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In History of Ideas, Constructivist Pedagogy Stems from German Idealism

by

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ABSTRACT: This essay starts with the thesis that major parts of constructivist theory have found a cozy dwelling in contemporary pedagogical-didactical discourse. Recent policy reforms in the German education sector are an example thereof. Nevertheless, theories of constructivism are not always apparent as such. Too often, when an author openly refers to constructivism his or her ideas are dismissed. This owes to the fact that, in general, history of science and theory of science have not yet thought over constructivism and autopoiesis deeply enough. A further problem is that the radicalism of constructivism often evokes the idea of arbitrariness.

The present essay tries to fill this gap in scientific discourse. It also contributes to the scientific, historical-genetic systematisation of paradigms. As the theoretical source of constructivist theory, German Idealism – for example, the works of Johann Gottlieb Fichte and Friedrich W. J. Schelling – is identified. Schmidt and von Glasersfeld later on contributed further specifications. Still older roots, digging in Aristotelean notions, have been pointed out by Mario Crocco and Colin Dougall for the theory of autopoiesis composed by neurobiologists Maturana and Varela, who were born in a culture partly shaped by four centuries of Aristotelean, Jesuit schooling; thus far, however, the present writer has not yet carried his research program onto the study of such roots. Autopoiesis theory, which basically dovetails and complements the constructivist paradigm, illustrates the implications of a theory of science as regards the theory of self-organisation.

After these steps of fundamental scientific reflection, it is possible to discuss and assess the merits of a pedagogy and a didactics inspired by constructivism: in the arrived-to scenario, the outcome of a constructivist pedagogy can be systematically derived from the theoretical framework. Many consequences of constructivism are nowadays widespread in the academic community concerned with pedagogy and didactics. The main feature of constructivist pedagogy and didactics is the focus on the student. Students are considered autopoietically closed systems and structural-selective acting systems that are only able to act on their own motivation and are incapable to respond to external motives. Therefore self-study, partner- or groupwork is viewed as the ideal means of successful education.

ZUSAMMENFASSUNG: Dieser Aufsatz beginnt mit der These, dass wesentliche Teile der konstruktivistischen Theorie im zeitgenössischen pädagogisch-didaktischen Diskurs implizit fest verankert sind. Neuere politische Reformen im deutschen Erziehungsbereich stellen dafür ein Beispiel dar. Nichtsdestoweniger sind Theorien des Konstruktivismus nicht immer offensichtlich als solche gekennzeichnet. Auch wird oft, wenn sich ein/e Autor/in auf den Konstruktivismus bezieht, von seinen oder ihren Ideen Abschied genommen. Dies beruht auf der Tatsache, dass im Allgemeinen die Geschichte und Theorie der Wissenschaft noch nicht genug über die wissenschaftshistorische und –theoretische Fundierung des Konstruktivismus und der Autopoiese reflektiert hat. Ein weiteres Problem besteht darin, dass der Radikalismus des Konstruktivismus oft die Idee der Willkürlichkeit hervorruft.

Der gegenwärtige Aufsatz versucht diese Lücken im wissenschaftlichen Diskurs zu schließen. Er trägt auch zu der wissenschaftlichen, geschichtlich begründeten Systematisierung von Paradigmen bei. Als die theoretische Quelle der konstruktivistischen Theorie wird Deutscher Idealismus – zum Beispiel die Werke von Johann Gottlieb Fichte und Friedrich W. J. Schelling – bestimmt. Schmidt und von Glasersfeld trugen später weitere Entwürfe bei. Auf noch ältere Wurzeln, die in Ansichten von Aristoteles graben, wurde von Mario Crocco and Colin Dougall auf die Theorie der Autopoiesie hingewiesen, die von den Neurobiologen Maturana und Varela aufgestellt wurde. Diese wurden in einer Kultur geboren, die durch vier Jahrhunderte aristotelischer und jesuitischer Schulung geprägt war. So weit auf das Studium solcher Wurzeln hat der gegenwärtige Schreiber sein Forschungs-Programm jedoch noch nicht fortgesetzt. Die Theorie der Autopoiesie, welche hauptsächlich das konstruktivistische Paradigma koordiniert und ergänzt, illustriert die Auswirkungen einer Wissenschaftstheorie v.a. in Anbetracht der Theorie der Selbst-Organisation.

Nach diesen Schritten grundlegender wissenschaftlicher Reflexion ist es möglich, die Verdienste einer durch den Konstruktivismus inspirierten Pädagogik und Didaktik zu diskutieren und einzuschätzen: Im Szenario des Angekommen-Seins, kann das Ergebnis einer konstruktivistischen Pädagogik systematisch vom theoretischen Rahmenwerk abgeleitet werden. Viele Folgen des Konstruktivismus sind heutzutage weit verbreitet in der akademischen Gesellschaft, die sich mit Pädagogik und Didaktik befasst. Das Hauptmerkmal konstruktivistischer Pädagogik und Didaktik ist das Augenmerk auf den Schüler und Studenten. Autopoietisch geschlossene und strukturselektiv agierende Systeme sind nur zum Agieren fähig. Deshalb gilt z.B. Gruppenarbeit heute als probates Mittel für den schulischen Unterricht.

RESUMEN: Este trabajo comienza por la tesis de que grandes porciones de la teoría constructivista hallaron cálida acogida en el discurso pedagógico-didáctico contemporáneo. Son ejemplo de ello las recientes reformas en las políticas públicas del sector educación en Alemania. Pero las teorías constructivistas no siempre se distinguen fácilmente como tales, tal vez porque a menudo, cuando un autor se refiere abiertamente al constructivismo, sus ideas son rebajadas. Se debe esto a que, en general, la historia de la ciencia y la teoría de la ciencia todavía no han pensado con suficiente profundidad el constructivismo y la autopoiesis. Otra dificultad que se añade consiste en que la radicalidad del constructivismo con frecuencia evoca la idea de arbitrariedad.

El presente ensayo trata de cubrir ese hueco del discurso científico y contribuir a la sistematización científica, histórico-genética, de paradigmas nocionales. Como raíz y fuente ideológica de la teoría constructivista se identifica al idealismo alemán; por ejemplo, la obra de Johann Gottlieb Fichte y Friedrich W. J. Schelling; más tarde, Schmidt y von Glasersfeld aportarían mayores especificaciones. Raíces aún más antiguas, arraigadas en conceptos de Aristotéles, han sido señaladas por Mario Crocco y Colin Dougall para la teoría de la autopoiesis compuesta por los neurobiólogos Maturana y Varela, nacidos en una cultura en gran parte moldeada por cuatro siglos de enseñanza aristotélica jesuítica; el presente autor, empero, hasta ahora no ha extendido su programa de investigación hasta el estudio de esas raíces. La teoría de la autopoiesis, que entronca, articula y complementa el paradigma constructivista, ilustra las implicaciones de una teoría de la ciencia sobre la teoría de la autoorganización.

Tras esas etapas de reflexión científica, de carácter fundamental, se hace posible analizar y evaluar los méritos de una pedagogía y una didáctica inspiradas en el constructivismo. En efecto, desde tal perspectiva, las consecuencias de la pedagogía constructivista pueden deducirse sistemáticamente del marco teórico. En nuestros días muchas secuelas del constructivismo se expandieron ampliamente a través de la comunidad académica vinculada a la pedagogía y didáctica. El rasgo prominente de la pedagogía y didáctica constructivistas es el foco que pone en el estudiante. Los estudiantes son considerados sistemas autopoieticamente cerrados y sistemas que obran de modo estructural-selectivo, sólo capaces de actuar en base a su propia ocurrencia e incapaces de responder a las incitaciones externas. Por ello el medio ideal de la educación exitosa es visto en la autoinstrucción y el trabajo en grupo o entre asociados.

1. Introduction

The author has already pointed out that a reflection in History of Science, about the philosophical and paradigmatic background of self-organisation theories, reveals that German idealism – mainly, Fichte's ideas – generated the modern self-organisation-theories and, on the way, the constructivism, which derives from it.[1] This essay builds on this fundamental insight, also expounded elsewhere[2], and asks here after its consequences in the area of pedagogy and the didactic disciplines. As regards the discussion details, the present exposition follows a middle course since, for the said purpose, the analysis of the conceptual historical grounds of modern constructivist pedagogy can no longer be carried out so elaborately as it was previously done. Nevertheless, it is necessary to illustrate at least the essential part of that argumentative reasoning, before bringing in the effects on the constructivist pedagogy and didactic.

At constructivism, an interdisciplinary paradigm is dealt with. The following disciplines, *inter alia*, make use of theories from the constructivistic stock:

- Biology
- Philosophy
- Political Science
- Sociology
- Discourse Analysis
- Literary Studies
- Systems Theory
- Chemistry
- Physics
- Medicine
- Neurophysiology

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[1] Stefan Schweizer, Deutscher Idealismus, Autopoiese und Radikaler Konstruktivismu-page *Electroneurobiologia* 2007; 15 (1), pp. 3-62.

