Forms of Organizing Human Society Inspired by Technological Structures

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Abstract

Fundamentally, any system consists of objects and relationships between these objects. A major goal in 'systems theory' concerns the systematic discovery of general patterns or principles that are broadly applicable across a wide range of domains. From this perspective, we investigate the patterns and other relationships that may emerge between computer networks and organizations of human society. Our investigation emphasizes not only that computer networks reflect human society in various ways, but also that new ways of organizing human society inspired by technological structures may be emerging.

Key words: technology, society, organization

1. Introduction

This paper contributes to our ongoing work in computer science, artificial intelligence (AI), information study, and new media study (Schuster 2007; 2008; 2009; 2011).[1] More specifically, the paper is on the interface between the aforementioned areas and the domains of the social sciences and the humanities. From a bird's-eye view, the paper is motivated from observations, in our previous work and elsewhere [e.g., in Caldarelli and Catanzaro (2012), or Kadushin (2012)], that there is a rich and profound interplay between computers and humans that may require some attention for various reasons.[2]

From observation, the various forms of the aforementioned interplay frequently seem to be mirror images of each other. As such the emphasis of this paper is an exploration of this relationship. For instance, in the domain of computer network topologies, a mirror image for a 'centralized' or 'decentralized' computer network might be a federal or confederal mode of government adopted by a particular state. There are, however, many more properties (physical and non-physical), patterns of behavior (visible and invisible), and forms of organization that are common between human society and technological structures. As an initial example, consider the complex systems of software programming languages and protocols that allow the form of organized and global communication we experience through the Internet today. If we compare these languages and protocols with those utilized in human communication, then we must acknowledge that there obviously are many similarities between technological structures and forms of organizing human society.

In order to understand these and other similarities more comprehensively, we first look at formative

1 Please note that this paper is an extended version of our work (Schuster 2016) presented at the 4th International Workshop on Philosophy and Logic of Social Reality (SOCREAL 2016), 20-30 October 2016, at Hokkaido University, Sapporo, Japan.

2 Although we casually speak about computers and humans here, we would like to mention that these terms stand representatively for various types of entities and environments including, but not necessarily limited to computer networks, virtual reality worlds, or robots, as well as the many facets of human nature and society. In addition, we would like to reemphasize the focus of our work, which is that of the wider computer technology domain.

interactions between human society and technological structures from a systems theory perspective (Section 2). Section 3 and Section 4 demonstrate a variety of ways in which human society and technological structures influence, shape, and inspire each other, and also that these interactions may lead to novel patterns of societal organization (referred to as 'swarm', 'entropic', and 'computational artistic society' in this paper). Section 5 proposes a potential explanation for the emergence of these patterns and, perhaps, the process of interaction between human society and technological structures more generally. Section 6 ends the paper with a summary.

2. Formative interplay as a feedback system

The motivation in this section is twofold. One goal is to interpret the process of formative interaction between human society and technological structures from systems theory. The second goal is to point out that the roots of this formative interaction reach back deep into our history, and we demonstrate this next through an example from ancient Greek mythology.

2.1 L'amour triomphe

The elegiac poem *Metamorphoses* written by the Roman poet Ovid (Publius Ovidius Naso, BC 43-AD 14) includes the famous myth of the Greek sculptor Pygmalion who fell in love with his own creation (Ovid 2008, 232-4). In the myth, the obscene Propoetides had dared to deny the divinity of the goddess Venus. In an act of revenge, Venus turned the Propoetides into vulgar women of the street (the first prostitutes). After seeing these women in their wicked ways, Pygmalion lived celibate, lacking the companionship and love married live can provide. Deep in his heart, however, Pygmalion desires for a bride. In his yearning, he begins to carve a woman out of ivory. As the statue grows in shape, Pygmalion becomes overwhelmed by the beauty and realism of his work and falls in love with his creation. Secretly, Pygmalion wishes he could have a wife like this. The goddess Venus, to whom Pygmalion prays in his despair, eventually grants this wish. When Pygmalion returns home one day and kisses the statue, Pygmalion realizes that it had turned human. The story ends with Pygmalion and the woman getting married and having a daughter.

In the context of this work, the ancient myth of Pygmalion describes the interaction between a member of human society and a structure of technology, namely the statue Pygmalion carved out of ivory. In a creative process of transformation, the statue becomes more and more - *human*. The main protagonist in this story, Pygmalion, also changes. Actually, he changes in two distinctive ways, internally, and externally. For instance, Pygmalion moves through the internal (invisible) states of being sad and disappointed to that of being in love.[3] On the other hand, he also experiences several clearly external (visible) transformations including that of becoming a married man and a father, for instance. Please note the significant weight these latter transformations carry in human society.

2.2 The triumph of new media

Our second example comes from the field of new media and the so-called new media environment. Although the history of these fields is relatively young, both terms stand for important developments in the fast-moving, modern-day world of the Internet.[4]

Perhaps, we all understand that, media are integral to our everyday-life. In its essence, the role of media is that of a mediator through which we interact and establish an understanding of the world, of our experiences, and beyond. In the last few decades, the development of the personal computer had an impact on the professional and social lives of individuals and organizations around the globe. The design of a global communication network in the form of the Internet and the invention of an interactive information space in the form of the World Wide Web (WWW) accelerated and guided this development into the omnipresent, creative information environment we all share today.

In the realm of academia, the relatively young, interdisciplinary field of new media studies is a child of this development. New media can be understood as on-demand content that is available anywhere and anytime on a range of devices (PCs, tablet computers, smartphones, etc.) through the Internet. The new dimension of the Internet, which allows interactive user feedback and creative user participation, therefore, makes new media fundamentally different from old media such as television, radio, or print media.

What is important for us to know is that a basic design pattern underlying the new media environment is that of a (closed-loop) 'feedback' system (see Figure-1). Although, in reality, the new media environment includes many more components (hardware, software, etc.), it is possible to imagine the new media environment in Figure-1 as a multi-dimensional, technology-based, interactive communication platform for society.

