

# The Web as Techno-Social System: The Emergence of Web 3.0

Celina Raffl\*,  
Wolfgang Hofkirchner, Christian Fuchs, Matthias Schafranek

ICT&S Center, University of Salzburg  
Sigmund-Haffner-Gasse 18  
A-5020 Salzburg  
Austria

{Celina.Raffl, Wolfgang.Hofkirchner, Christian.Fuchs, Matthias.Schafranek}@sbg.ac.at

## Abstract

This paper discusses current web developments, such as Web 2.0 and Social Software, as dynamic techno-social systems. Underlying our concept is the idea that the *World Wide Web* is an evolving techno-social system that transforms from a web, which was predominantly triggering cognition (“read-only”) towards a web of human communication (“read/write”) and co-operation. Based on this understanding of knowledge, we outline three evolutionary stages of web development and hence define Web 1.0 as a tool for cognition, Web 2.0 as a medium for human communication, and Web 3.0 as networked digital technologies that support human co-operation. The latter is yet not fully in existence, but it shines forth in online co-operation systems.

## 1 Introduction

Since the burst of the dotcom-bubble around 2000 we have entered a new phase of online communication and co-operation. Some claim that the Web was literally given back to the people. Certain new technological applications and increasing computer competences of users brought about a new generation of the web that is currently subsumed under notions such as Web 2.0 and Social Software. Mostly these terms are centred on concepts like online communication, community-formation, and collaboration. What is suggested in both academic and non-scientific debates around this topic is a new phase of the web that leaves behind static hypertext websites and ushers in new possibilities for knowledge management, e-learning and general knowledge technologies, and for virtual communities to form. The notions of Web 2.0 and Social Software thus refer to common actions people undertake in terms of co-operative and collaborative knowledge production, dissemination and storage. Nowadays the web focuses on rather novel applications like social networking, blogging, tagging, social bookmarking, or video and photo sharing and is not limited to conven-

tional functionalities, like news and information provision or online shopping. New and easy to handle technological applications brought further about a new generation of skilled web users, which are now designers and active contributors in innumerable communities, blogs, and wikis. As *producers* they generate content by aggregating, mashing-up, (re-)interpreting and distributing information.

Though this shift in quality of the web has been addressed in several debates, a broad and theoretical understanding of the dynamics of the web is still missing. Therefore we propose a *critical* theory of Internet and Society [Fuchs, 2008] that conceives the Web as a dynamic techno-social system and makes use of dialectical social theory construction and Evolutionary Systems Theory in order to suggest solutions to global problems, question the forces that hinder such solutions, and show how the Internet can contribute to the realization of positive potentials that are inherent in contemporary society.

## 2 Towards a New Theory of Evolutionary Techno-Social Systems

In order to grasp the emerging concepts of Web 2.0 and Social Software, we apply Evolutionary Systems Theory (EST) to social sciences and humanities.

### 2.1 Evolutionary Systems Theory

The term Evolutionary Systems Theory was coined by Ervin Laszlo [1987], Vilmos Csanyi [1989] and Susantha Goonatilake [1991]. It is a theory about evolving systems and a merger of systems theory and evolutionary theory which nowadays not only applies to biotic and human or social systems, but also to physical systems [Layzer, 1990; Smolin, 1995]. It is the most recent elaboration of General System Theory as founded by Ludwig von Bertalanffy [Hofkirchner, 2005]. It provides a transdisciplinary framework for the consilience of sciences (including social science and humanities).

The core of EST is a stage model. It is a phase model and a layer model in one (see figure 3). The stage model of evolutionary systems is based upon the principle of *emergentism* and the principle of *asymmetrism*. *Emergence* takes place in transitions in which systems

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\* Corresponding Author.

are produced by the interaction of proto-elements. *Asymmetry* describes the suprasystem hierarchies in which subsystems are encapsulated.