[2] Pia-Johanna Schweizer/Stefan Schweizer, Idealistisch geprägte Axiomatik des Selbstorganisationsparadigmas, in: Berichte zur Wissenschaftsgeschichte 29 (1) 2006, pages 53-66 und Stefan Schweizer, Politische Steuerung selbstorganisierter Netzwerke. Baden-Baden 2003, pp. 85-98.

This enumeration claims no completeness and, as a further discipline, pedagogy has to be named. In pedagogy the constructivist body of thought finds multiple uses. Essential parts of the spreading reforms in education and education planning are based on the constructivist body of thought. The student is to gain competences, rather than acquiring cognoscitive curricular contents forwarded by the teacher; or, in other words, improvement in learning primarily represent improvements in competences.[3] Constructivist approaches are also found in the control of the educative system: schools get a higher level of autonomy. Any efforts toward controlling, specially those by the Ministry or other administrative bodies, can be no more than controlling the progress of self-controlling.

As it also occurs in other disciplines, the scepticism regarding constructivist theories is nevertheless extensive.[4] This results, *inter alia*, from the uninhibitedness and radicalism of the constructivist body of thought. Who embraces the cause of constructivism in most cases only communicates its conclusions. The historical correlations relating to concepts and problems become concealed, a suppression not seldom due, in point of fact, just to plain unawareness. The historical dimensions of science are rarely found in the pedagogical literature, and any diachronic overviews use to be – at most – just short descriptive notes.

As this article wishes being of help to moderate these limitations, it starts with a discussion in the context of history of science and history of ideas, in which German idealism is identified as the precursor of the constructivist body of thought. Then, as the system-theoretical biological model of autopoiesis, by Chilean neurobiologists Maturana and Varela, lends itself finely to science-theoretical reflections, this feature is tapped for presenting autopoiesis in regard to its numerous discursive applications. After that, so as to bring the present article to a close, the constructivist-pedagogical body of thought is plainly and most succinctly represented, undiscussed but with explicit references to the previous exposition. The expected upshot is that no longer the thus presented results of constructivist pedagogy and didactics might appear surprising, or even mind-boggling.

[3] Sander, W. Politik in der Schule. Kleine Geschichte der politischen Bildung. Lizenzausgabe für die Bundeszentrale für politische Bildung. Bonn 2003, page 158.

[4] One at least can often see the Platonic-Aristotelic difference of opinion, about idealism and realism/empirism, as the starting point for agreement or disagreement with regard to the constructivism.

2. A reflection in history of science: idealism as the philosophical grounding of autopoiesis

The philosophical roots of radical constructivism and the "theory of autopoiesis" are to be looked for in German idealism, especially in Kant, Fichte, and Schelling. There the roots of the constructivist pedagogical discourse lie.

2.1 Kant's Copernican turn of transcendental philosophy

Kant's philosophy runs under the label of Critical Idealism and functions as a precursor of German Idealism. Critical idealism subjects to a fundamental examination the cognitive processes going on in the cognizing subject. That means, Kant does not let the philosophical reason wander over the unknown quarters of our material world. He rather concentrates the attention on the mind's inner space.[5] Besides, the similarity of the secularist trends in idealism and autopoiesis has to be pointed out, too: both try to acquire an advanced explanatory power without taking resource of transcendental constructions.[6] In this very fashion Kant attempts to enlighten, by means of the (pure) mind, the things behind the perceptible.[7] The interest of Kant's reasoning decant into three questions:

- what one could know (*was man wissen könne*)
- what one should do (*was man tun solle*), and
- what one is allowed to hope (*was man hoffen dürfe*).

Of these questions, the first one is speculative, the second practical, the third at once practical as well as theoretical[8]. In addition, one can make reference to Kant's transcendental physics as a metaphysics of the meta-physics. And for Kant, meta-physics is the scientific cognition, when it is compelled to jump, by way of concepts, beyond the empirical experience. This comes to be the case as it pronouces itself

[5] A point by Steffen Dietzsch, Deutscher Idealismus, in: Peter Prechtl / Franz-Peter Burkhard, Metzler-Philosophie-Lexikon. Begriffe und Definitionen. Stuttgart 1999, page 104.

[6] Immanuel Kant, Kritik der Urteilskraft. Hamburg 2003, page 406.

[7] Immanuel Kant, Prolegomena. Illinois 1989, page 134.

[8] Immanuel Kant, Kritik der reinen Vernunft. Hamburg 2003, pp. 838 f.

about knowledge, about the world – or reality – in general; about morality, beauty, or history.[9] There the intellect draws up a picture of the world that appears, to it, as the actual reality, in the sense of what is objectively given. This activity of the subject brings about, as its result, the creation (of the world): "For we do not know nature but as the totality of appearances, *i.e.*, of representations in us, and hence we can only derive the laws of its connexion from the principles of their connexion in us, that is from the conditions of their necessary union in consciousness, which constitutes the possibility of experience."[10] In his critique of the pure reason, Kant thus lays the foundations of an epistemological change of paradigm, by essaying to prove that we are not cognizant of the world as it is, but of the world as it seems to be so: simply as we recognize it. The recognizing mind is not an impression of the world, but the world is an impression of human mind.[11] Experience thus cannot be the showing itself, in our sensory intuition, of an essence existing independently of us, "but the conceptual and subjective schematizing of a spatial-temporal givenness."[12] It is the „pure sensory view as space and time" that "which makes the cognizance *a priori* possible, and this no more than for sensory realities."[13] Here the parallelism with the autopoiesis theory's cognitive autonomy is to become evident. It should be noted that, in this context, the sources of metaphysical knowledge can neither be of empirical origin, nor deduced from experiments.[14]

So the subject brings up, *i.e.* suscitates, the world. Whence it comes that this world is perceived in correspondence with the subject's structure, and only can be acted upon along with it. This corresponds to the autopoietical features of "*structure determination*" and "*operational unity*".[15] It ought to be critically protested, in this regard, that for Kant subjective cognition is not identical with a not-objective cognition, as the consciousness of each and every human being is structured in a way more or less similar. For that reason, the subjective cognition's meanings can be intersubjectively extrapolated, and shared. Therefore a distinction regarding the premises of the autopoiesis theory takes

[9] Volker Gerhardt, Kant, Immanuel, in: Metzler-Philosophen-Lexikon. Von den Vorsokratikern bis zu den neuen Philosophen. Stuttgart 1995, page 439.

[10] Immanuel Kant, Prolegomena. Illinois 1989, page 80.

[11] Lothar Pikulik, Frühromantik. Epoche – Werke – Wirkung. München 2000 page 34.

[12] Jean Grondin, Kant zur Einführung. Hamburg 1994, pp. 48 f.

[13] Immanuel Kant, Kritik der praktischen Vernunft. Hamburg 2003, page 58.

[14] Immanuel Kant, Prolegomena. Illinois 1989, page 13.

[15] Vergleiche Axel Görlitz/Hans-Peter Burth, Politische Steuerung. Opladen 1998, page 226.

place, since in autopoiesis theory the living beings' organisation is identical but their structure is different.[16] This discrepancy is cleared up in Fichte. Kant asserts that the function of thinking turns up from an activity whose originator is the self-conscious subject. That is to say, the intellect draws up a world picture in a sovereign way. Facts arise from the activity of the subjectivity, in such a way that one can say that facts would be our creation.[17] It further is specified that there is a relationship between the object's structure and the attendant form of judgement; or, that what we call "objects" is nothing else but "that, whereupon we, with our *accurate judgements*, make reference to."."[18] In the vein of Aristotle's Prime Mover, which moves toward Itself (thereby shaping up the whole Nature, with its admirably harmonized motions) every other thing "autonomously", by way of the love for It that the very Prime Mover by itself inspires in every other thing's heart, likewise in Kant the appeal of the real things in themselves acts as raw matter on the spirit's cognitive power and *a priori* forms, and is shaped up by these. *A priori* means a possibility of universal application, as well as a transcendental stage – or plane – of sensory perception.[19] The acquisition of knowledge in this manner is a composite occurrence. It does not only consist in the cognitive apprehension of sensual impressions. Kant's articulation of rational and empirical components in the occurrence of each acquisition of knowledge concurs with the basic views of the "theory of autopoiesis", as both components, *i.e.* the own understanding as ratio and the world as empirical fact, are created by the own self.

2.2 Fichte's constituting of the world by the subject

In current discussions, Kant is appreciated as a theorist of science. Nevertheless, it is reserved to Fichte (in contradistinction to Kant) the distinguishing trait of having put "the main emphasis, of the scientific acquisition of knowledge, on the deductive method" [20]. Whence Fichte demands that philosophy be established on some absolute, self-evident proposition, from which everything else could be deduced.[21]

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[16] Axel Görlitz/Hans-Peter Burth, Politische Steuerung. Opladen 1998, pp. 206 f.

