Chapter 1
Introduction to the Future Internet: Alternative Visions

Jenifer Winter and Ryota Ono

Overview of This Book

The Internet is inextricably intertwined with almost every sector of society, increasing its complexity and bringing forth numerous opportunities and challenges. It has been only 50 years from its earliest conception in the early 1960s, to its present state as a vast, *interconnected* network of networks spanning much of the globe and linking approximately 2.7 billion people, representing 39 % of the world's population, by the end of 2013 (International Telecommunication Union 2013). The Internet's global expansion has been the subject of much academic research and policy discourse in recent years. Due to the sociotechnical complexity of these changes, policymakers, businesspeople, and academics worldwide have struggled to keep abreast of developments. In addition to vigorous research to develop Internet standards and technologies that enable the interoperation of billions (and perhaps soon trillions) of computers in various forms, Internet studies has emerged as an interdisciplinary field drawing on both social scientific inquiry and engineering disciplines. Dutton (2013) highlights the broad scope of the emerging field of Internet Studies, and notes that foci address the technologies themselves, as well as design and development; technology use, "including patterns of use and non-use across different kinds of users and producers in various contexts"; and law and policy as it relates to the shaping "the design or use of the Internet, as well as emerging institutions and processes of Internet governance" (p. 2).

J. Winter (✉)
University of Hawai'i at Mānoa, 2550 Campus Road, Honolulu, HI 96822, USA
e-mail: jwinter@hawaii.edu

R. Ono
Aichi University, 4-60-6 Hiraike-cho, Nakamura-ku, Nagoya City, 453-8777 Aichi, Japan
e-mail: ryota@aichi-u.ac.jp

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Research and policy visions associated with Ubiquitous Computing, Ambient Intelligence, and the Internet/Web of Things all herald a future Internet in which the integration of myriad, heterogeneous objects into the everyday environment will enable economic growth, and enhance business and government efficiency, environmental sustainability, and personal convenience. In this book, a collection of academic futures researchers and futures practitioners explore alternative visions of the future Internet, presenting a compelling array of visions about how it will continue to reshape our lives—and how our decisions now can help shape this future. This book addresses the future of the Internet, or rather, alternative possibilities for the future Internet. It also focuses on the underlying values, beliefs, and thinking that are influencing the future and presenting alternative visions.

To explore possibilities for the future Internet, we employ a sociotechnical systems approach, focusing on the interplay of technical, social, cultural, political, and economic dynamics to explore *alternative futures*—that is, ones that are not part of the dominant discourse about the Internet. Our authors share perspectives that are not well addressed in current discussion about the future Internet and provide ideas about what might be. Awareness of these dynamics, and the fluidity of the future, is important as we move forward into the uncertain future. Our approach is intended to stimulate dialogue among academics, policymakers, and practitioners on a topic that will underlie most aspects of human life in the near-term future. This chapter begins by introducing the current vision of the future Internet as it appears in technical and policy discourse. We next introduce the field of alternative futures studies, introducing key assumptions and methods of inquiry. Finally, we introduce the individual contributed chapters that provide alternative visions of the future Internet.

Dominant Discourse about the Future Internet

The Internet has been increasingly studied in particular social and organizational contexts, acknowledging the ways in which specific institutional settings, actors, and processes help guide system design and evolution. The technologies associated with the Internet do not merely impact social structures—they are intricately linked to social, political, economic, and political developments—and are mutually shaped by them.

Many of the visions that shape the Internet's development and use are driven and governed by research institutions, corporations, and governments. To some extent, increasing cooperation between the private and public sectors in research and development has caused these distinctions to blur. Although aspects of the future Internet are still not manifest in our daily lives, these initiatives serve as a shared vision, enabling consensus about research and policy problems. In this way, those designing systems play the role of "social engineers" who actively create the future (Callon 1987). While there is not a single vision of the future Internet, there are a number of overlapping, and influential, visions shared between academic and corporate researchers and governments. These all point towards the emergence of a Ubiquitous Network Society (International Telecommunication Union 2005b).

