



Future of Internet

Bit Bang 4

Yrjö Neuvo & Elina Karvonen (eds.)

Aalto University's Multidisciplinary Institute of Digitalisation and Energy (MIDE)



Bit Bang IV

Future of Internet -
Societal, business, governance
and technological aspects

ISBN 978-952-60-3610-6 (PDF)

Cover: Petri Saarikko
Layout: Unigrafia / Mari Soini
Printed by: Unigrafia, 2012

Table of Contents

FOREWORD	4
REFLECTIONS ON BIT BANG 4	7
FUTURE OF INTERNET - SOCIETAL, BUSINESS, GOVERNANCE AND TECHNOLOGICAL ASPECTS	9
Are We All Criminals?	10
Back to the Future – Prediction of Incremental and Disruptive Innovations	33
From Democratizing Innovation to Innovating Democracy	64
Proliferation of the Crowdsourcing Phenomenon	94
Internet, Find Me a Job!	111
Gamification of Life: the Rise of Gaming and Its Effects on Society	133
How to Control the Internet? – A Complexity Perspective	167
Education Reloaded: From Socrates to Udacity. The Consequences of the Internet Changing Human Cognition and Work	192
SCENARIOS	217
Introduction to the Scenarios	218
Internet, Find Me a Cure	219
High Tech Nationalism	225
Internet Kindergarten	230
Trader's Network	237
APPENDICES	243
1 The Bit Bang People	244
2 Bit Bang Guest Lecturers Autumn 2011–Spring 2012	246
3 Course Literature	247
4 Study Programme in Tokyo	248
5 Tokyo Study Tour Reports	251

Foreword

Bit Bang – Future of the Internet: Societal, business, governance and technological aspects was the fourth multidisciplinary post-graduate course for doctoral students at Aalto University. Altogether 24 students were selected from five Aalto University Schools: School of Arts, Design and Architecture; School of Economics; School of Electrical Engineering; School of Engineering; and School of Science.

Bit Bang is part of the MIDE (Multidisciplinary Institute of Digitalisation and Energy) research program, which the Helsinki University of Technology started as part of its centennial celebration of university education and research. Professor Yrjö Neuvo, MIDE program leader, Nokia's former Chief Technology Officer, is the force behind this course.

The essential learning aims of the course were teamwork, multidisciplinary collaboration, global perspective, industry and business foresight, and scenario building. The passing the Bit Bang course required active attendance at the lectures and seminars as well as writing this joint publication based on the autumn and spring group works. The texts were written by doctoral students presenting their views.

During the academic year 2011–2012, the doctoral students discussed the societal, business, governance and technological phenomena that might affect the future development of the Internet. During the autumn semester, the students produced reports on the following four topics: Are We All Criminals?, Back to the Future – Prediction of incremental and disruptive innovations, From Democratizing Innovation to Innovating Democracy, and Proliferation of the Crowdsourcing Phenomenon. The textbooks for the autumn semester were the previous Bit Bang publications (I-III)

and Wireless Foresight – Scenarios of the mobile world in 2015 by Bo Karlson et al. (2003). Distinguished guest lecturers from industry and academia complemented the textbook material.

The spring teamwork topics were: Internet, Find Me a Job!, Gamification of Life: The rise of gaming and its effects on society, How to Control the Internet? – A complexity perspective, and Education Reloaded: From Socrates to Udacity. The textbook for the spring semester was Born Digital – Understanding the first generation of digital natives by John Palfrey and Urs Gasser (2008). In addition to the lectures and textbooks, the Bit Bang group made an intensive study tour to Tokyo, Japan.

To complement the themes discussed in the reports, the groups also produced short scenarios of the future in the 2020s. As a result, the second part of this book introduces four scenarios – Internet, find me a cure; High Tech Nationalism; Internet Kindergarten; and Trader's Network – with innovative and eye-opening approaches to the future.

We want to give our special thanks to Petri Saarikko for the Tokyo-inspired cover design and Anastasiia Gulimonova for her incisive illustrations in the fifth Chapter, Internet, Find Me a Job.

Hopefully the wide-ranging conversations that preceded the chapters will inspire the reader as much as it inspired the writers. We wish you captivating moments with the book!