EST resembles dialectical thinking as to *sublation* (“Aufhebung”) in Hegel’s sense [Fuchs, 2003; Hofkirchner, 2005; Fuchs, 2008]. The first connotation of sublation means to break, to cancel or to nullify. That is, to discontinue, reflected in the stage model by the point that marks the end of a certain stage of evolution. The second connotation is to keep, to save, to preserve, and to store. That is, to continue, comes to the fore when the scheme concedes that each new layer is built upon a preceding one and that the new stage comprizes not only the new layer, but parts of the old one. The third connotation is to raise, to lift. This refers to that leap in quality, that is depicted by the notion of the higher level that exerts downward causation onto the lower ones [Hofkirchner, 2005].

## 2.2 A Critical Theory of Social Systems

Based upon dialectical philosophy, EST therefore sketches the framework of social self-organization in a critical theory of social systems. Being *critical* means in this theoretical framework that it is normative while doing justice to the factual at the same time. It includes not only an account of the potential given with the actual, but also an evaluation of the potential, which sorts out the desired. Thus this theory embraces an ascendance from the potential given now to the actual to be established in the future as well as an ascendance from the less good now to the better then which altogether yields the Not-Yet in critical theorist Ernst Bloch’s sense, which he puts as: ”S is not-yet P, subject is not-yet predicate<sup>1</sup>” [Bloch, 1963]. Critical thinking concerns the difference and solution of the difference between actuality and potentiality, that which is and that which could and should be.

The central theme social theories revolve around today is known as the dualism of agency and structure. Those theories which aim to overcome the chasm between agency and structure deal with duality or dialectic in contrast to dualism. Societal structures emerge from individual actions and individual actions are shaped by societal structures. The impact of the structures is a constraining and enabling one [Giddens, 1984], but does not cause directly, and therefore cannot determine completely, individual action. A theory of social systems as self-organizing systems neatly suits the dialectical approach. Individuals are the actors on the micro-level that produce by means of their agency society (soecietal structures) on the macro-level.

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<sup>1</sup> Translated by the authors. Originally: „S ist noch nicht P, Subjekt ist noch nicht Prädikat“<sup>1</sup>. Or in one of his main work ”The Principle of Hope” [1959] he puts it like follows: „Das Nicht ist Mangel an Etwas und ebenso Flucht aus diesem Mangel; so ist es Treiben nach dem, was ihm fehlt“ [Bloch, 1959].

## 2.3 A Critical Theory of Techno-Social Systems

A critical theory of techno-social systems is based upon the concept of dynamic social self-organization in the dialectical, evolutionary systems perspective. There are several steps in developing this argument.

Any technological system is basically a *social* system in two respects. First, it is itself a self-organizing system, because it embraces particular actors and agency, and particular structures. Second, it is a particular subsystem of the universal societal suprasystem. Considering the *synchronous aspect*, there is an inner dynamic of the social system called technology. And there is a dynamic of this social system entailed by the overall system of society.

Furthermore, taking into consideration the *diachronous aspect*, there is a sequence of stages in the technological and social development that is the outcome of the dynamic in different granularities.

Theories of socio-technical systems from the Tavistock Institute to Günter Ropohl [1979; 2001] can be applied to question techno-social systems. *We suggest to use the term techno-social rather than socio-technical*. Although appreciating every (social science) approach that acknowledges the social nature of technology, we argue that the notion *socio-technological systems* is misleading in that sense that it insinuates that there are technological systems, that form a category, and that there are socio-technological ones, that form a subcategory of the former. In our understanding it is more likely the other way round: Technological systems are subsystems of social systems. Hence we employ the term *techno-social*.

## 3 From Cognition to Communication Towards Co-operation

In our understanding the web as a techno-social system develops from a web that fosters human cognition towards a web that facilitates communication and a web that enables co-operation. According to this understanding we identify three evolutionary stages in the development of the web, namely Web 1.0 as a web of cognition, Web 2.0 as a web of communication and Web 3.0 as a web of co-operation. These notions are based on the idea *of knowledge as a threefold dynamic process* of cognition, communication, and co-operation [Hofkirchner, 2002; Fuchs and Hofkirchner, 2005].