3 Here, it is interesting to understand that the creation, integration, and controlled utilization of such feelings and emotions in machines (e.g., robots, intelligent personal assistants, or virtual reality agents) is one of the goals of current AI.

4 For a good introduction to the field see Press and Williams (2010), or the classic work on media by McLuhan (2001).

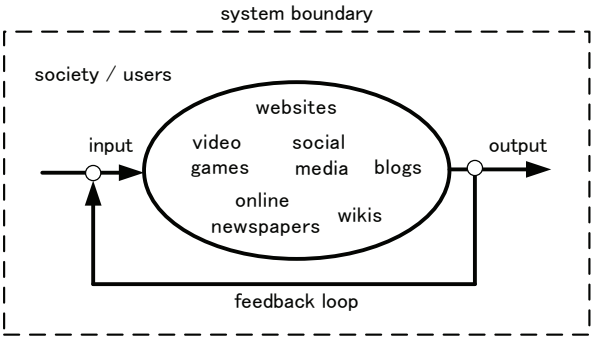

Fig.1. The new media environment as an example of a modern technological structure. The underlying feedback design pattern provides opportunities for a society to reorganize (and perhaps reontologize) in various ways.

On a higher level of abstraction, the way in which the system in Figure-1 works is relatively simple. Fundamentally, the system receives input from its users, does some processing, and produces some 'desired', tangible output. Usually, this output is directly accessible to its users through various devices. The crucial feature of the system is the potential it provides for user feedback, hence, creative user involvement and participation. This involvement may range from passive opinion forming to more active forms of participation. Ultimately, the complete experience encourages users to consume current output and to provide new input into the system (instantly, continuously, and voluntarily). Over time, this process can lead to the development of (local and global) dynamic patterns of structural and behavioral formation, reorganization, and, perhaps, reontologization in the system environment. Of course, this is the underlying idea and drive behind the so-called 'social web' (also called Web 2.0) with its various outlets such as YouTube, Facebook, Instagram, Twitter, etc.

As an example, imagine an on-line newspaper article (desired output) appearing on a website according to specific web-design criteria. So far, the process is passive (input generates output, no feedback). In terms of active feedback, we need to consider that many on-line newspapers provide a space (e.g., an Internet forum or a message board) where people can engage in a conversation by posting messages on-line. Such an on-line discussion site, therefore, is an environment where not only old or incorrect information can be updated or corrected (instantly, because on-line), but also where new information and opinions may emerge in relatively short intervals of time. It is exactly this rapid and instant dynamism that makes the new media environment so powerful.

Before we investigate the formative interplay between society and technological structures more deeply, let us spend one last thought in this section on the observation that the (net-)effects of a user interaction in the new media environment are often difficult to quantify. A study by Lin et al. (2016), for instance, reports on a possible type of behavioral pattern between social media use and depression among US young adults. Depression, including its quantification, is a troublesome and difficult condition, of course. Although similar problems arise when it comes to issues such as fake news, sexuality, violence, privacy, or security, for the sake of space, these issues cannot be addressed in this text.

3. Formative interplay between society and technological structures

We already mentioned before that the interplay between society and technological structures is bidirectional. The organization of this section appreciates this interplay by first looking into the 'from society to technological structures' direction and then into the 'from technological structures to society' direction.

3.1 Society shaping technological structures

Perhaps, the Internet is a relatively attractive computerized environment to begin with. Although the 'client-server' model (one of the most common network architectures on the Internet) and the 'peer-to-peer' model are not necessarily restricted to the Internet domain, they represent two ways in which the resources in a distributed application on a large computer network may be organized (Gray 2011, 67-88).

In the client-server model (e.g., for a business website), one or more computers act as servers to the rest of the network (the clients). In contrast, in a peer-to-peer network (e.g., for a file sharing application) there is no central service provider (server). All participating computers (clients) have equal status. From the viewpoint of our work, we find that these two types of architecture map into the domain of human society with ease. For instance, a peer review process may involve the evaluation of some body of work between people of similar standing and competence (the peers), while a travel agent (the server) may provide its services to a large customer base (the clients).

In the client-server and the peer-to-peer examples just mentioned, the clients, servers, travel agents, and peers, are tangible objects. It is necessary to understand that parallel to this physical dimension there also exists a less tangible dimension when objects communicate (e.g., two smartphones over a wireless connection). In this domain, it is possible to distinguish communication protocols such as 'broadcast' or 'token ring' technology. It is easy to understand these protocols in the human domain. Imagine a teacher handing out assignments to his students. (Please note that for the sake of simplicity, we use 'his' as a gender-free pronoun throughout this text.)

In a broadcast, the teacher would simply call the name of student '*X*'. In the case that student is present, they might raise a hand and receive the assignment from the teacher. Note that in a broadcast the call goes out to all students at the same time. In a token ring scenario, the teacher goes from one student to the next student asking 'Are you student *X*?'. In the affirmative case, the student receives the assignment. In the negative case, the teacher moves on and repeats the question to the next student. Note that in the token ring case the call goes out individually and sequentially. In reality, the number of communication protocols in computer networks is large, and so is the range of tasks they cover, which includes: preventing data packets from colliding on a network, routing of data, avoiding network traffic congestion, preventing errors in incoming and outgoing data, or some form of security.

Although there are many more examples worth mentioning in this section, we feel that the evidence for our case is already rather substantial, namely - that there is no doubt that technological structures can be mirror images of various aspects of human society.

3.2 Technological structures shaping society

From the reversed point of view, the 'from technological structures to society' direction, we can observe that the very creations of human enterprise (e.g., the computer networks) feed back a stimulus that encourages the emergence of new behaviors and organizational patterns in human society, too.

