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Mathew E. Gladden*

Utopias and Dystopias as Cybernetic Information Systems: Envisioning the Posthuman Neuropolity

While it is possible to understand utopias and dystopias as particular kinds of sociopolitical systems, in this text we argue that utopias and dystopias can also be understood as particular kinds of information systems in which data is received, stored, generated, processed, and transmitted by the minds of human beings that constitute the system's 'nodes' and which are connected according to specific network topologies. We begin by formulating a model of cybernetic information-processing properties that characterize utopias and dystopias. It is then shown that the growing use of neuroprosthetic technologies for human enhancement is expected to radically reshape the ways in which human minds access, manipulate, and share information with one another; for example, such technologies may give rise to posthuman 'neuropolities' in which human minds can interact with their environment using new sensorimotor capacities, dwell within shared virtual cyberworlds, and link with one another to form new kinds of social organizations, including hive minds that utilize communal memory and decision-making. Drawing on our model, we argue that the dynamics of such neuropolities will allow (or perhaps even impel) the creation of new kinds of utopias and dystopias that were previously impossible to realize. Finally, we suggest that it is important that humanity begin thoughtfully exploring the ethical, social, and political implications of realizing such technologically enabled societies by studying neuropolities in a place where they have already been 'pre-engineered' and provisionally exist: in works of audiovisual science fiction such as films, television series, and role-playing games

utopia; dystopia; science fiction; role-playing games; cybernetics; neurocybernetics; neuroprosthetics; neuropolity; posthumanism

* Matthew E. Gladden — Institute of Computer Science at the Polish Academy of Sciences (Instytut Podstaw Informatyki Polskiej Akademii Nauk)

Contact: matthew.e.gladden@gmail.com

Introduction

It is possible – and quite useful – to analyze utopias and dystopias as particular kinds of political systems whose power structures may reflect aspects of democracy, anarchy, oligarchy, autocracy, theocracy, or other forms of government (Sargent 1982). However, in this text a different and complementary approach is proposed: we argue that new light can be shed on our understanding of utopias and dystopias if we view them not primarily as particular kinds of political systems, but as particular kinds of *information systems* – not wholly unlike those found in desktop computers or a satellite network. That is, each human society can be understood as an information system in which the minds of the society's members constitute 'nodes' that receive, generate, and process information and which are linked by communication channels that allow data to be transmitted between them. Some information may be 'private,' accessible only to the node that stores it (such as memories held within a particular human mind), while other information may be 'public,' distributed throughout the entire system and available to inform and affect the behavior of every node (such as historical facts taught in a society's schools). If societies are understood in this fashion, one might envision a utopian society as analogous to an ideal supercomputer or wireless network, within which information is generated, processed, and propagated without errors or conflicts. Similarly, a dystopian society could be compared to a computer or network in which – whether by design or accident – structural mechanisms or software behavior prevents the system's components from accurately and efficiently receiving, storing, processing, generating, and transmitting information.

We will begin our exploration of this subject by drawing on cybernetic theory to propose a model of the unique information-processing traits that characterize a utopia or dystopia. This model underscores the fact that if the human minds constituting a so-

ciety should acquire new information-processing traits, such changes could cause the society to take on an increasingly utopian or dystopian character – and, indeed, such revolutionary transformations in the information-processing capacities of the human mind loom on the horizon, thanks to ongoing developments in the field of neuroprosthetics. Currently, neural implants are used primarily to treat particular medical conditions, however in the coming decades they are expected to be deployed more broadly for purposes of elective human augmentation and enhancement. Such technologies may, for example, eventually allow a human mind to share sensory experiences, memories, dreams, emotions, and volitions directly and instantaneously with other minds anywhere on the planet, or even beyond. This will enable human minds to link with one another in radically posthuman ways, forming 'neuropolities' that reflect new kinds of social organization that were previously impossible – such as hive minds in which information may be processed, stored, and experienced communally rather than within the nodes of individual human minds.

Because the use of such neuroprosthetic technologies dramatically reshapes the information-processing traits of human societies, it also dramatically alters the possibilities for societies to develop in ways that are utopian or dystopian. Drawing on our model of cybernetic information-processing traits, we will argue that the new network topologies and patterns of information flow made possible by neuroprosthetics will enable – or perhaps even render inevitable – the appearance of new kinds of utopian and dystopian societies whose existence had, until now, been unrealizable. It is not yet possible to empirically study such utopian and dystopian neuropolities in our real world, because the advanced neuroprosthetic technologies that enable their existence have not yet been perfected or widely adopted. However, we will suggest that it is possible to explore the social, political, and ethical ramifications of utopian and dystopian neuropolities by studying them in one place where they already extensively exist: in works of audiovisual science fiction. While many works of science fiction depict future neuroprosthetic devices in a way that is not (and not intended to be) consistent with actual principles of physics, biology, or logic, those authors and artists who have carefully crafted the most scientifically valid and technologically feasible depictions of neuropolities are, in a sense, 'pre-engineering' devices that our real-world scientific and technological abilities do not yet allow us to create – thereby allowing humanity to explore such technologies' social

and ethical implications and to decide whether or not we wish to further pursue their development.