Cognition is the necessary prerequisite for communication and both together form the precondition for the emergence of co-operation, or in other words: in order to co-operate you need to communicate and in order to communicate you need to cognize.

By cognition we want to refer to the understanding that a person, based on his/her subjective systemic knowledge, connects to another person by using certain mediating systems. When it comes to feedback, persons enter an objective mutual relationship, i.e. communication. Communicating knowledge from one system to another causes structural changes in the

receiving system. From communication processes shared or jointly produced reality and resources can emerge, i.e. co-operation. These processes represent thus one important dimension against which steps in the evolution of the web have to be assessed.

#### 4 The Web as an Evolutionary Techno-Social System

We define the web (as the most prominent part of the Internet) as a techno-social system, which undergoes a constant evolution by self-organization processes. Thus an understanding of the transformation of the web has to be based on such a dynamical approach.

Describing the web as a *techno-social system* refers to the circumstance that the web cannot be defined without connection to the human social realm. On the one hand the web as part of the Internet belongs to the technological infrastructure of society, which is itself a materialized outcome of social action. On the other hand the web is a social system of mediated cognition, communication and co-operation (CCC) as described above, which is based on this infrastructure as means of its realization. In both cases the web is the result of the interactions of human agents as producers and users. They are the driving force behind the construction and reconstruction of this overall system in all of its facets. This logic of a techno-social production and reproduction can be described as a dialectical relationship between human social agency and its intended – and also its unintended – consequences (see figure 1). Emerging from the local level of social interaction, the consequences of this action constitute a global level of social structure. The latter, in turn, influences further processes of action as it enables and constrains them at the same time.

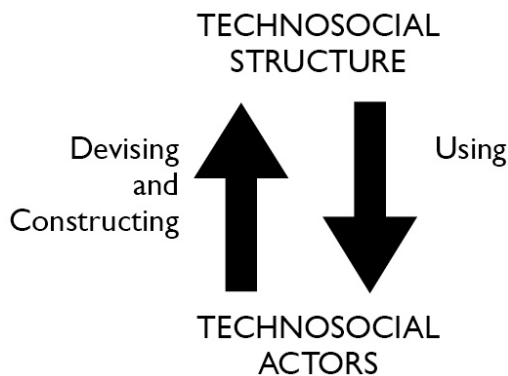


Fig. 1: The dynamic of techno-social self-organization

According to this concept of the dialectical relationship, the web can be interpreted as follows: The web is a social system in the above mentioned sense of computer mediated cognition, communication and co-operation. Using networked computer networks as means, humans interact in these three social forms by using and producing information. In consequence they collectively generate an emergent informational structure on a

system's scale. In a top down process this structure in turn enables and constrains their actions regarding information use and production. When talking about the web as a techno-social system the role of human actors in terms of the social production and reproduction of this system has become evident. The trend towards the convergence of content producers and consumers (*prosumers* or in case of the web we term the convergence of producer and user *produser*) is one of the most noticed processes in this respect [Rheingold, 1993]. On the other hand the web is also a complex technological phenomenon. First, it rests of course upon the Internet's hardware infrastructure (computers, routers, glass fibre connections etc.). Secondly, and this is the only aspect we want to refer to in this article when talking about the technical side of the web, it functions as a sophisticated piece of software (*code*). In this regard human agents are considered in their social role as *technicians* in a broad sense of the term. Already by using the web according to its function as social system of mediated communication the underlying software is always automatically actualized in its intent as means of social exchange. And by explicitly constructing, expanding and maintaining the web as a complex system of code, produsers and developers produce and reproduce it in a concrete technical sense. The code dimension enables and constrains the actions on a very basic level: the web's software state of the art at a given time defines both, the general possibilities of the mediated social cognition, communication and co-operation, as well as its further technical development.