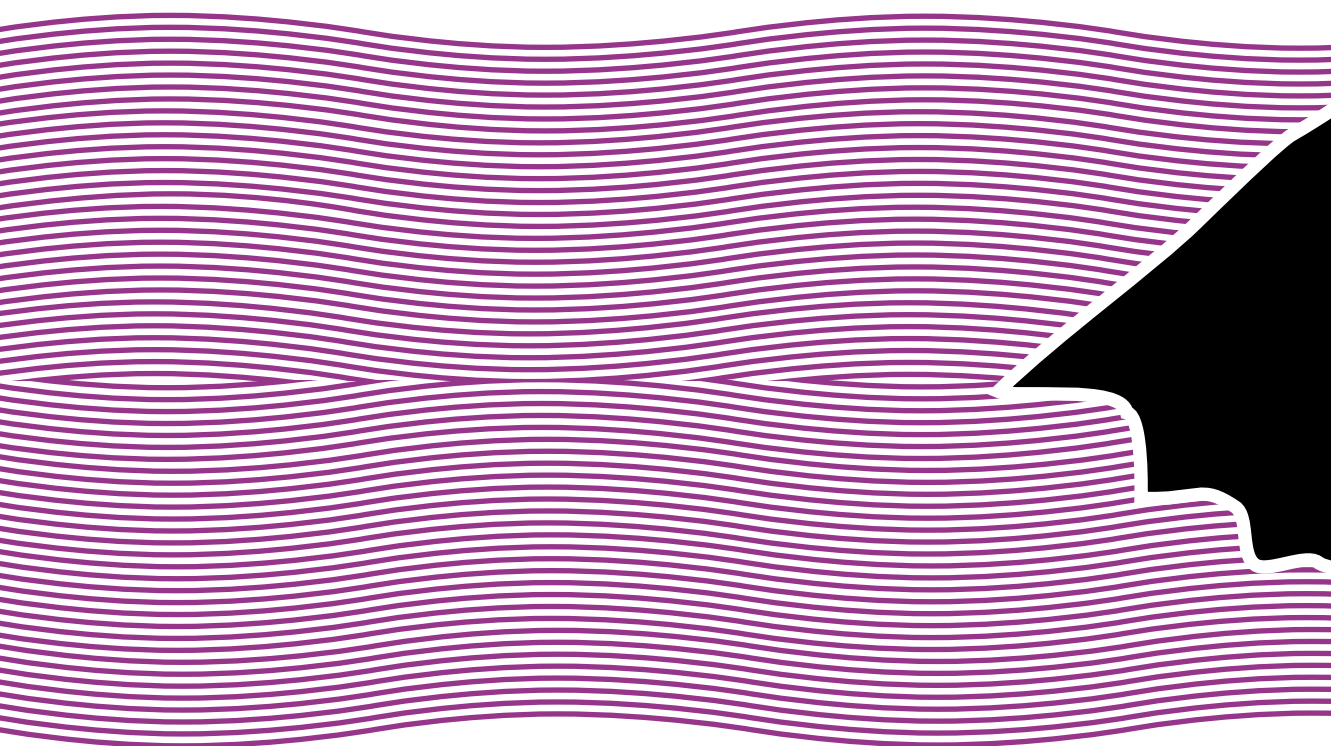
Yrjö Neuvo & Elina Karvonen

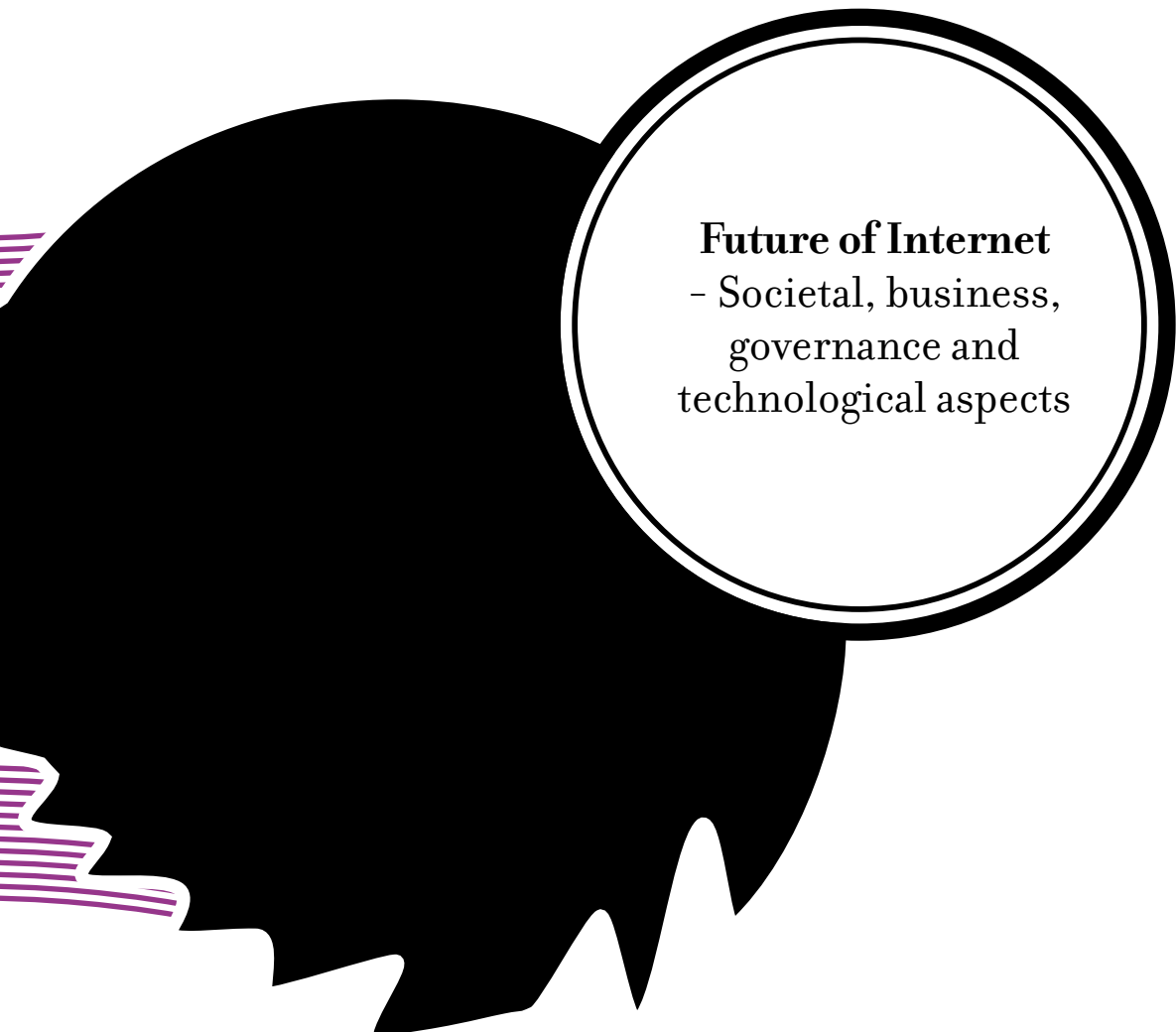
Reflections on Bit Bang 4

I have to say that it was my strategic mistake to participate in the Bit Bang on my first PhD year. It has most probably ruined all the future courses I planned to participate. This course is nothing like all other courses I took or will take in future, and I definitely enjoyed it the most. Not only because of eye-opening visiting lectures and extremely interesting follow-up discussions; not only because of our multidisciplinary team and pleasure of being able to make the group actually work as a group; not only because of priceless lessons I've learned about managing the work of other people; not only because of our amazing trip to Japan... It's all this and much more!

I was going to say at the end that I was terribly upset about the fact that this year's Bit Bang was the last one... Luckily, it is not! So, I wish the Bit Bang 5 to be at least as good as Bit Bang 4. I now start feeling jealous of next year's bitbangers: they have so much interesting stuff ahead of them! And I need to learn how to live with my Wednesday afternoons free.

Evgenia Litvinova





Future of Internet
- Societal, business,
governance and
technological aspects

Are We All Criminals?

Andy Best-Dunkley¹, Mário Costa², Hendrik Hielkema³, Suleiman A. Khan⁴,
Evgenia Litvinova⁵, Kari Visala⁶, Nam Vu Hoang⁷, and tutor Timo Kiravuo⁸

¹ Aalto University School of Arts, Design and Architecture, Department of Media
PO Box 31000, FI-00076 Aalto

² Aalto University School of Electrical Engineering, Department of Signal Processing and Acoustics
PO Box 13000, FI-00076 Aalto

³ Aalto University School of Economics, Center for Knowledge and Innovation Research
PO Box 21225, FI-00076 Aalto

⁴ Aalto University School of Science, Department of Information and Computer Science
PO Box 15400, FI-00076 Aalto

⁵ Aalto University School of Science, Department of Media Technology
PO Box 15400, FI-00076 Aalto

⁶ Aalto University School of Science / Helsinki Institute for Information Technology HIIT
PO Box 15400, FI-00076 Aalto

⁷ Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

⁸ Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

{andy.best, mario.costa, hendrik.hielkema, suleiman.khan,
evgenia.samochadina, kari.visala, nam.vuhoang, timo.kiravuo}@aalto.fi

Abstract

Over the last two decades, the Internet has grown into a global network with millions of users, offering our society many new opportunities. At the same time, law and ethics have not evolved alongside and hence do not reflect current online practices. When ordinary people use the Internet, they make decisions based on the law from the physical world, their personal moral principles and the behaviour of people around them. As a result, they can break the law unintentionally or on purpose, or act legally but immorally, therefore becoming *criminals*. We present three relevant examples, showing how law, ethics and actual behaviour often run into conflict. Then, we analyze the origins of each problem and ordinary people's motivations for their

actions. Finally, we discuss how different sources of regulation, namely law, ethics, the market and technical architecture, can influence the given examples. In this paper, we do not aim to find the optimal solution or predict the future. Instead, we discuss possible ways to regulate the existing situation and how such regulation can lead to the Internet of the future.

Keywords: Internet, crime, copyright, hate speech, online privacy, regulation

1 Introduction

The word criminal is colloquially used to label a person who intends to or has broken the law, i.e., committed a crime. In this paper, we are especially interested in a wider definition that covers everything in the grey area between legal but immoral behaviour, and illegal but morally or ethically justified actions. We focus on crimes that are committed by ordinary people *en masse* on the Internet. Such actions are interesting to study in detail since they do not clearly fit into the typical concept of crime. Understanding the causes and consequences of such behaviour can point to the need for making changes in both the norms and the laws of our society or for rethinking the architecture of the Internet.

In order to accurately specify the conceptual framework in which we operate, we first define a community as a social pattern, where individuals take different roles. This is a general definition and covers everything from transient interactions between a cashier and a customer in a shop to the role of citizenship of a country.

Typically, communities have different types of control mechanisms, which are set up in order to limit the actions of individuals participating in the social interaction. This needs to be understood in a very abstract sense. Examples of such control mechanisms include anything from the judicial system (law, police, and prisons) to moral norms passed down from parents to children. Crime, in the widest sense, is then defined to be a concept relative to the control structure that it violates, and in the usual case, the concept refers to breaking the laws of a community. A person who commits a crime then becomes a criminal from the point of view of that community and breaks the social contract of his or her expected role, thus potentially becoming an outsider to the community in question.

In a well-functioning community, crimes must only account for a small enough proportion of actions so as not to jeopardize the existence of the society in the first place. For example, it can be said that society ceases to exist in the case of widespread looting after large-scale natural disasters. If the majority of people commit minor crimes of some sort, this can often be interpreted as a discrepancy between the optimal strategies for individuals and the currently erected control mechanisms that have not adapted or stabilized to the contemporary situation.

In this paper, we focus on the effect of new technologies, specifically the Internet, and how it causes the control mechanisms of our society to be out of sync with the current social environment, thus creating pressure for many ordinary people to commit acts that are either criminal or immoral. The Internet has developed spontaneously, without any predefined model or strategy. Since the 1990s, when the Internet secured its position as the leading network architecture, and as the single global public information network, it has had more and more influence on all areas of life: in the public sector, in private life, and in corporate activities. The World Wide Web was developed in the early 1990s, but by the year 2006, 70% of American adults over 18 were using the Internet [1]. Technologies such as mobile phones capable of running web browsers and ubiquitous Wi-Fi access have recently made the Internet even more pervasive. This change has been profound, and as people manage their businesses and identities more and more online, actions in the digital world have real and important consequences for them. Most people are comfortable with the increasing capabilities in communication and data exchange that the Internet provides, but they do not recognize the growing implicit threats to themselves and society, such as violations of privacy, information security, and copyright protection.

The basic assumption underlying our paper is that technological changes happen before their social consequences are widely considered. Each new technology creates fresh possibilities for individuals and, in a way, “changes the rules of the game”, which then creates the need to adapt the existing control mechanisms to the new environment. When this adaptation is not successful, the differences between the digital and physical worlds produce a lack of correspondence between the laws from the physical world and possibilities and practices on the Internet. This encourages people to evade existing laws and behave according to the ethics and morals of the Internet society.

The judicial system in the physical world has evolved for a long time together with society and its norms. Existing laws are often simply adapted in a straightforward manner to the new situation created by technological advances. At the same time, cultural norms advance in an incremental way. People learn during their early childhood behavioural practices from their parents and peers, and from cartoons and fairy-tales, and this process continues while they grow up. As a result, the average adult understands the basic laws and norms governing our society. The Internet, as a disruptive technology, introduces a discontinuity in this evolution. When a person accesses the Internet for the first time, he or she faces a whole new world of possibilities without any knowledge of what is allowed or accepted as appropriate behaviour.

When a lot of ordinary people commit minor crimes daily, social tension on the Internet increases. Due to the lack of proper education, Internet users’ behaviour is often based on mirroring other users’ actions. People learn about the possibilities of the Internet from their colleagues, family members, and friends. Because they do not consider these people as criminals, they do not question whether those potential actions are legal. So this questionable behaviour is easily spread among the population.