Using Cybernetics to Understand Human Societies as Information Systems

The field of cybernetics was founded in the 1940s to provide an interdisciplinary vocabulary and theoretical framework for use by researchers studying processes of communication, feedback, and control within particular systems – whether mechanical, electronic, biological, or social (Wiener 1961: loc. 442ff.). Norbert Wiener, one of the co-founders of cybernetics, recognized from the beginning that cybernetics could be used not only to create technological wonders such as synthetic retinas and artificially intelligent computers but also to create more effective mechanisms for concentrating and exercising social and political power within human societies. From the perspective of cybernetics, attempting to design a better prosthetic limb and attempting to design a better government can be seen as two different manifestations of a more general problem: that of attempting to build a better *information system* that utilizes more effective and advantageous processes of communication and control (Wiener 1961: loc. 681ff.).

Wiener himself doubted that applying cybernetic theory to social and political systems would produce significant benefits for humanity; he considered it more likely to be misused by corrupt and self-interested ruling elites to create new forms of government that would only be more effective as engines of oppression and manipulation. Thus he focused his own research on applying cybernetic theory to the development of prosthetic limbs and artificial intelligence, which he saw as more likely to benefit society (Wiener 1961: loc. 707ff.). However, in his seminal work *Cybernetics: Or Control and Communication in the Animal and the Machine,* Wiener did note many ways in which human societies can be understood cybernetically as information systems. Such lines of thought would later be elaborated by management cyberneticists like Stafford Beer, who explicitly noted the need to advance the field of neurocybernetics in order to better understand the dynamics of human societies, including utopias (Beer 1986).

A Cybernetic Model of Information-Processing Characteristics of Utopias and Dystopias

By analyzing and synthesizing the thought of cyberneticists such as Wiener and Beer, we have developed a proposed model for describing particular human societies as 'utopias' or 'dystopias' on the basis of their possession of certain traits relating to the reception, generation, processing, storage, and transmission of data on the part of the 'nodes' that constitute the society[1]. It is hoped that beyond offering some explanatory value, such a model could potentially even be applied to predict how altering a society's information-processing patterns in one or two relatively minor ways could be enough to transform a utopia into a dystopia, or *vice versa*. In the remainder of this section we describe the seven dimensions that constitute our model of a society as information system and explain how different values for each dimension would contribute to a society manifesting itself as a utopia or dystopia.

1. Network Topology: Existence of Communication Links from Each Member to Every Other Member

Cybernetic theory suggests that in a system described as a 'utopia' we would expect to find that each node within the information system is able to communicate directly with every other node[2]. In the language of network topology, this represents a communication network that is 'fully connected': every node is directly linked to every other node and peer-to-peer sharing of information is commonplace. For a human society, this does not necessarily require that its members be able to communicate face-to-face; it is possible for two members to be separated by large distances but to still enjoy 'direct communication' if their communication is mediated by technology that is fast, reliable, and free from external censorship or distortion.

In a dystopia, on the other hand, there is no mechanism that allows all nodes to communicate with one other. In some dystopias, a fully connected network topology

[1] Traditionally, each 'node' within a society would be identified with a particular human mind. However, in a posthuman society, a 'node' could be understood more broadly as an individual site of agency and could also be an artificially intelligent computer, social robot, sapient subnetwork, or other agent that is considered a 'member' of the society.

[2] Our description of the network topologies that characterize utopias and dystopias draws on Wiener's discussion of the information-processing characteristics of human societies, which can be found in Wiener 1961: loc. 2929ff., 3039ff., and especially 3129ff.

might theoretically exist, but it is unable to function because the network is flooded with vast quantities of (potentially irrelevant or inaccurate) information that prevents its use for effective communication by individual members. In other dystopias, members may be linked by a network that displays a 'star' or 'hub-and-spoke' topology: in such an arrangement, individual nodes are not able to exchange information directly with one another; peer-to-peer communication is either blocked or simply absent. Instead, all members of society receive information from a single centralized hub. When one member of society wishes to transmit information to another, the information cannot be conveyed directly; instead, the information is transmitted to a centralized hub that decides whether to deliver the information to its intended destination – potentially after modifying the message's contents.