For instance, the production of a reliable and robust network (out of unreliable parts) was a major design goal of the early Internet. In order to achieve these goals, the designers of the Internet invented the now well-known, but at the time groundbreaking, design principles of decentralization, end-node verification, dynamic routing, or packet switching (Casad 2011; Tanenbaum and Wetherall 2013). In return, the Internet and the impact it has on everyday-life encourages scientists as well as activists in various areas to contemplate new types of society that may emerge in the so-called 'global village'. A decentralized society, may be one such type of society. Such a society may embrace concepts such as decentralized communication, decentralized law, decentralized energy production, and decentralized finance, all facilitated by the Internet.[5] Clearly, the intensity with which these ideas can be pursued today would have been impossible in the same way (if at all) in the pre-Internet (pre-computing) era.

Of course, whether we are going to witness the migration of our society into such a decentralized form, or whether it may be a process of meandering into an all-embracing 'infosphere', a reality envisaged by the philosopher Floridi (one of the key figures in the field of the 'philosophy of information'), is debatable (Floridi 2010; 2011). Equally debatable might be some of the ideas and concepts we are going to introduce in the forthcoming Section 4. Due to the nature of our work, the material we are going to present in that section requires us to comment on ideas and phenomena (e.g., network theory, social networks, crowdsourcing, or computer art) that are more or less well-known in the wider context of our work (Barabasi 2003; Caldarelli 2012; Kadushin 2012; Greenberg 2011). Beyond these established materials, however, we also would like to introduce and describe types of organizational patterns that seem to have a degree of novelty according to our understanding of the field. In this paper, we refer to these novel patterns of organization as 'swarm society', 'entropic society', and 'computational artistic society'.

4. Swarm, entropic, and computational artistic societies

In order to appreciate this section for what it may be worth, we first would like to set the ballpark in which we intend to identify and investigate the aforementioned forms (swarm, entropic, and computational artistic) of organization of society.

- First, we would like to emphasize that we do not claim that these forms of organization are 'everywhere', 'obvious', or 'clearly visible' in our society. Actually, in many cases, these forms of organization are often spontaneous and short-lived. Our argument, therefore, would be that these forms of organization exist in some places and situations in our society, and that these forms of organization are worth being interpreted and

5 Johann Gevers. The four pillars of a decentralized society. https://www.youtube.com/watch?v=8oeiOeDq_Nc. Accessed: 2017-03-14.

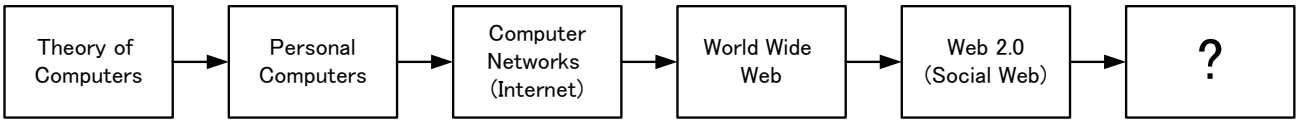

Fig. 2. Evolution of computer and network technology.

investigated.

- Second, we would like to stress that the environment in which we discuss these forms of organization, largely, though not exclusively, is the Internet, WWW, and new media environment.

After these relatively important clarifications, we continue this section by first compressing the development of computer and network technology into three distinguishable phases (see Figure-2).

Although there are various other names worth mentioning, the first phase may include Alan Mathison Turing (1912-1954), John von Neumann (1903-1957), or Claude Elwood Shannon (1916-2001). In simple terms, Turing outlined the limits of what computers can do by formulating the ultimate digital machine, the so-called 'Universal Turing Machine'. Von Neumann's contributions include the description of a computer architecture, the so-called 'von Neumann architecture', that remains a fundamental design feature of any modern-day computer. On the other hand, Shannon is often referred to as the father of the mathematical theory of information. Crudely, this theory describes the effective encoding and transfer of data through a communication channel (e.g., a computer network).

The second distinct phase includes inventors such as William Henry (Bill) Gates III (born 1955), Steven Paul (Steve) Jobs (1955-2011), Vinton Gray Cerf (born 1943), or a Sir Timothy (Tim) John Berners-Lee (born 1955). These names stand representatively for many people involved in the realization of powerful computer systems, their underlying hardware and software, as well as for the powerful inventions of the Internet and the WWW.

Lastly, the third phase of progress revolves around the founders of companies such as *Google* (founded 1998), *Facebook* (founded 2004), *YouTube* (founded 2005), or *Twitter* (founded 2006). All of these companies pursue their business under the aforementioned social web. The social web is an extremely powerful abstraction. For one thing, the social web urges our (information) society to redefine traditional values such as ownership (Heaven 2013), friendship (Brent 2014), or (digital) ethics (Han 2013). In addition, the term also stands synonymously for the seamless integration, augmentation, and infiltration of computing devices (tablet computers, smartphones, computer games, virtual reality glasses, brain machine interfaces, and others), - plus the plethora of services these devices provide - into our information hungry society as a new way of life.

The relatively young, interdisciplinary academic field of new media studies mentioned earlier, might be seen as a response to these developments. The field explores a wide range of issues on the intersection of computing, science, the humanities, and the visual and performing arts (Press and Williams 2010). It is important to understand that a crucial feature of this new environment lies in the potential for individual users (who do not need much technical expertise) to contribute and express themselves in a variety of ways on the Internet (e.g., from literary expressions such as blogs and digital graphic novels, to the visual and performing arts such as YouTube videos and on-line role playing games).

In the social web domain, so-called 'content management systems' are among the technologies facilitating this kind of participation. A content management system is like a tool that allows users to decorate an empty room according to their individual tastes - from the distance (i.e., over the Internet). Such a room could be a social web account, such as Facebook. Initially, a user registers for an account that is empty in terms of user-provided, personal content. Over time, however, the content in an account usually evolves, until it represents a form of virtual home or second identity of its owner.[6] Let us use an analogy to summarize this process. The early Internet was like a skeleton onto which the WWW began to weave a skin and some cloths. Content management systems transformed this poorly dressed entity into a catwalk where users metamorphose into attractive virtual models that in some way behave artificially alive.

