, to the accuracy of mathematical and physical notions. In other words, having become the main notion in the theoretical-cognitive structure of

physics, as well as, naturally, in the structure of linguistics, phenomenology, ethnology, psychology and social theory, the notion "observation" not only put the formulation of our knowledge of physical phenomenon in the dependence on the results of investigations of conscious series of phenomenon, which have always accompanied and accompany the research of the first ones, but it also requires from psychology or any other science, studying the theory of conscience, certain idealizations and abstractions capable to throw light onto that part of the notion "observation" where its phenomena roots in the status of sensing and conscious beings in the system of nature."(1)

Commenting on Mamardashvilly's texts from external viewpoint is not quite efficient. One can communicate with his texts joining to them in different ways, for instance, by means of the mentioned X-science. In particular, if this X-science about consciousness is synergistically grounded cognitology. And visa versa.

After all, post-non-classics is post-non-classics because in its context a synergetic observer involved in the communicative process is conscious of his body and his environment, at that having some particular historical optics which enables him to include in the scrutiny a certain cultural-historical measurement of the event – the act of observation, placing the event as a lasting non local process not in a physical, but in a historical or a conceivable virtual temporal variety, by means of reflection over the preceding communicative experience, in the process of germenevtic interpretation of unsteady texts of nature. In a little bit different conceptual scale of hierarchy of basis, standards, ideals and values in the science this question was studied profoundly by V.S.Stepin (5,6) who was the first to bring a successful, in our opinion, term "post-non-classics" to everyday life.

However, post-non-classical contextuality is opened for comprehension of dynamical, virtual nature of the event, its creative and cognitive principles that require a separate discussion in our theme.

About the personal basis in the synergetic

Synergetic is frequently associated with the names of G.Haken and I.Prigogine (5,6), who are considered to be the founders of synergetic, and quite fairly. Thus it is not so often mentioned that synergetic, in Prigogine's opinion, is only one of the private formulations of the phenomenological theory of the laser which in his time was offered by G.Haken, while from point of Haken's view the theory of dissipate structures of E.Prigogine is no more than a section of nonlinear onequilibrium thermodynamics. Apart from that, there are also another sides of interpretations (7,8,9,10).

Certainly, these distinctions of perceptions may be referred entirely and completely to merely subjective and completely casual aspects of the development of the science in general and formation of synergetic in particular. But we proceed just from the opposite point of view. We recognize that in the context of synergetic and synergetic approach such a reference, such an elimination of the personal beginning, would be equivalent to the loss of its specificity as synergetic discourse, which is formed as topos of " personal meetings ".

Let's emphasize once again: "personality" in a synergetic context is an inseparable from this context characterization, moreover - it induces and determines this con-

text. And again there is one of those new synergetic distinctions, namely - the distinction between personal knowledge and knowledge of the individual as such or between the thing also called - following the Cartesian paradigm of philosophizing - subjective knowledge. For us this distinction lies in the type of communicative competence of the individual, his, perhaps, communicative erudition, in the specificity of the type of the culture of communicative self-organizing. The subject of Descartes constitutes himself by means of his well-known formula: " I think, hence, I exist ". But "I think", according to Descartes, means "I doubt, introspect and, finally, I receive the access to myself by means of the critical intellectual autodialogue. But for us this type of the autocommunications is far from being the most reliable and faultless one just because skepticism and doubt lay in its basis. Anyway it is not a unique personal-forming type of the autocommunications. The dialogue type of the person, who is open, creative and focused on the trust to another person, and thus predisposed to the achievement of the steady intersubjective consent, is more interesting and essential.

However in the transition to personal measurement of synergetic we would like to be less declarative and more consecutive. This transition can be carried out in the different ways. From the methodological point of view it is convenient to use the concept of the research programs of Lacatos-Popper as a communicative intermediary, introduced by them for the conceptual representation of the processes of the growth of scientific knowledge .It is quite simplified, but enough for our purposes, research program can be presented as some kind of " topological product " of two conceptual spaces - a rigid metaphysical nucleus and the space of hypothesis, models, theoretical images and representations directly contacting the experiment . We have named the concept of research programs the concept of Popper-Lakatos though, in the eyes of many people it associates only with the name of the latter. However, the point is that the idea of the research program itself as a structural unit of representation of knowledge in dynamics of its growth for the first time was offered by Popper in 30-ties and subsequently it was advanced by one of his pupils - I.Lakatos. But we mention this circumstance not only for the sake of historical accuracy but also because, in Popper's opinion, the research program represents itself as the "environment" which the researcher is plunged into and by means of which he enters into the contact with a natural and artificial reality opened and created by him.

The research program of Popper in the 30-ties, when he formulated it implicitly in his well-known " Logic of a discovery ", was close to the concept of personal knowledge of Michael Polany, but later the ways of these two outstanding philosophers dispatched. For Popper, however, the basic tool of communicative self-organizing of the subject of knowledge became the critical dialogue and the skeptical autodialogue of Descartes, as to Polany the things are more complex here. Polany has made a courageous and far-reaching attempt to limit the tradition of skepticism in scientific knowledge for the benefit of some form of belief (generally speaking not necessarily the religious belief). No wonder, the basic work of his life - the book " Personal knowledge "- has a subtitle " On the way to post critical philosophy ".

It is natural, that Polany's attempt to justify the belief (fiduciarity) in scientific knowledge as one of the essential factors of dynamics of growth of Popper's knowl-

edge didn't gain sympathy. Meaning Polany, though not naming him, Popper has specially stressed the disturbing tendency of the justification of obscurantism and irrationality in scientific knowledge in the preface to the English translation of the articles of " Logic of a discovery ".

But Polany and Popper also speak about self-organizing communicative activity of the subject of the cognitive activity expressing in his self-transcendency. However the difference (and in our opinion an essential difference) is in the fact that according to Popper self-transcendency is realized mainly in the process of criticism, critical dialogue and self-criticism while according to Polany self-transcendence is carried out in a special sort of act of believe, self-feedback, self-engagement to the system of scientific knowledge, in passionate self-renouncing aspiration to truth. Basically, from the point of view of result, namely - an increase of depersonalized, over-individual, "objective - true" knowledge- specific forms of self-transcendency of the subject of scientific knowledge have no value. It is quite possible, that it is true, though as far as we know, nobody proved appropriate (meta-) theorems on this account. But the matter is that the growth of the depersonalized knowledge is not a unique result of knowledge. I would regard self-actualization of the person of the scientist in this process as its other result. Here again forms, means and ways of self-transcendency, their distinctions from the point of view of synergetic may appear essential, as in the context of synergetic self-transcendency, self-actualization and self-organizing of subjects of knowledge of the forming existence are internally connected with each other.

We actually mean these distinctions of self-transcendency when speaking about the spatial measurement of synergetic. More precisely, we mean " topology of ways " of (self) transcendency of synergetic, among which, inspite of all its pluralism, not all the ways are equivalent among each other.

We have already spoken about the distinction between self-transcendency according to Popper and Polany and we shall only add to the aforesaid that according to Popper self-transcendency is understood as overstepping the limits of conceptions dictated by the language dominating in a specific scientific program. Popper sees his primary purpose in "misidentification", liberation from the captivity of language prison into which a scientist who non-critically believes in metaphysical lines of this or that research program inevitably concludes himself. The release from adherence to former non-critically accepted and dogmatically used firm rules, methodological instructions, norms etc. - this is the pathos of the doctrine of Popper's critical rationalism. But after the long-awaited freedom is found, there is naturally the question - and what is next? Further the new identification, finding of new language ontology, follows without fail. At this point two ways of self-transcendency are possible - unconscious and realized, personal according to Polany and Maslow. In his book Maslow allocates and discusses thirty-five various meanings of transcendence among which, perhaps, the understanding of transcendence № 32 is the closest one to the concept of personal Polany's knowledge and his principle of fiduciary. " It seems to me, Maslow writes - that it is necessary to allocate separately a special sort of transcendence - transcendence as introection by a person of the supreme values and identification with them, submission of his desires and actions to these supreme values ". For Polany such value is the scientific true, its search. The scientist who has chosen this understanding of self-transcendency in scientific

knowledge is capable both of identification and misidentification of himself with this or that scientific program and/or a doctrine or teaching. In other words, he is more open to perception, discovering, to formation of the new, than his colleague who has initially chosen the track of a critical reflection.

But, if we shall return to initial Popper's understanding of the research program as a communicative environment into which the scientist is personally included and in which he develops the activity, we can within the bounds of this certain context identify the idea of a rigid metaphysical nucleus of the program with a kind of specific transcendence characteristic only for it. Or, speaking already the language of synergetic, once again identify self-transcendence with self-organizing, and the latter with the concept of forming of the parameters of the order in Haken's version of synergetic.

In other words, we proceed from the assumption that personal participation is implanted in a metaphysical nucleus of the program where that leading parameter of " the transcendental order " is "located", the parameter which not only focuses and directs the search of the scientist, but it is also the center of his belief in this search that gives him strength to resist the doubts in correctness of the way elected by him. And here again we put forward the hypothesis, that a metaphysical nucleus of Prigogine's program is the idea of overlapping of Time, the idea of bringing Time back to natural sciences. We mean, of course, Time in the context of its own creative qualities, such as irreversibility, plurality, and orientation. Using another language, we may say, that in the basis of Prigogine's program lays (self) transcendence of Time.

Prigogine himself more than once made attempts to realize this idea specifically by means of the formalism of the device of theoretical physics, introducing into consideration the operator of time, the idea of infringement of time symmetry at the level of fundamental laws of nature. It is important for us to pay attention to the personal-biographic aspect of this question. Namely to metaphysics of time, the aim of "reopening" of time is implanted in peculiarities of his personal experience, in his specific orientation onto transcendence of time, onto his experience as pure temporality, duration... And at this point he is internally close to Bergson. Exactly from this point springs his passionate aspiration to overcome the break between personal "internal" experience of time with the help of his external "objective" representation, reduced by the classical science of New time to a spatial image of one more additional spatial coordinate.

Bergson is, in every respect, a principal person here. And not only because he is a philosopher of temporality, but also because he, as a philosopher of interdisciplinary in the science and an authoritative opponent, resisted the expansion of physics which in the first half of our century claimed on the monopoly as a carrier of the paradigm of the most advanced scientific discipline, a carrier of ideals and norms of all scientific knowledge on the whole.

" Bergson's overlapping " itself, from our point of view, is a necessary moment of formation of synergetic as its cross-cultural, inter-, and transdisciplinary dialogue with another spheres of the embodied existence of human creativity. It is pertinent here to give the floor to the A.Bergson, commenting upon one of his first works " Experience of direct data to consciousness " (1889). This comment is represented in his interview to Charles Dju Bo who recorded it in February 1922. " It took me

years to realize, and then to admit, that not everyone is able to live again and again plunging into the pure duration as easily as I do. When this idea of duration had dawned upon me for the first time, I was convinced that it was enough to report about it and the veil would fall down, and I believed, that the person only needed to be notified of it. Since then I was convinced that everything occurred differently.... ".

So, the metaphysical context of Prigogine's research program, of course in our interpretation, is to restore the coherence (in some topological sense) of temporal experience represented in its fundamental divisions and oppositions of external and internal, subjective and objective, designed and open etc., to reopen time, to comprehend anew the arrow of time as the pattern of distinction of events, " which happened ", which " take place here and now ", in the present and which may be in the future, " if...., " to realize this pattern as the unity, as gestalt.

Interdisciplinary and principles of synergetic

The laser is a device in the work of which the natural and artificial, ordered and disordered, quantum and classical are combined. Synergetic in the image of the laser is naturally comprehended in the spirit of instrumentalist and neopragmatism, including interdisciplinary constructivism of the concept of Varela's and Maturana's autopoesis. The latter, in addition, is characterized by the critical attitude to "the silent assumption, hiding itself in the variety of formulations of so-called cognitive realism... according to which the world may be divided into the regions of discrete elements and tasks. The knowledge is the solving of the problems and in case of success it should correlate its results as elements, properties etc. with these pregiven regions. " (4)

Thus synergetic appears to be as much critical to classical and even to nonclassical disciplinary borders...

The postnonclassical instrumentalist of synergetic is interdisciplinary in its intentions that is why it is necessarily communicative, conventional and is open for the dialogue. And the dialogue requires a structural joining, structural interface, as its precondition.

The interdisciplinary instrumentalist of synergetic assumes adequate to it, dynamically steady, self-resuming and at the same time evolutionising communicative ontology, for example, such as the ontology of Varela's and Maturana's autopoesis. We shall notice in brackets, that this structural interface (structural coupling) is important not only for the dialogue of Prigogine's and Haken's programs and their symbiosis, but also for the use of images, ideas and representations of synergetic in social-humanitarian knowledge, psychology, political theories etc. N.Luhmann makes some interesting attempts in this field...