[17] Manfred Frank, Einführung in die frühromantische Ästhetik. Frankfurt a. M. 1989, p.14.

[18] *Ibid.,* pp. 14 f.

[19] Paul Carus, Kant's Philosophy, in: Immanuel Kant: Prolegomena. Illinois 1989, page 186.

[20] Urban Wiesing, Kunst oder Wissenschaft? Konzeptionen der Medizin in der deutschen Romantik. Stuttgart-Bad Cannstatt 1995, page 147.

[21] *Ibid.,*page 145.

More emphatically even than Kant, Fichte puts the subject into the focal point. Is the human being free and independent, or only a product or manifestation of an alien force?[22] Fichte's philosophical system can be understood as a praxis or system of action. The ego is identical to willing and knowing.[23] All heteronomy of the subject is denied, and it is highlighted the subject's own endeavour to encompass the prevailing infinity.[24] Fichte radicalizes Kant, as he rails against the doctrine of the "dogmatism" – until then ruling – whereby the human is the product of outer things and relationships. Fichte thinks: „I and my world are the product of my free activity" [25] He made the import of the spirit stronger, as "it produces a world out of the nothing, because only the I of the spirit exists" [26]. This yields an exact correspondence with the premises of the autopoiesis' axioms of cognitive autonomy, structural determination, and operational unity. In that connection these characteristic features can be clarified, and more concretely formulated, as that the subject brings up the world (as object), and the consistence of the object is totally dependent of the distinctively characterized, structured activity of the subject.

If the consciousness considers itself, and reflects on the preconditions of the own possibilities, it discovers the own 'I'-condition or egohood (*thesis*), which is thinkable only in connection with a 'Non-I' (*antithesis*, as this that the world can become). Both steps are themselves carried out subject-immanently, *i.e.* inside of the subject, thus coming along to abolish the contradiction, into the unity of the higher ego (*synthesis*). This is also the Absolute Ego.[27] One may not equate the Absolute Ego with the individual, because it is the individual who has to be deduced from the Absolute Ego.[28] This Fichte pointedly formulates, by

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[22] Johann Gottlieb Fichte, Die Bestimmung des Menschen. Hamburg 2000, page 32.

[23] Wilhelm G. Jacobs, Johann Gottlieb Fichte, in: Johann Gottlieb Fichte: Grundlage der gesamten Wissenschaftslehre. Hamburg 1994, page 51.

[24] Johann Gottlieb Fichte, Grundlage der gesamten Wissenschaftslehre. Hamburg 1994, page 205.

[25] "Ich und meine Welt sind das Produkt meiner freien Tätigkeit." *Cf.* Helmut Seidel, Fichte zur Einführung. Hamburg 1997, page 47.

[26] "... er erschafft eine Welt aus dem Nichts; denn es gibt nur das Ich des Geistes. Durch dieses Ich entsteht die Welt. *Cf***.** Johannes Hirschberger, Kleine Philosophie Geschichte. Freiburg/Basel/Wien 1980, page 156.

[27] Klaus Peter, Romantik, in: Eberhard Bahr (Hrsg.), Geschichte der deutschen Literatur. Von der Aufklärung bis zum Vormärz (2. Band) Tübingen/Basel 1998, page 352.

[28] Wilhelm Jacobs, Einleitung, in: Johann Gottlieb Fichte, Grundlage der gesamten Wissenschaftslehre. Hamburg 1997, page XI.

declaring that the (dividable) Ego sets up itself, which again sets up, against itself, a dividable non-Ego: „The striving of the I can't be set without setting a counter-striving by the non-I; for, the striving of the first comes from causality, but hasn't causality; and that it hasn't got any causality, is why it hasn't got its foundation from itself, because otherwise the same striving wouldn't be a striving, but nothing."[29] The subject's setting and countersetting work flows into a (dialectical) synthesis of subject and object as Ego and Non-Ego, whereby both the knowledge owned by the Ego, as well as its reflection, consist of a permanent setting-countersetting dialectic.[30] I can be concluded that the spirit has to be interpreted as act, specifically as an act that although determined *a priori* constitutes everything real, *i.e.* the nature etc., as knowledge. The Being, as the Whole of the self-realising possibilities in its self-excitation, is not material. It rather grants spirit, and comes into ex-sistence as the manifestation in consciousness of the multiplicity of its possibilities. The consciousness of the Being is the form, whereby the Being comes to ex-sistence and brings up for itself its possibilities, of phenomenizing as the multiplicity of an appearance-world and of placing its capacity of becoming conscious into its own view and knowledge.[31] In the autopoiesis-theory, the systems are self-organizing and self-producing. Thereby the system-immanent existence, and its relation to objects, are produced. Fichte names this a self-excitation of the spirit (*Selbsterregung des Geistes*), active to produce the world. The consequence is the same, as in both cases the external objects get constituted by the subject's activity. The requisites of the autopoiesis axioms of structural determination and operational closure are satisfied in Fichte's philosophy. About the objective existence of objects (Non-I realities), only statements after the subject's structure can be made. These reflections exactly correspond with the positions of the radical constructivism. Reality is created by the powers of imagination.[32] Cognition is self-set, in Fichte; the subject can act, can never react. Reality's composition is moulded in the subject's structure.

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[29] Johann Gottlieb Fichte, „Das Streben des Ich kann nicht gesetzt werden, ohne daß ein Gegenstreben des Nicht-Ich gesetzt werde; denn das Streben des ersteren geht aus auf Kausalität, hat aber keine; und daß es keine hat, davon liegt der Grund nicht in ihm selbst, denn sonst wäre das Streben desselben kein Streben, sondern Nichts." Grundlage der gesamten Wissenschaftslehre. Hamburg 1997, page 205.

[30] Lothar Pikulik, Frühromantik. Epoche – Werke – Wirkung. München 2000, page 37.

[31] Manfred Boin, Fichte, in: Metzler-Philosophen-Lexikon. Von den Vorsokratikern bis zu den neuen Philosophen. Stuttgart 1995, page 277.

[32] Johann Gottlieb Fichte, Grundlage d. g. Wissenschaftslehre. Hamburg 1997, page 146.

Aristotle (384-322 b.C), two Roman copies (mantle is a modern addition) of a lost bronze portrait made by Lysippos around 330 BC

Two portraits of Immanuel Kant (1724-1804)

Left, Johann Gottlieb Fichte (1762-1814). Right, Friedrich Wilhelm Joseph Schelling, Ritter von Schelling (1775-1854), young and old.

2.3 Friedrich Schelling's subject-object theory

The development, from Fichte's philosophy of consciousnes to Schelling's philosophy of nature, is supported on methodological grounds.[33] The early Schelling says that the ego is world-creator. Nature appears as a symbol of the spirit, which reflects himself in the exterior.[34] So in Schelling the perspective changes, as the interrogation comes to ask for how nature can become an object for the creator subject's gaze. Schelling puts it in this way: nature can become object for the cognizing subject, as it is the product of an unconsciously acting subject; a product that, in its most basic structure, harmonises with the structure of the ego.[35] Thus also Schelling sees how the subject builds up the object, but in Schelling's view this object has its own right as a real object, independent of the subject. The dialectic game of subject and object has to be regarded as foundation of the understanding of reality: "Every and any knowledge is based on the agreement of an objective with a subjective" [36]. On the other hand, the object presses onto the subject, as it, inasmuch as foreign to consciousness, presses for becoming conscious. This constitution of reality comes out of a conflict that has several levels: "So much for sure as it is that all knowledge in general is based on that contrast of intelligence and object, so surely that contrast cannot rise without object... Intelligence can never expand itself into infinity, prevented as it is from doing this by its own striving for coming back into itself. But, just as little it can totally come back into itself, prevented as it is from doing this by the trend toward being itself infinity." [37] Inasmuch as nature, consciousness has to be seen as a reflection of the spirit. By way of the abundance and wealth of nature, its objectivity and thereby its difference to the ego is demonstrated.

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[33] Peter Sloterdijk, Vorbemerkung, in: Michaela Boenke, Schelling. München 2001, page 13.

[34] Walter Schulz, Einleitung, in. Friedrich Schelling, System des transzendentalen Idealismupage Hamburg 2000, page XXI.

[35] Franz Josef Wetz, Schelling zur Einführung. Hamburg 1996, page 31.

[36] „Alles Wissen beruht auf der Übereinstimmung eines Objektiven mit einem Subjektiven". Friedrich Schelling, System des transzendentalen Idealismus. Hamburg 2000, page 9.