Vision of the Ubiquitous Network Society

The vision of a Ubiquitous Network Society pervades academic inquiry and policy goals. Several related research paradigms focus on the growing presence of heterogeneous computational devices in daily life. The key characteristics of a Ubiquitous Network Society include: (1) The geographic spread of the Internet, with more places becoming networked via fixed or mobile connections; (2) a shift from a one-to-many relationship between humans and computers to one where each person, on average, has many; (3) the embedding of computational intelligence into many aspects of everyday life, enhanced by the miniaturization, increased processing power, and reduced cost of computers; (4) the growth of technical standards enabling machine-to-machine (M2M) intelligence and the subsequent emergence of the Semantic Web (Berners-Lee 2000), a web of interlinked data that can be processed and analyzed by computers without direct human intervention; and (5) the emergence of new ways that humans interact with computers, other humans, and the environment.

In the late 1980s, Marc Weiser first shared the vision of Ubiquitous Computing, a near-term future characterized by the presence of multiple, networked computers per person in the everyday environment that help to extend, rather than burden, human concentration. This vision was featured in a 1991 *Scientific American* article, and has been very influential in subsequent academic research and as a guide to national policy. At its core, Ubiquitous Computing is human-centered and focuses on how to improve human experience in real contexts. Weiser (1991) emphasizes the distinction between virtual reality (where one goes "into" the virtual realm) and Ubiquitous Computing, where the physical world itself is actuated by computers and data:

> Indeed, the opposition between the notion of virtual reality and ubiquitous, invisible computing is so strong that some of us use the term "embodied virtuality" to refer to the process of drawing computers out of their electronic shells. The "virtuality" of computer-readable data – all the different ways in which they can be altered, processed and analyzed – is brought into the physical world. (Weiser 1991, p. 20)

Over time, Ubiquitous Computing research has focused on interaction contexts (Abowd et al. 2002). A related concept, Ambient Intelligence (AmI), arose in the context of the European Union's policy strategy for Information and Communication Technologies (ICTs) (the Fifth Framework Programme, Information Society Technologies, 1998–2002). AmI has focused on context-sensitive smart homes. Corporate visions also emerged. IBM produced the related area of Pervasive Computing (Hoffnagle 1999) during the late 1990s, focusing on technical and business infrastructures. Later, IBM initiated its Smarter Planet strategy (IBM 2008), focusing on the instrumentation of the physical world with trillions of networked sensors. HP has created a similar research initiative, Central Nervous System for the Earth (CeNSE) (HP n.d.).

The Internet of Things

Visions of the Ubiquitous Network Society tend to envision the "proximate future" (Dourish and Bell 2011, p. 133), so it is important to note that it is already present in many forms. More recently, these developments have fallen under the umbrella term Internet of Things (IoT), sometimes called the Internet of Everything (Bradley et al. 2013) or the Web of Things (World Wide Web Consortium 2015). Weber and Weber (2010) describe the IoT as a "backbone for ubiquitous computing, enabling smart environments to recognize and identify objects, and retrieve information from the Internet to facilitate their adaptive functionality" (p. 1). In this regard, the IoT is an emerging global architecture, although like the word ubiquitous, the phrase IoT has been used loosely by marketers and policy makers.

Broadly speaking, the IoT describes an array of developments that seek to uniquely identify and connect a wide range of everyday objects over the Internet, integrating the virtual world with the physical. This global architecture may support billions, or trillions, of heterogeneous objects. A variety of short-range wireless technologies, including radio frequency identification (RFID), near field communication (NFC), and wireless sensor networks (WSNs) enable the increasing instrumentation, measurement, and tracking of objects. In addition to supply chain management, the IoT is being used to collect data to enhance a variety of business processes (Uckelmann et al. 2010). In addition to well-established uses for logistics and supply chain management (Ashton 2009), related applications are being envisioned for a wide variety of industries and uses (International Telecommunication Union 2005a). These include the use of implantable, or even edible, medical devices for enhanced health care (CERP-IoT 2010); smart appliances, homes, and cities (Khan et al. 2012), including "Green ICT" as a means to reduce strain on the environment (Vermesan et al. 2011); real-time pollution and temperature monitoring (Hvistendahl 2012); natural disaster prediction and early warning systems (CERP-IoT 2010); structural engineering applications, such as identifying faults or stress in buildings or bridges (Agrawal and Lal Das 2011); agricultural productivity (CERP-IoT 2010) and food safety (Hvistendahl 2012); improved transportation via sensor-enabled roads and assisted driving (Atzori et al. 2010); and a variety of security-related applications such as radiation monitoring (Ishigaki et al. 2013) and intrusion detection (Khan et al. 2012).