Another related issue is the effect of the “Broken window” theory [2]. Even a normally law-abiding person might change his or her mind after observing how other people continuously perform fringe activities, which he or she is hesitant to do. When the overall social climate is not constructive, the number of “minor” crimes can increase.

It is a common perception that, because of the nature of the Internet, people can act anonymously and there is a very low possibility that they will be held accountable [3]. Moreover, some users may not see the consequences of their actions in the Internet as affecting the physical world.

The rest of the paper is organized as follows. In the next section, three examples are presented where ordinary people perform activities that can be considered illegal and/or immoral. These include intellectual property rights, hate speech, and personal data (or privacy) made public. In Section 3, we examine the legal and moral issues related to these examples and discuss motivation and technical aspects as well. Section 4 presents four sources of regulation. Section 5 discusses how the examples can be regulated. Section 6 concludes this work.

2 Examples

2.1 Example 1: IPR

► **Definition.** Intellectual Property Right (IPR) allows the owner of intellectual property – such as music, literature, and artistic work – to control and charge for its use. Intellectual Property Rights are broadly categorized into two major types: (1) Copyright, which provides the owner the right to control copying of his or her artistic and literary work. As it is generally a “right to make a copy”, the owner also has the right to be credited for any copies made; (2) Industrial rights, including rights like trademarks, patents, and trade secrets, which give exclusive business usage rights to the owners of their logos and inventions. Within this scope, different criminal activities can be discussed. One of them is copyright infringement, more specifically the unauthorized copying of software and music.

IPRs exist and are used in both the physical and online worlds. With the development of the Internet, good quality copies, distribution, and storage of intangible items such as e-books, software, music, films, etc., has become easy and cheap. Unlike in the physical world, where only the owner of the object can use and get its benefits, the Internet allows unlimited use of a single item. Many ordinary Internet users, without an understanding of IPRs, go on to use the creations of others without obtaining permission to do so. Strictly speaking, in terms of existing laws, any unauthorized use of an item protected by IPR is criminal in nature. The IPR owner of the item considers any unapproved copying as a deprivation of his right to be credited for the copy. However, in some cases there are dissonances with analogies from the

physical world, such as “whether it is possible to lend a piece of digital music to a friend in the same manner as it is possible to lend a physical book”. Even though the IPR legislation differs between countries, the purpose is fairly similar across the globe.

► **New situation.** IPR law might be misused to chill legitimate activities [4]. For example, copyright law could be used to silence other people’s negative opinion. A person could get an email saying that the information he or she has placed on a web site is under copyright protection and the company asks to remove it. In reality, no law is broken because it is a case of fair use, but an ordinary person does not know the law in detail. The company wants to remove negative information about its products or services from the Internet.

Generally, this affects freedom of speech and restricts the progress of new discussion opportunities provided by the Internet. Anti-circumvention laws slow the progress of several areas of research, such as encryption research or development of interoperable products [4]. It also affects the life of ordinary people when they face goals that can be achieved only with circumvention and the goal is not criminal. For example, can a parent use circumvention to protect his child from content on the Internet? Or can a person attempt to break privacy software in order to check how protected his computer is?

► **Motivation.** One important motivation has been described in the Introduction. People commit a crime unintentionally because they are not aware that it is a crime, mainly because of their lack knowledge of the law and Internet skills.

People who realize that their actions are breaking the law fall into one of two categories. In the first category, people find it acceptable to commit a crime because their motivation justifies their actions. In the second category, people find it unacceptable to break the law, but they still do it because they have no other option. Possible motivations include: purpose of use, such as use for education; economic reasons, such as the high cost of the copyrighted object; the unlikelihood of being caught and prosecuted for this kind of crime; the ease of breaking the copyright and the belief that everybody does it; the legal procedure for obtaining the item is much longer and more complicated; and the impossibility of legally purchasing the object. Also, some people believe that copyright law is old-fashioned and inappropriate to the current situation, and they intentionally act against it [3].

People find it unacceptable to copy out of concern for the law much more than for moral reasons [3].

The cost of copying and storing bits has approached zero at an exponential rate and, at the same time, it is impossible to control how users can manipulate information they have access to. Thus it is difficult to use traditional business models developed for the mass production of physical objects because nothing prevents users from simply copying the data they need. Copy protection methods and new business logic have so far been somewhat artificial and have considerably reduced the potential

benefits offered by an unlimited supply of virtual goods. It often happens that a customer who pays for an item such as a DVD movie gets an inferior experience to users who illegally copy the movie from the Internet. For example, anti-piracy warnings and advertisements are typically cut from the pirated versions. In addition, complex copyright law makes it more difficult to remix existing information and produce something new from it, even though this is the basis of all new cultural development.

With dramatic increases in the communication speed, storage capabilities, and anonymous copying and distribution of items (through peer-to-peer networks such as BitTorrent) over the Internet, copying content has become very easy. Because storage is cheap, nothing needs to be deleted, and any leaked confidential information tends to spread, making it impossible to contain it again. Therefore, the stupid deeds done at a young age can follow a person for the rest of their life.

The problem appears when there is a difference between the digital and physical worlds. For example, as to the copyright issue: you can copy the thing without stealing it, and the previous owner will still have his copy; the cost of copying is relatively low; customers can also redistribute the content, whereas in the past, only unauthorized producers could do that; finally, the reasons for restricting unauthorized distribution of the content are mostly economic.

The ongoing continuum in the technical growth of the Internet, such as faster connection speeds, vast availability of digital content, and anonymous peer-to-peer networks, are expected to make legal and illegal copying of content much easier. More interestingly, the expected new technological developments (such as 3D scanners that can scan tangible objects in the real world for making digital 3D models; and 3D printers like the RepRap and Makerbot, which can print digital models to replicate items in 3D) will open up a whole new world of IPR issues. It will become possible to purchase a single physical item and make unlimited copies of it thereafter. Though fascinating to an average user, for the owner of the copyright, it appears to be illegal copying of their product. Furthermore, it opens up new security issues, where someone might be able to scan and print a copy of your car key, for example.

The fundamental change “from atoms to bits” was discussed through many examples by Nicholas Negroponte in 1995 [5]; he noted that everything is currently being digitized into bits that can be handled by computers (and networks). The Internet has largely been following the prediction [5] that the operators will become only providers of dumb bit pipes instead of services, where the price of a transferred bit can greatly vary. The services can freely evolve in the Internet and be offered by anyone, and it can be said that we are moving from atoms to bits, from the physical to the virtual, in every area where it is possible. The uses of the Internet range from consuming virtual goods and communicating using multiple tools to the delivery of computing itself as an internet service (i.e. cloud computing).

This is a natural development because bits can be copied, transferred, and manipulated at almost no cost. The limitations of the physical world are removed in the Internet, and anything with a known algorithm can be immediately implemented

from bits. For example, it is impossible to “undo” actions in the physical world. It could be claimed that the core of our culture is gradually migrating to the Internet. And similarly to the tendency to replace hardware with flexible software solutions, the Internet is interfaced with the physical world only at the last possible point. It has been further claimed [6] that in the future, “we will live in the Internet”, which will be more personalized, interactive, context-aware, and semantic.

2.2 Example 2: Freedom of Expression and Hate Speech on the Internet

► **Definition.** According to Raphael Cohen-Almagor, hate speech is malicious speech deliberately discriminatory and intimidating, aimed at a specific person or a group depending on their actual or perceived characteristics. The intention of the speech is to dehumanize, harass, and degrade. Most often, this is based on gender, race, ethnicity, color, national origin, or sexual orientation [7]. The aim of hate speech is to desensitize the reader to the plight of the targeted group, to transform them into “the other”, something removed from “our” society. Hate speech, as with other hate crimes, is often done in groups [8].

► **New situation.** The rapid growth of the Internet and the World Wide Web has seen a similar increase in the amount of racist and hate speech material available in all media forms online, whether dedicated websites (over 8000 in 2008 according to the Simon Wiesenthal Center [9]), discussion forums, email lists, Facebook pages, or videos on YouTube.

Such a noticeable growth is explained by the fact that the Internet has several technical characteristics that facilitate hate speech activities. In the real world, a person often restricts him or herself in expressing radical hate speech publicly (and especially in the presence of victims) because of the possibility to be arrested or to be physically attacked. The Internet provides an environment where a huge variety of views are readily available and easy to find using search engines.

Like-minded users can find communication channels for their hate speech, and even relatively unpopular ideas can seem to have a large supporting community when it is gathered from the global population. Furthermore, as the usual practice in many message forums, websites, and blogs is to use pseudonyms instead of the real identity of the person, the discussion is not filtered by propriety and the need to protect one’s future reputation. The easy user interface of many online services for publishing globally visible comments at any time also lowers the threshold of virally spreading ideas, and our intuitive filtering is adjusted to situations where we are physically aware of the other persons we are communicating with.

► **Motivation.** People make hate speech when they see a problem and don’t have the possibility or desire to do anything other than talking. Problems may not be directly related to the group, but people generalize and find the evil group of people to blame.