[37] "So gewiß also alles Wissen überhaupt auf jenem Gegensatz der Intelligenz und des Objekts beruht, so gewiß kann jener Gegensatz in keinem Objekt sich aufheben ... Die Intelligenz kann nie ins Unendliche sich ausbreiten, denn daran wird sie verhindert durch ihr Streben, in sich zurückzukehren. Sie kann aber ebensowenig absolut in sich selbst zurückkehren, denn daran verhindert sie jene Tendenz, das Unendliche zu sein." Friedrich Schelling, System des transzendentalen Idealismus. Hamburg 2000, page 149.

Nature has to be regarded as life and soul; it represents a way to the spirit, a way whereby the spirit can find nature. Nature is in a permanently living and active process, and has to be conceived of as a living unity: "It is an infinite productive organism" (*„Sie ist ein unendlich produktiver Organismus*") [38]. Thereby the identity of nature and spirit – that characterizes Schelling's *Philosophy of Identity* – comes to light. Subject is object, reality is ideality. Nature is visible spirit, spirit is invisible nature. The many coincides with the One, the Absolute.[39] An essential characterization, of the ego as subject and object, results straight off.[40] Later – it might be worth a mention – Schelling's anthropologized philosophy of identity runs on the woman. This one is an object that pushes her own way to get in front of the subject, the male, for his watching. In a microcosmical analogy, the combination of the absolute and the omnicomprehensive takes place at an ideal combination of the types of man and woman; thus, of subject and object.

With Schelling, the removal of spiritual fatherhood for the "theory of autopoiesis" intensifies. Still, references pointing out to the premises of the autopoiesis theory can be produced while, at the same time, noncommensurable components exist.

Schelling demands a higher knowledge, one that could become investigated by the speculative philosophy of nature.[41] In Schelling's philosophy, Michaela Boenke spots evident parallels with the modern self-organisation discourse. Thus she properly refuses revolutionary radicality to this paradigm of modern science: at self-organisation it is dealt with "the science of organisations, or systems, that organize themselves, this explaining how, by means of elementary interactions, order comes into being and is maintained. Similar to Schelling, nature and cognition are comprehended as self-organizing systems" [42]. In the

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[38] Urban Wiesing, Kunst oder Wissenschaft? Konzeptionen der Medizin in der deutschen Romantik. Stuttgart-Bad Cannstatt 1995, page 191.

[39] Johannes Hirschberger, Kleine Philosophie Geschichte. Freiburg/Basel/Wien 1980, page 160.

[40] Walter Schulz, Einleitung, in: Friedrich Schelling, System des transzendentalen Idealismupage Hamburg 2000, page XXVI.

[41] Urban Wiesing, Kunst oder Wissenschaft? Konzeptionen der Medizin in der deutschen Romantik. Stuttgart-Bad Cannstatt 1995, page 143.

[42] „um die Wissenschaft von sich selbst organisierenden Organisationen oder Systemen, die erklärt, wie durch elementare Wechselwirkung Ordnung entsteht und erhalten wird. Analog zu Schelling werden Natur und Erkennen begriffen als sich selbst organisierende Systeme". Michaela Boenke, Über Schelling, in: Michaela Boenke, Schelling. München 2001, page 36.

autopoiesis' discourse, experience can only be explained by the functioning mechanisms of the brain.

2.4 Radical constructivism and the "theory of autopoiesis"

Until our times, the relationships of German Idealism and the system-theoretical biological theory of autopoiesis of Maturana and Varela had remained chiefly in the dark.[43] In contrast, the connections between radical constructivism and theory of autopoiesis are well known. The very Maturana and Varela, in their writings, make reference to ideas and views of radical constructivism, *e. g.* in the versions of Ernst von Glasersfeld and Sigfried Schmidt. Systems can act and never react, and this affords the epistemological grounds: „Reality is consequently the territory of objects and, thus, it is that which can be delimited as real. Therefore there is no doubt about this, *i.e.* about what reality is: to wit, an area that is determined by the operations of the observer."[44] So one comes to the philosophical-epistemological position of radical constructivism, a position „that, by continuing sceptical and constitutive theoretical reflections, conceives each form of cognition – even the cognizer itself – as a construction of an observer. Recognizing does not mean the passive figuration of an external objective reality, but denotes a process of original production, *i.e.* the construction of a cognitive world. The real world itself is no experienceable reality; reality is rather an always agreed to, observed, invented, therefore constructed reality" [45].

Glasersfeld asks, What radical constructivism is? His answer is: „Simply expressed, it deals with an unconventional way to look at the

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[43] As one of such infrequent approaches, *cf.* Pia- Johanna Schweizer/Stefan Schweizer, Idealistisch geprägte Axiomatik des Selbstorganisationsparadigmas, in: Berichte zur Wissenschaftsgeschichte. Band 29 (1), page 53-66.

[44] Humberto Maturana, Biologie der Sprache, in: Humberto Maturana: Biologie der Realität. Frankfurt am Main 2000, page 132.

[45] „die in Fortsetzung skeptischer und konstitutionstheoretischer Überlegungen jegliche Form der Erkenntnis - einschließlich des Erkannten selbst - als Konstruktion eines Beobachters begreift. Erkennen meint nicht die passive Abbildung einer äußeren objektiven Realität, sondern bezeichnet einen Prozeß der eigenständigen Herstellung bzw. Konstruktion einer kognitiven Welt ... Die reale Welt als solche ist keine erfahrbare Wirklichkeit; Wirklichkeit ist vielmehr immer wahrgenommene, beobachtete, erfundene, also konstruierte Wirklichkeit". Georg Kneer, Radikaler Konstruktivismus, in: Metzler-Philosophie-Lexikon. Begriffe und Definitionen. Stuttgart 1999, page 487.

problems of knowledge and cognition. Radical constructivism is based on the assumption, that every knowledge … exists only in the heads of humans and that the thinking subject can construct his knowledge only on the basis of the own experience. What we construct out of our experience, this alone, forms the world, in that we consciously live." [46]. The radical constructivism is interpreted as a special approach of the constructive theory of knowledge; it is about views of what is to be understood by the term "reality". Nonetheless, this reality has not to be equated with the being; such reality depends on knowledge [47], and reality is connected with the individuality or subjectivity. His insisting, on the bondage of experience and knowledge to the subject, leads v. Glasersfeld to a number of consequences.[48] A marking attribute of radical constructivism[49] is its abandoning the idea of any reality independent from subject.[50] Consequently, theory of knowledge becomes a theory of knowledge acquisition. Absolutely, social interaction is reality.[51] Cognition serves the organisation of the subject's world of experiences, not the detection of a reality independent of the subject. Knowledge generates itself depending on the subject, never being merely an object of passive reception: "Knowledge is actively build up by the thinking subject" ("*Wissen wird vom denkenden Subjekt aktiv aufgebaut*") [52]. Cognition is a mental instrument for adaptation, whose purpose consists

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[46] „Einfach ausgedrückt handelt es sich um eine unkonventionelle Weise die Probleme des Wissens und Erkennens zu betrachten. Der Radikale Konstruktivismus beruht auf der Annahme, daß alles Wissen ... nur in den Köpfen von Menschen existiert und daß das denkende Subjekt sein Wissen nur auf der Grundlage eigener Erfahrung konstruieren kann. Was wir aus unserer Erfahrung machen, das allein bildet die Welt, in der wir bewußt leben". Ernst von Glasersfeld, Radikaler Konstruktivismupage Ideen, Ergebnisse, Probleme. Frankfurt am Main 1997, page 22.

[47] Ernst von Glasersfeld, Drittes Siegener Gespräch über Radikalen Konstruktivismus, in: Ernst von Glasersfeld, Radikaler Konstruktivismupage Ideen, Ergebnisse, Probleme. Frankfurt am Main 1997, page 324.

[48] Siegfried Schmidt, Vorwort, in: Ernst von Glasersfeld: Radikaler Konstruktivismupage Ideen, Ergebnisse, Probleme. Frankfurt am Main 1997, page 12.

[49] For the ensuing, compare Siegfried Schmidt, Vorwort, in: Ernst von Glasersfeld, Radikaler Konstruktivismupage Ideen, Ergebnisse, Probleme. Frankfurt am Main 1997, pp. 12 f.

[50] Again it becomes clear, that the relations to German idealism in these basic presupposition cannot be neglected.

[51] At this point, radical constructivism is closer than idealism to the "theory of autopoiesis", which precisely stresses the social area of interaction!

[52] Ernst von Glasersfeld, Radikaler Konstruktivismupage Ideen, Ergebnisse, Probleme. Frankfurt am Main 1997, page 96.

in the construction of viable[53] conceptual structures. The advances in human knowledge can be characterized as evolution, not as a movement drawing near to a truth. The function of "cognition has an adaptive character, exactly in the biological sense of the word, and aims at befitting or viability." [54].