Within the technical literature, there are a number of different foci that are being coordinated by different industrial and research groups and standardization bodies. Atzori et al. (2010) describe three overlapping technical visions that guide IoT research. The first is a things-oriented view that addresses the real-world objects. A 'thing' is something that we wish to instrument or measure. These could be objects such as articles of clothing, automobile parts, livestock, plants, the human body, or even a particle-sized bit of paint. Things must also be able to communicate with other objects using short-range communication technologies. RFID is the most commonly discussed standard at this time, but there are a wide variety of possibilities, including NFC-embedded smartphones, nanoelectronics, sensors, or other embedded systems (Vermesan et al. 2011; Vermesan and Freiss 2013). Communication-enabled things can measure, compute, monitor, and communicate information about a wide variety of data from the environments they are embedded in. In addition to laptops, mobile phones, and other types of familiar computers, we are increasingly encountering many small, often invisible, devices that are not typically thought of as computers.

A second IoT-related vision focuses on the networks themselves. Over the past decade, a variety of short-range, wireless technology standards have matured, including RFID, NFC, and wireless sensor networks based on IEEE 802.15.4. At this time, a variety of communication standards are still in development to connect these intranets of things to the Internet. To allow these intranets to connect to the global Internet, flexible, open standards are required.

The final vision guiding IoT development is semantic-oriented. In the near future, the data being collected by things will be enhanced by technical standards for linking structured data via the World Wide Web. This "linked data" allows machine intelligence to process the growing amount of data on the World Wide Web (Heath and Bizer 2011). Vermesan et al. (2011) describe things as:

> active participants in business, information, and social processes where they are enabled to interact and communicate among themselves and with the environment by exchanging data and information "sensed" about the environment, while reacting autonomously to the "real/physical" world events and influencing it by running processes that trigger actions and create services with or without direct human intervention. (p. 10)

Semantic specifications focus on how to organize, store, and search for objects and data related to the IoT. Attention focuses on developing software agents that can independently search and perform tasks over the Web and on the underlying communication standards that allow information exchange (Vermesan et al. 2011). Ashton (2009), credited with first using the phrase Internet of Things in 1999, argues that the purpose of IoT research is providing computers:

> with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. RFID and sensor technology enable computers to observe, identify and understand the world – without the limitations of human-entered data. (Ashton 2009, para. 5)

In addition to the technical foci outlined above, the Ubiquitous Network Society has been used as a guiding vision in national policy strategies. An influential report on the emergence of Ubiquitous Network Societies by the International Telecommunication Union (2005b) highlighted ICT policy initiatives by Japan, South Korea, and the European Union that focused on related technologies. Japan's u-Japan policy strategy (2004–2010) sought to realize the first Ubiquitous Network Society by 2010 (Ministry of Internal Affairs and Communications 2006). Moving forward from success in developing broadband infrastructure and use nationwide, u-Japan focused on the use of ICT to solve social problems, including caring for a rapidly aging population via Ambient Intelligence (e.g., smart homes that could monitor elders' well-being), protection against food contamination (e.g., by tagging and tracking foods for ease of recall), and creating early warning systems for natural disasters. This strategy was described as “a paradigm shift to a world in which ICTs become as natural as air or water” (International Telecommunication Union 2005b, p. 22). South Korea reformulated its ICT master plan (IT839, 2004) as u-IT839 in 2006, focusing on the integration of the “real” and cyber worlds (Oh 2008). Similarly, the European Union’s Directorate, General Information Society and Media began to focus on the IoT in 2005 under the i2010 policy framework for the information society and media (2005–2010) (European Commission, Community Research and Development Information Service 2012). The European Union has also funded the CASAGRAS (Coordination and support action for global RFID-related activities and standardization) program, in order to coordinate international issues related to the IoT. The CASAGRAS project seeks to foster development of a global infrastructure that links physical and virtual objects. In 2010, China also shifted its strategic ICT focus to the IoT, and it has become a focus point in China’s 12th Five Year Plan, guiding policy from 2011 to 2015 (“China working on unified national Internet of Things strategic plan,” 2010, July 5; Hvistendahl 2012). China’s coordinated strategic development has included the development of an IoT Center in Shanghai; development of the city of Wuxi (and other cities in Jiangsu) as an IoT industrial park and research and development center, and centers in the province of Guangdong focusing on standards development and building technical ties to Macau and Hong Kong.