From a historical perspective, the social web (new media environment) appears to constitute a form of reality visionaries such as Paul Marie Ghislain Otlet (1868-1944), Vannevar Bush (1890-1974), or the German artist and political activist Joseph Beuys (1921-1986) contemplated several decades ago. Paul Otlet is often considered to be the father of 'information science'. Together with like-minded people, notably the Nobel Prize for Peace laureate Henri La Fontaine (1854-1943), Otlet carried the vision that knowledge is going to have a positive impact on humanity and world peace. The so-called *Mundaneum*, a partially realized, global (universal) repository for all the world's knowledge, used to stand as a powerful testament of this vision.[7] The influence of the American Vannevar Bush was similarly profound. He is widely acknowledged for his understanding of science and technology, as well as for his foresight in terms of the ways in which the emerging digital technology might affect society (Bush 1945). On the other hand, Joseph Beuys developed a view of a society in which 'jeder Mensch ein Künstler sei' (where everyone is an artist) through the mystical term 'social sculpture' (Stachelhaus

6 Here, it is interesting to mention that the word 'avatar', which is commonly used to describe entities in some virtual reality environment, is a concept borrowed from Hindu religion, where it refers to some form of 'incarnation'.

7 The Mundaneum. http://www.mundaneum.org/en. Accessed: 2017-03-14.

1995, 78-98). Interpretations of this term understand social sculpture foremost as a process of transformation or shaping of society through the collective creativity of its members into an entity of cultural, moral, and ethical significance.

Maybe, we should emphasize here that, in the past, driving this process should have been, or was indeed, the role of the 'traditional' artist. The difference today is that this artist could be you, me, or indeed everyone else (who has access to the Internet).[8] Nevertheless, with this brief introduction to the development of the wider computer environment, we are ready to organize the various examples mentioned so far, plus some new ones, into various (rather frequently overlapping) strands of society.

4.1 Swarm society

We investigate swarm societies from the points of centralization and decentralization. In computing, the field of 'swarm intelligence' (Hassanien and Emary 2015) studies the collective behavior of decentralized, self-organized systems (natural or artificial). Usually, individual agents in such systems do have limited ability. Nevertheless, the combined outcome these agents achieve often demonstrates behaviors that seem to surpass the ability of each individual agent. Take the case of the captivating flight behavior among migrating birds. In a close-up, the trajectory of a single bird looks erratic and unorganized. Yet, from a wide-angle shot perspective, the flock of birds remains together and stable in a largely 'self-organized' configuration.

Human societies exhibit various forms of (de) centralization, too. Casually speaking, a human society may have a center in terms of location (e.g., from caves to our solar system), or leadership (e.g., from tribal chiefs to emperors). Likewise, a society may feel decentralized as in being lost in the vastness of space (location), or enjoy a status of equality as in 'animal farms' (leadership).

It is not too difficult to identify swarm-like, decentralized, self-organizing behavior in our more recent time, too. To begin with, we could take the case of the recent refugee crises that is happening in various places across the world. The way in which many of these refugees (migrants) travel (migrate) carries the fingerprints of decentralization and self-organization. It is instructive to notice the role various new media tools and applications play in this crisis, too. Perhaps, one of the most valuable possessions a refugee may have could be a smartphone. The smartphone is all in one, compass, navigation tool, job finder, entertainer, communication tool, and organizer of all possible things. Ultimately, it is the lifeline that provides those who have very little with a virtual 'home'. In order to support the case of swarm-like societal behavior further, we provide a few more examples around the topics of: 'firestorm', child abuse in the so-called 'darknet', and decentralized communication in so-called 'mesh networks'.

A firestorm (Pfeffer at al. 2014) could be described as a sudden, massive reaction or outburst of negative criticism or protest on social media (Twitter, Facebook, etc.) concerning a wide range of issues including gender, race, sexuality, politics, popular culture, and others. Although there seems to be a daily pool of cases from which we could take examples, a recent case concerns the actress Jodie Whittaker who was chosen to be the first female incarnation of the main protagonist, 'The Doctor' in the hugely popular British TV series 'Doctor Who'.[9] Without going into the details of the actual social media messages posted, which involve gender bias, abuse, support, etc., it is interesting to analyze the dynamic of a firestorm. The agents involved have weak ties (almost anonymity between each other) and limited forms of interaction (posts on social media), while the global pattern (which has a kind of temporal dynamic and stability) of the interaction appears decentralized, self-organized, erratic, and short-lived, which are all swarm-like characteristics.

Our next example concerning swarm-like features of organization of (elements of) society, considers the disturbing case of child abuse and child molestation in the so-called darknet [(a computer network that can be accessed only with specific software, and that through this software provides a considerable degree of anonymity for its users (Biddle et al. 2002)]. The article[10] we are referring to, explicitly comments on issues how such a platform functions (i.e., the strategies and behaviours, providers and users of such a platform apply in order to remain anonymous, informed, and coordinated). Largely, these strategies revolve around mobility, flexibility, rapid communication, decentralization, and self-organization, which are all swarm-like features.

In order to somewhat counterbalance the upsetting example in the previous section, let us briefly demonstrate a case where elements of society can benefit from technology that operates on emergent, swarm-like behaviors. Beekman and Beekman (2013, 309-310) mention that mesh networks are an alternative to networks that rely on centralized routers. In a decentralized mesh network, a message hops from

8 It may be even a machine such as the 'painting fool', which is a computational creativity project in the AI domain. http://www.thepaintingfool.com/. Accessed: 2017-03-14.