A distinguishing mark of radical constructivism is that the meaning of linguistic expressions is evaluated as a result of individual experience. Thus, regarding communication, meaning comes into being only from the partners of the communication and from their effort to construct meanings in their cognition. With regard to the learning, it is valid to say that the art of teaching has to consist in building up the art of learning: „Constructivists… regard every knowledge as instrumental. Thus reasons should be communicated to the learner at the start, as to why certain ways of acting and thinking are regarded as desirable. From that, necessarily, follows the explanation of the specific relations in which, supposedly, the knowledge to be acquired is to function." [55] The art of the teaching has little to do with the transfer of knowledge, "its main aim ought to be to educate the art of learning" (*„ihr grundlegendes Ziel muß darin bestehen, die Kunst des Lernens auszubilden*.") [56] All responsibility stays in the individual.

This point, in the fields of history of ideas and philosophy, reminds again of the attitude of idealism. A theory of knowledge oriented on the subject is synonymous with an empirical theory of cognition, given that radical constructivism only can prove itself truly instrumental at problem solving, via selection-like viability. Practical survival decides about the usefulness of cognition and evolution.

Similarities to Maturana's evolutionary biological understanding of the term of progressive drift are obvious. Based on this predisposition, the connection is to be pointed out of the self-organisation discourse with newer scientific developments, *e. g.* inside of Anglo-American neurophysiology, which claims that decision-making processes are organ-

[53] The concept of viability assumes neutrality as regards the concept of survival.

[54] [Die Funktion der] „Kognition ist adaptiver Art, und zwar im biologischen Sinne des Wortes, und zielt auf Passung oder Viabilität". Ernst von Glasersfeld, Radikaler Konstruktivismupage Ideen, Ergebnisse, Probleme. Frankfurt am Main 1997, p. 96.

[55] „Konstruktivisten ... betrachten alles Wissen als instrumental. Als erstes sollten daher dem Lernenden die Gründe vermittelt werden, warum bestimmte Weisen des Handelns und Denkens als wünschenswert betrachtet werden. Daraus folgt notwendig die Erklärung der spezifischen Zusammenhänge, in denen das zu erwerbende Wissen angeblich funktionieren soll." *Ibid.,*page 284.

[56] *Ibid.,*page 309.

ised in the brain by selforganisation and networking.[57] Terms like reality and truth only receive substandard meaning.[58]

3. Epistemological considerations on the biological and system-theoretical conception of autopoiesis

The axiomatic of the theory of autopoiesis asserts that all living systems are by definition autopoietic systems, *i.e.* systems, and further self-organizing ones. Life without external influences is conceivable. To draw a contrast wih the vitalistic views still prevailing in the nineteenth century in the historical-scientific context of the theory of autopoiesis, this notion can be understood as a secularization or detranscendation of the life concept. Maturana and Varela describe self-organization so: "Our suggestion is, that living things characterize themselves in that they literally produce themselves all the time. To this we make reference by calling their defining organisation an 'autopoietic organisation' " [59]. Whence it is sure that the living systems share the same organisation (or, form of organisation): "By *organisation* are to be understood the relations that must exist between the components of something, so that it may be recognized as a member of certain class." [60] Autopoietical organisation defines the unity of the system.[61] The organisation is responsible for the production of itself. It is the same in all living things, and constitutes the mentioned unity of these systems. In contrast, those very systems differ from each other with regard to structure. It is in no way amazing, therefore, that the difference between organisation and structure be depicted as fundamental. The antagonist components, "invariance" and "dynamics", come to play a role: "To me [...], the distinction between organization and structure has been a fundamental distinction, namely one that allowed us to tell apart what is invariant in a system and what is allowed to change in it." [62] The variable structure

[57] Wolfgang Singer, Der Beobachter im Gehirn. Frankfurt am Main 2002, pp. 168 f.

[58] Gerhard Roth, Das Gehirn und seine Wirklichkeit. Frankfurt am Main 1997, pp. 314 ff.

[59] Humberto Maturana/Francisco Varela, Der Baum der Erkenntnis. München 1992, pp. 50 f.

[60] Humberto Maturana/Francisco Varela, Der Baum der Erkenntnis. München 1992, page 54.

[61] Ulrich Druwe, Politische Theorie. Neuried 1995, page 349.

[62] Humberto Maturana, Einführung, in: Humberto Maturana, Biologie der Realität. Frankfurt am Main 2000, page 20.

is called the constituent parts, the ones that constitute in a concrete way a unit and realize its organization.[63] The structure is variable: "The autopoiesis occurs as a dynamic process, that cannot be comprehended by a static and momentary contemplation of its constituent parts' distribution. That is why a living system exists only by continuous structural transformations, demanded from its autopoiesis, and only as long, as these transformations are retained in the constitution of their ontogenesis [...] A living system can be realized in many different, changing, dynamic structures." [64] In contrast, the organisation of the living entity is constituting its identity and is also invariant. Organisation and structure can be described as follows: "A living thing is characterised by its autopoietical organisation. Different living things differ by their different structures, but are not different with regard to their organisation." [65]

A comparison of autopoietical systems, as *i.e.* fish and human beings are, shows that, in both cases, the comparison deals with living systems. These, as regard to their autopoietical organisation and the organisational closure related to it, are identical. Instead, with regard to the structure, differences exist. In order to be able to exist autopoietically, the fish need support by other medium, *i.e.* an environment diverse of the one fit for human beings. The system-theoretical-cybernetic "theory of autopoiesis" is specified by the following axioms; the representation in eleven points serves for clearness:

1. Autopoietical organisation exists at living systems and defines the system's unity. The organisation of all autopoietical systems is identical; this organisation permits a distinction vis-à-vis the environment. For living systems, it is valid to affirm that, "Living systems as autopoietical systems are structure-determined systems, and everything that is valid for structure-determined systems is valid for them. That means, in particular, that everything that happens in a living system, happens in the factual operation of the features marking its constituent parts in accordance with their relations of neighbourhood (relations of contiguity), which are produced just by this very operation. Thereby the models of governance and regulation in no way reflect the factual operations in the structural realization of a living system. They cannot do this, just because they are not intertwined with the concrete relations of contigu-

[63] Humberto Maturana/Francisco Varela, Der Baum der Erkenntnis. München 1992, page 54.

[64] Humberto Maturana, Ontologie des Beobachtens, in: Humberto Maturana, Biologie der Realität. Frankfurt am Main 2000, page 183.

[65] Humberto Maturana/Francisco Varela, Der Baum der Erkenntnis. München 1992, page 55.

ity." [66] It is worth noting that the livings systems' autopoietical organisation has implications on the systems' relations with the environment. The axiom makes possible the delimitation of the autopoietical system from its environment, with which the connections are verified in terms of relations of contiguity.

2. Constituent parts, and relations among components, constitute autopoietical systems. The "theory of autopoiesis" queries after the mode and form of the system's organisation. [67]

3. Among constituent parts, three sorts of relationship exist, namely, the relations of constitution, specification, and order. (1) The spatial extension of the system is produced by the *relations of constitution*. (2) The identity of the system is established by the *relations of specification*. (3) The (autopoietical) process is controlled by the *relations of order*.

4. The fourth axiom states that autopoietical systems are organisationally closed, as their constituent parts produce relations and the relations produce constituent parts. This is a circular causality, that produces the system. The system organises itself, and thereby it produces itself. Productions and renewals take place all the time within and during the autopoietical process, as otherwise the system's very existence would become endangered. In autopoietical systems, the character of circular organisation guarantees the reception of the environmental support or environmental influences – mainly allopoietical or originated in the medium – as it is necessary for the system's existence, even if this support or those influences cannot be experienced as such.

5. The autopoietical organisation moulds into a concrete form the system's structure. This is dependent on allopoietical or environmental support: *e. g*. air, as a medium for breathing; other persons, as a necessity for development and plenitude of existence. Therefore it is valid to assert: "Living systems are units of interaction. They exist in a setting."[68] The environments or media are allopoietical and autopoietical. Humans for living need not only air (allopoietical), but humans. Both, in this sense, are media.

6. Structural couplings take place between autopoietical systems and their environmental supports. In this process a correspondence is requi-

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[66] Humberto Maturana, Ontologie des Beobachtens, in his Biologie der Realität, cit. p. 182.

[67] *Cf*. Bergmann, A., Erklärungspragmatik und politische Steuerung. Berlin 2001, page 199.

[68] Humberto Maturana, Biologie der Kognition, in: H. Maturana: Biologie der Realität. Frankfurt am Main 2000, page 26.

site: "A living system either exists as a dynamic, structurally determinate system in structural coupling with the medium … or it doesn't exist at all. Or, in other words, a living system, as long as it lives and operates in its area of existence, necessarily keeps a dynamic coincidence with its milieu." [69] If oxygen would not have been an environmental supportive means for human beings, these, as they actually are, could not exist in the prevailing context.