At this point of our reasoning the metaphysical question of reopening of spatiality in synergetic is transformed into the question: whether it may be done by synergetic itself, by its methods and means?

Or, perhaps, an import of ideas from outside is necessary? And if so, what ideas? Our answer to this and similar questions, is certainly positive, if it is realized, that such characteristics as "circularity", self-reference, autopoetry, communicativity,

dialogue are principal ones for synergetic thinking as net thinking and, mainly, metaphorical one.

We shall try to look at the problem of interdisciplinary from within, from the positions of the subject scientific knowledge. The methodology of interdisciplinary researches is a horizontal, as E.Laslo says, transdisciplinary connection of the reality - an associative one, with metaphorical carries, frequently symbolical, bearing an enormous heuristic charge, in contrast to a vertical relationship of cause and effect of disciplinary methodology. The disciplinary approach solves the specific problem, which has arisen in a historical context of development of a subject; selecting methods from the settled and as a rule hierarchically ordered toolkit. And an interdisciplinary approach is additionally opposite to it when the tasks are searched for the given universal method and solved effectively by it in the diversified areas of human activity. It is a considerably different, holistic-network way of structurization of reality, where creativity, polymorphism of languages, a metaphor and analogy, network thinking, circular causality etc are in the focus. Here the most important thing is rather the course from the knowledge as " to know how ", than from the knowledge as " to know that "; knowledge from the method, but not from " a well defined, disciplinary task ". So at this stage of modeling mathematics appears - the language of interdisciplinary dialogue, though we are inclined to forget about this, preferring to speak about natural-science approaches which are becoming interdisciplinary, for instance about the theory of fluctuations.

We recall only some of interdisciplinary plots of XX century: the principle of N.Bohr's additionality - the transference of a quantum principle on the sphere of creativity, mentality, language etc., which was possible only due to the authority of the founder of the quantum mechanics; A.B.Chizhevsky's heliotaracsia - the search of rhythmic cosmic-terrestrial correlations in the most various displays of life on the planet; R.Thom's theory of accidents very quickly taken on arms by humanists; and certainly cybernetics and the system analysis, today passing on the baton to synergetic which tries in network images to associate the methodology of all previous currents.

Psychology and technology.

What is the peculiarity of translation of interdisciplinary synergistically focused methodology in culture or science? Personal experience of such a communicative activity in the environment of humanitarianly focused experts testifies to the existence of two basic problems: the problem of interaction of two cultures in Charles Snow's spirit and, the basic one for us, the problem of overcoming (but not substitution) of disciplinary type of thinking for which the interdisciplinary methodology is not only marginal, but also frequently contradicts corporation ethics, distracting attention from essential problems of discipline, as it solves "casual" problems the majority of which are either not so interesting, or not yet interesting, or will never arise. Frequently it causes the reaction of tearing away from the side of disciplinary organized thinking, which is aimed at cognitive realism. Really, you see there is no even habitually outlined, subject statement of a problem. Everything looks as though the method itself "searches" the problem! Whether it is realized or not, but the guarding disciplinary reflex of cognitive realism works here also as a reaction

on the claims of the carrier of interdisciplinary methodology who is accused in dabbling, unreasonable ambitions. But the intention of the latter is not to take root, having pressed disciplinary corporate hierarchy, but to improve the communications so that in case of the arisen mutual understanding to cooperate and consult on the application of the offered methodology and language. All this reminds of technology of orgconsulting in the sphere of scientific methodology (and less common - missionary work). As a result there is a new type of the mobile communication by means of wandering among the settled population " peddlers from universals ", which they did not get used to, but which in our century of landslide streams of information will allow to cope with them. Here again there is a division of labor between synthetics and analysts since methodologies are in the relation of additionally to each other, more precisely, of duality, - a subject and a method, a vertical and a horizontal.

The development of synergetic is inevitability stratified on a degree of formalism and concreteness of language, is metaphoric and polyphonic, but has a rather rigid skeleton of methodological principles which, unfortunately, today is almost indiscernible behind a peel of arrogant motives and any associations. It demands regular restoration and updating, which the periodic interdisciplinary forums might take over.

But all comes to the end and when the method is reprinted, mastered by disciplinary thinking, the agiotage dies, the fashion passes away to revive with a new force during the next dissociation and linguistic chaos in the description of a reality, and beautiful packing and bright advertising of holistic arch-type will be not less intriguing and significant. The new wave of coherence of scientific understanding will be distributed by indefatigable adherents of interdisciplinary probably more widely, resounding and being deformed most whimsically and unexpectedly in scientific culture and ordinary consciousness, so that afterwards to dissipate in the efforts of set of the analysts creating variety and complexity of interpretations of this world.

A few words about the fashion on synergetic

Nevertheless, it is necessary to emphasize that the understanding of synergetic in various contexts is different, and today there is no its standard definition as, for example, there is no strict definition of fractal. Besides the volume and the contents of the subject extend greatly, causing unlimited delights of neophytes and protests of the most strictly conceiving professionals standing at the "sources" and grievously watching the distortion of the historical truth, and priorities. It is a cultural phenomenon of recognition and consequently also of its understanding, arch-type of the integrity in different areas of culture and its expansion goes from the most authoritative component - science, moreover an interdisciplinary one. It is possible to get upset over the fashion on synergetic, and its free interpretation, but the history encounts several trends of a similar sort: fashion on cybernetics, the system analysis, the theory of a relativity, and as for XYIII century - saloon evenings of Voltaire about " the new mechanics ", and even the society of "Newtonian ladies ", that finally promoted the fastest introduction of Newton's "Basis" in the university courses of Europe (despite of the resistance of many continental authorities). The

fashion will certainly pass, but the principles and language of synergetic will be incorporated in the bases of culture, and time will disseminate mirages of misunderstanding.

Synergetic is connected with the names of our contemporaries: I.Prigogine, G.Haken, S.Kurdjumov, D.Thom, J.Klimontovich, B.Mandelbrot, and D.Chernavsky... Though it has arisen as the theory of the cooperative phenomena in tasks of laser theme, it gradually got more and more general status of the theory describing open-ended, nonlinear, unstable, hierarchical systems. Already in the field of natural sciences there is an opposition to such an interpretation of synergetic, someone prefers to speak about nonlinear dynamics, or about the theory of dissipate systems, the theory of open systems, the theory of dynamic chaos, autopoesis etc. In our opinion the apologia of synergetic may be justified only after the introduction of a problematic of the observer, human-dimensional systems, self-referent systems, thus expanding methodology of synergetic till the field of complete culture. In the given work we understand synergetic in this expanded interpretation. Philosophically speaking, we understand synergetic is a science (more precisely speaking a movement in a science) about forming existence, about the formation itself, its mechanisms and their representation. Here again it is important to avoid another extreme, not to profane its methods, not to take a great interest in fashionable synergetic phraseology, weaving metaphors; but to remain on the positions of a certain science, to use its potential as a technology of universities fulfilled in practical activity.

Shortly about principles of synergetic

In the truncated variant it is possible to offer 7 main principles of synergetic**.** (14, 22)

*Two principles of Life***:** 1 - homoeo-statics and 2 - hierarchy; which characterize a phase of stable functioning of the system, its rigid ontology, transparency and simplicity of the description, G.Haken‘s principle of hierarchical submission (long-living variables subordinate short-living ones), presence of steady dissipate structures-attractors which the system functions on.

*Five principles of formation***:** 3 - *nonlinearly*, 4 - *instability*, 5 - *non-isolation*, (those three “NOT” which were avoided in every possible way in classical methodology and which allow the system to enter a chaotic creative phase, usually occur due to positive feedback), 6 - *dynamic hierarchy* (generalization of the principle of submission on processes of formation - birth of the parameters of order when it is necessary to consider the interaction of more than two levels and the process of formation itself is the process of disappearance, and then of the birth of one of them during interaction of at least three hierarchical levels of the system, here, in contrast to the phase of life, the variables of parameter of order are the fastest, the most unstable ones), 7 - *observability* (a relativity of categories of the order and chaos to the level of supervision, the scale of an existential window, which may even transform the chaos into stable functioning). The last two principles include principles of additionality and conformity, circular communicativness and relativity to the means of

supervision, starting the process of the dialogue between the internal observer and the meta-observer.
Such creative point of view on formation always existed in the culture. It was represented, speaking the modern system language, by the creative triad: the Way of action + the Subject of action = the Result of action, and it is fixed in verbal structures of the language; in the roots of bisexual asymmetry of the person as a biologic species, in the way of transferring the information. In an ancient philosophy this triad was represented as the following: Theos, Thelos, (Logos) + Chaos = Space. In synergetic its explication is the process of birth of a hierarchical level as the result of interaction of the two nearest levels: « Managing superslow parameters of top mega-level « + « Short-living variables of the lowest micro- level « = « Parameters of the order, structure-forming long-living variables of meso-level».
At studying hierarchical, open, self-organizing systems this approach proves to be the most effective.

Language games from synergetic

The notion of an event of physics, as well as of a point in mathematics, is initial and its simplicity is important in the ontological basis of the science. So it is in a classical science, where we join directly the absolute truths through the idealized objects (a material point and instant event) and models (the inertial and isolated systems), transferring their images on the reality.
But there comes the century relativity and quantum and the event finds a big conventionality, additional degrees of freedom, it depends not only on the object to which it occurs, but also on the system of readout of the observer, such as supervision, a context. Truthfully, the discourse is already about compound binary events: in the theory of a relativity it is the measurement of existential intervals, absolute in classics up till now, and in the quantum mechanics it is interconditionality of simultaneous measurements of two independent observed earlier in classics values. We shall remind that elementary event and the act of measurement (supervision) in physics are inseparable. There is nothing to add here after Einstein and Bohr to physical interpretation, but not a philosophical one. Binary events or pair acts of measurement are actually relative to the means of supervision. Thus the physical reality is allocated with the elementary communication procedure - connectivity, which is contextual in the sense that it depends on the means of supervision, it already non-trivially dislocates the atomic event. In classics the communication is stiffened, there is only one context (the space and time are absolute).
The science is substantially spontaneous, full of non-reflected psychologisms, its concepts are closer to common sense and sensual images, than it is usually accepted to think, and I hope to show, that it was the event in generalized - temporal sense which became the prototype of lots basic mathematical and natural-scientific designs, concepts and laws.
In a broad sense *event* assumes: something has taken place, was held, has come true, began to exist and up to that time did not exist. And at the same time the event happens to be elementary, atomic, insignificant; and it happens to be significant, pow-

erful, epoch-making. The latter must be rather connected with the sense of the event. Any event may be understood in the qualities listed above, depending on a context, and consequently and on the position of the observer choosing the context. Dislocation, or clothing of elementary event in more and more wide context dissolves it in the totality of the world while cutting the context down, or its clasterisation, scale hardening may lead it to the atomic sense. Formation is also the reason of event, but not its final sense. The event tears the fabric of time here and now, but time heals, tightens it with the hems of senses, reconciles the event with the life of the past and future by myriads of strings - contexts.

Basically synergetic context assumes plurality and ambiguity of ways reopening of spaces and time. It is also one of the features of synergetic discourse as discourse of sciences of epoch of a postmodernist style or a postnonclassical science.

Generally speaking these ways exist only potentially in an possibility just as there is a word not yet conceived in the game "Yes – No", on the example of which J.Willer shows the distinction of understanding of measurement in the classical mechanics and the mechanics quantum.

These ways can be relatively marked by means of the indication of those initial "toposes", the places with which we begin our conversation. The first is the place of the mathematical, determined by mathematical toolkit of synergetic. First of all it is the device of the nonlinear differential equations, phase portraits, attractors, bifurcation, Thom-Arnold's theory of accidents and other intriguing things. I would stress, that is the device, the toolkit of synergetic generated originally in A.Poincare's works in connection with the tasks of mechanical movement and, first of all, tasks of stability (and instability) of movements of heavenly bodies.

Thus, the circular way is outlined: the mathematical description with the help of the differential equations is applied to the description of dynamics of language, basically the same language, on which basis and with which help mathematics in images of Euclid's geometry, the Cartesian system of coordinates, the Newton-Leibniz's analysis of infinitesimal and systems of representation of knowledge similar to them were formed. Today it is not so necessary to be the most experienced philosopher-gnoseologist so that to see that all this mathematics is only one of the possible machinery of knowledge and that it is not a representation of external in relation to us reality as itself, but it is only a representation of our specific attitude to the world in a context of the dialogue with it, set by the specificity of the way of its questioning.