9 Der Spiegel. Erster weiblicher 'Doctor Who'. Viel Lärm um was? http://www.spiegel.de/. Accessed: 2017-07-28.

10 Der Spiegel. Darknet-Forum 'Elysium'. Wie die Kindesmissbrauch-Plattform funktionierte. http://www.spiegel.de/. Accessed: 2017-07-28.

wireless device to wireless device until it finds a destination. The route the message takes, therefore, is ad hoc, which means that the network topology at any time is self-organized and could be in any form at any stage. What is the advantage? Mesh networks can be employed in areas where there is a lack of broadband Internet. Actually, this would be the case of a self-organized (because anybody can do this wherever he/she wants to) implementation of a self-organized network. Mesh networks are also useful in situations where individuals want to set up a temporary (private) communication network in order to achieve a certain goal. Such a group could be an emergency team (e.g., fireman fighting a hazardous fire or some other kind of disaster situation). On the other hand, a mesh network also could be employed by a group of protesters or activists during an uprising or some other form of campaign. (One advantage here could be that the mesh network can be controlled by the protestors/activists, which can be the cause of governmental concern and interference.) There are many more applications of mesh network technology. What is important here, however, is that mesh networks are an example where a technology that operates on the principles of decentralization and self-organization supports situations in which groups of society organize themselves and operate in a swarm-like fashion. For instance, although firefighters and political activists are organized in some kind of structure, in action, the (unforeseen) events unfolding in a particular situation may dictate a course of action that may require rapid decision-making and spontaneous (unplanned) responses, which are a form of self-organization.

Our last example in this section, reflects the case that human societies may be prone to a form of intellectual (de)centralization, too. An example from the domain of literature may support this view. The so-called 'literary canon' is an important idea in literature and culture. Simplistically, a literary canon may describe a body of books (e.g., the works of William Shakespeare) that have been traditionally accepted by scholars as the most important and influential in their society or culture. More recently, those researchers who investigated large-scale trends in literary style found that the influence of classic literature (the literary canon) on contemporary writers is declining (Hughes et al. 2012). Their research on a large body of literary works (current and past) revealed several trends including that: (i) authors of any given period are similar in style to their contemporaries, (ii) the stylistic influence of the past is decreasing, and (iii) authors writing in the late 20th century are instead strongly influenced by other contemporary writers. From our point of view, therefore, the literary canon represents a centralized form of literature, while the current literary scene appears more decentralized, self-organized, and swarm-like. The literary canon is one example. Other examples, may come from the world of on-line publishing, open-access, blogs, wikis, and various other highly dynamic and versatile environments holding an ingrained capacity to shape and impact the intellectual sphere of human societies.

4.2 Entropic society

Entropy is a fundamental concept in physics. We distinguish two types of entropy: 'natural' entropy and 'artificial' entropy.[11] An instance of natural entropy could be an ice cube melting away in a glass of water. The ice cube changes from a state of low entropy (generally associated with a form of higher organization, here ice) to a state of increased entropy (generally associated with a state of lower organization, here water). The process happens without any enforcement, spontaneously and naturally, according to the laws of physics. Artificial entropy is similar to natural entropy in considering situations where systems change from states of high organization (low entropy) to those of low organization (high entropy), and vice versa. Crucially, however, it is human thought and rational thinking that initiates these state changes.[12]

Events such as the French Revolution, for instance, represent cases of artificial entropy. The French Revolution transformed a monarchy (high organization, low entropy) in a process of social and political upheaval into an intermittent state of chaos (low organization, high entropy), before converging into a modern democracy (high organization, low entropy again). For us, the interesting step is the intermittent state of chaos with its rapid increase of artificial entropy. More generally, we suggest the concept of artificial entropy as a tool for analyzing situations where systems, triggered by human thought and intent, experience rapid and massive organizational change. The Internet and the social network domain represent such a system in our eyes.

Let us elaborate more concretely on two examples from the domain of art (past and current), in order to better understand our argument about entropic society. From a past perspective we look at the art movement of 'Dada'. In his book on Dada, Kuenzli (2006, 14) writes that

> '… Dada, more than any other movement, has shaken society's notion of art and cultural

11 Please note that this distinction is not entirely new. The philosopher Floridi (2010; 2011) speaks about anti-entropic information entities and processes in his work. Our motivation here is to pursue and understand (and, perhaps, expand) this distinction in some way.

12 Understandably, such a distinction should lead to a wider discussion. For the sake of brevity, however, this text omits a detailed exploration of this topic.

production. Fiercely anti-authoritarian and anti-hierarchical, Dada questioned the myth of originality, of the artist as genius, suggesting instead that everybody should be an artist and that almost anything could be art.'

How could a transformation into such a radical form of art emerge, and what does it have to do with entropic society, or with society in the first place? Scholars in the field, including Kuenzli (2006), always point out the cultural crisis period of the First World War (WW1), and that Dadaists (as well as other intelligentsia) believed that the systems used for constructing an interpretation of the world were inadequate (as demonstrated by the horrors of WW1). Dada, therefore, is a form of deconstruction (please note that we consciously avoid going into the work of Derrida here) of a cultural sign system through a new sign production, namely that of Dada. According to the people involved, this new system should be able to change society's interpretation of the world not only in the domains of art and literature, but as a whole Kuenzli (2006, 17). Although the rebellious impact of Dada was profound, some individuals perceived it as a means rather than an end in itself. These individuals looked at Dada as a first step into a new beginning, where, after the negative work of deconstruction (the result of which individuals perceived as a kind of void), a new interpretation of the world could be generated in a creative, positive process (e.g., through the various successors of Dada such as Surrealism or Constructivism). Let us stop here, and look at what this may have to do with entropic society. Our argument would be that society goes through stages of high organization (low entropy), such as a pre-WW1 society, through a phase of low organization (high entropy), such as the state created by the (negative) deconstruction of Dada, to enter again a state of high organization (low entropy), for instance by inventing or creating new systems of interpreting the world.

Let us now move to our second example, which involves the work of the audiovisual multimedia artist Davide Quagliola (born 1982, artist name Quayola). The starting point in Quayola's work are popular paintings (high organization, low entropy) of the 'Old Masters' (e.g., Botticelli, or Rubens).[13] Initially, Quayola produces high-resolution digital images of these paintings. A computer program then repeatedly fragments these digital images in an iterative process into a series of intermittent images (low organization, high entropy) until, in a process of inspection, a new object of art (high organization, low entropy again) that is aesthetically pleasing to the artist's eye emerges, and thereby, may require a new way of interpretation.