Public Awareness and Discussion

The developments associated with the Ubiquitous Network Society are already present in many forms. However, many—such as tiny, embedded sensors or standards enabling linked data and machine analysis—are not visible or widely discussed by citizens. Corporate public relations and advertisements, as well as government policy visions, focus on the Ubiquitous Network Society as a way to fuel economic growth, enhance business and government efficiency, add convenience and self-feedback for consumers, improve physical security, and enhance scientific knowledge. The messages that the public encounters are techno-utopian narratives that envision ICT as a means to better human life, yet there is little critical discourse or inclusion of non-experts. These techno-utopian narratives imply that technological development is positive and necessary, and that ICT will dramatically alter the meaning and practice of life in the near-term future—for example, reducing income inequities, improving public health, or mitigating humans’ negative impacts on the environment. Essentially, this is a technologically deterministic view, suggesting that global ICT development is moving us towards an ultimate goal (*telos*). This view also suggests that ICT is separated from situated social, cultural, and economic phenomena: ICT affects our lives, but we have little influence in the development or rejection of technologies. Critiquing this techno-utopian and deterministic view encourages realistic assessment and greater public participation in the development of ICT and the communities it is embedded in. A number of Science and Technology Studies (STS) scholars have developed theories of technology and social change that more directly examine ICT and network-centric dynamics (Lamb et al. 2000; Kling 2000). The relationship between the social and technological is not limited to technology impacting the social realm—they are mutually arising phenomena, enmeshed with sociocultural, political, economic, or scientific aspects.

Risk society theorists (Giddens 1990; Beck 1992) argue that modern life is characterized by human-created risk borne of technological developments. Threats such as global warming or reliance on automated systems are embedded in technocratic processes that place little value on public input. Modern societies "both manufacture and must control risk. Risks are not just moments of danger as we forge forward: they are the process itself" (Woollacott 1998, p. 48). Increasingly, trust in the expert systems that enable them is eroding. Therefore, public policy makers must consider not only scientific data, but also global institutional networks and public attitudes. The process of risk assessment and decision making, currently left to the scientific and policy communities, must more actively engage the public. The techno-utopian vision of the future Internet is encountered by citizens in a variety of ways. The most visible manifestations include mobile phones and smart appliances. Global mobile subscriptions reached one billion in 2002, and in 2015 reached over seven billion (International Telecommunication Union 2013, 2015). Smart appliances enable consumers to monitor or communicate with home appliances such as washing machines or refrigerators. Corporate advertising and scenarios about the near-term future focus on convenience, connectivity, and social well-being. IBM, as part of their Smarter Planet strategy, has created a number of video advertisements with problem scenarios addressed by the IoT. In one, the town of Bolzano, Italy, faces caring for a growing elderly population. The video's narrative shows IBM's Smarter Cities team working with local authorities to outfit elderly residents' homes with sensors that enable the city to monitor their health and send workers to care for them based on this intelligence (IBM 2013). In another advertisement, IBM shows connectivity between cars, telematics data, and smartphone apps that are intended to add new, value-added services to consumers (IBM 2014). In addition to convenience, these scenarios are presented as a means for cost savings. Further, the underlying instrumentation of the natural world presents the opportunity for economic growth. In one video, networking equipment manufacturer Cisco describes the IoT (here, called the Internet of Everything) as the "new economy," hinting at the possibility of endless growth through data analytics. Governments' engagement with citizens in relation to the IoT has focused on describing potential social and political goods, such as health and assisted living, protection from terrorism or natural disasters, or intelligent transportation. A focus on techno-utopian possibilities leaves little room for critical reflection or discussion by citizens. There has been little attempt to understand communities' ideas about what constitutes a desirable future Internet. Involving citizens early on (i.e., problem identification, agenda setting) allows a broader range of concerns to be voiced and may also increase acceptance and public commitment in the overall planning process. Establishing such a dialogue also helps to educate stakeholders about emerging issues that may significantly affect their lives. Because the future is characterized by uncertainty, alternative methods for exploring possible futures via negotiation by multiple stakeholders can help us to shape more desirable outcomes. The second section of this chapter introduces the field of alternative futures studies, which underlies all discussions of the future Internet in the following chapters.