2. Creation of 'Synapses' Between Nodes that Evolve in Response to Information Transmitted

In a utopia, individual nodes are connected by a communication link or 'synapse' whose functioning and characteristics evolve over time in response to the kind and quantity of information transmitted between the nodes[3]. In a human society, this means that individual members are connected by personal relationships that grow, deepen, and evolve over time as a result of the members' interactions.

In a dystopia, nodes are not connected by communication links that evolve over time as a result of their use. In a human society, this may mean that persons are allowed to exchange information between one another but not to develop lasting personal relationships. The exchange of information is an *ad hoc* occurrence limited to practical and functional matters; the system may disincentivize or actively block the transmission of information that could spur the creation of deeper relationships involving empathy, trust, friendship, admiration, or love.

3. Circulation of Accurate and Relevant Public Information in 'Active Memory'

In a utopia, there are mechanisms which insure that all of the relevant and accurate public information that nodes need in order to make effective and well-informed

[3] For the material upon which we have based our description of this 'synaptic' information-processing aspect of utopias and dystopias, see Wiener 1961: loc. 2849ff.

decisions is maintained in a state of 'active memory' in which it is continually circulating throughout the system and available to all nodes[4].

In a dystopia, there may simply be a lack of any mechanisms that allow for the circulation of such accurate, relevant, and necessary public information (e.g., a lack of oral storytelling, physical libraries, or the Internet), or there may be mechanisms that proactively suppress the circulation of such information.

4. Contribution of Information from All Nodes to Inform Systemic Decision-Making

In a utopia, the system as a whole arrives at systemic decisions by gathering, assimilating, and synthesizing information provided by all of the nodes within the system, and the basis and outcome of any systemic decisions that are made are effectively communicated to all of the nodes.[5] This means that the decision-making node(s) are able to identify any informational disequilibria that exist within the system (e.g., the fact that some nodes are interpreting particular data in a way different than other nodes or that some nodes possess information which other nodes lack) and to act in a way that seeks to achieve informational homeostasis within the system[6].

In a dystopia, not all nodes within the system provide information to inform the determination of systemic decisions. This may result from practical constraints: e.g., the population of a society may be too large and spatially dispersed to communicate regularly and effectively with the society's central decision-makers. However, it can also occur when a society is controlled by a small group of decision-makers who have no desire to gather input from the society's members or to identify and resolve informational tensions and imbalances; indeed, the central decision-makers may ignore or actively block the flow of information from the society's members, attempt to create and exploit informational tensions and imbalances in the society (e.g., through the use of propaganda and

[4] See Wiener 1961: loc. 2929ff. and 2951ff., for a discussion of the role of circulating memory within a system and Beer, 1986, 11-16, for a discussion of how the accuracy or inaccuracy of information circulating in public memory can contribute to its utopian or dystopian character.

[5] In some ways, this is analogous to the holonomic theory of the brain, according to which the human brain constitutes a holographic storage system: a memory is not stored locally in a particular neuron; rather each sufficiently large portion of the neural network contains all the memories of the entire brain (Pribram 1990).

[6] With regard to a human society, this does not require that a society function as a pure democracy in order to be utopian; it could conceivably possess some centralized authority (as in an oligarchy or monarchy), as long as the actions of the decision-making node(s) were informed by input from every other member within the system and the rationale and effects of decisions were honestly and accurately communicated to all members.

disinformation), and make decisions based on their own 'anti-homeostatic' self-interest[7].

5. Attainment of Informational Homeostasis

In a utopia, the system has already achieved informational homeostasis and possesses feedback mechanisms that allow such a state to be maintained or recovered in the face of any unexpected internal or external disruptions.

A dystopia is not characterized simply by the lack of informational homeostasis; indeed, most human societies lack full informational homeostasis without thereby being dystopian. An ordinary society may comprise different subnetworks of nodes that have access to different information and interpret data in different ways; such a society likely includes some nodes that are striving to promote informational homeostasis within the system, while other nodes attempt to create or reinforce anti-homeostatic mechanisms for their own ends. Rather, a dystopia is unique because displays a sort of 'pseudo-homeostasis' that is not the hectic informational give-and-take of an ordinary society but instead a mirror image of the equitable and 'enlightened' informational homeostasis found in a utopia. The difference between a utopia's true homeostasis and a dystopia's pseudo-homeostasis is that in a utopia homeostasis is achieved by fully incorporating all members of society into the network and facilitating their direct communication to allow informational imbalances to be identified and resolved through the exchange of accurate and relevant information; in a dystopia, pseudo-homeostasis is achieved not through identifying and resolving informational imbalances but by creating structures that conceal or misrepresent them[8].