For example, hate speech can increase the self-esteem of the peer group. Trying to change the opinions of others is usually a cheaper way to advance one's goals than taking direct action, and the Internet provides the perfect tool for anonymously disseminating political messages.

In online communities, when a person sees that other members of the conversation feel able to express hate speech, he or she can also express an opinion in a more radical or offensive way. Differing views are not often visible because everyone can choose exactly what they are interested in seeing and the narratives between different groups can more easily become fragmented compared to a world where mass media channels were the main method of acquiring information. Therefore, an active orientation to find new sources of information and open-mindedness may be required. On the other hand, boundaries based on geographic location and language will become less important.

The right to free speech has been one of the cornerstones of the Internet since its earliest days. Having been born of a cross-fertilization of U.S. military technology (ARPANET) and radical West Coast counter-culture ideals highly skeptical of centralized governmental control and surveillance, freedom of expression and the possibility to remain anonymous while doing so have remained central pillars of many Internet civil libertarians' beliefs. Yet the right to free speech has a darker side. Since the earliest online bulletin boards and discussion forums, certain groups and individuals have used the Internet to spread hate speech and other extremist beliefs. By the late 1980s on Usenet, the "alt.*" newsgroups had already appeared specifically to enable continued freedom of expression in the face of emerging content censorship by service providers. Particularly within the alt. newsgroups, extreme discussions concerning religion, ethnicity, and sexual orientation were prevalent. In 1995 the first extremist white power website, Stormfront, was launched by former Klu Klux Klan member Don Black in order to spread racist, bigoted propaganda to an Internet audience. As Black has said, "The Internet is that opportunity we've been looking for ... We never were able to reach the audience that we can now so easily and inexpensively" [10].

The freedom of expression libertarians will protect the rights of racists and bigots due to an unyielding faith in the First Amendment to the US constitution – the right to freedom of expression and free speech in all cases. They believe that restricting neo-Nazi material online would in effect be worse than allowing it to be published. Unfortunately the evidence shows that allowing someone to say or do something hurtful to others, increases the chances that he or she will do it again. It is also much more likely that bystanders will copy the behaviour (the "open window" syndrome mentioned earlier). Therefore, the easy spread of populist, racist, and nationalist propaganda via social media creates its own means to an end – society starts to accept this behaviour as normal, the victimized group (whether immigrants, gays, or ethnic minorities) become "deserving" of their victim status, and therefore any verbal or physical action against them is legitimized. Just as the Jews in Nazi Germany were

portrayed as corrupt money lenders who deserved their fate, today's immigrants in Europe are portrayed as lazy exploiters of state (and therefore taxpayers') money. The politicians behind these populist nationalist movements are eloquent orators who are well versed in treading the thin line between legality and criminal incitement. For example, in the case of Dutch politician Geert Wilders' acquittal of incitement to hatred lay in his clever use of words (against Islam, a religion, rather than against Muslims as people and individuals) [11]. Similarly, Finnish members of the Perussuomalaiset party frequently run into trouble for using what they regard as "common language" to describe immigrants and claim that everyone understands them when they talk this way. Society has allowed racist speech to become acceptable, which breeds fear and causes exclusion for those on the receiving end. Throughout Europe there has been a significant shift towards a nationalistic and discriminatory culture against those regarded as outside "normal" society. The ordinary person posting to a discussion forum or blog may not even regard themselves as racist, yet use language that hurts mentally and possibly can lead to incitement of physical violence against minority groups.

Of course not all hate speech is directed at immigrants, gays, and people of color. In a significant case in June 2010, Judith Butler, renowned gender theorist and writer, turned down an award from the Berlin (gay) Pride due to the organization's close connections with Homonationalist movements and groups said to be actively racist and anti-Muslim [12, 13]. Gay white males see conservative Islamic immigrants as a threat to their way of life and actively use the Internet to spread Islamophobia among their own community. Black rappers have also come under the spotlight for racist lyrics idolizing violence against whites, and just as in some cases of white racist attacks, black criminals have been found to have been inspired by racist music. Some might argue that this proves there is nothing wrong or unusual with white racism, but it's a fact that there has been no historical long-term systematic violence against white people in the same way as that perpetrated against Africans during the slave trading era. We live in a post-colonial world where wounds still run deep, and in many societies people of color are still repressed and at the bottom of society. It is therefore natural to maintain that protection of minority groups within society from hate speech must be a top priority.

What can be done against hate speech? Many argue that an effective way to combat hate speech is to expose it for what it is. But how can one have a dialogue with bigots? More effective is education, preferably started at an early age. It is important to stress to young children the common values of living together with people from different backgrounds before they can get contaminated by racist ideas. White supremacist websites have deliberately targeted school children, offering them free racist stickers and CDs. On social media sites such as Facebook, a kind of citizen watch is possible, looking out for and reporting unacceptable behaviour and posts. There are also a number of anti-racist groups founded on Facebook such as "1,000,000 against the BNP", as well as others against homophobia and other forms of hate speech.

Companies can be forced to take down offensive material, or at least pressured by bad publicity into doing so. On the other hand, in most countries Internet Service Providers (ISPs), as common carriers, have a responsibility to pass any traffic offered. Forcing ISPs to become censors creates many problems, as they would become open to lawsuits both for failing to censor and for breaking the censored parties' rights. In addition, quality censorship is not cheap, especially pre-publication censorship, and public opinion may be against the censorship.

In many cases, it is very difficult to effectively use the law to prohibit online hate speech due to differing national laws and attitudes toward freedom of expression. For example, in a landmark case, *Yahoo! Inc. v. La Ligue Contre Le Racisme et L'Antisemitisme*, two French student organizations brought charges against Yahoo! for offering Nazi memorabilia for sale in France through their auction site. The original case was won in France, but Yahoo! appealed the decision in California in the U.S., where the court's decision was that to enforce the original French ruling would be in breach of the First Amendment to the U.S. Constitution [14]. As the vast majority of hate speech websites are hosted on ISPs in the U.S., European lawmakers cannot take action against them even when the sites are clearly aimed at local European audiences. Within Europe, steps have been taken to tackle cybercrime on a multinational level. The Council of Europe's Convention on Cybercrime is a serious attempt to control various forms of online activity such as child pornography, copyright infringement, and fraud. The U.S., having observer status at the Council, signed and ratified the convention only after the Internet Hate Speech protocol was removed [15]. In addition to national and international regulations to prevent hate speech online, individuals and organizations can block and prevent access to websites and services by using firewalls and filters. This can be particularly effective for schools as a way to prevent pupils accidentally coming across offensive materials.

Generally, the social attitude towards hate speech is negative. However, because of the attitude towards the Internet as a virtual world without many connections to the real world, people often take Internet hate speech less seriously than the same opinion expressed in the physical world. This includes people who do hate speech, their victims, and strangers who observe it. Such opinions might facilitate public hate speech even more.

Each country (except the U.S.) has laws against hate speech, which cover both the real world and the Internet. The problem with hate speech laws is the impossibility of clearly defining what hate speech is and what it isn't. The border between being intentionally insulting to somebody and having a personal negative opinion is relatively vague in most non-extreme cases. Because of that, there is a conflict between freedom of speech and restrictions on hate speech. It is possible to misuse hate speech laws to aim for chilling effects or manipulate other people's opinions.

Nowadays, a single law covers both offline and online hate speech. Nevertheless, the amount of Internet hate speech constantly increases and the law is not applied strictly. So far, if we compare it with the IPR infringement crimes, it is not that

common among ordinary people, and social attitudes are still negative. However, in the future, this might grow into a serious problem, especially if we remember that the very low probability of being caught was called one of the main motivations for IPR-related crime [3].

2.3 Example 3: Personal Privacy

▸ **Definition.** Personal privacy can be broken by making public some private information about a person. This concept is very wide. It possibly covers different types of information, such as facts, gossip, and photos, and different methods of sharing, such as emails, forums, social networks, etc.

▸ **New situation.** Since many people have digital cameras in their pockets, other actions by ordinary people are easily recorded. For example, FailBlog¹ is a blog website launched in 2008 where users can upload pictures of dumb activities. FailBlog is already full of posts about normal people being photographed doing something stupid, by other ordinary people. This can imply that we are moving towards a transparent society where anything you do will end up on the Internet if it's shameful enough.

At the same time, the widespread use of social media platforms like Facebook and Flickr encourage us to allow strangers into our most intimate moments. We post photos for “friends” to see, forgetting that this is an open ecosystem and the data will flow out freely. We get a notification that someone has “tagged” us in Facebook, yet we don't remember the photo having been taken. Of course this is not only an invasion of personal privacy but potentially a crime – you should have to give permission for any photo of yourself to be made public. As a “nobody”, you just shrug and move on, yet a celebrity photo can cause scandal and a lawsuit. Similarly, Google Street View has run into problems with some ordinary people who insist that photos of them be removed from the online service.

Many of these communication tools are unexpectedly powerful in the dissemination of popular information, as can be seen from the cases where, for example, a Facebook party invitation has spread wildly and caused a disturbance. The threshold for relaying a message in these new media is lower than in the traditional ones because it is much easier, and broad/multicasting is the norm instead of two-sided conversation. A message that was previously only private can easily become public in the Internet, and pranks and trolling have a completely new meaning in this new context.