Uncertainty of the Future

Human beings are mostly interested in knowing the future. If we are able to know something in advance, we are able not only to use the knowledge to benefit ourselves or others but also to reduce our anxiety about the future. The future, however, continuously negates our efforts to know it beforehand and reminds us that it is more uncertain than we expect. Even so, we cannot help but move forward, trying to identify as many certainties as possible to guide our actions.

The same can be said in relation to the future Internet, which may change in unexpected ways while still playing a significant role in future human endeavors. Thus, we need to identify as many certainties as possible to make the best use of the future Internet. The most often used method to understand possibilities for the future Internet is to collect information that we consider useful for forecasting its development. We believe that such information is the best guide for understanding uncertainty. By collecting, processing, and analyzing such information, we seek to build a framework that acts much like a telescope through which we gaze out at the future Internet.

This information-oriented approach to the future may have stemmed from the approach adopted by most academic disciplines in their research (Dator 1996), aimed at distilling something certain from something uncertain. In this endeavor, information is essential, as findings always depend upon evidence from data analysis. One weakness of such an approach is that those disciplines unconsciously assume that they can determine, with certainty, future phenomena or events as long as they employ rigorous methods of data collection and analysis.

The technologically deterministic view of the future Internet exemplifies such an approach to the future. Those who adopt this view observe technological developments and societal changes in the past and present, analyze the relationship between them based on the belief that the former must be the cause of the latter, and then use the causal relationship to forecast the future Internet. This view, as well as those associated with most academic disciplines, misses an undeniable fact: regardless of what is assumed and believed by researchers, how much data is collected, and how sophisticated the analysis performed, the future continues to be uncertain.

By definition, the degree of uncertainty about the future is typically far greater than in the present: the future is unknown, and extrapolations based on present knowledge are unlikely to aid us in facing the future (Bell 1997; Inayatullah 2002a, b). Bell (1997) argues that, while our knowledge about the past can help us understand the validity of our beliefs, it is inadequate to deal effectively with unknown situations in the future. Thus, we need to alter our approach to examining the future.

A new approach is offered by an interdisciplinary academic discipline called "Futures Studies" and "Futures Research." What distinguishes futures studies from most academic studies is that it values and tries to *understand* the uncertainty of the future. Acknowledging the inherent uncertainty of the future helps us to expand our ideas about the unknown future. If we stick to and only value certainty, our options and choices end up very narrow. If we are open to uncertainty, though, we become open to various possibilities in the future. In fact, the concept of "possibility" is what futures studies most treasures and what other disciplines negate (Dator 1996).

Understanding the Future Internet through Futures Studies

In order to study the future Internet, futures studies provides us with the most appropriate perspective. In addition to its attitude towards uncertainty, futures studies has several characteristics that help us examine the uncertain future.