However, the aprioristic inconsistency of attempts of using of the specialized mathematical language as means of knowledge of natural language of daily intercourse does not result from this. Eventually, synergetic sense occurs as a result of short circuit of communications, in creation and/or reconstruction of communicative cycles (hyper-cycles, according to Eigen), in which and by means of which the research procedures are realized. We shall add also, that at this point, with reference to language, the division into natural language and specially invented language, artificial, which is the language of mathematics hasn't the character of their opposition.

So, Senses arise, as contextual dislocalization of atomic event, dislocation in the event space - time, both in the past, and in the future (for what the causal ideology of exact natural sciences has a soft corner in the heart). However the spatial in a synchronous cut of a reality dislocation of the event is also possible: it is a correla-

tive, probable analysis which empirical sciences, the humanities, ordinary and archaic consciousness (for example an astrology) are inclined to, a useful and mysterious holistic image of the world arises, but a temptation also arises to explain it by the direct interaction of correlates, though it is absurd as a rule and there are general reasons for them in the past. It is possible to say that sense is a polycontextual attire of the event, its history and forecast, more precisely their possible variants, its participation to the world not always unequivocally set by the contexts.

The context starts from circumstances of place and action, but then expands by loops of conditional sentences, isolating from all conceivable circumstances the new details, but consciousness, satiated by redundancy of such game, breaks off the circuits of epithets, relies on the previous experience, - we do not need words, everything is clear. This " everything is clear " leaves an opening for semantic pluralism, which sprouts, on boundaries and edges of stipulated spaces and ways. And such ambiguity is inevitably connected with an information finiteness of the person which is realized on epistemological borders in any experimental science, but in our case it is obliged to the technology of judgement, finiteness of depth of any context - one of the aspects of a principle of observability, the attempt of supervision over the infinite whole by its final part. However, axiomatic theories build the system as a tower above the final number of axioms, and usually hope on final (probably algorithmically) depth of a context, but here there are also insuperable complexities, which we will talk later about. The matter is that in the science itself there was a case of theorems about non-existence (Galois, Gedel, and Von Neumann), when the theory groped its epistemological border from within.

*Clothing as recognition***.** Going from the whole to the private is well done in the quantum theory of a field when, proceeding from the coordinated equations of a field which usually can not be solved, fragmentation, onthologisation of the first approximation is made: n-partial sectors, asymptotic conditions, condenses, strings etc. Then ontology is corrected when "clothing" the badgered values in iterative procedure of the theory of indignation. The theory of indignation is an analogue of the reflection testing and renorming physical values. But it is important, that going from the whole to the private, we understand the degree of correctness of this transition, which cannot be expected at the processes of construction from private to the whole! The ontological border is groped, as singularity - the theory of indignations fails, the system is unstable, is not determined; and the change of ontology is necessary for its overcoming, the birth of new senses, quite in Z.Deleous's spirit: " The nonsense grants the sense ". However, the theory of indignations is only step-by-step construction of reality, though claims of the initial ontology on its description are immense. But, steps become shorter and shorter, and we are already stamping uncertainly at the forbidden line (the main flag - harbinger of any accident is the " delay of characteristic rhythms of system "), in a captivity of F.Girenok's pattern spaces. This sight of the internal observer included into the work is only the technology of diagnostics of a stalemate, and a regular method of research of the border which, as usual, has a fractal nature, but in no way allows to overcome it, to glance into transglassity.

Here it is necessary to consider more precisely the analogy between recursive descriptive processes of reflection and procedures of the theory of indignations. There are three types of the latter:

a) Initial indignation does not leave the frameworks of the area of convergence (we implicitly assume metrication or at least topological nature of psychosomatic space), or the horizon of predictability in case of dynamic chaos; A reflective process regularly converges to some concept adjusting the initial representation and step by step affirming in it creating the illusion of finding of the firm truth. The area of convergence is an image of space transparent for understanding. All converging iterative procedures of the decision of the nonlinear equations (a method of compressing displays) are of this type; motives-ideals of early germenevtics are those also. To such type of processes it is natural to relate recalling-purifying of the atomic image - context, its emersion on the surface of consciousness.

b) The initial indignation is great and does not converge to any result, reflective loops are not pulled together, but derivative "vicious" circles, or chaos. Here we may speak about the missing lines, full uncertainty of result. For some reason it is accepted to connect reflective process with this type of bad infinity. This process, nevertheless, is productive and may be used as a mode of search, generation of new contexts.

c) But there is also the third, poorly known, but probably the most realistic, mixed alternative: so-called asymptotic line of the theory of indignations. Its behavior is unusual - on several first steps (sometimes rather numerous) we observe the process converging to the certain result, but the subsequent members of lines result not in specification, but in deterioration of the result, the line misses, disseminating the arisen Mirage of understanding. That does not prevent the usage of such lines in practice - all lines of the theory of indignations for quantum fields are asymptotic and are used until they converge, though it creates the borders of accuracy of prediction, but wonderfully conforms to the experiment. We shall dare to state that ratio has the asymptotic type of germenevtic lines: our mentality probably protects itself from the excessive stability of opinion, gets tired of monotony of infinite acknowledgement, reserving its right for the chaos of doubts which rushes into consciousness and destroys the quasi-stable not firm concept or sense, if it is specified further; here we admit only a delicate lateral sight. In it there is an explication of Bohr's principle of additionality in the processes of knowledge which K.Jung and N.Bohr insisted on, in it there is an internal creativity of the sense impregnated by germenevtic touches, suddenly blowing up its environment by miriades of contexts, flying up eventually to the symbolical. It is the source of its self-movement - any banal idea sooner or later at its discussion gives rise to the photogenic chaos - the channel of access to any concepts, really - "what rubbish the verses are born from".

We shall emphasize another aspect of interdisciplinary - the unity of genesis of formal and natural languages. Our task is to show the communication of natural language and cognitive psychology with cognitive language of modern physics and mathematics, to show its capability of repeated convergence, the first attempt (social physicalism) appeared to be a rather doubtful one.

The question may arise: why the general language means of science and humanitarian knowledge, this cognitive revolution the witnesses of which we become, were outlined only nowadays? The matter is that for two centuries the fundamental science was based on ideals of reduction, ideals of a reduction to the elementary forms of movement, images of continuous, exact procedures of solving of dynamic problems. And only in our century physics have understood the hopelessness of the

search of exact solution of supercomplex quantum-field tasks (none of the realistic models is solved), but they have developed the language of consecutive approximations to the solving - the theory of indignations, in its elementary form used by Newton at the search of roots of the equations. It turned out to be possible to put it into the language of discrete “events” (the approached solution + function of influence = a more exact approached solution of a task). Certainly the first example of application of the theory of indignation’s is almost 2000 years old, - the well-known epicycles of Ptolomey. This approach was not the main one in mathematics for a long time as it contradicted the ideals of beauty and simplicity and was very labor consuming, because all science of new time searched for precisely solved tasks. Though iterative methods developed in the theory of special functions (A particular special-function is called by the name of almost every famous mathematician). The situation has sharply changed only with appearance of computer engineering, but you see, different circuits of numerical methods is the language of events itself!

The diagram language in physics has arisen because of the need of the description of very complex systems, as well as, however, in humanitarian sphere. Here is one more reason on which humanists rejected the classical scientific methodology - a different level of complexity of objects of the research, which demanded also different methods. Today we see the obvious rapprochement of positions on the ground of modeling in cognitive diagram. So, one of authors showed that language of the modern quantum theory of a field (Feynman‘s diagram) is structurally isomorphic to inducing grammars of all natural languages - Chomsky‘s grammars.

Two sights on formation
(The observer and meta-observer)

Genesis of modern methodology of synergetic, probably, should be carried out from A. Poincare. The fundamental results lying in the bases of the modern theory of dynamic chaos inherent to the majority of mechanical systems and idea of formation in the reduced description - the theory of bifurcation are associated with his name. From him it is possible to trace two lines - a view on formation from within when the observer is included into system and his supervision over unstable system, the dialogue with it which is brought in by uncontrollable indignations, which was especially brightly demonstrated by the quantum theory, and a view from the outside - when the system is structurally steady, and the influence of the observer on the system can be neglected.

The last approach, the view from the outside, answers the rough description when the idea of crisis is reduced to a point - a point of bifurcation. In the arsenal of synergetic methods it is the theory of accidents first of all. The idea is that initially the ontology of only one structural level is given- variables in which terms the bifurcation equation for parameters of system order is written. Its solution is unequivocal, except for one point of bifurcation where it is unstable also by jumping passes to a steady branch - there is a change of ontology across. It is the view from the outside. The point of instability, of becoming is not unpacked here. All mechanisms of chaos are out of sight, from one condition of homeostasis we pass to another one

immediately. The system is almost always steady and the observer, to be more exact a mate-observer, is a quite classical one.
But also in this approach it is possible to catch the precritical phenomena - so-called flags of accidents: a critical delay of characteristic rhythms of the system, increase of amplitude of possible fluctuations of the window of a dying away parameter of the order in the vicinities of the point of an accident. The level of generality of the theory of accidents is that its models, well known in physics of phase transitions, now begin to find an application in economy, psychology, art. For example, before an economic crisis there comes the well-known condition of stagnation when the characteristic periods of the revolution of the capital turnover increase appreciably. The same effects can be observed in the natural phenomena - the lull before the storm, in creative work, in poetic images.
The engineering used further answers the spirit of the classical theory of stability in linear approximation according to Ljapunov in the vicinity of homeostasis. The theory of accidents helps to make a model, to design an evolutionary tree of alternative ways, distracting from internal mechanisms working on crossroads of system's history, without introduction of hierarchy of the level of submission of this or that system of parameters of the order.
We shall consider now the questions of thin structure of crisis. As we have seen it is necessary to allocate three its stages: immersing into chaos, life in chaos, and an exit from chaos (self-organizing). In this approach we inevitably face the actualization of basically infinite number of hierarchical levels and ontological plans of formation, basically infinite sensitivity of unstable system to external influences both from the part of the universe and the observer, with principal openness and participation in the condition of chaos with all events and an opportunity to channel from the outside certain principles not shown in the condition of homeostasis. Here the observer may not be a classical, external observer; he is necessarily included into the system.
The stage of transition to chaos is the most investigated one nowadays. Already the elementary systems with one and a half degrees of freedom, such as Lorenz's model, show all the palette of universal scripts of entering the chaos. It is Feigenbaum's script - the infinite cascade of bifurcation of doubling of the period with universal scaling, Pomo-Mannevill's script - the transition to chaos through transition from…to, and Ruelle-Takens's script - after bifurcation of trebling of the period the occurrence of a strange attactor is possible. Their universality can be explained by the fact that the script is classified also in terms of the elementary accidents and has the same level of generality and structural stability. Exactly for this reason the dynamic chaos is common not only in physics and natural sciences, but also in a society, mentality, creativity.
At a certain stage of the development of the tree of bifurcation or on the appearance of the strange attractor the stage of a dynamic chaos comes bringing with itself both plenty of possible structures, and impossibility of their full comprehension. Tracing the trajectory becomes very difficult and the language of the statistical description is introduced: probable distribution, correlative functions, Kolmogorov's entropy etc.; however, in contrast to the problem of the great number of particles - thermodynamic chaos - the complexity has an essentially different nature here - dynamic chaos. Usually it is the modes of so-called not computable systems when trajecto-

ries fill in geometrical objects of fractal nature, set not by the algebraic equations, as habitual varieties, but by the iterative procedure. On one hand, fractals assume statistical interpretation, and on the other hand - they have an analytical origin and very rich geometrical structure on any scale for which principles of self-similarity, the principle of channeling of micro- and macrostructure are characteristic. Fractals are typical stochastic structures on strange attractors.
But every time the system has sprouts of all the variety of structures identified in chaos. These images could be compared with a principle " life in formation " - the mixture of elements, which probably should be in real life not only when the structure is visible on one scale, and the chaos on the other, but they also exist simultaneously in one reality.
The process of transition from chaos to the order - the birth of parameter of the order, the choice among alternatives and potentialities is the moment of truth of the phenomenon of the structure. The thing frequently called self-organizing is its end, simply observed chaos - order - the process of the exit onto the attactor from the border of the area of its attraction. But the matter is that in the stage of chaos there is no advanced attractor, it should be born still. Probably, it is possible to expect several scripts of self-organizing. The first one (slow) - when any local quasi-stable structure begins competing with another spatial structures gradually increasing, then the choice of alternative will depend on which of them the system is in at the moment of the exit from the mode of chaos due to the change of external conditions, and probability, accordingly, will depend on the time of staying in it. The second one (the birth of parameter of the order) - transition from unstructured homogeneous chaos, such as generation of the laser, or morphogenesis according to Turing when there is a phenomenon of merely collective occurrence of structures, the struggle of fluctuations. The third one - a chain of the opposite bifurcation, shrouding, veiling the process of stabilization of structure.
The narrative tone of this unit is characteristic of a classical meta-observer capable to take a look at the field of opportunities or to make repeated experiments. But the view from within, the life in chaos change considerably the very type of that epistemological space in which there is an inquiring by the person of the nature, another man and himself, assumes an interdiction on many ways of a reasoning given above.
And a classical meta-observer himself is idealization also because he is pulled out from a cultural - historical context though he is a child of time, with his language, with his own fixed scientific means and methodology, but it is also necessary to increase a time scale at least up to the event level of construction of certain models let alone the epochs of change of scientific paradigms as he gets into the condition of including into system, into the process of designing its future and new epistemological spaces.