1 Fail Blog <http://failblog.org/>

► **Motivation.** There are several possible motivations for sharing private information publicly, depending on the intentions of the person who does it. One option is if a person who publishes some private information breaks the privacy unintentionally. A person does not think it can be harmful, either because he or she does not understand the problem of privacy at all, or because he or she thinks that it is not a problem in this particular case. A border case motivation, which is especially common on Facebook, is making a friendly joke. If a person intentionally breaks someone else's privacy, he or she might do it out of a desire to play dirty, increase their own self-esteem, get revenge, or manipulate other people.

In order to make the discussion less abstract, we are going to focus on a more concrete example of a personal privacy invasion crime. *A person takes a picture of his friends' drunken faces at a party, posts the picture in Facebook and tags his friends. The post is shown in the news lists of all their friends, and many people have seen the picture before everybody managed to remove the tags.* The publication act is unrecoverable. The private information has been made public, and even removing the photo would not restore the privacy. In the case of Facebook, the photo also might contain meta-information about the people who are displayed.

The behaviour described above is legal. The photo is the IPR of the author, and he is allowed to publish it. On the other hand, it invades the privacy of the people displayed in the photo, and they cannot do anything to prevent its publication or to force the author to remove it. From their point of view, the act is immoral.

Generally, society and particularly the friends of the people in the photo accept this kind of behaviour and they may even find it funny. However, they may change their opinion when their own photos are published.

The legal and moral issues of taking a picture of a person without asking permission or even against their wishes are actively discussed in the photographic community. The final decision in each concrete case depends on the photographer's personal opinion. In most cases, the photo is not distributed to a wide audience. Instead, if a photographer shares a photo on the Internet, the audience becomes much bigger and so the possible moral damage to a person being captured can be much bigger.

The problem of sharing information and personal privacy in general becomes more and more important. Mobile devices with audio and video, nearly continuous connection to the Internet, social networks, blogs, forums, and other communication platforms – rapid development in all these areas makes it technically easier and easier to share personal information.

Moreover, there is a general intention to be online and share different aspects of life. For example, Iraqi-born artist Wafaa Bilal is known internationally for provocative on-line performance and interactive works. For the 3rd Eye project, Bilal had a camera surgically implanted on the back of his head to spontaneously transmit images to the web 24 hours a day.

Currently, however, social networks, the most popular platform for sharing, do not provide a sufficient mechanism to support several levels of personal information sharing. Only recently have people started to think about the amount of information they share with others; and Facebook has introduced, after Google+, features to limit the visibility of certain posts to certain groups of receivers instead of all friends of the user or a wider audience.

3 Sources of Regulation

The examples in the first chapter illustrate a type of behaviour that is, up to a certain level, undesirable from a societal perspective. Behaviour that, in itself, might have a negative effect on society. If everybody copies music, movies, etc., then nobody would be able to make money producing them and no investments would be made in the arts. The need to control some forms of hate speech is evident from the content of their messages, and the advances in database technology make the need for privacy and protection of an individual's data more and more important. There exist various ways to regulate behaviour, and this chapter categorizes the main sources of regulation.

Society needs regulation to function. This has always been so in any sophisticated society. Regulation exists to ensure that the things that one person or organization does will not put too big a burden on somebody else. In most cases, regulation limits the behaviour of people and put constraints on their actions. These constraints can take various forms in different contexts and the Internet, with its virtual environments and locationless space, has created a different context and the regulation of our behaviour will have to be adapted accordingly.

There are various sources of regulation, such as law, ethics and norms, market, and technical architecture [16]. In this chapter, we will discuss each of them in detail.

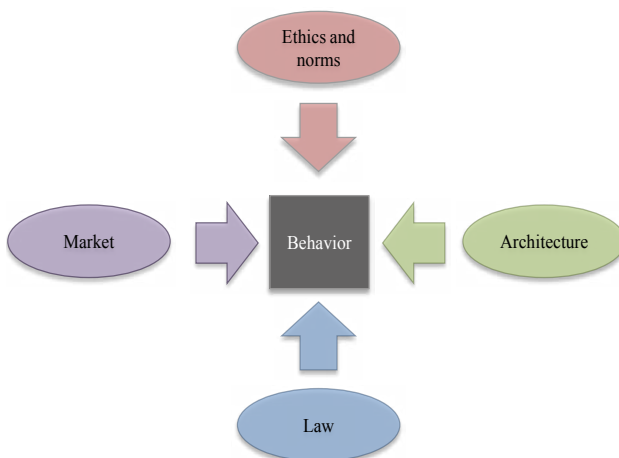


Fig. 1. The source of regulation, from [16]

3.1 Ethics and Norms

Ethics and norms shape our behaviour: they are the unspoken agreements that regulate what we do and how we act. In a church, the same laws apply as in a bar, but our behaviour is different. That difference stems from the different norms that percolate the location and the context. Ethics and norms are formed by social interaction, and they shape those interactions so there is a duality and self-reinforcing mechanism [17].

On the Internet, there are different Ethics and Norms than in the real world. This has some causes and consequences that are not yet fully understood. The initial anonymity on the Internet and the ability to shape your persona as to what you would want it to be have had a profound influence on the way behavioural norms were shaped online. Different places online also make for different behaviour, from the friendly interaction on Facebook with people that you know, to the extreme opinions on the .alt styled newsgroups to the online warfare in the MMORPGs. In every context, a different set of norms is prevalent.

3.2 Legal

Legal regulation is the set of laws, agreements, and contracts that both limit and protect what we do. There are many different “jurisdictions” that we are adhering to at one time or another. Different rules apply when we are in a public space or at home. When we drive, for example, we have to abide by more rules than when on a bike, and there are different rules for adults and minors. Also, different countries have different rules and laws.

Ideally, the laws of democratic countries should reflect the possible game-theoretic equilibrium, if it exists, between the different goals of the citizens. However, individuals are often not well informed about the problems behind legislation and, in general, many interest groups and businesses have lots of lobbying influence over politicians. Laws can also be based on local tradition and culture or the historical evolution of the current power structures. We do not want to take a position on what laws should be absolutely chosen or which form of organization should be generating them, but examine the most prominent legal approaches to tackle the aforementioned concrete problems one-by-one and analyse their consequence.

It needs to be understood that the laws themselves have negative externalities and a price to implement them, and their potential benefits always need to be weighed against these costs. Laws often cannot directly address problems but need to be interfaced with some simple control point in society, and all of their effects need to be understood. Firstly, a law should be enforceable in order to be of any practical use. It is also important to avoid too general laws that could be used as political tools. For example, a law that basically everyone breaks can be used for arbitrary discrimination if it is only applied selectively to a certain group. Badly designed laws can also have

unintended side effects: if the possession of certain information is made illegal with a stiff penalty, it could easily be used to incriminate innocent victims. In addition, new laws can cause some other changes in the behaviour of people. In general, the amount of laws should be kept to a minimum, as they can ossify the society and limit the freedoms of individuals unnecessarily.

It is practically impossible to formally define a law that talks about the open real world and perfectly captures the simple, intuitive intention of the law. Therefore, laws need to be always viewed as working approximations, and preferably they should have an expiration date, especially when they deal with fast changing technologies such as the Internet.

It could be said that in addition to the local effects of the Internet, probably the most challenging legal aspect of the Internet is its global nature, where any transaction can have participants from multiple countries all over the world, and information stored on the other side of the world is as easily accessible as local data. On the Internet the first question is where you are, what country you are in, or where is the server that hosts the site you wish to visit, for example, to gamble without paying tax for the winnings. Secondly, if the Internet cannot confirm who you are, it is unable to decide which rules and legislation apply to you, or whether it can show pornographic images just because you claim to be over 18, for example.

Laws tightly interact with the culture or cultures of a country. When most of the citizens share the same values, conceptual framework, and assumptions, it is possible to use relatively compact legislation and interpret the law according to the spirit of the law instead of its literal meaning. For example, the Finnish law is relatively easy for a layman to understand as the interpretation and concept of justice are shared by most citizens of Finland. On the other hand, the U.S.A. has multiple cultures living side by side and it could be said that this necessitates a more literal approach to the interpretation of law and the emphasis on formal procedures such as binding precedents by higher courts and previous rulings. In the Internet, there is even a wider spectrum of cultures and a possible new international law governing the Internet probably needs to be based on the smallest common denominator shared by all humans. For example, the justice system should in principle treat everyone equally, but if the international law would be only enforced by local organizations, there would be a considerable difference to the practices used in different parts of the world.

3.3 Market

The market regulates our behaviour. The cost of something can be so low that there is no need for legal or other protection, because nobody would want to steal it.

As an example, the market is able to provide a product or service at such a low cost that there is no incentive to get it any other way. No sane person in Finland would start stealing drinking water, hence there will be no special regulation needed to protect the ownership of drinking water and people will not start putting special

locks on their taps. However, when the market makes certain items very valuable, and as such creates an incentive to steal them, other protection such as safety deposit boxes, safes, security guards, etc. become more attractive.