In order to summarize our thoughts on entropic society in this section, we would like to hypothesize that the processes of iterative destruction and reorganization are an essential part of human existence. Old ideas and concepts not only gradually change, they are also often (consciously, as well as unconsciously) smashed and utterly destroyed. Far from being useless debris, eventually, these high entropy remnants are the material out of which new, low entropy structures and forms of organization will emerge. We feel that the Internet and its environment are a platform where such processes can thrive and grow deep into the fabric of human society and beyond. This is why we feel that calling such forms of organization entropic societies may carry some value in it.

4.3 Computational artistic society

We mentioned earlier that the boundaries between the various types of society we propose in this paper are rather flexible and often overlapping. The work of the artist Quayola mentioned before typifies this flexibility rather well. As we shall see shortly, his work (and vice versa for the works of other artists mentioned in this section) deserves a place in what we call 'computational artistic society', too. Let us give an idea about this concept by modifying the quote 'everyone is an artist', attributed to Joseph Beuys earlier in this text, in the following way:

'In the new media environment everyone can be an (a computational) artist.'

It is obvious from this quote that the new media environment forms the backbone of a computational artistic society. We need to remember now that the field of new media studies deals with a wide range of issues on the interface between computing, science, the humanities, and the visual and performing arts. The remainder of this section uses examples from these domains in order to demonstrate the potential that computational art provides for preserving, changing, and extending various dimensions of 'traditional' art in a creative and formative dialog with society.

Out of many possible examples, let us begin with so-called 'fractal art', also called algorithmic art. This relatively young art form concerns the computer-(software)-based creation of images and structures that are self-similar under different scales of magnification. Fractals and fractal art emerged in the 1980s in the wider context of 'chaos theory' (Mandelbrot 1982; Greenberg 2011). One of the underlying ideas of this art form (and chaos theory) is that complex (natural, and artificial) structures (e.g., that of a tree, a snowflake, an organ, a landscape, or a Quayola image) can be

13 Meet Audiovisual Auteur Quayola. https://www.youtube.com/watch?v=fTw8b9Pwmr4. Accessed: 2017-03-14.

generated from relatively few and simple building blocks (e.g., geometric shapes such as lines and triangles, or mathematical equations such as those describing the famous 'Mandelbrot set') in an iterative, software-driven process. We already indicated that the work of Quayola follows a process that is very similar to this approach.

Another possible work in this category could be the paintings based on color charts or the famous stained glass window in Cologne Cathedral produced by the German artist Gerhard Richter (born 1932). Similar to Quayola, Richter, at some point in his career, utilized procedures that involved various elements of randomness (e.g., for the arbitrary arrangement of colors in a work) in the production process of his paintings, and, in a different medium, the aforementioned stained glass window in Cologne Cathedral. The important point to understand here is that in these cases, neither the artist (Quayola, or Richter), nor the computer (software) work in isolation. Rather, the artist and the computer are in a constant dialog (though maybe not on equal terms) about the direction into which their creation should evolve.[14]

Another area in which the new media environment impacts dimensions of traditional art (its creation, presentation, consumption, preservation, etc.) is that of literature. Let us consider the case of digital graphic novels by referring to the exciting children fantasy 'The Wormworld Saga' created by Daniel Lieske (born 1977).[15] Of course, in these diametrical media environments (digital versus traditional paint) there are the obvious differences in terms of the production tools. Keyboards, sensitive graphics tablets, monitors, or computer graphics programs, for instance, have replaced old fashioned pen, paper, brush, canvas, or palette. However, it is also important to take note of the profound changes concerning the physical and sensuous dimensions of old media. For instance, the weightless, never-aging ebook edition we can download and read on any computer screen has replaced weighty, voluminous, bulky, new or second-hand, smelly, stained, or otherwise sensuous paperback and hardcover editions. Likewise, on-line, the concept of a 'page' has been transmuted into one long and seamless, almost infinite two-dimensional surface where readers use a 'mouse' or a touch pad to (at the same time) 'watch' and 'scroll-read'[16] through a text.

The case of The Wormworld Saga also provides an opportunity to comment, briefly, on new models of project financing. The Wormworld Saga, among other ways, is partially funded by a 'Kickstarter'[17] crowdfunding (a form of crowsourcing) campaign. Alternative finance environments like Kickstarter provide an opportunity for creative artists to propose their projects on the Internet to a global audience, thereby maximizing the possibility to raise funding.

The last example we would like to present in this section relates to performance art. In his 2003 endurance stunt 'Above the Below', the popular American magician and illusionist David Blaine[18] (born 1973) spent 44 days in a transparent Plexiglas case, suspended in the air (in an altitude of about 9 meters) on the south bank of the River Thames in London. The stunt attracted considerable public interest and media attention. An important factor of the performance was the Internet, which allowed viewers around the globe to witness this extraordinary spectacle live on-line. We are less concerned here about the physical and mental experiences a body may go through in such a challenge. Rather, we are interested in the environment in which the event took place, which includes its physical location (London, England) as well as its virtual location in the Internet. In the past, lacking adequate media support, the direct experience of such an event would have been tied down to a relatively fixed and confined local space (e.g., a circus, a cabaret, a festival, or a market). Obviously, these restrictions would have impacted spectators in various ways. In terms of participation, the impact is clearly visible in the decision-making, the preparation, and the effort it may take to go, for instance, to a circus (or to London), and the time it takes to quickly check on the Internet how David is doing in his cage today. On the other hand, in terms of the 'lasting' impact an event may have on an individual, there is no doubt in our mind that experiencing the mastery of an extraordinary artist directly, as opposed to indirectly through an intermittent agency, are two different things entirely.

The final point we want to make here in relation to the Above the Below endurance challenge, is to hint

14 In terms of computer creativity we would like to mention that a software program is a completely deterministic procedure. Nonetheless, there is often an element of creativity, which may express itself in the reaction (e.g., surprise) the creation may evoke in an observer. This reaction arises out of the huge number of arrangements the software can explore and produce in a relatively short period of time. Creativity, therefore, is related to the generation of an output in a predefined solution space that is impossible to comprehend for the human involved in the process. Please note that the paper by Boden (2009) provides an interesting introduction to this topic.