Chaos and generalized rationality

Chaos as an internal property of nonlinear dynamic system, arises almost always and almost everywhere and not only in the systems with a great number of extents of freedom as it was accepted to consider not long ago, but also in so-called systems

of small size. From the knock of wheels and driving on a swing up to a plane's flutter, the behavior of laser radiation at some modes and turbulence - it is iniquitous. The chaos, figuratively speaking, exists everywhere, veils practically all phenomena of our life both surrounding us and inside us. And if we do not always notice it as it is - namely do not identify it as an internal property of dynamic system, it is only because it can be observed only from the point of view of the certain prospect determined by a quite narrow area of parameters (for example, in the field of a point of bifurcation), or is shown at a level of scales of very big times (as in case of movement of planets of solar system). In other words, the chaos lives on the borders of spatially time scales of our perception of the reality as already becoming life. Thus it may seem the chaos in some ontological sense is marginal to the reality, not being its necessary essential property. This feeling, however, disappears as soon as we include in ontology not only life, but also the process of formation. Besides, the transition from life to formation leads also to the radical recomprehension of the role of chaos in the universe. In life there was always a grain of formation, which was rejected by the classical temporal rational mind as something dark, and opaque, caused by the subject and can be eliminated by him by means of mastering the certain skills of thinking (Descartes)

The Chaos was torn away as an image of ignorance, as something preventing knowledge, as an obstacle in its way. A creative role of chaos as a generator of the new information, definitely represented in the ancient Greek picture of the world, was, naturally, something alien for a classical rational self-transparent mind.

And only recently it was clearly realized that chaos in its universality and omnipresence is not always and everywhere an obstacle to knowledge, that is why it is something that is obligatory for elimination. It is just because scientists, as it repeatedly happened in the history of science, saw what they could and wanted to see, because of linear (mainly) approach to an explanation and understanding of the reality, and because of the absence of the powerful computing means necessary for inducing phenomenon of determined chaos of long iterations of the equations of dynamics. In this connection the public unique in the history of science apology of the president of the International union of pure and applied mathematics sir Arthur Lighthill, made by him on behalf of the colleagues, is of great interest here. He said that for three centuries the educated audience was misled by the apologia of the determinism based on Newton's system whereas it is possible to consider, at least since 1960, this determinism to be an erroneous position.

In case of the advanced determined chaos there is a new problem of the description of the reality by the internal (and not just an external one) observer. Here again the question of accuracy of the task of an initial condition of the system becomes a key one. The matter is that in Newton's mechanics it is just a verbal exercise since the idealization is usually accepted, that close conditions remain close ones during the evolution of the system, which, in turn, allows to describe the system for a long time in the language of trajectories. In case of dynamic chaos we deal with principally another system: the majority of solutions are unstable in the initial data, while very much close index points of phase space (exponentially quickly) run up fast d (t) = d (0) EXP (t/T) where T is a reverse Lyapunov's parameter in other words - the time during which trajectories of points run up on distance in e-times (2.718.) is greater than the initial distance between them i.e. any vicinity of an observable point

is not transferred compactly to phase space, but is washed away, mixing up with other conditions. Then very fast the close becomes the distant, and the distant - the close and not a classic language of trajectories, but the language of their bunches, ensembles, probabilities etc. becomes the natural language.
Thus the source of extreme complexities is not in the complex device of a certain dynamic system (and more less in the number of its extents of freedom) and even not in the external noise (which is only another expression of complexity of other system - an environment), but in the initial conditions of movement and instability. Owing to the continuity of phase space in the classical mechanics, these initial conditions contain infinite quantities of the information which providing instability staticizes in such a complex irregular pattern of events, which are identified as dynamic chaos. Figuratively speaking, the particle in its movement represents, takes out this information (9).
So, the internal observer, having started together with the system can not predict its behavior in the language of trajectories already in time τ - named also *horizon of predictability* of the future that means simultaneously the restriction of Cartesian-Newton rationality. Similarly at a retrospective view (on the same reasons) the horizon of reconstruction of the past on depth T arises.
In that case the observer knowing the dynamics of system may use determinative language only in a small existential window of transparency - T $(\forall x T)$ Newton's rationality. The comparison with the condition of the limited visibility in the muddy water because of dispersion of light is pertinent here: we see the veil, the border of perception. From this point the change of ontological lines follows, one of the parameters of which is the transition to probable language behind the horizon of predictability.
Basically it is possible to continue this process of quasi-classical description by steps of duration τ, and τ now depends on a point of phase space (water may have different transparency in different parts of the reservoir) if to observe the system repeatedly performing classical reduction from the ensemble to realization. It is a position of the observer - historian, chronicler of the events with the limited forecast and its periodic updating, it is a construction of a tree of opportunities of evolution outstripping the real evolution of system only by one step. As a matter of fact, futurologists and our ordinary consciousness work like this nowadays.
Thus, the spatial-temporal scale (of a variable step) of observers in the communicative relation to each other as though transmitting to the system from the neighbor to the neighbor is necessary for preservation of elements of quasi-classical limited rationality. It is also possible to speak about one observer accompanying the system. It is not just an observer - a chronicler of events, a storyteller, but also, philosophically speaking - a reflecting historical consciousness in the accompanying system of readout. In contrast to the theory of relativity, here we mean not a relativity of moving systems of readout, but relativity of a place - time to dynamics - dynamics of time - space.
The vivid example of systems with horizon of predictability or a window of classical rationality gives us so-called climatic models. One of them - Lorenz's model (only one and a half degree of freedom) in which there is a mode of a strange attractor, that is advanced dynamic chaos. Exactly for this reason short-term weather forecasting for the period more than two weeks is practically impossible. Correla-

tive probable dependencies and structures are usually guessed on the big intervals of time. For example, folk signs of numerous forecasts belong to another empirical type of rationality, century-old folk wisdom and, probably, answer the presence of stochastic, fractal structures on climatic attractor. The belief in folk signs here quite rationally corresponds (communicates) to scientific probable interpretation of dynamics of the system.

One more example is connected with a problem of reduction in scientific knowledge. Why is the full and exhausting explanation of the chemical phenomena by means of physical language supplemented with quite powerful computing resources impossible? The same thing concerns communicative reduction of biology in chemistry. The matter is that solving Shredinger‘s equation for a multipartial atom or a molecule, especially for the processes realized in chemical reaction which go through unstable stages of their development, we face the self-coordinated task of several bodies for which by virtue of the occurrence of a mode of dynamic chaos, the exact account of all details is basically impossible, as the dynamic chaos is potentially complete and can not be divided into its separate components. In such context the traditional disciplinary chemical language of valences, kinetic factors, channels of reaction etc. is to the point here.

In physics itself the problem of reduction that is a problem of transition from the dynamic description of the system to thermodynamic one is not solved finally yet. Fundamentally the importance of the discovering of non-integrated systems by Poincare consists first of all in the fact that in dynamic chaos we face with a qualitatively new form of the movement which is not reduced to its elementary known before forms, such as the movement along a straight line and a circle.

And the problem of reduction of the probable irreversible in time laws to determinative representations has no solution, because the languages used here exist in different epistemological spaces. In other words, solving the problem of reduction in this case would be equivalent to making full reduction of formation to becoming life...

The concept of dynamic chaos assumes a new open form of rationality. This form of rationality consists of three basic types. The first type - of beliefs, signs of folk wisdom. It is, as a matter of fact, a complete probable view on the stochastic structure of the reality. The second one, opposite to it determinative view of classical science, true on small times of the horizon of predictability. And the third one, a reconciling type of historically local rationality, probably, peculiar to medieval culture and ordinary disposition.

The internal unity of all three types of rationality found in dynamic chaos proves an opportunity of formation in modern culture of the generalized rationality in which context the science and practical wisdom really need each other.

In particular, in dynamic chaos belief, as a way of restoration and maintenance of confidential contact of the person with an external and internal reality, gets its rational justification.

Creative Universe

The dynamic chaos has one more remarkable quality - it opens the system for the external world. In this mode it is naked and defenseless to any small external influences. The concept of the closed isolated system becomes an unattainable idealization. The system enters the dialogue with the universe; it joins the Universe, feels as its part and similarity. In a chaotic evolutionary phase the perception, the reception of the information from a complete source, synchronization and harmonization of the system in the consent with space principles are possible. Here, probably, the creative, creative beginning of chaos, alongside with internal sources, are hidden. We call it a communicative function of chaos. In science such phenomenon is realized through effects of synchronization of hours, biological rhythms of organisms, communities connected, at first sight, by slightly small interactions of arbitrary nature. Probably, existential structures are synchronized due to the communications by means of their chaotic and stable components; probably the solution of understanding of harmony (22) is hidden here.

At the same time the ideas of self-reduction of system, self-generation of senses, self-development of a matter are actively discussed in Prigogine‘s and Haken‘s last works. Thus in non- reduced dynamic systems the act of reduction occurs continuously, as though the system constantly measures itself, giving birth to the new information and with the occurrence of hierarchy of time in the largest part of the system long-living variables become the parameters of order of new homeostasis, subordinating the system by means of the set of negative feedbacks.

So, formation in the given context is first of all the process of self-generation of chaos of parameters of the order by means of which evolutionary valuable selection, birth, packing and compression of the information are realized.

So, discovering of the phenomenon of dynamic chaos allows comprehending anew the process of formation of a post nonclassical science as self-organizing of interdisciplinary knowledge. The post nonclassical science not only designates the border of determinative perception of the world focused on the potential hierarchy of laws of life, but also simultaneously includes the practical wisdom of tradition in the discourse.

Postnonclassical epistemological space

One more way may be initiated by means of introduction of the idea about post nonclassical epistemological space, as such space in which a synergetic subject finds himself. The necessity of its introduction is caused by the fact that synergetic as an interdisciplinary trend includes also philosophical measurement, communication of philosophical tradition, integrating it to some extent with a modern postmodernist paradigm in which a subject is not given initially, but he becomes, does not contend, but strengthens himself in the variety of self-transcendence, the variety of communicative practice in the broad sense of this word.

It is essential that postnonclassical epistemological space is derived by the interdisciplinary situation, in which the synergetic subject defines himself. That is why this communicative space of reproduced distinct dialogues - events-meetings is organ-

ized initially on chaotically built network fractal principle, not according to initially given firm logical hierarchy. “ The metrics “ in such space is set not by a degree of “ affinity to the truth “ which is in its turn supervised by logic of deductively developed statements. This logic may be weakened, may become empirical, probably, inductive, Bayes, and the movement to the truth itself is thought in different paradigms - images or symbols - “ ascension to the heavens “, or absorbing into the essence of things. Such space is also a communicative one by its nature, but it is necessary to realize that this specialized communicative space is focused on management and control that is why this space is monological, a space in which there is no place for “another one”. But synergetic sees its purpose not just in ascertaining distinctions of forms of the organization of epistemological spaces of classics, nonclassics and, at last, post nonclassics. It sees its task in their reduction to topological conformity with each other in the context of all human experience in all variety of internal and external (intersubjective) forms of its representation in language, symbols, verbal and nonverbal communications.

In postnonclassical epistemological space by which synergetic is guided and which is derived and supported by it, the topology, the measure of affinity and remoteness is set by the measure of affinity and remoteness “I” and “Another”. In different cases different names are used for this pair. For example - “subject - subject”, “I - You”, “I - He”, “I-We”, “I - She”....

Different types of communicativictics, spatiality, symbolical character, corporality will be meant correspondingly.

These and other distinctions are important and essential for reopening of space as a certain communicative form of existence of culture, work of art, music, philosophy etc. But we are interested in the postnonclassical interdisciplinary subject who defines himself “ inside the science “, is in it, “ is plunged into it”, speaks and writes its language, changing himself in this process as well. And it is not the science in general, but the science gone through several radical paradigm shifts in our century-first of all a relativistic and quantum revolutions, and then - discovering of such phenomena as dynamic chaos, fractal growth, reopening of the principle of self-similarity in the nature, the big explosion and co-evolution... “ Inevitability of the strange world “ of quantum phenomena, and then of the world of nonlinearly as a whole have put the problem of the unity of science not as an abstract theoretical one, but as a personal problem first of all, as a problem of self-actualization of the person of the scientist in the situation of valuable crisis and deep semantic splittings in scientific knowledge, the scientist, whose intellectual and moral position dislocates more and more and redefines anew by the dynamics of nonlinear interdisciplinary interaction.