First, futures studies understands that novel events (not foreseen by extrapolation) will surely happen in the future (Bell 1997). While many events that occur in the future may look similar to events in the past, and these similarities enable us to plan for the future based on previous experiences, something unexpected or unthinkable has occurred many times in human history. One example is the appearance and/or spread of an entirely new technology. In the ICT arena, telegrams, the telephone, microwave transmission, satellites, fax, cellular phones, the Internet, and smart phones are all such technological developments, which had been unthinkable before. Each of these was transformative.

Second, a theoretical tenet of futures studies is that people's *images of the future* actively shape both individual and group action (Polak 1973; Bell 1997). Futures studies assumes that an image of the future is a prerequisite for human action, as this is what motivates us to action. Without an image, we are unable to move forward. As Rubin (1998) notes, "a person's orientation toward the future is based on making these mental images a part of reality and then directing his or her actions and decision making along the lines drawn by these images" (p. 499). Dator (2002) states that, "futures studies does not try to study 'the future', since 'the future' does not exist to be studied. What does exist, and what futurists can and often do study, are 'images of the future' in people's minds" (p. 7). According to Bell (1998), "no theory of society and social change is complete if it does not incorporate the idea of the image of the future" (p. 327). Thus, images of the future are key to understanding the contours of the future.

Third, futures studies claims that the shape and nature of the future will be determined by images of the future conceived by people living in the present (Bell 1997). People's images continue to change, their actions and behaviors deriving from those images change and, as a result, our future changes. Thus, the future is not completely predetermined. Although present circumstances do constrain the development of future events, *the future can be influenced by human action*. Clearly, human beings cannot control many aspects of the natural world, but we are able to control other natural and social events. Having the power to shape the future of human societies is one of the greatest privileges and responsibilities of human beings. Futures studies reminds people of this power and encourages them to use it wisely.

The characteristics of future studies outlined above suggest that a new image of the future will bring about a new kind of future. Therefore, we can conclude that the most effective way to forecast the future is not to focus on the most probable image but to examine multiple images of the future. While the dominant perspective is useful to show us a probable image of the future, futures studies helps us to pay attention to future possibilities in a much wider context. Thus, in order to see the future of the Internet, we should see it not from the dominant perspective, which is mostly derived from the past successes of the Internet, but from outside the established culture of the Internet, allowing new images to be explored and critiqued. The authors in the following chapters will elaborate a variety of images of the future from their respective unique perspective in order that the contours of the future are more extensively delineated.

Scenarios in Exploring the Future

An often used method in forecasting the future is an extrapolation of a variety of variables. The technologically deterministic view, for instance, uses this method to forecast the future from the trends in the present with regard to new technological developments. The extrapolation reflects an assumption unconsciously shared by many planners that the future will emerge as the extension of the past and the present (Heijden 1996). The extrapolation satisfies the need of planners, which is to find *an answer* as a result of their forecasting efforts. These planners believe that it is possible to forecast the future somewhat accurately and the endeavor for such a goal is worthy (Heijden et al. 2002).

Extrapolation may be useful when forecasting is done on the near-term future, where it is reasonable to assume that the present environmental conditions may not change much during the time frame. If this condition is not met, however, using extrapolation to forecast the future is quite problematic. For instance, it won't reveal what uncertainty remains because it focuses on revealing what can be declared certain (Heijden 1996). Extrapolation requires the planner to determine what the planner is interested in finding out in the future. Once this choice is done, any uncertainty falls of out of scope of the forecasting work. Also, extrapolation is often adopted when some ongoing strategy or policy needs to be supported in the future (Heijden et al. 2002). When this method is chosen with this agenda in mind, the resulting forecast will end up representing an artificial future.