7. As just seen, among autopoietical systems and milieu structural couplings come to be, in whose structural complementarity interactions take place. Structural couplings have effects able to change the system states. This axiom refers just to the interactions among autopoietical systems and milieux, namely to the special territory of structural couplings. Coevolution means complementarity: "Interactions are achieved only as the environmental medium and the system show structural complementarity. The biological term "coevolution" clarifies complementary, recursive relations. The medium triggers actions of the autopoietical system and these, in turn, cause other actions of the medium."[70]

8. The structure of autopoietic systems determines the seven changes of state, just mentioned. This means, that the outer influences make themselves represented at the system as perturbations. Thereby autopoietic systems interpret the environment in a selective way, proper to their structure. No changes in inner structure can be externally determined. Cognition and autopoiesis are supposed identical; it is postulated that life is cognition, and vice versa. The stimuli that are experienced are selfproduced. Everything that stimulates the system into acting, has to be assessed in the system. A "structure-determined system is a system, in which everything that happens, happens as structural change…" As this assertion makes evident, autopoiesis theory takes for granted the thorough inexistence of anything like empsyched systems, *i.e.* mixed structural-nonstructural systems, whose organic regulation utilizes a diversity of non-structural intonative reactions, called sensations. On the contrary, "This assertion means that the structural changes of a structure-determined system in the wake of an interaction cannot be determined from the outside. An external impulse, that interacts with a structure-determined system, can only trigger in this system structural changes, but these are determined by the system itself." [71] In

[69] Maturana, H., Ontologie des Beobachtens, in his Biologie der Realität, cit., page 183.

[70] Burth, H.P., Steuerung unter der Bedingung struktureller Koppelung. Opladen 1999, page 162.

[71] Maturana, H., Realität, in his Biologie der Realität. Frankfurt am Main 2000, pp. 244 f.

autopoietic systems, it is no question of distinguishing between inner and outer influences. Influences are produced as system-immanent.

9. Territories for consensus rise into existence, and become available, to the very extent that further autopoietic systems stand in the same medium and permanent interactions develop among such systems. Consensual areas come into being by structural couplings. It thereby seems, from the observer perspective, that the two systems' changes of state reciprocally determine each another, interactions thus coming into being. Yet the autopoietic systems act.[72]

10. When, through the channel of the linguistic modality, in the consensual areas, direct – *i.e.*, first-order – practical coordinations between autopoietic systems become also feasible, then a consensual area of second order arises. About this phenomenon of linguistic communication, it is said: "Speech, as a biological phenomenon, consists of a flow of ever recurring interactions, which form a system of consensual behavioral coordinations of consensual behavioral coordinations ... Whereby it comes to light that linguistic communication as a process doesn't take place in the body (nervous system) of the participants, but in the said area of consensual behavioral coordinations, that manifests itself in the flow of their recurrent bodily meetings." [73] Language is thus not to be seen as immanent, *i.e.* anchored to the system (nervous system), but as running in the autopoietic systems' area of the consensual behavioral coordination. For the systems installed in language, it is indeed possible to distinguish between "inside" and "outside". It is contended that, by means of this area of linguistic communication, human consciousness and human identity become generated. As regards to human communication, the utilization of language is seen as significant: "Humans operate as living systems in linguistic communication, *i.e.* in an area of recursive, reciprocal consensual perturbative influences, that constitutes their territory of existence as such. Therefore, as a territory of recursive consensual coordination of actions, language is an area of existence, and as such, it is a cognitive area: one, defined by the recursion of consensual distinctions in an area of consensual distinctions."[74] In this way, linguistic communication enables autopoietic systems for conscious operation in an area of existence determined thereby. Agreeing with Wittgenstein in freely formulating this concept, one could as

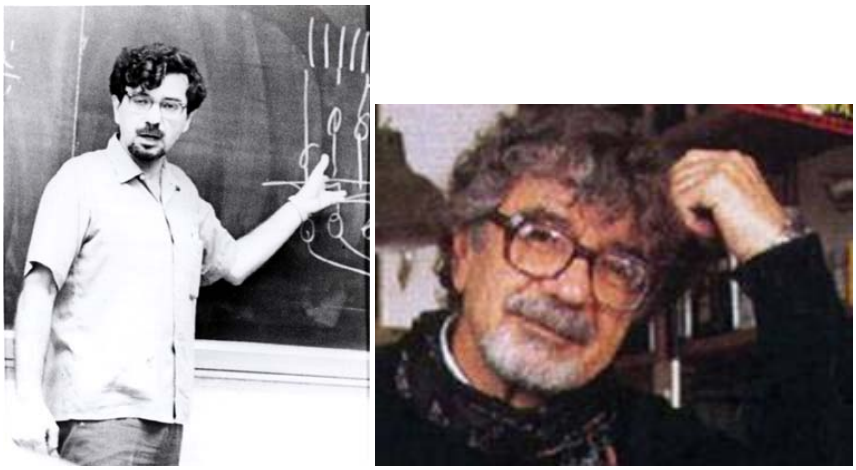
[72] *Cf*. here Görlitz, A., Burth, H.-P., Politische Steuerung. Opladen 1998, page 209.

[73] Maturana, H., Ontologie des Konversierens, in: Humberto Maturana: Biologie der Realität. Frankfurt am Main 2000, page 362.

[74] Maturana, H., Ontologie des Beobachtens, in: Humberto Maturana: Biologie der Realität. Frankfurt am Main 2000, page 202.

well say this by pointing out that the human beings' world is the world of their language.

11. By means of long lasting structural couplings, the autopoietic systems of higher order can be built up. Important is a distinction; namely, that an observer can describe as allopoietic the coupled autopoietic systems in their relations, inasmuch as they had became constituent units of a higher order system. This so happens, because in the coupling process the systems that act as constituent parts fulfil a function for the higher system, despite their actual being just in a system-supporting autopoietic process. The process autonomy and the cognitive autonomy of autopoietic systems are deduced from the theories of life and cognition. The first is featured by a theory of dynamic systems, the second manifests itself in the cybernetics of second order.[75]



Humberto Maturana Romecin (born 1928)

Francisco Javier Varela García (1946-2001)

[75] *Cf.* Burth, H.-P., Steuerung unter der Bedingung Struktureller Koppelung. Opladen 1999, page 206.

Ernst von Glasersfeld (born 1917)

4. Cognitive Science, Interaction Psychology, and Empirical Pedagogy

Whence it results valid, for scientific theories and scholastic knowledge, to maintain the opinion that a (nevertheless) transient leader of German sociology, a vehement advocate of methodological individualism and opponent of constructivism, admits: "Experiences inasmuch as theories are nothing but constructions of the brain – or of the scientists' brains – at first totally independent of an "objective" reality" anywise characterized, then only along the inner processes and conditions of reproduction, the *autopoiesis*, of the self-construction of the brains and organisms that carry them" [76]

Along with it goes the task of imagining a reality independent of the subject.[77] The pedagogic discourse has adapted many ideas from the constructivist-autopoietic discourse, above delineated.[78] Sorry to say, and omitting no more than a few essays unfortunately rare to find,

[76] "Und daß Wahrnehmungen wie Theorien nichts als Konstruktionen des Gehirns bzw. der Gehirne der Wissenschaftler sind – erst einmal ganz unabhängig von einer irgendwie gearteten "objektiven" Wirklichkeit und nur entlang der inneren Prozesse und Reproduktionsbedingungen, der Autopoiesis, der Selbstkonstruktionen der Gehirne und der sie tragenden Organismen." Hartmut Esser, Soziologie. Allgemeine Grundlagen. Frankfurt am Main 1999, page 54.

[77] Siegfried Schmidt, Vorwort. Frankfurt am Main 1997, pp. 12 f.

[78] For the following *cf.* Back-Haas, A., Konstruktivismus als didaktischer Aspekt der Berufsbildung, in: Bonz, B. (Hrsg.), Didaktik der beruflichen Bildung, Baltmannsweiler 2001, pp. 220-238.

among the authors of pedagogic literature only the fewest let the reader see these relations.[79] In addition, now essays exist that offer detailed analyses of constructivism as a trend in the German didactic-pedagogic discourse too.[80] Against the above outlined background, rather than surprise us, many of its consequences nowadays resulting may explicate by themselves. And, what is more, the stigma of being arbitrary and incomprehensible, occasionally sticked onto the pedagogic-constructivist discourse, becomes invalid.