We understand these three levels of human social action and the technical aspect of the web as hierarchically integrated in one system (see figure 2). The cognitive, communicative and co-operative social aspects and purposes (CCC) of the web are based on the web's code and technological infrastructure as their means of realization. Thus humans acting on the web not only produce and reproduce the respective informational structure, but also the underlying software dimension. As experts, hackers, laymen, common users etc., humans refer and contribute to this tremendous techno-social system. They can be understood in their social role as technicians and further adapt code to their social communicative needs.

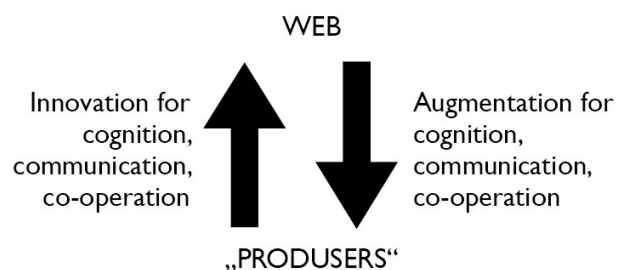


Fig. 2: The dynamic of the self-organizing web

Applying the EST-framework to our topic therefore means two things. First, the web is a self-organizing

system that undergoes evolution according to the stage assumption. Second, the web as techno-social system is embedded in the human social world and hence follows the specific logic of social self-organization just mentioned above. Living these diverse dimensions of the overall sociosphere, human beings constitute what is meaningful to them and realize it. Thus the idea of shaping the web's evolution is concerning its social ends and development of the whole sociosphere.

But in turn, the web as techno-social system itself generates new meaning as well, hence not only reflecting but also contributing to the evolutionary change of the overall sociosphere of which it is a part of. In other words, the dynamic of the self-organizing web is intertwined with the self-organization of society at large in a mutual shaping way. Hence, to understand the web and its evolution we also have to take into account these dialectical processes on this higher level and cannot examine this dynamic in a more or less isolated manner.

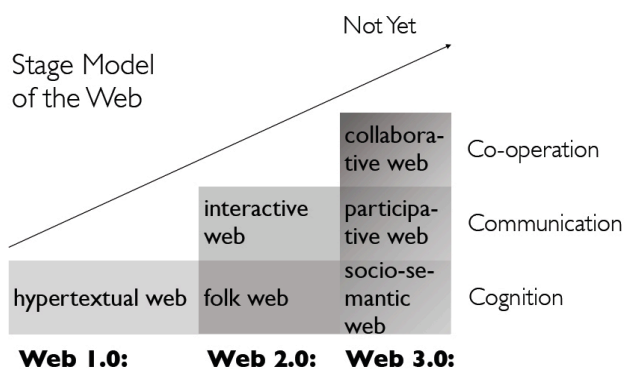


Fig. 3.: The dynamic of the techno-social self-organization of the web

## 5 An Evolutionary Stage Model of the Web

Building upon what we have discussed so far, we can now introduce our suggestion for an evolutionary stage model of the web. Accordingly, the dynamic of the self-organizing web as a techno-social system as described above leads to changes in the overall quality of this system in terms of a temporal succession of stages. In our evolutionary model of the web (see figure 3) we distinguish three stages: Web 1.0, Web 2.0, Web 3.0. The stages are expressions of three different forms of sociality.

This model has to be read in the following way: the x-axis is the timeline and shows different phases of the evolving web (Web 1.0, 2.0, 3.0). The y-axis visualizes the hierarchy of the different levels, comprising the different forms of sociality (cognition, communication, co-operation). Each level is the precondition for the next, but does not necessitate the next level. If we shift from one phase to another, we also jump from one level to the next. The new level subordinates the old level and reshapes it, it re-ontologizes it, and forms, together with it, the system of the new phase. In the following three sections we

give a more detailed description of the model above, referring again to the three discerned social forms of the web, but now based on the dynamic theoretical fundament of social self-organization.