Futures research/studies offers a better method of forecasting, *future scenarios.* Herman Kahn, who used this term for the first time, describes scenarios as "a hypothetical sequence of events constructed for the purpose of focusing on causal processes and decision points" (Kahn and Wiener 1967, p. 6). Wilson (1978) explains several key characteristics of a scenario: it is hypothetical and will never come true as it is depicted; it should not be the full details but only an outline; and, it is multifaceted and holistic in the approach to the future. He writes that a scenario seeks:

> only to map out the key "branching points" of the future, to highlight the major determinants that might cause the future to evolve from one "branch" rather than another, and to sketch in the prime consequences of a causal chain. (p. 226)

A scenario is an imaginary environment or sequence of events, one of an infinite number of "stories" that can be told about possible alternative futures (Schwartz 1996). They are not forecasts or presented as such. Rather, they are intended to displace readers from a present-focused mindset and enable them to "systematically explore, create, and test consistent alternative future environments that encompass the broadest set of future operating conditions" (Glenn 2009, p. 3). Scenario development is based on a holistic approach that recognizes the interdependence of social and technical system elements.

Heijden (1996) argues that in order to correctly understand the meaning of multiple data and information one's mental model needs to be multifaceted and holistic. Alternative futures scenarios are thus an effective tool by which one's mindset is trained to be open to a variety of information. Heijden et al. (2002) state that scenarios help people to confront unexpected changes and uncertainty, to give a chance to examine one's mental model, to broaden it, and to correct their inherent aversion to the uncertain future.

To create a scenario, a focal issue and "driving forces" that are at work in the present are identified, along with a few key trends or events that could lead to significant changes in the future. These include key factors in the local environment and driving forces in the macro-environment, i.e., major trends in society, technology, politics, the economy, and the environment (Schwartz 1996).

This book is a collection of such future scenarios. It presents not only visible, but also invisible, facets of alternative futures. How the future Internet will appear, its shape, and functions all depend on what assumptions, values, and ideologies present, as well as future, generations choose. We would like to see that critical decisions are made consciously and not by a small number of powerful stakeholders but by all beneficiaries of the future Internet. We expect that the following chapters will help achieve this goal.

Introduction to the Chapters

The following chapters convey different perspectives about the future Internet, highlighting many different uncertainties and preferences.

Rex Troumbley ("Coercive cyberspaces and governing Internet futures") examines how early images of cyberspace that viewed Internet freedom as a technologized neoliberal marketplace of ideas shaped discourse about the Internet, then analyzes how economics, security, and environmental change shape the future of the Internet. Using Google as a case study, he shows how Internet companies direct development towards corporate visions and shape users' behaviors so that users act as predictable consumers. He also examines the creation of an alternative system of Internet governance based upon "multistakeholder" principles, and argues that this process is part of a corporate futures vision that monopolizes creativity.

Mario Guilló ("Futures of participation and civic engagement within virtual environments") examines the gap between the theoretical potential and the actual performance of the Internet in relation to civic engagement and presents a typology of those participation processes that are taking place within social networks, focusing on the forces that could influence the way in which citizens participate via the Internet in coming decades. He examines several participatory foresight initiatives taking place over the Internet and describes challenges related to increasing the participation of different actors in the common task of solving global problems and taking concrete action.

Sohail Inayatullah and *Ivana Milojević* ("Power and the futures of the Internet") explore power and the futures of the Internet. While speed and access have led to new applications that can help the disadvantaged, the deeper transformative change, to date, has been the power of the few to dramatically influence the many, and centers of (former and current) power continue to receive much more attention than globally marginalized spaces. They examine how, as the future Internet extends its reach into space and the deep inner spaces of our minds, power will be circulated and explore whether reality will always be a realist zero-sum game.

Sirkka Heinonen ("The future of the Internet as a rhizomatic revolution toward a digital meanings society") challenges the idea that we can separate technology from natural life. She describes the current evolution of the Internet according to a rhizomatic model, where knowledge is not disseminated systematically or logically based on a hierarchical binary tree-model, but follows the organic way of rhizomes to grow in all directions, penetrating all available niches. She claims that this new model heralds a *digital meanings society*, where people using the Internet are empowered in their search for meaning in all activities and meaning becomes the main capital.