15 The Wormworld Saga. https://wormworldsaga.com/. Accessed: 2017-03-14.

16 In cases such as The Wormworldsaga, we would like to add that the simultaneous 'watch-scroll-read' through an infinite canvas defines a new type of media experience we may call 'SmoVel', because it is a hybrid between watching a movie in slow-motion and reading a novel.

17 Kickstarter. https://www.kickstarter.com/. Accessed: 2017-03-14.

18 David Blaine. http://www.davidblaine.com/. Accessed: 2017-04-08.

at the dimension of 'preservation and cultivation of history' the new media environment also provides. The performance by David Blane is that of a flesh and bone human being, of course. Despite this realism, we may feel that a number of spectators, perhaps, was ready to consume the experience in the spirit of a somewhat superficial, short-term event, rather than in the way of a somewhat more penetrating experience that stimulates a mind more profoundly. In the past, traditional books used to be associated with guiding consumers to exactly this kind of deeper, more lasting type of experience. It is interesting, therefore, to mention the short story 'Ein Hungerkünstler' (English: A Hunger Artist) by Franz Kafka (1883-1924). In all likelihood, this sad and painful work by Kafka (2013) describes several of the experiences David Blaine may have had while hovering in his Plexiglas framed isolation over the River Thames. To what all this boils down to is that although rather different in space and time, Blain's Above the Below and Kafka's Ein Hungerkünstler have a lot in common. From this point of view of commonness, preservation in the new media environment (as in all other communication environments throughout the course of human history and culture) does not always mean plain copying or recording only - rather it also often means inter-contextual preservation, transformation, and extension. In any case, in all these forms and instances of preservation and presentation, we can clearly recognize some basic elements of humanity and society. Indeed, if we look at this recognition a bit more introspectively, then, we also may recognize a process that is similar to natural, biological reproduction, which is a thread we shall explore more deeply in the remaining sections of this paper.

5. On the origins of formative interactions

The previous sections showcased the multifaceted interrelationship between human society and technological structures. Despite various examples, however, we have not arrived at a meaningful 'explanation' of this phenomenon, yet. We would like to use the remaining space in this text in order to attempt such an explanation. Although we have to acknowledge that our forthcoming exposition is speculative, we hope that it evokes some kind of response about the importance of this phenomenon in the mind of the reader. To begin with this undertaking, let us consider the role of an artist (computational, or otherwise) in the new media (or any other) environment.

5.1 The role of the artist

Please note that in this section, we cut the comprehensive discourse about the role of the artist short by looking at the works of a few scholars only. We also intend to approach the topic through the lens of our previous writing in some way, for instance, by rephrasing the quote mentioned earlier that 'everyone is an artist' in the following inquisitive ways:

> 'Why should everyone be an artist (computational or otherwise)?'

> 'Is it possible that everyone can be an artist (computational or otherwise)?'

> 'What happens when everyone is an artist (computational or otherwise)?'

If we envisage the new media environment as an open space into which human culture and life can move, progress, and evolve, then we could look at the work of the German scholar Erich Fromm (1900-1980) for a discourse from a social science perspective about 'why' this directed development might happen. In some of his works, Fromm, among other considerations, writes about the 'liberation' of man through 'love' and 'work' [e.g., Fromm (1979; 1993; 2005)]. Our interpretation of these terms would be that Fromm may consider love as a universal gesture in which humanity acknowledges and embraces everything that exists in this world in a positive, caring, forward-looking, i.e., loving way. On the other hand, the stance Fromm takes on work, might be that of a perpetual process of self-assessment, self-refinement, and self-fulfillment (individually, and collectively) that allows everyone to grow and develop into a stable, firmly grounded, and well-functioning member of society. Ultimately, this experience is one of freedom, a kind of comfortableness in oneself, society, and, perhaps, the world at large.

We are inclined to respond to the second question, whether it is possible that everyone can be an artist (computational or otherwise), with a 'conditional yes' for various reasons. For one thing, we simply share the positive analysis Fromm provides in his work. Our encouragement also comes from the huge number of possibilities for positive growth, development, and elucidation the new media environment seems to provide for individuals. On the flip-side, we say conditional yes, because the creative participation in the new media environment requires an understanding about the adequate utilization of the tools of new media, which requires various forms and levels of skill in terms of new media (and computer) literacy. Of course, as it does in all ways of life, this requirement only revitalizes and continues the ancient relationship between the teacher and his student.

For the last question, what may happen when everyone is an artist, we turn to the German philospher

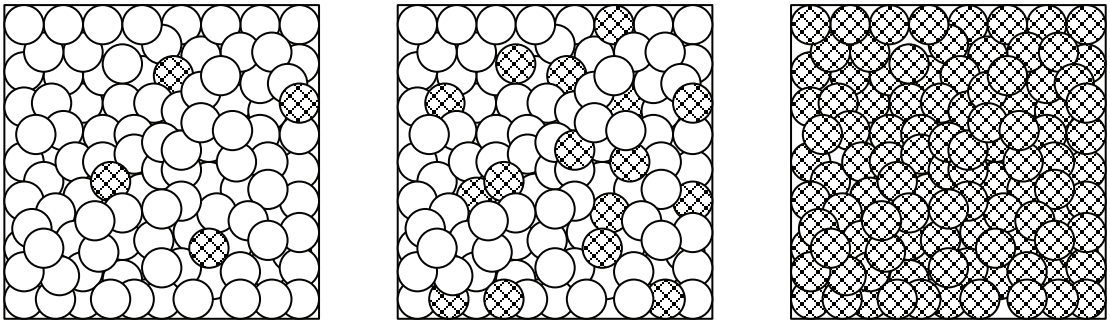

Fig. 3. Identity, indistinguishableness, and entropy. The entropic death of art.