### 5.1 Web 1.0 as Web of Cognition

The early phase of the World Wide Web (WWW) was dominated by hyperlinked textual structures. It builds the first stage of our model: Web 1.0. We refer to this aspect as a dynamic self-organizing system, where new websites emerge on the WWW. Pages appear, disappear, reappear in alternative forms or are mirrored on other servers etc. The detailed structure of the web cannot be known, predicted, and controlled to a full extent. Its complexity steadily increases with its growth. The number of websites and links in the WWW are a measure of this complexity. When a new website is introduced, it is embedded into the existing web and extends the latter by creating links that lead from and to this webpage. Hence each webpage is based on other websites, search engines, link lists, and so on, but it cannot be reduced to them, because it has its own specific content and structure.

Creating links is the essential operation of networking in Web 1.0. It is a self-referential system. When a new link is created the system refers to itself by actualizing its content. Each webpage refers to a number of other webpages that again refer to other sites etc. Self-referentiality is the essential nature of the hypertext and 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, which are discovered by active human beings that browse the web and create their own personal path. A hypertext system reproduces itself by the permanent self-reference of the category text.

Web 1.0 is a web of cognition. It is mainly about the consumption of information (a cognitive process) that is presented in hypertext form. Browsing the web and relating oneself to its knowledge content represents such a social fact. Though web pages are individually consumed, the cognitive processes are conditioned by external social structures such as ideas produced by others that are presented on a website. The cognitive form of sociality represents the general basic layer in our model. It builds the fundament of all three stages. But it changes its quality when it reappears in the subsequent stages. As it is reworked by the emerging higher levels Web 1.0 forms the evolutionary starting point. We name this layer *hypertextual*. In a short explication, comprehending the above stated, it can be said that this term covers the classic notion of the web as a decentralized platform of documents (text interspersed with multimedia objects like images) edited in HTML. These document based web resources are designed merely to be *read only*. The cognitive social power of this first stage largely derives from the power of the hypertext link. Every web content producer can link to any other document resource on the web creating and expressing an increasing conceptual space of thematic and social relatedness.

## 5.2 The Rise of Web 2.0 and Web 3.0

Since the millennium the character of the web has successively been changing. With the rise of new heavily frequented platforms such as MySpace, YouTube, Facebook, Wikipedia, Friendster etc., communication and co-operation have become more important features of the web. This development has led to qualitative changes mainly in the way people make use of the web concerning its social dimension. It leads us to the introduction of the further two stages of our model, based on the dynamic theoretical fundament of social self-organization: the web dominated by communication referred to as Web 2.0, and the web dominated by co-operation referred to as Web 3.0. Our impression is that around 2005 Web 2.0 fully emerged and the web entered a new phase of development. Web 3.0 is not-yet fully existent, but it shines forth in online co-operation systems such as Wikipedia [Fuchs, 2008].

Regarding our model, this perceived change in quality corresponds to the transition from Web 1.0 to the new stage of Web 2.0. This shift in quality – driven by the process of social self-organization – justifies the claim for suggesting this next stage in our model. In terms of the stage model this means that a new layer is added, marking the emergence of the new stage of Web 2.0.

Underlying the second and third stage, we refer to this layer as *communicative* in a general sense. One new quality of Web 2.0 is that it is *interactive*. The latter term can be explicated clearer by connecting it to the notion of *communities of interest*, which could characterize the whole Web 2.0 stage in its core. These communities usually consist to a large extent of people who share a common interest or passion. They interact on the web preliminary in terms of communication. Thus producing and reproducing all the platforms and Social Software tools characterize the web in its current social form, i.e. social networks, social bookmarking, blogs, all kinds of crowd sourcing activities, online gaming etc.

Many of these applications cannot always be clearly categorized. Either they are novel or have already existed for a while, or the communicative or cognitive dimension is predominant considering each single one of them respectively. The crucial point is that the overall context in form of the web has become interactive in the social communicative sense and thus everything that is happening on the web is now reworked by this new social dimension.