6. Relation of Private to Public Information

We can define 'private' information as that which is stored within a single node and accessible only to that node. If information generated by a particular node can also be accessed by some other nodes, it can be described as 'non-private'; if it is available to *all* nodes within the system, it can be described as 'public.' Similarly, we can describe as

[7] For a discussion of a system's ability to receive and process information from all of its components to inform decisions and achieve informational homeostasis, see Wiener 1961: loc. 3070ff. and 3149ff.
[8] For a discussion of the failure of social and political systems to achieve homeostasis, see Wiener 1961: loc. 3106ff.

'non-public' information that is available only to one node or a small number of nodes but not to all nodes within the system. Using these definitions, we can say that a defining characteristic of a utopia is that it contains very little 'non-public' information that is stored within individual nodes (or groups of nodes) and not available to the entire system. This may at first glance seem counterintuitive, as a frequent image of 'dystopia' is that of the surveillance state that continually monitors the actions of its citizens and seeks to control their internal thoughts, desires, and loyalties. It is thus easy to imagine that a utopia would be a society in which citizens are able to keep all of their thoughts, memories, and desires hidden from the view of their fellow citizens. And indeed, it might be true that in a utopia, no members of society would be forcibly *compelled* to publicly reveal their most honest thoughts and desires – nevertheless, they might voluntarily choose to do so. From a cybernetic perspective, if members of a society do not accurately and robustly communicate their deepest thoughts and desires to one another, it will be difficult for that system to exist as a utopia, because there will be no means for identifying informational tensions and imbalances within the system and peacefully resolving them to achieve homeostasis. Moreover, although a dystopian state might indeed spy on its citizens or forcibly extract information from their minds, that information is likely to be made accessible only to the governing elite and their agents, who utilize it for their own anti-homeostatic purposes; a dystopian state would not be expected to gather the most honest thoughts and desires of all its citizens and make that information publicly available to all – because that would only reveal the extent to which the dystopian system was loathed by its members, potentially laying the groundwork for development of a popular uprising. Only in a utopia would one expect to find a vast preponderance of public over non-public information.

Conversely, a dystopia is characterized by its near complete lack of accurate, meaningful, and relevant public information. While it may be true that the dystopian state conducts vast and intrusive surveillance of its members – thereby depriving them of the ability to maintain any of their information as private – the central decision-making node(s) do not make that wealth of information public but instead conceal, secure, and exploit it for their own ends. What little 'public' information is allowed to circulate within the system is likely to be disinformation, propaganda, and inaccurate 'origin

myths' produced or authorized by the central node and calculated to reinforce the anti-homeostatic nature of the system[9].

7. Locus of Greatest Knowledge within the System

Drawing on real-world examples, Wiener notes that it is possible for a system as a whole to possess either *more* or *less* information than is possessed by its individual members (Wiener 1961: loc. 3070ff., 3149ff.). We would argue that a utopia will be characterized by the fact that the system as a whole possesses more information than any of its individual nodes – because the system is able to assimilate, analyze, and synthesize vast amounts of data from all of its members, allowing it to recognize patterns and generate insights that an individual member does not have the resources to achieve. The locus of greatest knowledge (and, we would suggest, even 'wisdom') thus emerges at the level of the system as a whole and its systemic information-processing and decision-making, not in the actions of its individual members[10].

A dystopia, meanwhile, will be characterized by the fact that the system possesses less information, knowledge, and wisdom than do its individual members, insofar as each individual member possesses cognitive mechanisms for identifying and resolving informational tensions and imbalances within himself or herself to achieve informational homeostasis, while the society as a whole possesses no such mechanisms (or, indeed, contains mechanisms that actively work to prevent the attainment of homeostasis).

Neuroprosthetics: The Shift from Medical Therapy to Human Enhancement

The bodies of a growing number of human beings are home to implantable computers, typically in the form of implantable medical devices (IMDs) such as defibrillators, pacemakers, deep brain stimulators, and retinal and cochlear implants; body sensor networks (BSNs); or some of the more sophisticated forms of RFID transponders (Gasson et al. 2012; Gasson 2008). Such implantable computers increasingly serve as sites for the reception, generation, processing, storage, and transmission of large amounts of highly sensitive information (Kosta & Bowman 2012; Li et al.,2011; Rotter & Gasson 2012) re-

[9] For a discussion of the relationship between private and public information in a system, see Wiener, 1961, loc. 3070ff. and 3149ff.

[10] This, again, raises the possibility of understanding a utopian society as a sort of holographic information system – and understanding the holonomic human brain as a kind of 'utopia.'

garding their human hosts' everyday interactions with the environment, internal biological processes, and even cognitive activity.