The connectivity of internal experience, “ the way to yourself “, self-reopening in a new dialogue – meeting - such situation is badly comprehended by a symbol - metaphor of transcendency of space in an image of steps of the ladder leading higher and higher. The image of the way, Tao, midlines is closer here... Epistemological space in which our subject finds himself is understood (naturally, as a certain desirable idealized image, as a project) as the space of possible ways, findings of new senses, openings and dialogues. It is also the space of culture of psychosomatic self-healing, finding of a new feeling of freedom, clearing; the space, in

which the expression: the culture is a therapy of the sole finds a directly experienced sense...

From lens classical paradigm to Haken‘s and Bohm‘s laser – holographic paradigm

Here we would like to return to the theme “ Haken‘s laser paradigm “, treating it as a new communicative environment in which the synergetic connection of mental, sensual, mental, corporal, material open anew as the subsystems involved in the processes of self-organizing, in which totality our presence in this varying world is actually realized, our becoming life in it, our interaction with ourselves and others, interaction, a part of which is also our cognitive activity.

As it was already said above, Haken‘s place in the system of interdisciplinary communications, his chronotop, for me is set by what we call a laser paradigm as a certain new problem field arising in a context of understanding of the laser as the tool of knowledge, representations and initiation of processes of self-organizing in the environments most different by their “substrate” structure, but similar in their behavior “ near the points of instability “.

Under the statement of a physicist Graham, Haken‘s colleague, the merit of the latter is in the proof, that laser is not only an important technological tool, but itself represents the most interesting physical system, capable to teach us much. Lasers take a very interesting position between the quantum and classical world and Haken‘s theory explains us how these worlds may be connected among each other.... Laser can be considered as a crossroads between classical and quantum physics, between equilibrium and nonequilibrium phenomena, between phase transitions and self-organizing, and between regular and chaotic dynamics as well. At the same time it is the system which we understand both on a microscopic quantum-mechanical level, and on macroscopical classical one. It is a steady basis for studying the general concepts of nonequilibrium physics.

Here again we come across the image of laser as a communicative intermediary. In this sense “ the laser paradigm “ does not mark a certain new scientific revolution with all its communicative breaks and incommensurabilities of old and modern languages. “ The Paradigm of the laser “, on the contrary, is realized as means of elimination, “curing” of these breaks. “ The paradigm of the laser “ if to use Maslow‘s term, is “Taoistic”. It is natural to ask then, why to speak about any new paradigm at all if something not revolutionary, but evolutionary is meant. Basically, it is possible, certainly, not to speak about a new laser paradigm, but we do not see any reasons for it. It is well known, that Kun‘s concept of “paradigm” is extremely multiple-valued, which in due time caused numerous critical remarks to his address. His critics have counted more than thirty meanings of the term “paradigm”). But in the list of these meanings there is at least one, which is rather important for us, though remaining in the shadow up to now. The paradigm is a communicative environment, language communicative space in which the scientific community is plunged, “is suspended”, as N. Bohr liked to say, in such a manner that we do not know where “the top” and where “the bottom” is in this space. Let’s notice in brackets, that this Bohr‘s statement we interpret in this case as polemically directed

against a priority logical- epistemological spaces of a classical science and philosophy of the Kanto's epoch and for the benefit of network epistemological science of the quantum-relativistic era; the era when instead of a theoretical-plural basing of mathematics a theoretical-categorical one has come.
Certainly, the change of one classical paradigm of monologue knowledge to another one for the scientist who got used to it for years, is equal to the change of his place of living, the change of the habitable by him " ecological niche ". And this as it was marked above, assumes another type of self-transcendency, than the one practiced by him earlier. And switching to another way of self-transcendency frequently appears to be extremely difficult, even impossible. From here there is a communicative break of different generations in science, split, sharply released dramatic impossibility of achievement the necessary intersubjective consent etc.
Therefore the conversation about different incommensurable paradigms, different language onthologies, different worlds and/or the spaces produced by the use of different languages is quite clear. However, it would be desirable to understand when exactly this conversation is "pertinent" and when not.
From this point of view the laser paradigm as inducing synergetic ontology and applying for restoration of communicative coherence of paradigms - spaces of the former communicative experience of knowledge, undoubtedly might promote this understanding of "relevance". The laser paradigm creates a qualitatively new active environment of the communications built in a certain generalized superspace or hyperspace that is why as far as we have taken up language creativity it would be more pertinent to speak about a hyperparadigm, hyperspace etc.
" But the world is not the laser " - as Haken likes to repeat. Synergetic does not share universal transcendental claims and illusions of the classical mind. It reopens the ancient principle " the person is a measure of all things ".
Such valuable-qualitative characteristic of its as "humanness" becomes the measure of knowledge (Maslow). With reference to biology and medicine he writes in this connection: " Accommodation in the uniform, quantitatively measurable space of humanity of all diseases with which psychiatrists and therapists are occupied, all infringements which give food for meditations for existentialists, philosophers, religious thinkers and social reformers, gives huge theoretical and scientific advantages. Besides, we may place various kinds of health which we already know about, in a full palette of their demonstration, both within the limits of borders of health and outside it in the same continuum - we mean demonstrations of self-transcendency of a mystical merge with the absolute and other demonstrations of the highest opportunities of a human nature which will open the future for us".
But then, perhaps, we open the world? Or it opens to us? An unequivocal answer to thus formulated questions is impossible. Synergetic knowledge taken in the context of history of natural sciences of the new time, is also the postquantum knowledge. And speaking about the discovered by someone in general after the quantum mechanics, without references to the observer, his place and to those means - devices with the help of which he realizes supervision, moreover not stipulating, that the discovered, created by the process of supervision, means being in a captivity of the relic language prequantum epoch. Not going into details of epistemological plot the observer- the observed in quantum physics, we shall content ourselves to the declaration that in the synergetic world there is no constant observer; the observer be-

comes, arises in the intricately organized stream of acts of the communications, communicative events. In this world the question: “ What is the object of knowledge? “ becomes senseless. There is no object of knowledge. To know means to be able to behave in the adequate way in the situations connected with individual acts or cooperative interactions. This idea can be expressed a little bit differently using the metaphor of the laser as communicative cognitive means. Our “ epistemological laser “ throws its highly regulated coherent light not all around the” irrespectively from us existing universe “, but selectively allocates a certain cooperating area with a complex “ topology of cutting and pasting “, called the reality and described in the appropriate language so that this description might be reproduced and steadily communicated to “another one”. But still for us the laser acts only as a tool, though having rather unusual properties. The reference to D.Bohm‘s still poorly mastered heritage may help us to promote further in the understanding of the laser paradigm. He made in due time a lot of powerful attempts for building that new ontology of the world, that new reality which “disappears” behind the scenes of operationally submitted mathematical formalism of the quantum mechanics. To present more evidently the concept of quantum-mechanical integrity and its difference from the integrity assumed by classically focused knowledge from Galilee’s epoch and up to Einstein, Bohm has introduced the concept about two instrumentally caused paradigms of scientific knowledge: a so-called paradigm of a lens and a paradigm of the hologram (or a holographic paradigm).

This innovation was not properly appreciated by philosophers and methodologists of the sciences. Meanwhile Bohm, distinguishing the named paradigms, has made a far-reaching attempt to take into account cognitive lessons of the quantum mechanics, integrally presented as the principle of the integrity of the forms of language, ways of supervision, a tool context and theoretical understanding in the historical evolution of the science of New time. It was an attempt to construct an original “ quantum germenevtics” of the language and the device in the situation when the perceiving person basically has no direct and straight access to the world of the quantum phenomena and processes.

The starting point of his reasoning was a lens as the device and the tool of knowledge which, in its turn, has caused coherent to it pattern of thinking the features of which, despite of a great number of researches of philosophers and historians of science, are not completely realized up to now. It is, probably, caused by the fact that “ lens type of thinking “ itself in many respects dominates on the meta-level of consideration of the science as well. It is trivial enough that the lens is the tool of formation of the image of the reality in the form of subjects where each point of the original with a high degree of accuracy corresponds to the point of an image. It is a postulate of geometrical optics (and a wave one, in its geometrical approximation).

But however it is not so trivial that due to the “ point by point display “ as a base gnoseological model of carrying the information from the researched object to the subject - observer perceiving it, the lens in a great extent strengthens the process of our “regional” realizing of different parts of the object as separate and delimited from each other patterns and relations between these parts, thus complicating and/or deforming the perception of the whole.

This circumstance strengthens propensity to think in the terms of the classical order of the analysis and synthesis, thus distributing this way of thinking far beyond its applicability.
But already the theory of relativity, and then, to the greatest degree, the quantum mechanics began to find the limitation of integrity of the synthesis of the images of lens thinking. The ontology of integrity of different nonmechanical, but also of an inorganic nature of the universe the description of which cannot be presented in the language which would be coherent to the tool context of classical lens order, the analysis and synthesis of point elements as well- defined parts of a complete image, more and more began to declare about its implicit existence.
But if the matter took such a turn there is a natural question: what tool might give us the direct idea about such tool context within the framework of which the quantum integrity might be represented in the self-coordinated way.
Such intuitive idea comes if we address to the hologram as to the tool for the record of "whole". What is the quantum-holographic paradigm according to Bohm becomes clear from the following brief description of the function chart of the tool context, in which it defines itself. The scheme is the following. The beam of the laser falls on a translucent mirror thus being split into two beams. One part falls onto a photographic plate, another one - after the reflection by some complete structure - original. As a result a so-called interferentional pattern is recorded on the photographic plate - a complex and thin pattern of the embodied events, a remembered image - pattern of the original correlating to it not pointy as in a lens, but in some more complex way. This conformity or correlation is found out only at the illumination of the hologram by laser light. Thus the wave front is recreated similar to the form of the wave front going from the initial complete structure, and we may see in some range of possible prospects (points of view) the initial complete structure in its three-dimensional representation. We shall also see it illuminating by laser light only a part of a photographic plate. The interferentional pattern even in a rather small area of a photographic plate is connected with all its complete structure, and each part of the original is connected with the entire pattern on a photographic plate.
So we come close to the idea about a holographic paradigm as a synergetic paradigm where the nonmechanical dynamic whole may be completed (organize itself) in parts. We come to an image of the world having its holographic memory, the world organizing itself in the form of some superhologram, the information from which (= perceive) we may count only with the help of a source of coherent laser light, having occupied a connected with the original cognitive position of "observer - participant" so that it was possible to see "the phantom image - picture", practically indistinguishable from the original in borders of some cone of prospects. Such "autopoetic" ontology of the universe, including ourselves, with our cognitive communicative activity " inside it", basically may be deduced from in an appropriate way interpreted statements, that " a laser is the beacon of synergetic " and that " the world is not the laser ", but the laser is a part of our world. We shall not say that restoration of ontology on operationally measuring schemes given in the supervision is a problem having no unique solution. There may be a lot of such onthologies.

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From neuronets to network noospherical thinking

We scrutinized the laser-holographic version of synergetic paradigms so intensely because it enables us to understand more evidently and intuitively the specificity of synergetic approach to knowledge of complex systems, such for example as the human brain and to show how this approach appears to be away from the traditional methodological dichotomy of the distinction "reduction - anti-reduction" as its communicative interpretation-dialogue nature is seen much more clearly in this case.

Patterns and designs of the activity of the brain no matter where they would find demonstration are essentially non-local and "to see" the images embodied in them and to interpret them we need not the lens, not a microscope and not the coherent to these tools classical order of procedures of the analysis and synthesis of lens thinking, but the laser, its coherent light with high information density and a place, a cognitive position reproducingly fixed and passed to "another" with the help of available language means. It seems as if the circle became isolated, though not completely as we do not know quite definitely yet the place in the mental space of our representations whence we may distinguish that multivariate image of activity of a brain which is formed, and then is recreated anew by the laser of Haken's synergetic.

But synergetic refuses any sort of search of the substratum-located traces of memory (anagrams), being oriented onto search and recognition of forms of storing and operating by the information in its non-local, dynamically distributed, virtual form. Here synergetic comes across so-called connectivistic approach to active computing environments of storage and processing of the information. But synergetic goes further offering more intriguing prospect of perception by the person of himself in evolutioning self-referent universe having non-local holographic memory. For synergetic " the brain in the light of the laser " is also the brain as a complete dynamic system in the conditions near the points of instability where it undergoes a great variety of qualitative transformations, " phase transitions ", connected with processes of self-organizing of the information and occurrence of new parameters of the order (dynamic attractors), therefore there are new marks and symbols, and also the systems of its representation uniting then in the language networks of intersubjective cooperation.