In this hierarchical sense the relationship between the communicative and cognitive layer has to be seen. In specific consideration of the Web 2.0 stage we refer to the general cognitive social level as *folksonomic*. The term is derived from the word *folksonomy*, which is usually defined as social collective result of individual free tagging actions of all kinds of information and objects on the web [Vander Wal, 2007]. We chose this word to express the difference to the hypertextual cognitive level of the first stage. Compared to the cognitive-social praxis of just browsing the web, the term *folksonomic* expresses a

shift to a more specific and intense form of sociality on this basic social level, because it is being reworked by the emergence of the higher communicative level of interaction. Thus personal operations, done on this level, become more socially intense as well. The social drive for more intense social exchange on the web has led to the development of accordant software tools that allow for the possibility of letting individual actions become publicly visible, providing surplus for a huge crowd of users.

## 5.3 A Foretaste of Web 3.0

The so far last transition in our model is characterized by the self-organized leap from the stage of Web 2.0 to the one of Web 3.0. In terms of the stage model, this means that the co-operation layer is added, marking the emergence of the new stage of Web 3.0. As already suggested for the terms *cognition* and *communication* above, we now can also think of *co-operation* as the general term, while the word *collaborative* is chosen to refer to the more stage-specific understanding of this social dimension. Regarding Web 3.0, this more specific meaning should be linked to the notion of *community of action*, which characterize this whole stage. Usually such communities consist of actors who do not only share a common interest or passion, but also develop associative social relationships and common goals for starting collective activities, thus achieving the possibility of bringing about a real change of given structures.

It is this collaborative type of community that is needed for working out collective intelligence and to accomplish that leap in quality that is required to move the development of the web in direction of a real co-operative social structure. In this respect we refer to this third stage by the notion of a Not-Yet as introduced by Ernst Bloch, a future that can be glimpsed and anticipated in what is already possible in the here and now. A co-operative Web is only possible in an overall co-operative society. Today, society is predominantly based on instrumental reason and the logic of competition, it can be characterized as transnational informational capitalism [Fuchs, 2008]. This capitalist character of society hinders the realization of a co-operative society that allows the emergence of Web 3.0 [Fuchs, 2008].

In analogy to the proposed understanding of the transformation of the first stage of the web by the second one, we now suggest that *collaboration* in terms of communities of action might transform the interactive and folksonomic specific levels of Web 2.0 into a further deepened social exchange. We want to refer to such a social intensification on the communicative level as *participative*. Hence the meaning of the interactive social is narrowed to some kind of real affective concern for each other in order to follow and achieve common goals. And on the cognitive level the folksonomic might be further developed into what is called now the *socio-semantic Web*. The term indicates a very interesting and just recent development in the field of Semantic Web research, namely, the integration of social web techniques

(folksnomies, wikis) into the construction of so called “light weighted” community based Semantic Web solution, thus immediately integrating the social aspect of community with the technical level of the web to a new kind of intelligent symbiosis as the basic web layer [Van Damme *et al.*, 2007].

## Conclusion

In this paper we have argued that the turn towards Web 3.0 should not only remain a technological turn (as for example in common understandings of the Semantic Web), but it requires the transformation towards a fully co-operative society as a precondition [Fuchs, 2008]. We defined the web as a dynamic techno-social system and based our concept of the web development on Evolutionary Systems Theory. We have outlined three evolutionary stages of the development of the World Wide Web, namely Web 1.0 as a tool for thought, Web 2.0 as a medium for human communication, and Web 3.0 as techno-social networks that support human co-operation. This means that we distinguish between a cognitive web, a communicative web, and a co-operative web. Very often the notions of Web 2.0 and Social Software refer to the web dominated by communication and co-operation (including community-formation). In order to distinguish between these two aspects we have suggested the distinction between Web 2.0 and Web 3.0. Hypertext is a Web 1.0 technology, blogs and discussion boards are Web 2.0 technologies, wikis are Web 3.0 technologies. The latter – Web 3.0 as a co-operative Web in a fully co-operative society – is Not-Yet in existence in Ernst Bloch’s sense, but it remains more than utopian, since it already shines forth in a number of collaborative online tools. The Web is networking individuals, organizations, institutions and societies at a global level and thus could work as a force that provides the glue by which cohesion of an emerging world society could be supported.

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