One kind of computer that integrates with the human organism in an especially powerful and intimate way is a neuroprosthetic device (or 'brain-machine interface system') that links directly with the brain's neural circuitry. A neuroprosthetic device may either be physically inserted into the brain, as in the case of a 'brain implant,' or it could potentially surround the brain, as in the case of a full cyborg body (Lebedev 2014: 99). Such neuroprosthetics increasingly operate in rich and complex biocybernetic control loops with the organism of their human host, allowing the cognitive activity of their host to be detected, analyzed, and interpreted for use in exercising real-time control over computers or robotic devices (Fairclough 2010; Park et al. 2009).

The neuroprosthetics that are currently in use have typically been designed to serve a restorative or therapeutic medical purpose; they might treat a particular illness or restore some sensory, motor, or cognitive ability that their user has lost as a result of illness or injury. It is expected, though, that future generations of neuroprosthetics will increasingly be designed not to restore some ordinary human capacity but to enhance their users' physical or intellectual capacities by providing abilities that exceed or differ from what is naturally possible for human beings (Gasson 2008; Gasson et al. 2012; McGee 2008; Merkel et al. 2007). Such technologies' potential use for physical and cognitive enhancement is expected to expand the market for neuroprosthetics and implantable computers well beyond the limited segment of the population that relies on them to treat medical conditions (McGee 2008; Gasson et al. 2012).

Envisioned Advances in Neuroprosthetic Technologies

Researchers anticipate that future models of sensory neuroprosthetics such as retinal implants may give human beings the capacity to experience their environments in new ways, for example through the use of telescopic or night vision (Gasson et al. 2012; Merkel et al. 2007) or by overlaying external visual data with supplemental data displayed using augmented reality (Koops & Leenes 2012). Some researchers envision the development of devices resembling more advanced retinal and cochlear implants that can record all of a person's audiovisual experiences for later playback on demand, effec-

tively granting the person perfect audiovisual memory (Merkel et al. 2007; Robinett, 2002).

Other researchers have envisioned the possibility of a person being able to regularly download new content onto a memory chip implanted in his or her brain, thereby instantaneously gaining new knowledge or skills (McGee2008). The potential feasibility of such technologies is being suggested, for example, by successful experiments with implanting artificial memories in mice (Ramirez et al. 2013). Even more futuristic scenarios include the development of a 'knowledge pill' that can be ingested and whose contents – perhaps a swarm of web-enabled nanorobots (Pearce 2012) – travel to the brain, where they modify or stimulate neurons to create engrams containing particular memories (Spohrer 2002). Another technological advancement that is especially important for our consideration of neuropolities is the ongoing development of brain-machine-brain interfaces (Rao et al. 2014) that may eventually allow direct and instantaneous communication between two human brains that are physically located thousands of miles apart.

The Rise of Neuropolities

The growing use of such advanced neuroprosthetic devices will not only affect the internal cognitive processes of the individuals who possess them; it will also dramatically reshape the ways in which human beings interact with one another and the kinds of communities that they will be able to jointly create. Already 'cyborg-cyborg interaction' is becoming a fundamental aspect of contemporary human society, and it will serve as a foundation for new kinds of social relationships and structures as the integration of neuroprosthetic devices into the human brain becomes more ubiquitous (Fleischmann, 2009). Neuroprosthetics will allow for increasingly intimate and intense forms of communication that do not actually involve physical face-to-face interaction but are instead mediated by technology, thereby facilitating the development of new kinds of posthuman interpersonal relationships in which it will no longer be considered necessary or important for one's fellow participants to possess physical proximity – or even status as biological beings (Grodzinsky et al. 2011)[11].

[11] Neurocyberneticists, futurists, and the creators of science-fiction works (especially tabletop role-playing games) are already developing ontologies and typologies of neuroprosthetics to help us classify the kinds of advanced neuroprosthetics that are under development or are expected to someday be realized and to understand the impact that they will have on human cognition, environmental interaction, and

Such social and technological change is being spurred by transhumanist thinkers who argue that genetic engineering, cybernetics, and nanotechnology can and should be used to create a more meaningful, more transcendent, 'enhanced' form of human existence – as well as by more broadly posthumanist thinkers who argue that future societies may include many different sources of intelligent agency that will create meaning in the universe through their richly complex networks and relations (Ferrando 2013). Such entities might include unmodified 'natural' human beings, genetically engineered human beings, human beings with extensive cybernetic augmentations, human minds that dwell permanently in virtual realities, social robots, artificially intelligent software, nanorobot swarms, and sapient networks.