The so-called *Situated Cognition* is one of the approaches feeding from the constructivist-autopoietic body of thought. This approach emphasizes two features, none of which encounters like attention in other learning and pedagogical theories. Situated Cognition focuses itself first and foremost on the inclusion of the being situated of the learning. Thereby it is concretely asked for, in which situation, and in which context, the learning individually takes place, *i.e.* in each of the learners. This aspect is completed by taking a higher-level perspective: the social, cultural, and historical contexts have to be also looked upon in second term. This certainly sounds banal, but its relevance almost cannot be overestimated. From an eurocentrist perspective in the tradition of Enlightenment, learning is frequently spoken of as an intrinsic value. It follows that the permanent learning, unbroken along the entire life, owns a value hard to outdo. But learning is contingent. The educational science "basically can incorporate critically only those 'constructions', *i.e.* all myths and fragments of knowledge, which the pedagogy is proud on" [81]

Moreover, learning depends on conditions both sychronic and diachronic. One imagines the learning underwent in a culture in which women's destiny is keeping house and yard, giving birth to (male's) children, serving the man. Which value learning has there, for women? Can one soundly speak of the value of learning, in an African refugee camp? What about the school lessons in concentration camps? The aforementioned points provide a certain guidance, appropriate for the discipline of pedagogy. And one has to incorporate the topic of the physical-social contexts of the thinker, into the issue of the cognitive events' being situated. In the process, by "physical-social context", the

[79] *Cf.* Heinz v. Foerster (Hrsg.), Einführung in den Konstruktivismus, Zürich 1985.

[80] *Cf.* Pongratz, L., Untiefen im Mainstream. Zur Kritik konstruktivistisch-systemtheoretischer Pädagogik, Giessen 2005.

[81] Die Erziehungswissenschaft „kann im Grunde nur jene 'Konstruktionen' aufarbeiten, d.h. alle Mythen und Wissensfragmente, auf die die Pädagogik stolz ist." Gudjons, H., Pädagogisches Grundwissen. Bad Heilbrunn 2001, page 47.

"sphere" of the student can be meant: does s/he grow up in a small communitarian apartment? Is this communitarian apartment situated in a socially "weak" milieu that features youth gangs, criminality, alcoholism, unemployment? With whom does the student grow up? How do his social contacts look like? This aspect, in addition, relates on the physical constitution of the individual: which physical and psychological preconditions are given to start with? And, besides the learner's being situated as regards the physical and social circumstances, also the personal and social epistemologies play a role. This means that, between the group and the individual, beliefs and concepts can differ. The formation of these differences, as well as their becoming conscious, secure a learning process for the individual as well as for the collective. With this, the interactive relationships of individual and group becomes relevant to shape up the process of learning.

A further point is the so-called conceptual competence. This means, that individuals are able to learn consciously. All of these three mentioned aspects require a partly autonomic individual. And all of the three components prove to be even more applicable in the assumption of an autopoietic individual. In the view under consideration, every human, according to her or his structure and organisation, is responsible for her or his own learning processes: "Accordingly the subject (as living system) is the sole originator of the knowledge, its constitution and construction. The human constructs his world, in which s/he lives self-referentially and autopoietically." [82] This didactic-pedagogic premise does not relieve the State, school, and teachers from their responsibility to educate their autopoietically organised students, or citizens. Rather they have to enable the students' learning processes in their autopoietic frame.

The current quintessence of pedagogy can therefore be summarized so: teachers don't have to transmit curricular contents, as they are instead responsible for the organisation of learning processes. In this way, the transfer of the focus of analysis onto the student has been outlined in the last reforms of the educational plan in Europe. Autopoietic systems shape up their learning processes by themselves. Mission and aim is, reaching to each pupil in her or his autopoietic, selfreferential structure and organisation. Yet hardly one of the reformers of the European educational plan or pedagogues imagines the connections, in History of Ideas or History of Problems, of the constructivism or the

[82] "Danach ist das Subjekt (als lebendes System) alleiniger Urheber des Wissens, seiner Konstitution und Konstruktion. Der Mensch konstruiert seine Welt, in der er lebt, selbstreferentiell und autopoietisch." Gudjons, H., Pädagogisches Grundwissen. Bad Heilbrunn 2001, pp. 46 f.

system-theoretical biological theory of autopoiesis with the German Idealism. It is apparent that especially at this point, where the behaviorism comes up against the borders, the constructivistic pedagogy has to get ahold.

With its initial stimulus-response mechanism[83], behaviorism has quickly reached the boundaries of the explanation in the predicative, descriptive, and causal-analytical areas. The integration of the object as a black box (*stimulus* → *organism* → *response*) has remedied, though just a little, this theoretical insufficiency, or deficit. In this fissure, the constructivistic didactic successfully places itself.

As regards the constructivism's coming into being, an essential starting point was the problem of coping with sluggish knowledge. In constructivist pedagogy, sluggish knowledge typically means indirect, incoherent knowledge due to "frontal schooling", which preclude experiencing an integrated connection. Frontal schooling implies a teacher presenting input to the students by lecturing or by dialectical means (teacher asks a question, gets an answer, asks another question, and so on). In the search for alternatives, the network metaphor comes into play, as it is used, for example, by neurophysiologists Singer and Roth. Singer looks at the emergence of decision-making events assuming that it occurs in the brain, as self-organized and network-organized processes.[84] On the above outlined background, the outcomes encountered by the hard, empirically orientated neurophysiology are not to surprise.

In the (radical-) constructivist variant, it rather is indicated the relativity of such terms as *reality*, *truth*, etc.[85] It is assumed that there are "just as many individual realities, as there are real brains" ("*ebensoviele individuelle Wirklichkeiten, wie es reale Gehirne gibt*") [86]. Each brain produces its own reality in accordance with its autopoietic and self-referential organisation. Any processes of perception are self-organizing.[87] The form of organisation is the same, namely autopoietic, but the structure of the humans can vary.

This has taught us the science-theoretical reflections of the system-theoretical-cybernetic models of self-organisation. Along their lines,

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[83] Peter Prechtl, Behaviorismus, in: Peter Prechtl / Franz-Peter Burkhard, Metzler-Philosophie-Lexikon. Begriffe und Definitionen. Stuttgart 1999, page 69.

[84] Wolf Singer, Der Beobachter im Gehirn. Franlfurt am Main 2002, page 168 f.

[85] Gerhard Roth, Das Gehirn und seine Wirklichkeit. Frankfurt am Main 1997, page 314 ff.

[86] Gerhard Roth, Das Gehirn und seine Wirklichkeit. Frankfurt am Main 1997, page 333.

[87] "Jegliche Wahrnehmungsprozesse sind selbstorganisierend". Wolf Singer, Der Beobachter im Gehirn. Frankfurt am Main 2002, page 167.

the constructivist pedagogy tries to manage the mentioned issue, that of the sluggish knowledge.

In this endeavor, it considers that when frontal schooling is being imparted to the students, the external stimulation coming from the educator doesn't reach – in the form of perturbations – to these students, deemed autopoietic closed systems. So the teacher has rather to organize also the circumstances and the set of parameters affecting the pupil, so that the latter by herself or himself could enact her or his learning in accordance with her or his structure and organisation. The teacher's task, in the opinion of constructivist pedagogy, consists in building up learning-arrangements, which offer to the pupils freedom to follow their own ways of learning.[88]

A definitive goal of the constructivist pedagogy is therefore raising the ability for transfer. In this view, "ability for transfer" is the counterpart of "sluggish knowledge".

On the background of these succinct expositions, it has to be understood that the teacher should not be the centre of the lessons. The teacher is rather the moderator of the educational endeavors. On him it is incumbent to organize the lessons.

As steering oneself is viewed as the central attribute of learning systems, one can ask, whether and how possibly learning systems can be steered.[89] Learning in constructivism is "constructive achievement of the individuals [...], that can be prompted and accompanied by the teacher, but not steered. So to the professional task of teachers it is incumbent to plan such *learning's surroundings* that allow successful learning, and to *accompany* this learning."[90]

Moreover, in this context also it is valid that "If learning is understood as „self-development of a cognitive system" (Aufschnaiter), the importance of self-responsibility and active inner processing cannot be

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[88] Huwendiek, V., Didaktik: Modelle der Unterrichtsplanung, in: Huwendiek, V., Bovet, G., (Hrsg.), Leitfaden Schulpraxipage Pädagogik und Psychologie für den Lehrberuf. Berlin 2000, page 36.

[89] Zum Paradox der Steuerung autopoietisch geschlossener Einheiten Cf. Stefan Schweizer, Politische Steuerung selbstorganisierter Netzwerke.

[90] Sander, W., [Lernen gilt im Konstruktivismus als] „konstruktive Leistung der Individuen [...], die von Lehrenden angeregt und begleitet, nicht aber gesteuert werden kann. Zur professionellen Aufgabe von Lehrenden gehört es dann, solche *Lernumgebungen* zu planen, die erfolgreiches Lernen ermöglichen und dieses Lernen zu *begleiten*." Politik in der Schule. Kleine Geschichte der politischen Bildung. Lizenzausgabe für die Bundeszentrale für politische Bildung. Bonn 2003, page 157.

overstated." [91] The old image of a foreign steering has to be revised. [92] One rather has to replace foreign steering by reflexive self-steering.