Thus there is also a non-eventual approach in science, arisen at the end of XX with the theory of neuronets, cellular automatic devices, synergetic computers. Basically it is not possible here to use the theory of indignations, eventual language and ideas of reflection. It is the world of non-located processes, and not of events. Systems work completely non-distributely in a mode of self-organizing. From the ideas perceptron of 60-ties when processing of the information by an eye was modeled, such systems distinguish images, solve intellectual tasks, and in this sense they are closer to consciousness of contemplation and intuition about which the science still can not tell anything intelligible. You see, even in the elementary and becoming well-known cell-automatic game "Life" where the condition of object depends on the condition of environmental objects, in the environment patterns of excitation appear, named "animals" for whom it is necessary to use Lamark's descriptive methods of times, and any theoretical forecast, the reduction to elementary forms of life

is impossible. We are just compelled to accumulate situational experience in computer experiments. The theoretical science in its supreme stage generates a layer of knowledge methods of development of which are quite historical, humanitarian. This convergence also begins now in new generations of expert systems, ideas of an artificial intellect. Certainly we may say that the area of the transcendental lays outside the border of language complexity, but, that it somehow not desirable to believe that it is only the impossibility of disparalleling and reflecting the complete process in ours neurocomputer and it will not soon come to feelings, emotions, existential philosophy.

Synergetic with its “laser-holographic paradigm “ makes observable and recognizable everything which is non-observable and unrecognizable from the positions of all approaches to the brain as a system functioning “ in a norm state” mainly in a condition of balance, homeostasis, moreover as a system the basic function of which is keeping and supporting this very homeostasis.

In his last book specially devoted to consideration of functioning of positions of the synergetic approach, Haken has convincingly shown the efficiency of laser model of self-organizing - selection of unstable styles, occurrence of one or several parameters of the order, subordinating all another styles by the principle of self-selection and “circular” causality - for an explanation of processes of teaching, recognition of images, making decisions, processes of achievement of the constructive consent in human communities etc. The matter is that in processes of self-organizing there is a qualitative compression of the information, as a result of the quickly proceeding, that is why frequently escaping supervision process of natural self-selection the product of which is an observed parameter of the order.

The sense of born information pattern is found, to be more precise, in the view of Haken‘s remark about the affinity of the developed by him synergetic approach to the brain and mentality, to ideas and representations of gestalt psychology.

So the circle of reopening by synergetic of its own spatiality locks itself during the conversation about its concreteness. But it is only one of possible circles. Another circle - the way “Synergetic 2 “ as we call it, synergetic of processes of knowledge as self-organizing supervisions - communications, is practically indistinguishable from the first one in this focus. So that this distinction “would take place”, it is possible to apply to the plot of development of methodological principles of synergetic, starting from subject - objective interpretive principles of observability, conformity, additionality and, reinterpreting them as intersubjective principles of the communication by means of which synergetic spatiality is formed as human-dimensional embodied human environment.

Synergetic mesoparadigm: problems of modeling in the anthropoid sphere

In closing we shall discuss internal problems of synergetic arising on a level of formal methods, but directly connected with epistemological borders of mind and culture.

Heuristic and philosophical aspects of modeling of public processes are being discussed especially intensively recently, the obvious progress not only in metaphorical transference of methods of synergetic onto humanitarian ground, but also in understanding of psychological and methodological problems of application of these methods (9-13,27) is again observed here.

At the same time, mathematical modeling of social processes is still a delicate and for many people doubtful theme because of bad definiteness of concepts of the condition of social system, validity of the kind of connections and its differential dynamics. Universal recipes cannot solve these questions and they will always remain the subjects of the dialogue of the expert - sociologist and the mathematics - fashion designer. The dialogue itself, according to the words of one famous mathematics, frequently reminds " love games of the blind in the thickets of a nettle " - notwithstanding obvious interest of the parties there are constant and unpredictable situations of sharp misunderstanding and dislike. Probably that is why it is possible to hear very authoritative humanists speak about danger of the use of formal methods in the antropic sphere where the person is reflective, unpredictable, free, culturally historical. All this is true, but if we try to keep cognitive and forecasting value of science what the natural sciences have succeeded in, and not just descriptive-comparative one, the search of the average, collective degrees of freedom which yield to mathematical modeling is inevitable, taking into account social-genetic aspects of the human nature. And we suppose a greater stress on principles of observability and the communications (11,14,22) is necessary in modeling.

Problems of differential dynamics. In our opinion, the key problem is that the majority of physical models use Markov's approach, i.e. the condition of system is defined at the subsequent moment of time entirely and completely by the condition at present time, it is the main principle of differential dynamics. Exactly for such models, since A.Poincare's times, the qualitative theory of the differential equations, the theory of bifurcation, the theory of dynamic chaos strongly develop; the intuition of Prigogine-Haken synergetic paradigm, its universal recipes of work with the order and chaos is worked out here. But the person and socium own the depth of memory more than of only one step, and Markov's processes are, probably, not the most adequate images of historical and social development just because the system may study, get experience.

For the sake of justice we shall notice, that it does not cross out the successes of local differential modeling on conditionally small times where intensive researches on soft modeling with the help of bunches of models, indistinct multitudes (V.Arnold) are conducted.

Nevertheless, solving the problem of memory this way is impossible. In particular, already biological systems assume simultaneous interaction of at least three generations, we shall remark that exactly on this reason in alive systems, and in systems with memory generally, there is the allocated status " gold section ", that is the gen-

eration and an opportunity of distinction of harmony (30) which basically cannot be proved within the framework of differential dynamics, are peculiar to them.

Problems of neurocomputing. During the last two decades another, not local concept develops - the concept of synergetic computing, the cellular automatic devices, realizing the ideas of an artificial intellect. It is some kind of a substrate approach when changing rules of "dialogue" of the elements - neurons we create cellular automatic environment with the certain properties subject to studying during the training of neurocomputer and solving of various tasks with its help. A certain neurocomputer trained by experts some typical methods and style of solution is necessary for every class of tasks. Here problems of memory, training, education or self-education are solved in a humanitarian way, the system is certainly historical, but we pay for it by the opacity of actions of such system, it is not always predicted, and the question of correctness of its behavior or results is not correct. It is rather an intuitive style of the solution of tasks than a descriptive process (9, 25). And we abandon " the world of truths " of differential dynamics and immerse into " the world of opinions " of neurocomputer reality. This other extreme point of view will open much for us about social system, it is computer Guru, which will teach nothing, but will solve our problems itself.

Mesoparadigm of synergetic. We know little about limitation of descriptive procedures of positive knowledge, horizons of understanding, but we know that reflective process makes us inevitably closer to them providing its quite high intensity (19,25). Here lays, in particular, limitation of procedures of the theory of indignations. Therefore under mesoparadigm of synergetic we shall understand the approach taking place between Markov's "amnesiac" descriptive processes Scilla and Kharibda of genetic methods of neurocomputing. Actually, it is the synthetic approach when the system develops quite predictably, and during the formation its genetic program - memory is required, internal space, which itself may change, then the development occurs again under the differential laws. Thus points of bifurcation, of a choice are passed not casually, (equality of issues), but taking into account genetic propensities of the system. We find similar ideas in the concept of "channels" and G.G.Malinetsky's "jokers" (27).

The internal space may have its hierarchy of levels, which on the external plan may look as the display of sequence and synchronism in behavior of various subjects of the system, or subsubjects of the individual. Fractal time communication pattern arises which cannot be described in frameworks of Markov's approach. As an example of such approach to the nature and society the method of rhythmcascades may serve (28-30), offered by one of the authors in 1996. Its applications to reconstruction of history and the forecast of development human-dimensional systems assume command work of experts of various disciplines and there are encouraging results already.

In our opinion the synthetic approach in frameworks of mesoparadigm of synergetic will allow to animate its many well-known models for humanitarian application and to put forward an essentially different class of effective communicative models. Today this program may be realized in frameworks of a more and more popular network approach to anthropoid environments.

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11
Synergetics of communicative scripts

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Communication and nonlinear environments

Communication, connection, connectivity, integrity of space of communication and its participants. Today we meet all these images in the theory of the nonlinear environments, a roughly developing trend of synergetics. And it is not a problem that the participants in modern models are still primitive as well as their interactions, but the collective communication may give surprisingly beautiful, frequently complex and unpredictable results. Actually at first approximation the behavior of the person in acts of communication are set by communicative intentions, specific ways - means of communication and interpretation preferences. There are not so many variants and complexity of behavior arises at the moment of the spontaneous or realized choices which are possible to be considered as the nonlinear casual environment of internal space of each element.

Anyhow in the metaphor of casual nonlinear environments where elements have nonlinear interactions and self-actions which can be complicated by the possible distributions of types of these interactions we meet all images of cognitive processes of communication. Therefore synergetics, therefore modeling of communication is more than a metaphor. Here the nonlinear casual environment is the language environment, elements of environment are objects of communication, self-action is a cognitive process, and interaction is a communicative channel. As information may be born and generated, these are the models of not necessarily physical environments or fields. In this metaphor N-element sector relates to the collective, two-element - to the dialogue. Excluding in the pair communication self-action out of one of the elements we approach the subject of objective dichotomy. Too strong division of internal spaces of the subject - object dialogue and the channels of their interaction results in a classical paradigm of knowledge, and singlesidiness of inclusion of some element - observer (separating of its internal space from the environment) results in a nonclassical paradigm of knowledge. Full absorption of the observer in nonlinear environment leads to the postnonclassical paradigm of knowledge.

About types of the interdisciplinary communication

Discrete elements of environment may be not only neurons and cellular automatic devices. In epistemological spaces depending on the scale of division of internal spaces and spaces of channels of communication they may be a private theories within the framework of one discipline, disciplines within the framework of one science or sciences within the framework of general scientific discourse. Therefore we will understand the term "interdisciplinary" more widely than only an interaction of disciplines.

We suggest allocating five types of interdisciplinary strategy of communication and, accordingly, five types of usage of the term interdisciplinarity.

1 interdisciplinarity as *the coordination of languages* of related subjects. The question is about general for both disciplines phenomenological base where each of them uses its thesaurus. These are relations between physics and chemistry, biology and chemistry, psychology and sociology etc.

2 Interdisciplinarity as *transcoordination of languages* of not necessarily close disciplines. The question is about the unity of methods, general scientific invariants, and universals used by different disciplines. First of all these are methods of mathematics - the language of natural sciences, but also the system analysis and synergetics which are frequently more adequate for humanitarian disciplines than mathematics.

3 interdisciplinarity as *heuristic hypothesis - analogy* carrying designs of one discipline into another one firstly without a due substantiation. Incompleteness and creativeness of such hypothetical transmissions forces additional procedures of their substantiation within the framework of the given discipline, or revision of the bases of the latter. For example, the hypothesis of the wave - pilot in the quantum theory introduced for an explanation of phenomena of corpuscular-wave dualism has not got accustomed, but possible waves which are conventional today have completely upturned the ideas of our common sense about quantum ontology.

4 interdisciplinarity as *the constructive interdisciplinary project***,** organized form of interaction of many disciplines for understanding, substantiation and, probably, management of phenomena of supercomplex systems. Today it is environmental problems, global studies, anti-recessionary management, social designing, problems of artificial intelligence, integrated psychology and medicine, an outer space exploration etc In physics, for example, it is modeling of evolution of the universe in the frameworks of cosmological antropic principle. Investigation of any serious failure is the interdisciplinary project of confirmation of the hypothesis - hypothesis-version of the reason of the accident.

   The basic problems of the organization and realization of interdisciplinary projects are communicative ones: capsuling of languaga and epistemological spaces of disciplines, their insufficient interaction, original disciplinary snobbery and aggression, which is natural, because there is a danger of infringement of a protective zone of hypotheses of discipline. The greatest physicist of XX century Richard Feinmann had been appointed the head of the commission on investigation of the destruction of the space shuttle

"Shatl" after the start. His conclusions - infringement *of the coordination of understanding of languages* of numerous technical services, communicative breaks. The example of the successful interdisciplinary project almost one century long, to be honest not yet completed, is A.L.Chizhevskiy's theory of hellion terrestrial connections which was born as an insane, in the opinion of scientific community, *heuristic hypothesis* about influence of the Sun on terrestrial bio-social phenomena and which demanded thirty-year self-sacrifice from the scientist for establishment of hundreds of correlations of these phenomena with Solar activity. Only at the end of XX century we began to realize the nature of interdisciplinary chains of these correlations: from flashes and streams of protons, to ionosphere, magni sphere and magnetic storms, biospheric mechanisms of perception of abnormal radiations and frequencies, to pscycho-phisiological mechanisms of these influences.