Aubrey Yee ("An Internet of Beings: Synthetic biology and the age of biological computing") describes the pending merger of biology and technology, where synthetic life will become indistinguishable from natural life. She describes the Internet as playing a central role in the production of synthetic life forms by providing the platform for global collaboration—the capacity to literally transport life through space via strands of DNA code. She notes that advances in bioengineering have blurred the distinction between beings that are built and those that are born, and discusses the ethical, cosmological, and political challenges that accompany this transition to an Internet of Beings.

John Sweeney ("Infectious connectivity: Affect and the Internet in postnormal times") uses the concept of Postnormal Times to investigate the Internet's infectious connectivity, exploring the emerging forces and issues pushing and weighing the Internet in the years to come. Wielding black swans, black elephants, and *black* *jellyfish*—a new concept for emerging issues analysis—to seed scenarios for and within the context of postnormal times, this chapter uses the Three Tomorrows method to construct and extrapolate the concept of infectious connectivity, which aims to understand the ways with which Internet-related factors and forces can and might affect our all-too-human bodies.

Jenifer Winter ("Algorithmic discrimination: Big data analytics and the future of the Internet") discusses several technical changes related to the Internet—the social semantic web and linked data, the instrumentation of natural and social processes (e.g., Internet of Things), big data analytics, and cloud-based facial recognition—focusing on several related threats. As billions, or trillions, of everyday objects, including the human body itself, are equipped with sensors, a variety of new types of data will be collected, aggregated, and linked to other personally identifiable records. She argues that these changes transgress personal privacy boundaries and lead to unjust algorithmic discrimination and loss of anonymity, resulting in undemocratic shifts in power.

Ana Bossler ("Metadata analytics, law, and the future of the Internet") draws on Bauman's (2006) concept of a fluid society, where the Internet emulates market networks, to describe the growing strategic importance and value of personal information. From a legal perspective, she discusses the rise of metadata analytics and a growing economic model where citizens are the product. She argues that the Internet, as a new political-economic space, has established a new frontier where the relationship between constitutional law (i.e., the political dimension) and regulation (i.e., the economic dimension) has the potential to produce a new legal framework that takes these challenges into account.

Rolv Bergo and *Dan Wedemeyer* ("Information, noise, and the evolving Internet") argue that, as mobile standards and devices continue to advance, we will be connected in a much more symbiotic way. Instead of accessing the Internet using traditional means, more dynamic interfaces like speech, presence, gestures, and thought control will evolve and be seamlessly integrated into our daily lives. Drawing on Anthony Giddens's (1990) concept of reflexivity, they examine technical changes related to the near-term Internet, the growing tension between information and noise (misinformation and disinformation), and discuss implications for the policymaking process.

José Ramos ("Liquid democracy and the futures of governance") argues that Internet technologies, coupled with new political cultures, herald radical transformations in democratic decision-making. He examines how emerging technologies deepen democratic participation, how we might avoid or transform futures where the Internet is employed to maintain political-economic oligarchies of power, and what new political cultures and contracts may emerge through the convergence of the Internet and political engagement. Using the example of the recent Liquid Democracy on-line decision-making experiments in Germany, he argues that we are witnessing a shift from formal representative democracy to situational and fluid forms of governance.

Enric Bas ("The Liquid Self: Exploring the ubiquitous nature of the future Internet and its pervasive consequences on social life") examines the role of the Internet in socialization processes and identity formation worldwide. He argues that human beings are at a historical crossroads resulting from both existing and potential technological advances that may induce radical bifurcations concerning social change and human evolution. He notes that we are heading towards the convergence of physical and virtual worlds via the Internet of Everything; with true ubiquity of the Internet and no option for voluntary disconnection, the relationship between machines and humans will be altered.

Conclusion

This introductory chapter described the dominant techno-utopian vision of the future Internet that guides corporate and governmental strategies. The chapter also introduced the field of alternative futures studies, a means to perform systematic thinking about alternative futures that underlies all discussions of the future Internet in the following chapters. It was argued that current discourse leaves little room for critical reflection or discussion by citizens about what constitutes a desirable future Internet and that establishing such a dialogue is essential. It is our intention that this goal will be furthered by the work presented in this volume.

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