Still, steering can therefore consist of steering for self-steering. Otherwise the teacher would be superfluous. His or her function can only consist in scheduling impulses. The impulse is the initial ignition for the self-steering processes. From those theoretical premises some conditions can be deduced, to be applied to the context of the learning. The pedagogic-constructivist approach requires, for the learner, the highest degrees of freedom that are possible. Only this degree of autonomy enables the learner to become actively self–steering. Indispensable precondition is, nevertheless, that the learner himself may recognize and appreciate the degrees of freedom given and entrusted onto her or him. Accordingly, the profitable use of the scope of action given to her or him is, so to speak, the learner's own responsibility.

At this point, some questions open up in connection with the psychology of the knowledge acquisition. The first is: What knowledges are and how are them related to the world? The self-steering and self-organisation of the knowledge come up with the assumption of a cognition achieved by way of a closed and autopoietic brain.

For that reason, knowledge emerges in the moment of acting. Knowledge in no way is encoding or representation. This is to be understandable on the above exposition of the German Idealism's and constructivism's theory of knowledge. Then the question follows, for how the structure of knowledge looks like and how does it come into being. At any analysis of the knowledge, its embeddedness in the social context has to be taken into account, and an overall picture has also to be modelled. The physical, psychological, and social components merge into each other, a fact that has already been commented.

A further question touches the maximal support for knowledge acquisition. Also for this question there is already an answer. School and teachers are only allowed to provide instruction aimed to promote the learning. Further consequences are connected with the authenticity of the notices, and their situatedness; also, with the *multiple contexts*,

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[91] Wenn Lernen als „Selbstentwicklung eines kognitiven Systems" (Aufschnaiter) verstanden wird, können Eigenverantwortung und aktive innere Verarbeitung gar nicht wichtig genug genommen werden." Huwendiek, V., Didaktik: Modelle der Unterrichtsplanung, "Die alte Vorstellung der Fremdsteuerung gilt es zu revidieren", in: Huwendiek, V., Bovet, G. (Hrsg.), Leitfaden Schulpraxipage Pädagogik und Psychologie für den Lehrberuf. Berlin 2002, page 36.

[92] Back-Haas, A., Konstruktivismus als didaktischer Aspekt der Berufsbildung, in: Bonz, B. (Hrsg.), Didaktik der beruflichen Bildung, Baltmannsweiler, 2001, page 225.

multiple perspectives, and *social context*. In order to really reach right now some reduction of sluggish knowledge and a rise in the ability of transferring knowledges, it results essential to abide by the following basic assumption.

Namely, cognitive construction depends on previous knowledge, the available mental structures, and the already existing convictions. So it might be difficult to change from top to bottom the so called *deep cores*, inasmuch as these are barely modificable intersections of fundamental axioms, normative as well as ontological.[93] With regard to such *'deep cores'*, the cognitive maps – in the sense of convictions – are barely changeable. Knowledge, in each case, is moreover constructed by the single incumbent person: on her or his own. In the individual, a permanent need exists of linking every new knowledge with the older ones and the connotations are socially conditioned, whence multiple possibilities of interpretation are possible. All this leads to different results of learning in the different pupils. It becomes necessary some applicative connectionship of the learned, and such an application relationship exists, *e.g.*, in a so called *narrative anchor*. Intense demands press onto the learner in the teaching and learning process corresponding to the view outlined here. The significance of the metacognitive abilites of reflection and control of the active learning is very high. The learner ought to be able of controlling and reflecting on her or his own learning and learning-process.

Still further, and more concrete, practical consequences for shaping the environmental conditions of a constructive learning can be now derived from what was already said. Under the term *authenticity* gets along the insight, that realistic problems and authentic situations have to be generated to serve as frame, and context of application, for the knowledges to be acquired. In turn, *multiple contexts* means that the learner is to apply the learned knowledge flexibly, and on different contexts. Under *multiple perspective* reference is made to the insight, that curricular contents are looked at – and dealt with – under different aspects and from different viewpoints. *Social context* definitively taps on the learning process' setting: this setting, environment, or atmosphere of the learning process, in learning groups fosters cooperative learning and collective problem-solving. Learning in common means, that the learning takes place in the form of, *e.g.*, work in group or, maybe, partner work.

[93] Compare with the concept of *deep core*: P.A. Sabatier, Advocacy-Koalitionen, in: Héritierm A. (Hrsg.), Policy-Analyse. Opladen 1993, page 116 ff.

The contents (of learning) should not become immune against critiques. This comes from the requisite that the student enjoys the maximum of possible degrees of freedom. Moreover the student must be allowed to build her or his own cognoscitive constructions, interpretations and experiences. As already said, also the degrees of freedom have to be recognized as such. This is so, because in the constructivistic understanding of learning, both the subjectively experienced situation and the room for practical action (which must be used!) are relevant. Constructivistic pedagogy always requires a practical orientation of the curriculum.

With this, all those conventional didactic methods such as frontal schooling became excluded, in which the teacher mediates the facts in the form of conversational instruction, by lecturing and by asking-developing the topics. Orientation to action means that „the teacher feasibilizes that the learner educates herself or himself independently" [94]. Therefore in constructivist pedagogy it is valid to affirm that „If learning takes place autopoietically, then the own creativity of the participants must be given as much place as possible in organized learning situations. A didactic of feasibilizing [...], principally, has to be preferred to a didactic of teaching." [95] One might have heard of that, in some non-European countries, the autopoietic-constructivist pedagogy is not seldom rejected, on the misunderstanding that its prefiguration of the students' closure favors to engross, or immerse, the native students into a purely social world and into the production of services, rather than into the primary or the industrial production areas. Thus, specially in populations that previously had achieved a high educational level, the autopoietic-constructivist pedagogy finds objectors, who assume that it cloaks the political aim of facilitating domination by way of intensifying the influence of the social control media among the natives, while diminishing their possibilities of discovering and exploiting by themselves non-social facts, *i.e.* in physics, chemistry, high technology, etc., that could undermine their exclusion and enfeeble their being dominated.

[94] Huggenschmidt, B., Technau, A.: „dass der Lehrende dem Lernenden ermöglicht, sich selbstständig einzubringen.“ In: Methoden schnell zur Hand. 66 schüler- und handlungsorientierte Unterrichstmethoden, Stuttgart u. Leipzig 2005, page 12.

[95] Wehner, M., „Wenn Lernen autopoietisch stattfindet, dann muss in organisierten Lernsituationen der Eigenkreativität von Teilnehmern möglichst viel Raum gegeben werden. Eine Ermöglichungsdidaktik [...] ist prinzipiell einer Belehrungsdidaktik vorzuziehen.“ In: Das Jugendprojekt LUPO – Demokratie lustvoll erleben und lernen, in: Breit, G., Schiele, page (Hrsg.) Demokratie-Lernen als Aufgabe der politischen Bildung. Lizenzausgabe für die Bundeszentrale für politische Bildung, Bonn 2002, page 303.

While every technique, pedagogical or not, lends itself to misuse, any similarity, in the reality, to such situation would only join constructivism in its stressing the importance of context in education. Nonetheless, by orienting the education toward action, one can as soon as possible do justice also to the achievements of the empirical pedagogy. This is so, because the learner's connotational world is different from the teacher's one, and too because each learner is in a learning situation that differs from that of the other learners.[96]

To sum all this up, one might retain these notions: Knowledge acquisition is a constructive process, and learning an active process based on experience. With it no longer the teacher, but the learner and the knowledge, are in the centre of attention. Constructivism explains the relationships among which the to-be-acquired knowledge is to function: "The art of teaching has little to do with the transfer of knowledge; its fundamental aim has to be educating the art of learning." [97] In this respect, it is the view of constructivist pedagogy that the teacher must become a developer of competence. This means that, along the lessons, also technical, methodological, social, and personal accompanying competences are developed, the teacher being there a supplier of knowledge that understands itself as a process-helper and process-companion.[98]

[96] Schelle, C., Einstellungen von Schülern und Schülerinnen zu Gesellschaft, Politik und Demokratie – Hermeneutische Rekonstruktionen und Konsequenzen für die Fachdidaktik, in: Breit, G., Schiele, page (Hrsg.) Demokratie-Lernen als Aufgabe der politischen Bildung. Lizenzausgabe für die Bundeszentrale für politische Bildung, Bonn 2002, page 119.

[97] E. v. Glasersfeld, "Die Kunst des Lehrens hat wenig mit der Übertragung von Wissen zu tun, ihr grundlegendes Ziel muss darin bestehen, die Kunst des Lernens auszubilden." In: Radikaler Konstruktivismupage Frankfurt am Main 1997, page 309.

[98] Huggenschmidt, B., Technau, A., Methoden schnell zur Hand. 66 schüler- und handlungsorientierte Unterrichstmethoden, Stuttgart, Leipzig 2005, page 19.

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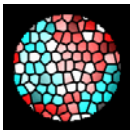

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