The project is built as a bridge between islands of the disciplines as the route in a complex landscape of the disciplinary discourses and if its purpose is the heuristic hypothesis and if its purpose is a searching-descriptive activity. In any case all three previous types of interdisciplinary communication are used. It is necessary to emphasize that performance of the interdisciplinary project demands set of minor hypotheses of the coordination on each border of interaction of disciplines, and at first sight breaks Okama's principle of razor. We shall note as well that the price of check of a heuristic hypothesis, a mistake on the joints of disciplines or inaccuracy of the hypothesis itself in the interdisciplinary project is much higher than in one discipline.

5. interdisciplinarity as *network communication* or *self-organizing communication***.** So this way happens the introduction of interdisciplinary methodology, transdisciplinary norms and values, invariants and universalies of the scientific picture of the world, so happens the development of synergetics and system analysis, style and hearings in scientific socium. These are networks of scientific schools and associations.

It is possible to consider especially communications in activity triads "subject-means-object" and educational spaces "teacher-environment-pupil". The procedure of consecutive paired coordination, coordinations in cognitive columns of these triads result in two reflective levels responding to collective interactions - conditional communications. Thus there is a combination theory of communicative scripts of achievement of integrity of communicative space. This strategy may be applied both in interpersonal dialogue and psychotherapy, and during the autocommunications.

Communication as mathematical modeling of the complex

Mathematics with "human face", democratism of modern mathematical modeling, humanitarian mathematics, and soft modeling - all these terms seemed to sicken the high standards of mathematical thinking produced by centuries. As the famous physicist D.S.Chernavsky says - "if in the past the description of the reality was allowed to geniuses (Newton's, Einstein's and Mackswell's equations), today synergetics makes everyone a genius: teaching to model the world of complex systems in diverse effective ways.

Loss of "strictness" which synergetics is frequently reproached with, in our opinion is connected with several methodological aspects that are necessary to be spoken about in detail.

First, at modeling of the complex we deal both with direct and reverse problems. Let's explain on the example what is meant: if the system is set by bidimentional differential dynamics it may describe oscillatory processes, and knowing an initial condition we may find it at other moment of time (a direct problem for which there is a single solution); if the oscillatory behavior of system in time that is experimentally observed it is possible to restore parameters of model giving such behavior (a reverse problem). It is obvious that reverse problems have set of solutions (bidimentional models are only their only insignificant part). All problems of restoration of the reason in an incomplete set of possible consequences, supervision have ambiguity of the solution. Exactly for this reason the choice of model in a reverse problem is connected with arbitrariness of the expert - fashion designer, his design gift. However problems of recognition of images, reverse problems of dispersion, a problem of geological investigation, satellite-monitoring etc. can be considered to be reverse problems for which it is possible to find solution only during the last 30 years by means of powerful computers. And even having the whole information on behavior of the system, these problems in mathematics are referred to as incorrect or singular ones by virtue of strong instability of the result (the sort of required model) to small indignations of experimental supervision. Stabilization of the result, i.e. determination of the model, occurs due to the procedure of regularization - account of the aprioristic information set by the human being.

So, direct problems - restoration of dynamics according to the initial data when the model is fixed unequivocally, are objective stage of process of modeling - the usage of ready model. (Exactly in this context the familiar expression was born: "Mathematics thinks for us"). While problems of choice of a model, the type of the equation on the observablyy data is a human-measured problem and it is essential ambiguous and it depends on a field of known or allowable solvable models, or capacity of computer algorithms which is naturally defined by the scientific-historical stage, possibilities and preferences of the mathematician-fashion designer.

Second, the special feature of the synergetic era of mathematical modeling which Anri Puankare dreamt hundred years back, but to tell the truth he spoke about the qualitative theory of only differential equations, is that the space of new classes of models constantly extends in a mode with an aggravation that is connected first of all with explosive evolution of opportunities of computers. Today this is rather instrumentalism of high technologies of mental, to be more exact, computer experiments which simply was just impossible in the epoch of becoming of exact natural

sciences when reverse problems of modeling in physics, search of the law - modeling equations was made by creative revelations of many generations of scientists and the reality itself submitted to few universal laws which all private laws were reduced to. For example the image of space of conditions in physics was being formed for more than 2000 years, in chemistry - 300 years, in biology this concept has not settled yet, and in psychology and social sciences there is no definiteness to speak about. Thus in socio-humanitarian sphere the concepts of system and model which assume a certain space of conditions, can not have universal character today, it is necessary to search for area of applicability of private models, that it is frequently more difficult than the analysis of model and is rather a skill to be successful, rather than reasonable. But here the future supercomputers and expert systems of an artificial intellect apparently will be able to help.

Today in humanitarian sphere for a reverse problem a heurism of substitution of the modeling equation giving similar dynamics of observable properties is basically applied, and property - variable and the appropriate space of conditions is generated by the model, and not the other way round as in a direct problem. It is a method of metaphor - analogy, a method of adjustment. It is natural, that the area of applicability, a correctness of such model is badly determined, which causes irritation of many mathematicians and the pathos "incomprehensible effectiveness of mathematics" dies away for many humanists. It would be possible to move by means of the method of sorting out all possible models on supercomputers of the future and to sew the reality in polymodelling representations because of economy of descriptive means, but this pragmatical approach is poorly similar to a modern science of search of universalies.

Other approach of the description of a complex reality is connected to ideas of construction of an artificial intellect, expert systems, to be exact with neuroncomputing, a problem of recognition of images and development of decisive rules of behavior - parameters of the order of cellular-automate environment. It is also a reverse problem of modeling, without an opportunity to find out the area of a correctness of decisive rule, with that difference that now the dynamic model is not showed, though the algorithm of effective behavior is probably found faster in real problems, it is a way of modeling of thinking which can not explain the way it thinks, neither can we. Moreover, the problem a degree of reliability of the result is forbidden.

About parallels of formal and natural language environments and communications

Efficiency of soft modeling in the humanities on the basis of a deep generality of languages of a science and other languages of culture,---today is the only hope for interdisciplinary dialogue of the natural scientist and the humanist. Here we shall discuss the problems of language, knowledge, thinking, which have bright presentations, uniform not only for cognitive psychology, but also for exact natural sciences and the mathematics exposing interdisciplinary, epistemological basis of culture. The details of the mentioned theme can be found in (1-3).

Further it is convenient for us to distinguish two moduses of thinking: consciousness of judgement and contemplation. Consciousness of judgement: controllable delocalisation of an atomic event, the descriptive description, adding politemporal virtual contexts, down to atemporal symbolical senses, invariant to a context to the given event. It constantly addresses to contemplate consciousness on border of delocalisation where new events are born expanding the sense of initial atomic event. This way speech develops, an organism grows, the history is written. The consciousness of judgement wrings out from completeness of life a dry skeleton of the topos of the mental landscape hiding transcendental acts in indecomposable atomic acts - events - units of event network of the reality. Exactly about the cognitive language of consciousness of judgement is the most part of our conversation. We shall show that this consciousness is not closed, but has a natural border, the horizon of approachability, the mental border of complexity.
The consciousness of contemplation historically also bases in the initial and final phases on the products of consciousness of judgement already curtailed earlier ontologic unit names - senses which are unpacked without additional activation of consciousness of judgement. In a median phase actually contemplation occur non-verbal non-event processes such as parallel calculations in computer networks, - an intuitive phase. The last part of this article is devoted to this type of consciousness.

Event as a temporal category

Clothing as recognition. Going from the whole to the private is well done in the quantum theory of a field when, proceeding from the coordinated equations of a field which are usually not solvable, we make a fragmentation, ontologisation of the first approach of n-partial sectors, asymptotic conditions, condensates, strings etc. Then ontology is corrected with clothing of measures in iterative procedure of the theory of indignation. The theory of indignation is an analogue of the reflection testing and renorming all physical measures. The ontological border is groped as singularity - the theory of indignations disappears, the system is unstable, not certain; and to overcome it some change of ontology, birth of new senses, quite in Z.Deleza's spirit is necessary "nonsense gives sense". At this point it is necessary to stop on the analogy between recursive descriptive processes of reflection and procedures of the theory of indignations. There are three types of the latter:

a) Initial indignation does not leave the frameworks of area of convergence or horizon of predictability; reflective process regularly converges to some concept adjusting initial representation and step by step affirms itself in it creating illusion of finding of the firm truth. Such are all converging iterative procedures of the decision of the nonlinear equations (a method of compressing displays), such are motives - ideals of early germenevtics a) initial indignation is great and does not converge to any result, reflective loops are not pulled together, but derive "vicious" circles or chaos. Nethertheless this process is productive and may be used as a mode of search, generation of new contexts.

b) But there is also the third, poorly known, but, probably, the most realistic mixed alternative: so-called asymptotic line of the theory of indignations. Its behavior is unusual - on several first steps (sometimes rather numerous) we notice the

process converging to a certain result, but the subsequent members of lines result not in specification, but in deterioration of the result, the line misses disseminating the arisen mirage of understanding. Which does not prevent us from using such lines in practice - all lines of the theory of indignations for quantum fields is asymptotic and are used until they converge, though it creates borders of accuracy of prediction, but this wonderfully coordinates with the experiment. We shall dare to state that ratio has rather asymptotic type germenevtic lines: our mentality, probably, protects itself from excessive stability of the opinion, gets tired of monotony of infinite acknowledgements, reserving the right to itself for chaos of doubts which rushes into consciousness and destroys the quasi-stable concept or sense, if we continue to specify it; here we only admit a delicate view of lateral sight. here there is an explication of Bor's principle of additionality in the processes of knowledge which G.Jung and N.Bor insisted on, here there is an internal creativeness of the sense impregnated by germenevtic touches, at any instant blowing up its envelope by myriads of contexts insisted, flying up eventually to the symbolical. It is a source of its self-movement - any banal idea sooner or later being discussed gives rise to protogenic chaos - the channel of access to any concepts, it is true - "out of what rubbish the poetry is born". Such creative (inducing) view on becoming, any event always existed in culture. It is represented, using modern system language, by a creative triad: *the Way of action + the Subject of action = Result of action,* and is fixed in verbal structures of language; in roots of bisexual asymmetry of the person as a biological kind; in images of divine family of ancient religions, in cosmogonic myths and philosophies, about its explications in science and culture - more detailed in (1).

Chomsky's Grammar and Feynman's Diagrams

Today cognitive models today become the languages of sociology, linguistics, and psychology. Feinmann's toy rules-pictures for the last forty years are the language of avant guarde of fundamental physics (the quantum theory of a field). Wonderfully any elementary event in a microcosm (top) is formed by a pair of fermions and bosons (all particles in a microcosm are divided into fermions and bosons), Thus three-tailed units are one of the representations of creative triads from which then form a complex diagram, a network - script of a complex process of interaction of many particles, interweaving of their destinies, their destruction and birth. The real process is the sum of Feinmann's scripts - diagrams or virtual (possible) processes.

But we also can try to model any narration, any humanitarian system, to unwrap them in time by means of cognitive diagrams using units - events. Noem Homskiy noticed this generative property of language at a level of syntax in 50-ties (some time after discovering of Feinmann's diagrams). These general rules of combination of morphemes at construction of phrases and sentences are called Homskiy's universal grammar. On closer examination in Homskiy's linguistic trees we find the same creative triad, more detailed in (2).

Chart language in physics has arisen because of need to describe very complex systems, however in humanitarian sphere as well. This is one more reason why humanists rejected classical scientific methodology - a different level of complexity of ob-

jects of research that demanded also different methods. Today we see obvious rapprochement of positions on the ground of modeling in cognitive diagram.

Multiregularity of Time of Events. Language Game „Kaleidoskope“ as a Generator of Senses

If now we distinguish objects of language and the senses given to them by Aristotle's reasons each word, the morpheme may be in one of three in relation to atomic event qualities, already well known to us. It makes possible misidentification of essence and word to create interpretation ambiguity, to force events to communicate, to create interpretation plots, to animate event networks, to legalize free creativity of the observer in them. Aristotle would have hardly allowed such arbitrariness in Deleza's spirit.

So, property of nondirectional linguistic triads - events (before attributing senses to words: active, passive reasons, a result) is a plurality of time contexts, and time is always directed to one of three components, in the direction of the result. The above said allows us to speak about multivariate (three-dimensional) time of interpretation of event. The meeting in one unit of three concepts supposes minimum three interpretations of event independent of the context, making them active the person may think rather unexpectedly, paradoxically, associatively - metaphorically. We seem to create and joke in the six-measured time - space, we are just not able to imagine it. At a level of graphic language of event network it means just a choice of the direction of movement in the unit as the choice of one of three contexts sets a choice of one time from three streams of time indicating a direction of exit from the unit. In Feinmann's techniques one diagram can be really read by many ways, depending on how the time context is directed. In the language environment a good exercise for development of associative abilities and contextual efficiency is the game "kaleidoscope", invented by the author and applied by him with students - humanists taught natural sciences. Its purpose is throwing the directions of time in an elementary linguistic triad due to the change of the context, the jump of semantic gestalt (2) is connected to it.