Byung-Chul Han, who writes on a range of topics (e.g., burnout society, transparency, neoliberalism, or digital swarm society) related to the digital new media landscape (Han 2010; 2012; 2013; 2015). The concept that we are going to hijack here from Han's thoughtful discourse is that of 'transparency' (Han 2012). As far as we understand it, Han reflects on transparency as an effect in the form of a kind of information overflow, omnipresence, and exhibitionism caused by a systemic pressure (innate, and/or artificially created) in the new digital landscape. Of course, it is easy to associate this effect with the many details, which are often very private, individuals post about themselves in the various mainstream social media outlets. Han considers this form of neurotic exhibitionism as a kind of nakedness that is close to pornography. Figure-3, which relates to this view in some way, considers transparency from the point of our work.

The point Figure-3 tries to make is that when everyone is an artist, then art simply no longer exists. For instance, one of the roles of an artist (patterned circles in Figure-3) is similar to that of an explorer charting the wilderness of limitations and extremes on the fringes of the human condition. The exploring artist distinguishes himself from others (circles without a pattern in Figure-3) exactly because those others are 'not' artists. That is, we need a contrast against which the artist can stand out and distinguish himself. When this contrast disappears (picture to the right in Figure-3), everyone is the same. (Of course, the contrast also disappears when nobody is an artist.) Perhaps, one way in which we can recognize this phenomena today is in the flood of creations that appear daily on the Internet in the form of videos, images, podcasts, or literary works (including graphic novels). Of course, we do not say that this is a bad thing in itself, or that the quality of these works is low. What we are saying is that it is increasingly difficult to distinguish between what a work of art actually is - not because art has disappeared or that it got extinct, on the contrary - it is because it is everywhere.

In order to conclude our excursion into bohemian society, we go back to Section 4.2 where we elaborated on the idea of entropy as a state of sameness, or shall we say indistinguishableness. The same section also mentioned that a system in such a state may be the canvas on which new forms or structures of organization may emerge (e.g., remember Quayola and his work, as well as the ideas of chaos theory). A pressing question, therefore, is what sort of society may succeed an artistic society? We shall return to this question later. For the moment, we want to pick up on an issue we mentioned at the end of Section 4.3, where we seemed to recognize a similarity between the process of formative interaction between society and technological structures (e.g., the larger new media environment) and natural, biological reproduction.

5.2 Formative interplay from an evolutionary point of view

Let us introduce our view on the process of formative interaction between society and technological structures, and its relationship to natural, biological reproduction through the following proposition:

> **Proposition-1:** *In its essence, the process of formative bidirectional interaction between human society and technological structures is an expression of an evolutionary principle. The process is similar to natural, biological reproduction. However, it is also different to this form of reproduction, because of the involvement of the dimensions of human intelligence and rational thinking.*

As a starting point, let us look at the concept of a 'meme', which the evolutionary biologist Richard Dawkins (born 1941) introduced in his book 'The Selfish Gene' (Dawkins 1976). In his book and elsewhere,[19] Dawkins considers memes as agents that are similar to

19 Richard Dawkins on memes. https://www.theguardian.com/media/video/2013/jun/20/richard-dawkins-memes-cannes-video. Accessed: 2017-04-08.

self-replicating genes. In contrast to genes, which are responsible for the inheritance of phenotypical traits, however, memes are responsible for the transmission of cultural ideas. So far, so good. Unfortunately, an idea is an idea, it is something that lacks a 'real' representation in this world such as, for instance, a tree has. Ultimately (acknowledging controversy), an idea is a construct of the mind.

By speaking about the concrete material realization (instantiation) of ideas, Proposition-1 goes a significant step beyond mere ideas (genes and memes). From the perspective of this work, what we seem to see in these realizations of ideas is, of course, not bound to be inter-species inheritance (in the sense that elephants breed elephants). The realization of an idea, as we perceived it throughout this text, may find its manifestation in a wide range of objects and environments. At first glance, because these expressions are 'trans' rather than 'inter', these structures bear little resemblance to humans. Closer inspection, however, shows - and this is an important point of our work - that many of these structures are permeated by, let's say phenotypical expressions, hinting at a human creator.

We have almost reached the end of our journey. The final issue we would like to address here is the growing degree of similarity we can find in human created technological structures. The issue is particularly pressing when we think about the AI domain. This domain is special in the sense that it is not a simple human trait that we try to transfer into a structure of technology. Actually, it is quite the opposite, because the feature we talk about here is one of the defining traits of being human - intelligence. Essentially, by attempting to build AI, we transfer the ultimate valuable thing into a structure of technology.[20]

Let us contemplate such a structure in the shape of a future version of a 'Robo Thespian'[21] that is powered by a 'Cray'[22] supercomputer. We can only speculate - and maybe keep a lock on the drawer where the knifes are (Wilde 2015) - about what might be going on in the circuitry of such a 'Thespian Cray' when it looks back at itself, or at some weird carbon-based biological structure, through the idealistic mirror of self-contemplation.

20 Please note that there is a problem in AI that is similar to the inter versus across species issue mentioned earlier. Traditionally, AI applications perform extremely well in single domains (Silver et al. 2016), but struggle in problems that require the ability to reason and generalize across multiple domains (Mnih et al. 2015).

21 Robo Thespian is one of the world's most advanced humanoid robots (Verner et al. 2016). https://www.youtube.com/watch?v=Rx38lkbLZLk. Accessed: 2017-04-09.

22 Cray Inc. supercomputers. http://www.cray.com/. Accessed: 2017-04-09.

6. Summary

The motivation in this work was to investigate the relationship and formative interplay that may emerge between human society and technological structures. With a focus on computerized environments, notably the Internet and the new media environment, our work explored this relationship via a great variety of examples. In terms of formative interplay, we noticed various forms of emerging organizations of society (swarm, entropic, and computational artistic). In one of the central sections of this paper, we interpret this formative interplay as a process that is similar to natural, biological reproduction. Overall, we feel that our work could lead to stimulating discussions in a range of fields.

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