On the Internet the market is significantly different from the physical world. Everything can be copied, so the idea of scarcity is fairly useless. When anything can be reproduced at nearly zero cost, there will be little need for a shortage. This means that the classic market rules, those that depend on scarcity, do not apply.

3.4 Architecture

Architecture is what makes something possible to do. My house is protected by ethical norms - it is considered wrong to break in and steal items. It is against the law and controlled by architecture, as there are locks on the doors to prevent access. But a photocopy, or, in the case of music and video, by inferior quality tapes, losing part of the quality of the original, was severely limited by the cost of making copies. The changing architecture, namely the Internet, has changed that significantly. There is now the ability to distribute perfect copies at near zero cost. So our behaviour changed accordingly. The original law does not deal with this situation well. When first created, copyright laws were established to “support and stimulate the creation of inventions and useful arts by giving the creator a limited right to exploitation of the fruits of his labour”. There was a trade-off between societal benefit, the creation of inventions and useful arts, and personal benefit, the limited right of exploitation. The present copyright laws do not represent this distinction well.

4 Scenarios

The various sources of regulation discussed in the previous section provide different approaches to deal with the fields of tension considered in this work (see Examples). In the following, a scenario analysis is considered. The development of intellectual property rights, hate speech, and private data made public are studied in the context of each source of regulation. It is important to note, that we are going to discuss only possible applications of sources and the resulting directions of future Internet development, not expected or optimal. Often several sources need to be combined.

Table 1 presents all possible scenarios we discuss in this section. Each scenario is presented with a general description and, in some cases, with a concrete example or method how it can be implemented (marked with *italic*). A scenario is marked with ■ if it could bring possibly negative consequences, such as violation of public interests or suppression of innovation. ★ are used to mark scenarios which are partly implemented in the current Internet and seems to be a successful, such as alternative business models for distribution of copyright protected products.

Table 1. Various scenarios of how different sources of regulation can be applied to regulate example situations. A scenario is marked with & if it could bring possibly negative consequences. ★ are used to mark scenarios which are partly implemented in the current Internet and seems to be successful.

	Example 1: IPR	Example 2: Hate speech	Example 3: Personal Privacy
Law	Strict law; sanctions to ISP and users; law enforcement ■ Change concept of IPR: <i>Creative Commons</i>	Law aimed to control users in doing hate speech ■ Law aimed to restrict organizations: <i>Yahoo! prosecuted for Nazi memorabilia auction items</i> ■	Law aimed to organize sharing of personal information Law that obliges service providers to implement control mechanisms
Ethics and Norms	Cultivation of moral principles about IPR infringement Education with focus on technical issues and IPR concept theory and practice: <i>schools, educational advertisements, cartoons, electronic games</i> ★	Teaching mutual respect in schools taking into account the anonymity in Internet. Cultivation of moral principles of behaviour on the Internet	Teaching respect towards privacy of other people Sense of indifference towards private data made public
Market	Alternative business models for product distribution: <i>Spotify, iTunes, micropayments</i> ★	Reputation of blogs and social media	Reputation of social media platforms and their control mechanisms: <i>platform that provides better quality service becomes more popular</i> ★
Architecture	Prevent usage of unauthorized product <i>digital watermarking, software preventing scanning</i> Technically stop distribution of the content <i>Disabling peer-to-peer networks</i> ■	Technically monitor and end acts of hate speech: <i>censorship on ISP, deep packet inspection systems</i>	Ban technologies and services, censorship ■ Easy-to-use control mechanisms: <i>tagging with approval</i> ★

4.1 Intellectual Property Rights

Law as a source of regulation for IPR. Currently, there is an attempt to regulate the IPR area with law, which cannot be considered successful. Legislative means of regulating intellectual property rights infringement on the Internet consist of manufacturers implementing copy protection mechanisms, legal sanctions for circumventing such protection mechanisms, and demanding Internet service providers to remove websites infringing intellectual property rights. However, millions of Internet users constantly share illegal material such as software, e-books or even watch IPR-infringing YouTube videos, and the current legal system does not have the necessary resources to engage on such a regulatory approach.

Generally, there are two approaches as to how current laws could be changed. One approach is to make the laws more strict, increase sanctions and punishments and implement the execution of the law more carefully. In this example the IPR concept itself remains the same, while people are forced to follow it. This will increase the revenue of IPR owners, but probably hinder the global progress and education level. In addition, stricter legal regulation would, most likely, severely compromise the anonymity of Internet users.

Another approach is to change the traditional IPR concept itself to make it more appropriate to the current situation. For example, some intellectual property owners have been moving towards Creative Commons² type of rights, where (world-wide) recognition for their work tend to be the reward such creators are expecting to receive. Alternative business models allow authors and content owners to find ways to finance their operation from customers not based on the copyright (the access might be free), but from voluntary donations made by customers. These aspects combined with arguments that intellectual property rights violate public interests or suppress innovation are likely to lead to an end to intellectual property rights in the future.

Ethics and Norms as a source of regulation for IPR. If IPR laws remain the same, education might be a good solution, especially because many people perform IPR infringement since they either are not aware of the fact that such an act is illegal or do not care about it. Schools can play a crucial role in developing children's awareness to intellectual property rights and their infringement. Novice adult users should be also involved in the education process. Public education, especially that of government and judiciary officials, can be achieved through educational advertisements on different communication media, cartoons, as well as electronic games.

Another important issue is the need to change people's attitude to IPR infringement crimes by, for example, demonstrating the analogy between crimes on the Internet and in the physical world. It may be instructive to compare illegal copying of movies with shoplifting, though there are subtle differences between the two: unlike shoplifting, illegal copying of a movie does not result in loss of property to the owner. Nonetheless, the idea is to create a culture where intellectual property rights infringement is an act to be frowned upon and a sense can be developed that crime is not confined to the physical world but also has effects on the Internet. Such an approach could influence Internet users who are yet to infringe intellectual property rights.

Market as a source of regulation for IPR. The success of Spotify and iTunes in providing access to high-quality music in a convenient and low-cost manner has shown that IPR infringements can be greatly reduced solely by changing the business model. Internet users are willing to make small (or micro) payments for high-quality digital content rather than downloading content illegally. Yet current online payments sys-

² <http://creativecommons.org/>

tems are time-consuming, require a significant amount of identification procedures, and are very rigid. For example, one cannot pay for a Spotify subscription with a card issued by a country outside the (currently) nine countries where the Internet music service is available. Such a difficulty may lead to downloading illegal music albums. Therefore, new forms of Internet payments with low levels of bureaucracy and world-wide availability are expected to lead to a decrease in intellectual property rights infringement.

Electronic borrowing is another example of market based regulation for Internet property rights. Libraries or other community services may acquire licenses for lending e-books, music albums in digital form, or even software, based on the premise that Internet users are willing to keep their digital copy for a limited amount of time, despite the near-zero cost of storage. Such a market solution may be more challenging to implement in case of software licenses. Nevertheless, long time usage of software is typically work or study related, and in such cases software licenses are typically acquired by companies and universities world-wide.

Architecture as a source of regulation for IPR. Technology can be made in a manner that prevents intellectual property rights infringements by Internet users. Examples include digital watermarking, software preventing scanning and copying copyrighted documents, or disabling peer-to-peer file sharing protocols by Internet service providers. Such an extreme approach of regulation may lead to government censorship, omission of anti-intellectual property movements' and unacceptable restrictions on those who wish to share their own digital creations with other Internet users.

4.2 Hate Speech

Law as a source of regulation for Hate Speech. Basically the approaches to limiting hate speech on the Internet can be divided between laws applying to individuals and laws controlling organizations providing the services for communication. The first approach requires storing the identity of the users in order to be enforceable and the second approach cannot tackle P2P services without being too general. Furthermore, the law can target hate material aimed with political motives such as racism or nationalist propaganda or smearing of individuals.

David Cameron, the conservative Prime Minister of the United Kingdom, recently suggested the introduction of a law that could allow the government to disable social media platforms in periods of so-called national emergency. Such a proposal came during the aftermath of the riots that took place in several English cities, where five people lost their lives. Cameron's proposal aims at regulating incitement to violence on the Internet and is an example of how hate speech can be regulated by law. In essence, it extends the suspension of civil rights and freedoms, typical of a state of emergency, to the Internet. Therefore, such a type of regulation inherits most of the

problems associated with a state of emergency namely, human rights violations, dictatorial regimes, and abuse of a citizen's privacy. For example, the Arab Spring, which received full support from European Union leaders including David Cameron, would not have become a reality if the governments in Tunisia, Egypt, and Libya had such a regulatory tool.

Another reason against regulation of this problem only with laws is the questionable effectiveness of the sanctions. In case a person is sued and punished for a hate crime, the punishment will most likely increase the person's hate and his or her wish to express it [8]. Because of this, making laws more strict is not a good solution. One option to overcome this problem is to have more focus on ethics and social education.