Laws and Event Networks

We have carried out detailed consideration of triad physical laws in (1) where it is shown that from Aristotle's ideas about movement and elementary laws and to Shredinger's classical linear equation and procedure of quantum measurement, we have laws - events in triad sense, i.e. an event not in physical, background time, but in time of a sequence of cogitative acts. Thus the skill to solve problems is just identical to the skill to work with triads of laws in all three-time contexts!

Now we understand that the problem is not in physics (it was just the first to formalize Platoon-Aristotle's laws of philosophy), but in our way of thinking, the structure of language, and elementary laws may be only triad ones.

Well, are there non-triad laws? Certainly, every time when we have nonlinear system solutions of which are not obvious, and sometimes are ambiguous. From times

of Newton solutions are built by the method of iterations, consecutive approaches where each approach continues a circuit of triad events on one link: thus there were the first event columns without the loops, approaching solutions, specifying the process of delocalisation, clothing of the first approach, specification of sense. it is much serious with Maxwell's equations for an electromagnetic field which is linear, but nevertheless it is impossible to write down the triad law for it. So, the law of development of any field, nonlinear system or human mutual relation is not described by one creative triad - event. But our reason gives in to such problems and we approach their description by the network of triad events such as Feinmann's diagrams, or we give it to the computer which solves a problem moving step by step on some event net without which there is no computer algorithm. We shall note, however, that today in computer models units of a network may have more number of the ends, as, for example, in neuron network of the brain (though any polytail can be presented as a fragment of a triad network). In humanitarian sphere we work with the text this way - germenevtic procedure of coming back to the read, the specification of understanding, quite similar to the theory of indignations in physics. The reflective processes of thinking are also organized this way.

This universal system approach allowing to isolate an intrinsic kind of laws and communications of not only triad type today is developed in the works of scientific school of J.I.Kulakov - so-called "theory of physical structures". Thus triad language forms a basis of the elementary laws of a nature and thinking, and which it is not less important, allows to create a fabric of events for the approached description of more complex laws. These structures were for the first time interpreted in physics, but have considerably more general status, as universalies of our thinking at consideration of relations of unstructured objects. The typology of allowable formulations of laws, invariants of language is actually suggested, which probably explains "incomprehensible efficiency of mathematics" not only at the description of a nature.

And today supercomplex mathematical methods of exact natural sciences have the projections in psychology and linguistics.

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Language as Lingvo-Chromodynamics

Now we shall try to apply ideas of modern quantum chromo dynamics and linguistics. Homskiy's grammar shade the invariance of elementary semantic designs - sentences. They are very similar to tops and trees of Feinmann's diagrams: the same active and passive pledges, event network - tree supposes a unequivocal stream of time. But if Feinmann's column has loops, its internal orientation (arrangement of arrows on internal lines may be ambiguous). There is a plurality of interpretations of a complex event; plurality of senses - presentations of scripts at the fixed plot - external lines the column. To understand how this is achieved it is necessary to allocate even more deep layer of the language---morphological classes, classes of equivalence to formation of active and passive pledges and other parts of speech from the given word. We shall name these transformations inside the class a color group of a word. Then according to Feynman and Homskiy in one top three different colors always converge, we shall choose them so that in the sum there will be a

white color (top - event is colorless). For example the active reason is red, passive is green, result is dark blue. White color we shall apply to additional degrees coming to the top---circumstances of a place, time, action (the analogue of a charge of the top in Feinmann's diagrams) The offered interpretation reproduces the idea of color symmetry of quarks: in baryons three color quarks are incorporated in a colorless combination. In such circuit the same word - class of equivalence may show one of three colors (becomes the active reason, passive, result) at interaction with other objects of language. So, generation of senses arises for the following reasons:

1. Color combination theory in morphological classes and, accordingly, change of orientation of internal lines of graphs (game "kaleidoscope"), since the change of color (direction) of one top conducts to change of colors of two other ones.

2. Change of a context due to colorless component---environment of events (circumstances of places, time, and action), something alike frame ideologies for tops of graphs.

Finally, the structure of language is represented here by the graph of color base above which colorless layers of circumstances of events are built on, which are in their turn curtailed color columns.

In this approach not any column can be painted in coordination with a rule of dullness of tops, therefore not any narrative design appears grammatically correct; and those or other technologies of painting and generation of senses may clear up, in a result, mechanisms justifying Sapire-Worph's hypothesis.

About prospects of the uniform language

In conclusion of this unit we shall note that Wood's model invented in 60-ties and claimed in the beginning of 90-ties when supercomputers became accessible is most popular today among linguists and mathematicians-developers of programs of machine translation and checking of texts. This model generalizes Homskiy's ideas allowing to place on edges of graphs the conditional operators and to open elementary tops finding in them columns – clusters of thin structure of underground explaining a hyper textual fabric of the language making it infinitely measured. This technique is quite adequate to procedures of clothing and renorming in diagram technique of the quantum theory of a field.

Now it becomes more and more obvious that there is a prospect of a uniform method of the description of natural languages and quantum-field realities, and it is quite probable, as we tried to show above, that these approaches will fruitfully cooperate in the nearest future.

Is however therey are difficulties which are connected first to the high level of professionalism of experts, there are few of them; second with the fact that discussed materials belong to esoteric kitchens as physicians and linguists and interdisciplinary dialogue is required, the point and the motive of a meeting; thirdly, modern development of computer models of processing of texts will be carried out under the orders of large international corporations and generally are them "now how", an intellectual product inaccessible to interdisciplinary usage.

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About the Cognitive Border of Event Language

To propagandize negative result, theorems of non-existence is psychologically less comfortable than to advertise the proof of existence (they should not be confused with the rules of an interdiction coming out of knowledge of invariants, for example laws of preservation). But exactly they limit the channels of efforts of scientific community, and in the science appeared a cage of theorems about non-existence when the theory gropes the border from within.

To these few theorems we refer Galua's theorem of insolvability in quadratures generally of the equations from the fifth degree; Gedel's theorem of incompleteness, meaning the opportunity of checking the validity of many formal theories, Heinemann's theorem background about absence of the latent parameters in the quantum mechanics, well, perhaps, it is all. Here we suggest adding one more universal result: lines of the theory of indignations of the quantum theory of a field have asymptotic character, i.e. from some step, the further summation of lines does not improve, but worsens the result, and a line solemnly disperses, though we were already almost at the purpose. It is interesting that no matter how little the indignation is, a line all the same eventually disperses, there are just no other lines. This is the property of the quantum field theory in which as against classical one there are loops at Feinmann's diagrams, i.e. graph is not a tree. By the way, the well-known problem of renorming is connected with loops. In language of cognitive concepts loops on the graphs are reflective procedures. Here again there is a problem of a stream of time (on a tree there are no such problem). Physics solve it by means of introduction of return movement in time as movements of an antiparticle; in cognitive space - as object of language with denying of all given qualities. Birth and the subsequent annihilation in quantum vacuum of pair a particle – an antiparticle, or self-action of a charge on itself radiating and quickly absorbing quantums of the field, these are the processes duplication of which dresses particles in laces of vacuum eyelets. This plenty of particles cannot be seen in details, that it is forbidden by Geisenberg's well-known principle of uncertainty, therefore particles in loops are called virtual, i.e. not realized in real ones and therefore they are observed only indirectly. Process of clothing of a naked particle in a fur coat of virtual vacuum particles - quantums (all terms are and for a long time are officially accepted by the physicians) is called in the theory of a field as renorming of its attributes (charges, weight), and for us it is the elementary example of procedure of localization, or revision of a position in reflective process. So a fashionable trend virtualistics might use the effective language of a serious science counting already about 50 years.

Now our basic result is the reason for the asymptotic lines. In quantum physics the topology of graphs with loops becomes complicated too quickly (the number N of topmost graphs with loops grows proportionally to N!) which results in divergence of lines of the theory of indignations which arise at the solution of the dynamic equations which in turn are consequence of extreme principles of physics (a principle of the least action). In the process of thinking we do not know laws but if we assume that there is a certain extreme principle the conclusion shall follow about inevitable asyumptoticity of reflective procedures of thinking, i.e. Okama's razor is not intellectual vivisection, but the only way to cope with sense-destroying power of reflection. One of the greatest mathematicians J.I.Manin says: "performative state-

ments erase the place of the reference in natural languages, and in formal languages leads to the vicious circles. Now we understand that erosion in infinite process is always destructive".
So, event language has horizon of reflective procedures of judgment, behind which there is the chaos of consciousness, frustration of mentality, and here lies the limitation of descriptive component of ratio. Probably, it is connected with the defect of approach of structures of an infinite rank (according to Kulakov), a network of elementary events (such is also the quantum field).
It does not mean at all that the reflection behind horizon is not applicable, but its efficiency in clearing initial sense is just lost, though it may be the generator of new senses in the chaotic unpredictable stream of consciousness, but it is already closer to intuition rather than to logic.

From Event Networks to Neuronetworks

But there is also non-event approach in a science which appeared at the end of XX century with the theory of neuronetworks, cellular automatic devices, and synergetic computers. Basically it is not possible to use the theory of indignations here, event language and ideas of reflection. It is the world of not resulted, non-localized processes, instead of events. Systems work completely - in a mode of self-organizing. Beginning from the ideas of perceptron of 60-ties when processing of the information by an eye was modeled, such systems distinguish images, solve intellectual problems, and in this sense are closer to consciousness of contemplation and intuition about which the science can already tell something substantial. You see even in the elementary well-known cellular automatic game "LIFE" where the condition of object depends on a condition of environmental objects, there are patterns of excitation in the environment called "animal" for which it is necessary to use Lamark's descriptive methods of times, and no theoretical forecast, the reduction to elementary forms of life is impossible. We simply are compelled to accumulate situational experience in computer experiments. The science theoretical, in the maximum stage generates a layer of knowledge the methods of development of which are quite historical, humanitarian. This convergence also begins now in new generations of expert systems, ideas of an artificial intellect.
Certainly we may say that outside border of language complexity lies the area of the transcendental, but we don't want to believe that this is only impossibility to disparalell and reflex complete process in our neuro-computer and it seems to me that feelings, emotions, existential philosophy will not be discussed soon.
And nevertheless the ideas of an artificial intellect are entirely connected today with neuro-computing. The matter is that consecutive processing of the information controllable by logic algorithms occurs extremely slowly in comparison with parallel calculations such as recognition of images in Hopfield's elementary neuro-networks which can be trained and reconstructed practically in an analog mode how it occurs in life of the child.
Actually neuro-computing is a substrate approach to a problem of thinking as against processual -algorithmic, logical: we do not know the processes distributed neuro-environment, we do not know where and what happens, but we know the

device of local substrate units – “neuron” and its connection, and it is quite enough to operate and train neuro-network. Thus the association in the elementary variant arises as precedent - recognition of object of training similar to object of training society, the creative association or a metaphor is, according to D.S.Chernavskiy's words, recognition of the decisive rule which have appeared a general one for different training sets; so the method of analogies is realized in the computer. Probably process of meditation also means creation of volumetric neuro-network with the distant, coherent order of neurons at which reflective logic procedures should be inevitably temporarily stopped.

What it has to do with language? A lot. As nonverbal components of language are not a descriptive part of discourse connected with education, cultural tradition, psychosomatic condition, sympathies in dialogue etc., are objects of training sets which a person inherits, keeps and creates all his life subconsciously using them generally intuitively. We see in the verbal communications only top of an iceberg, only shadows of consciousness of contemplation, its fragments of bodyness.

Training neuro-computer on recognition of morphemes and syntactic units of language its organization as a semantic network on which the given text stretches that results in its automatic hierarchization, themesation and even, to a certain extent, to comprehending. It allows to process texts very quickly, clusterly seizing sense by blocks how we look through the newspaper, but if there is a wish to arrange the detailed analysis of fragments. Thus it is quite simple to algorithmize logic procedures in neuro-networks, but they are improved due to associative communications, here is the essence of an artificial intellect being born.

Speech and logic thinking have arisen as a social product but it does not mean at all that such type of the communications will always dominate. Nowadays it is possible to observe professionals understanding each other half-word, close people understanding each other without words, a good teacher is laconic, and high art speaks language of few symbols. The problem is in having behind the shoulders extensive experience of various training sets mastered by community and individuals, here the level of culture is observed. Today such opportunity is given by the INTERNET and speed of consumption of information itself which tests us by streams of chaos, plunging in prostration, or teaching other methods working with it. Probably, we are really on the threshold of the new neuroaramorphos if not a biological one than a machine one for certain.

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