Drawing on the definition of a 'polity' as "An organized society; a state as a political entity" (*Oxford Dictionaries* 2015), we would suggest that human minds possessing advanced neuroprosthetic tools will be able to interact with one another and with other intelligent agents in remarkable new ways, collaborating to create social structures that are not identified with or restricted to a particular geographical location (and are thus not 'neurotopias') but are instead 'neuropolities' that link minds together in a radically posthuman or transhuman fashion. A neuropolity can take the form of an organization, community, society, or even entire civilization of minds that are united as an information system through the use of neuroprosthetic technologies.

social organization. For example, it is envisioned that *content-exporting* (also known as *'uplink'* or *'upslink'*) prosthetics will allow a human being to share his or her sensory experience in real time with others that possess *content-importing* (or *'downlink'* or *'downslink'*) prosthetics (Cascio 2003, 64-65; Gladden 2015). *Mnemoprosthetics* will allow human beings to draw instantaneously on vast pools of shared information and communal memories (Gladden 2015). *Allosomatic* prosthetics will allow a human mind to become temporarily or permanently 'embodied' (either physically or virtually) within a new body or groups of bodies; such devices would include *xenosomatic* prosthetics that provide a radically non-human experience of sensing, manipulating, and dwelling in the world, *neosomatic* prosthetics (also known as 'shells' or 'synthmorphs' (Boyle et al. 2011, 27)) that physically replace all of a human being's body (apart from the brain) with a new synthetic physical housing, or *docesomatic* prosthetics that allow a human being to function as an avatar within a virtual environment (Gladden 2015).

If neuroprosthetic devices are classified according to their relationship to the agency of their human hostmind, we can identify types such as *heteiroprosthetics* that possess their own synthetic agency and serve as a companion or advisor to their human hostmind; *archoprosthetics* that possess or extend into the hostmind some external intelligent agency and which are able to control at least part of the hostmind's sensory, cognitive, or motor processes; and *syzygoprosthetics* that introduce some intelligent external agency into the hostmind in such a way that the hostmind is consciously aware of and experiences the other entity's (or entities') thoughts or volitions from within the hostmind's own cognitive processes, rather than simply as sensory input (Gladden 2015). Syzygoprosthetics create the potential for new and radically different forms of human social organization in which the mechanisms for communication, control, and collaboration are far more sophisticated and powerful than those of traditional human organizations such as families, corporations, or nations; they may even allow human minds to merge many aspects of their sensory, cognitive, and motor processes to form communal 'hive minds' (Gladden, 2015).

As neuroprosthetic technology begins to advance more rapidly – likely splintering into many diverse technologies with varying levels of power and sophistication – the humanity that utilizes such devices may itself fragment into many different 'posthumanities' that no longer possess either the desire or ability to communicate with one another. The earth may thus become home to countless neuropolities that overlap with one another geographically but whose social realities are completely disjunct – different civilizations that are unable to interact socially with one another and whose respective forms of culture, commerce, ethics, religion, science, and political governance will diverge along isolated paths (Abrams, 2004; Gladden, 2014).

Neuropolitic Tools Supporting Utopian and Dystopian Systems

Utilizing our model of the cybernetic information-processing traits that characterize a utopia or dystopia, we can identify and understand ways in which the rise of neuropolities enabled by the widespread use of neuroprosthetic devices will make it easier or more difficult for utopias and dystopias to appear within our world.

For example, the technologies incorporated into a neuropolity may facilitate the development of utopias by providing powerful new tools that allow individual human beings to share their thoughts, memories, and experiences with others and by enabling even large societies to utilize a fully connected network topology that was previously only possible for small communities. Similarly, neuroprosthetic technology may make it easier to gather information from all members of a society for purposes of informing systemic decision-making, and it may allow information to be more effectively promulgated throughout the system, thereby promoting homeostasis.

On the other hand, neuropolitic technologies could just as easily facilitate the development of dystopias by providing adept users of such technologies (whether they be corporate or government agents, activist groups, or lone neurohackers) with powerful new abilities to overload or corrupt a system's mechanisms for the circulation of active memory and to block the propagation of accurate, meaningful, and relevant public information. Similarly, those with sufficient knowledge of the neuropolity's neuroprosthetic technologies could disrupt peer-to-peer communication between members and undermine the system's mechanisms for maintaining informational homeostasis.

Utopian and Dystopian Neuropolities in Audiovisual Culture

Because the advanced neuroprosthetic technologies that would enable the existence of utopian and dystopian neuropolities have not yet been perfected and widely adopted, it is not currently possible to empirically study such utopias and dystopias in our everyday world. However, we *are* able to explore the social, political, and ethical ramifications of utopian and dystopian neuropolities by studying them in one place where they already exist: in works of science fiction. Creators of numerous science-fiction works have labored painstakingly to develop fictional realizations of neuropolitic technologies and societies that are scientifically, technologically, commercially, culturally, and psychologically feasible and self-consistent. Creating such works is, in a sense, 'pre-engineering' within a simulated world devices that our real-world scientific and technological abilities do not yet allow us to create – thereby allowing humanity to explore their implications and decide whether we wish to pursue the development of such technologies. In particular, audiovisual works such as films, television series, manga, computer games, and table-top role-playing games allow us to ponder – and, in a sense, even experience – the ways in which neuropolitic technologies may eventually facilitate (or even impel) the appearance of new kinds of utopias and dystopias within our world.