Ethics and Norms as a source of regulation for Hate Speech. It is common for schools to teach children and teenagers about mutual respect with regards to race, ethnicity, and religion. However, such norms are typically taught as rules either with punishment to those who do not follow them or exclusion from a social group. Hate speech on the Internet has the characteristic of preserving the user's anonymity, so that the possibility of being punished or excluded from a social group is no longer present. This goes at the heart of the hate speech problematic: mutual respect should be a common practice regardless if anonymity is preserved.

Market as a source of regulation for Hate Speech. Market based regulation of hate speech may be achieved simply by the reputation of blogs and social networks. Such web platforms are responsible for taking the measures they believe are adequate for preventing (or even supporting) hate speech. Internet users may choose web platforms based on their ideological beliefs. Assuming humanity moves towards a more condemning attitude towards hate speech, web platforms that support hate speech will be confined to a small group of extremists with no significant impact on society.

Architecture as a source of regulation for Hate Speech. The architecture of Internet can be made in a way that hate speech becomes impossible. These include censorship in Internet service providers and platforms, or deep packets inspection systems. For example, search engines in the People's Republic of China are subject to censorship when Internet users search for Tiananmen Square related topics. Another example is the deep packet inspection based mechanism provided by Nokia and Siemens for the Iranian government, allowing for censorship and control of Internet traffic [18].

4.3 Privacy

Law as a source of regulation for Privacy. Strict laws concerning the processing of personal information are not practical in the (global) Internet as it is extremely

difficult to hold individual users accountable for their violations of the law. Existing legislation was not designed with social media in mind.

Even if there would be sanctions for breaking personal privacy, in practice this kind of law would probably have low effectiveness on ordinary people, because it is rather difficult to maintain its execution. A more realistic approach would be to require social media platforms to provide easy-to-use control mechanisms for preventing private information of Internet users being made public and change people's moral attitude towards it.

Ethics and Norms as a source of regulation for Privacy. Advertisements in mass media can be a way of effectively improving awareness of Internet users regarding the dangers of making private data public. Education of both children and novice Internet users may also increase the level of respect towards personal privacy. On the other hand it is equally important to respect other Internet users private data which is made public. For example, Finns have an enormous sense of respect in regard to home privacy, even though houses have large windows that expose the private goings on of citizens.

Market as a source of regulation for Privacy. Similarly to Hate Speech, we believe the reputation of social media platforms can be a way of regulating the problem of private data made public. For example, if a social media platform has overtly complicated (or none at all) features that allow users to manage their private data, it is likely such a platform will lose its subscribers to a competing platform.

On the other hand, the current situation on the market facilitates even more active sharing of personal information. Popular social services, mobile devices, development of new services with sharing functionality - all this might lead to the situation where a person does not care that much about private information remaining private. Future Internet might have a very low level of personal privacy.

Architecture as a source of regulation for Privacy. The option of banning technologies or Internet services is a very unattractive one, but it could prevent Internet users from making private data public. Such an approach, however, resembles governmental censorship and may be interpreted as a violation of freedom of expression. Even though, such an approach guarantees the privacy of citizens.

However, simple technical solutions could help to reduce the possibility of a privacy infringement. If we consider our example of a Facebook post, it is relatively easy to design a user interface solution that will prevent such situations. In the Russian social network³, whose functionality is basically similar to Facebook, one possible solution is implemented. When a user adds a photo, it is possible to tag other people

3 V Kontakte, www.vkontakte.ru

on it. However, those tags are not visible to anybody until a person who is tagged has approved it.

In the near future we even might have a system, which automatically detects people's faces in the photo and subscribes them to the photo. If an author wants to publish the photo, he or she needs permissions from all the people displayed in it. This might generate a huge amount of approval requests, of course. However, this simple model could be easily improved, for example with users profiles, where a person can set if he or she is interested in receiving those requests and so on.

5 Conclusions

In this paper, we have shown how the ubiquitous adoption of the Internet has resulted in a “new gold rush to the digital world”, where old control mechanisms and the power structures of society have not been able to keep up with the fast technological advancement that has opened new ecological niches for cultural tussles. This has resulted both in ordinary people committing minor crimes *en masse* and new types of uncontrolled unethical behaviour having widespread effects. The paradigm has shifted; engaging in a criminal activity has become much easier and tempting than refraining from it. A significant majority of people are involved in criminal activities, however many still don't realize this while some fail to confess.

Our study has focused on three prominent examples, namely copyright, hate speech, and personal privacy. We have analysed each of these problems from the point of view of four sources of regulation that limit our behaviour, namely legislation, norms, the market, and technological solutions. These form a matrix of scenarios that we use to study the main consequences of different kinds of potential remedial reactions in the future.

All of the covered issues are complex, interface with many aspects of society, and can therefore only be scratched from the surface in a short text. Predicting the future is notoriously difficult, but some trends and high impact consequences can be extracted from our scenarios: Technology will continue to change quickly and sources of regulation need to be flexible if we want to keep up with the progress. This brings up the key question, of whether the control mechanisms will be able to scale at all with the increasing individual freedoms and power offered by the Internet.

On a personal level, we gave our own answers to the question “Are we Criminals?” and six out of eight people confessed that, yes, they are criminals. One does not consider himself/herself a criminal and another believes that he/she has never done anything criminal on the Internet. Although very simplistic and naive, it shows that minor criminal activity is widespread.

References

1. Pew Internet & American Life Project. Surveys March 2000 - May 2011. <http://pewinternet.org/Trend-Data/Internet-Adoption.aspx> (2011)
2. Wilson, J.Q. and Kelling, G.L.: "BROKEN WINDOWS: The police and neighborhood safety". The Atlantic, March. (1982)
3. Siponen, M.T. & Vartiainen, T.: Unauthorized Copying of Software - An Empirical Study of Reasons For and Against. ACM Computers & Society. 37(1), 30-43 (2007)
4. Chilling Effects Clearinghouse, <http://www.chillingeffects.org>
5. Negroponte, N. Being digital. New York: Knopf (1995)
6. Ormala, E.: Presentation "Can Europe's ICT Industry Survive" at Bit Bang 4 lecture on 9.11.2011 (2011)
7. Cohen-Almagor, R.: Fighting Hate and Bigotry on the Internet. Policy & Internet. Vol. 3, Iss. 3, Article 6. (2011)
8. Gilmour, G.A.: Hate-motivated violence, Analysis of Persons Who Commit Hate-motivated Violence, (1994)
9. Simon Wiesenthal Center, Digital Terrorism and Hate 2.0. Los Angeles, CA: SWC (2008)
10. Werts, D.: How the Web Spawns Hate and Violence. Newsday, October 23, 2000, B27. (2000)
11. de Vries, U.: Anger and Courage: 'Wilders' and the politics of exclusion, <http://www.guardian.co.uk/commentisfree/2011/jun/23/geert-wilders-acquitted-incitement-hatred> (2011)
12. NO HOMONATIONALISM, <http://nohomonationalism.blogspot.com/>, (2011)
13. I must distance myself from this racist complicity, <http://www.blacklooks.org/2010/06/%E2%80%98i-must-distance-myself-from-this-racist-complicity-judith-butler-turns-down-berlin-pride-award/>, (2010)
14. Banks, J.: Regulating hate speech online. International Review of Law, Computers & Technology. 24:3, 233-239 (2010)
15. Banks, J.: European Regulation of Cross-Border Hate Speech in Cyberspace: The Limits of Legislation. European Journal of Crime, Criminal Law and Criminal Justice. 19, 1-13 (2011)
16. Lessig, L.: Code: Version 2.0, Basic, 2006
17. Giddens, A.: Profiles and critiques in social theory, Berkeley: University of California Press, (1982)
18. Christopher R. and Loretta, C.: Iran's Web Spying Aided By Western Technology, The Wall Street Journal http://online.wsj.com/article/SB124562668777335653.html#mod=rss_whats_news_us, (2009)

Back to the Future – Prediction of Incremental and Disruptive Innovations

Somaya Arianfar¹, Jan Kallenbach², Håkan Mitts³, Olli Mäkinen⁴,
Lionel Reya¹, Abu Shohel Ahmed⁵, and tutor Kristi Grišakov⁶

¹ Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

² Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

³ Aalto University School of Arts, Design and Architecture, Department of Media
PO Box 31000, FI-00076 Aalto

⁴ Aalto University School of Electrical Engineering,
Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

⁵ Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

⁶ Aalto University School of Engineering, Center for Urban and Regional Studies
PO Box 12200, FI-00076 Aalto

Abstract

This chapter explores the increasingly challenging activity of predicting technological innovations in Internet applications and services. It introduces the concepts of incremental and disruptive innovations and illustrates how waves of technological innovations emerge as a consequence of their interaction. We describe selected future prediction methods and outline their limits when faced with the accelerating occurrence of disruptive innovations in the Internet business. Their potential to induce behavioral changes in the individual use of a technology may ultimately lead to its adoption on a societal level and thus may change entire markets. Three case studies describe how incremental and disruptive innovations gave rise to waves of innova-

tions in the fields of mobile handset markets, online shopping, and the computing industry at large. We conclude that a “user-pull” approach, in which the needs of potential and actual technology users serve as the primary basis to develop predictions of technology innovation may lead to better and more robust results. However, social media provide a world-wide platform of an immediately accessible mass market, making potentially disruptive innovations harder to predict as the diffusion of such innovations can happen now at an unprecedented speed, and consequently the prediction horizon for companies competing in the related markets becomes more unstable and ever shorter.