Such examples from audiovisual culture can be grouped broadly into 'utopian,' 'dystopian,' and 'mixed or ambiguous' neuropolities[12]. Within the context of this article, it is not possible to provide a comprehensive classification and analysis of the likely thousands of audiovisual works created within different cultural traditions around the world that reflect some aspect of a utopian, dystopian, or mixed or ambiguous neuropolity. If the conceptual framework developed in this text proves useful, then such a detailed study – and perhaps the accompanying formulation of new dimensions for addition to the cybernetic model introduced in this article – could be the subject of future research within the fields of cybernetics and cultural studies. In the remainder of this text,

[12] It is possible for a work of science fiction to depict a society that utilizes advanced neuroprosthetics – and even displays utopian or dystopian traits – but is not a neuropolity. For example, in the computer game *Shadowrun Returns* (2013) the main player character can utilize neuroprosthetics to carry out tasks such as controlling a drone or entering the Matrix to hack into a data vault, however neuroprosthetics do not play a significant role in social interactions or communication with other characters and the main player character is not required to possess them. Some particular societies within the Shadowrun game-world could indeed be classified as neuropolities, however.

however, we will confine ourselves to noting several examples of audiovisual works which demonstrate that it is possible to identify utopian or dystopian manifestations of our model's dimensions within fictional works. Although our selection of a small number of particular works is by nature somewhat arbitrary, we hope that it can provide a helpful starting point and indicate the directions in which this research can be further developed. Below we thus highlight several such utopian, dystopian, and mixed or ambiguous neuropolities – many of which are not simply fictional 'depictions' but rather actual *embodiments* of neuropolities, insofar as they engage a player or user in an immersive or interactive experience that brings the neuropolity into existence, if only in a limited and provisional way.

Utopian Neuropolities in Audiovisual Culture

A number of science-fiction role-playing games feature neuropolitic communities or states whose cybernetic information-processing characteristics display utopian traits, as defined by our model. For example, in the game-world of *GURPS: Transhuman Space* we encounter the utopian Gnu-Covenant Isolate community, whose "primary ideology is that of intellectual freedom and complete openness. Combining infosocialism with transparency […], the island is known for its 'public noosphere,' where all content on individual computers is open to all other citizens for duplication and modification" (Cascio 2003: 28). Player characters in the *Transhuman Space* world can also visit the Transpacific Socialist Alliance (TSA), which largely reflects the doctrines of 'classic infosocialism,' according to which "the role of the state is to act as the 'social monopolist,' having ownership of all intellectual property, but making it freely available to all parts of the society." Referring to some of the TSA's member nations, it is noted that "[Augmented reality] networks in Bangladesh, El Salvador, Madagascar, and Peru are highly democratic, open systems allowing everyone 'write access' – many AR locations are covered in virtual commentary, debate, and graffiti" (Cascio 2003: 48). Such societies reflect a utopian preponderance of public over private information and effective mechanisms for promoting informational homeostasis.

Similar utopian traits are found in the game-world of *Nova Praxis,* where almost all everyday activity occurring within humanity's Coalition of Free States is recorded by 'the mesh,' whose data is made broadly accessible. The Coalition's citizens enjoy a uto-

pian existence in which "the same technology that provides the interface between your devices (and/or augmentations) and the local mesh, also function as the eyes and ears of AI Monitors that watch your every move." For the most part, "Coalition citizens have grown accustomed to this and most never give it much thought. It is the price they pay to be a citizen, and most are happy to pay it. Their needs are met, they are protected, and they are free to enjoy whatever legal forms of entertainment they wish" (McConnell 2010: 12). However, those who find the continual surveillance intolerable are able to emigrate and live outside of the Coalition's system, thereby helping to maintain informational homeostasis within the system.

The utopian traits of a fully connected network topology and mechanisms for achieving informational homeostasis are explicitly seen in the strongly neuropolitic game-world of *Eclipse Phase,* with its space habitats that are home to "thriving utopianist enclaves" (Boyle et al. 2011: 68). For example, in discussing the political organization of utopianist colonies in the outer reaches of the Solar System, it is noted that "Several colonies […] use special high-bandwidth connections to give their members access to each other's surface thoughts and emotional reactions, allowing them to hold vast democratic political meetings where everyone present can feel the general emotional reactions of all of the other members as easily as they can feel their own" (Boyle et al. 2011: 58).

Finally, animated series such as *Ghost in the Shell: Stand Alone Complex* (2002-03) and *Stand Alone Complex: 2nd Gig* (2004-05) depict efforts by particular groups to create neuropolities with utopian cybernetic information-processing characteristics; moreover, in its vast, decentralized, information-rich, commercialized 'free-for-all,' even the public net accessed by ordinary individuals for everyday activities displays numerous utopian characteristics, despite having not been purposefully designed for utopian ends.

Dystopian Neuropolities in Audiovisual Culture

Dystopian neuropolities are found in numerous science-fiction films such as *The Thirteenth Floor* (1999), *eXistenZ* (1999), *The Matrix* (1999), and *Ghost in the Shell 2: Innocence* (2004). A recurring dystopian information-processing trait seen in such works is the fact that a neuropolity's active memory does not circulate accurate information about the most basic facts of the neuropolity's existence – such as whether the world experienced by its members is 'virtual' or 'real.' Thus whatever informational ho-

meostasis members of the society might perceive is in fact a false homeostasis fabricated through the use of neuroprosthetics that conceal the true nature of the physical and social reality in which such individuals exist. A related dystopian trait is the fact that in many such films, the neuroprosthetic mechanisms enabling communication between human minds are subject to centralized monitoring and editing and limit the minds' ability to create authentic long-term relationships for the exchange of information.

Often, such cinematic dystopian neuropolities are recognized, confronted, and destroyed by a protagonist over the course of a film. While such a narrative arc may be driven largely by dramatic exigencies, it also reflects the reality that a dystopian neuropolity may be vulnerable to overthrow by an individual protagonist because – as reflected in our cybernetic model – the mind of an individual member of that society may contain more knowledge and wisdom than does the system considered as a whole.

Mixed or Ambiguous Neuropolities in Audiovisual Culture

Finally, there are many neuropolities found in audiovisual science fiction that simultaneously display both utopian and dystopian information-processing characteristics – or which are seen to undergo a transformation from utopia to dystopia, or *vice versa*. For example, in films such as *Dark City* (1998) and *Avalon* (2001), it is either hinted or explicitly stated at the end of the film that a neuropolity that had previously been dystopian in nature has either been transformed into or given way to a (potentially) utopian neuropolity, as a result of the protagonist's actions. In *Inception* (2010), the neuroprosthetic technology utilized by the film's protagonists creates an informational disequilibrium between those individuals who realize that their shared experience is a dream and those who lack that awareness; similarly, much of the information circulating in active memory within the dream-world is an intentionally misleading fabrication. Opposing those dystopian traits, however, is the utopian characteristic that the film's neuroprosthetic technology displays a cathartic tendency to make what was previously private information public, as over time individuals' hidden memories and desires are revealed and become part of the shared dream experience. Another ambiguous neuropolity is the Borg collective as depicted in *Star Trek: The Next Generation* (1987-94) and other *Star Trek* media. On the one hand, it appears that individual members of the collective are able to communicate directly with one another and have access to vast quanti-

ties of communal public information and that some form of informational homeostasis of achieved. Moreover, it appears that the system as a whole possesses more knowledge than its individual members. However, counterbalancing these generally utopian traits is the dystopian fact that a member's most sincere and deeply felt dreams, desires, and aspirations are not truly communicated to other members of the collective but rather artificially suppressed, so that even the individual himself or herself no longer experiences them. Similarly, an individual's ability to form communicative links with other members that grow and evolve over time is also purposefully impeded.

Conclusion

As we have seen, by building on the interdisciplinary theory of cybernetics it is possible to understand human societies as information systems in which human beings comprise interconnected nodes that are able to receive, generate, process, store, and transmit information. In particular, utopias and dystopias can be understood as information systems that possess unique cybernetic information-processing characteristics. The anticipated growth of neuroprosthetic technologies for purposes of human enhancement will radically reshape the ways in which human beings create, access, and use information – and will thus allow human minds to link with one another in ways that were never previously possible. Insofar as this expands the array of different kinds of information systems that human beings can create, it will also make possible – or perhaps even inevitable – the appearance of new kinds of 'neuropolitic' societies that are utopian or dystopian in nature. While we cannot yet observe such utopian and dystopian neuropolities in the real world, we *are* able to study and (to some extent) even participate in them by experiencing the many works of audiovisual science fiction in which they already exist. Through such experiences, humanity is beginning to explore the ethical, social, political, religious, and cultural implications of such neuropolities. We can hope that the knowledge gained through such exploration will help ensure that if posthuman neuropolities are eventually realized within the real world, they will develop in ways that reflect more of utopia than dystopia.

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