Keywords: Prediction of innovations, disruptive innovations, incremental innovations, user behavior change, technology waves, online shopping

1 *Introduction*

Every human being constantly predicts the future. Almost any kind of decision involves some degree of prediction, even though we might not think about it. In some cases, the predictions are rather trivial, like when deciding on an outing together with friends based on the weather forecast. In other cases, predictions are highly uncertain, e.g., when deciding on investments in pension funds.

Not only do humans predict, also organizations predict. It is in fact a very common activity in all businesses. “A useful forecast provides insights that lead to effective action in the present.” [B1, p. 15] summarizes the need for prediction in strategy development, market research, and product planning to anticipate the behavior of customers, markets, and competitors.

When governments make their yearly budgets, they use a wide range of predictions on how the economy, the demographics, the international competitive landscape, and many more factors will evolve. The time spans of such predictions range from a few months to several decades.

In the years following World War II, technology predictions have started to gain the attention of governments and market. Evidently, technology prediction is highly relevant to businesses involved in high-tech markets. But technology prediction is also relevant to other players due to the changes that new technologies create. Technological changes may have a huge impact on the behavior of individuals, which further affects social behavior in groups and communities and ultimately society.

The Internet continues to be one of the key technology and innovation platforms driving the industrial evolution of today’s society, and there seems to be no end in sight for Internet-related innovations. It is therefore of enormous business and political interest to be able to correctly predict the future development of the Internet.

To understand the future of the Internet, it therefore seems necessary to under-

stand at least two things: what is innovation? and how to predict the success and impact of innovations.

In this chapter, we first take a closer look at future prediction. We continue in Section 2 with a description of different types of innovation, introduce technological waves in Section 3 and prediction methodology in Section 4. A case study is presented in Section 5, and its results in Section 6. Finally, a conclusion is made in Section 7.

1.1 Terminology

Figure 1 presents a schematic of key concepts related to innovation as they will be used in this paper. The view is a compilation of terminology.

The key scene for innovation is a market where a number of players (service providers, manufacturers, etc.) compete with each other to provide customers with a product. The product can be a physical product or a service or a combination of these.

The market conditions in which the producers exist are defined by the external factors of the market (one example being the commonly used PESTLE factors – Political, Economical, Social, Technological, Legal, Environmental factors).

New or improved versions of products and/or services represent the outcome of the innovations created by the producers. The key features of offered products and services are defined by their drivers, which mostly can be understood to be the primary purchase criteria of the customers. The success of a product in the market is measured as the product adoption.

If innovations are represented by new products or services or by significant features changes/enhancements of existing products or services, then the adoption of these new products and services by customers can form a new market. Adoption often goes along with a change in the way customers use technology, i.e., the widespread behavioral change in using technology indicates technology adoption. Such a change in behavior in turn can have an impact external to the market and could lead to changes in the economic and political environment of the market, thus creating a feedback loop back into the market.

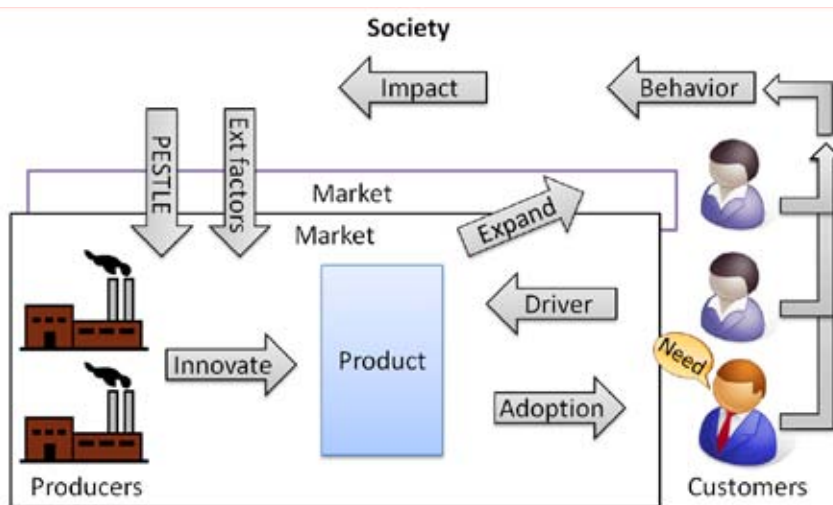


Fig. 1. Terminology used in the paper

2 Prediction

What exactly is ‘*Prediction*’? In the dictionary, prediction is defined as making statements about something in advance, especially on the basis of special knowledge. In practice, prediction is about foretelling the most probable future. By this definition, prediction is a more limited form of foresight in which multiple possible futures are considered equally probable in the course of time. The more accurate and detailed a prediction gets, it becomes more believable and provides better guidance on making informed decisions. However, it comes as a paradox that the more accurate a prediction gets, it becomes more likely to be wrong.

As an example, assume that in 1830, person ‘A’ would have predicted that one day in the future, sound would be transmitted over wire. Assume that at the same time, person ‘B’ would have predicted the same thing with more detailed information on when exactly this would happen, i.e., in the year 1860 people would be able to talk to each other over long distances with the help of some wire-related technology. Looking at these predictions from the simple perspective of being 100% right or wrong makes prediction ‘A’ valid while ‘B’ is invalid (the telephone was patented in 1876). However, from a market perspective, prediction ‘B’ is much more valuable since it gives a time frame to make proactive decisions to a possible change in the market (although wrong in this case).

Based on the above example, we are NOT interested in general predictions that, regardless of being right or wrong, do not play a major role in affecting market decisions. Instead, in this work we ARE interested in predictions that represent a metric for making market decisions. From a market perspective, predictions are often used to make more informed decisions and reduce surprises. With this logic, a prediction and the decision made based on it does not necessarily need to be 100% correct to be

successful. A good prediction can balance between being correct to some extent and being able to provide more details, which reduces undesired effects.

Many of the technology and market prediction efforts today are in line with our definition of a good prediction. For example, the US national research council (NRC) has published a full report on the need for Avoiding Surprise in an Era of Global Technology Advances [B10]. Another NRC report from 2009 [B1] explicitly states that: “The value of technology forecasting lies NOT in its ability to accurately predict the future but rather in its potential to minimize surprises.”

Predicting the future in the sense of reducing surprises does not seem to be completely impossible. When we talk about surprises we are not concerned about the general wonders of the human brain. Instead, we are concerned about the surprises in market/military logic in which competitors or enemies are able to surprise others by new products/ technologies.

Looking at the history of inventions that have affected various markets, one can observe that they often had come from a limited cluster of players who knew the most about the sector they were inventing for. As long as the predictor had enough knowledge of what every player is developing (preferably in a known timeframe) and what would be the consumers’ reaction to the possible outcome of that development, there were no surprises. For example, as long as the US army had the top physicists in the world during the World War II, there was no way that US enemies could surprise the US army with anything more sophisticated than the atomic bomb.

However, after World War II and especially in recent years, a more balanced level of knowledge distribution among different enemies and competitors in the market has emerged. The more balanced the level of knowledge is, and the easier it is to enter the competition, the more difficult it gets to predict the future.

Another phenomenon that makes predictions more difficult is unexpected user behavior. As a customer base gets more sophisticated and knowledgeable, it becomes more and more difficult to know how user behavior towards a certain technology will develop. To exemplify, it has been seen many times that big companies - the leaders of innovation in the technological front - have failed to avoid surprises. The very technology that big companies curate and develop acts as a tool against them. This has been seen all throughout the history of technology. Xerox, which has pioneered in the development of personal computer, was surprised by PC’s capitalization [A10]. The same thing happened to IBM, which was a big player in mainframes. In this case and similar scenarios, the big companies, which are often significant players in the existing mass market of a technology, fail to understand the market impact of those technological surprises in time. In other words, well-established companies mostly are so concerned with their current customer base that they forget future market trends and surprises that these can create. This means these big players can easily lose their market position because of their inability to foresee the arrival and effect of new technologies in their market.

Therefore, from the market perspective, it is very important and perhaps vital for big players to be able to predict the future. A good prediction allows a company to define and adjust its policies based on future trends and survive in a competitive market.

2.1 Types of Prediction

There are many aspects to predictions. For the purposes of this study, at least two types are of interest. We call these types defensive and offensive.

The main point of defensive future prediction is to avoid surprises that could have a potentially negative impact on the person or organization making the prediction. An example of a defensive prediction could be a person taking a mortgage on their home. A defensive prediction in this case might be a worst-case prediction about future interest rates. The purpose of such a prediction is to ensure that the person taking the mortgage can pay the mortgage also in the case of a high interest rate. Companies might use defensive prediction to track competitor activities in order to avoid being overtaken by surprise moves made by their competitors.

Offensive prediction has a different purpose. In the case of offensive predictions, the person or organization making the predictions actively looks for future trends or events that could open up the possibility for surprises and disruptive innovations.

Defensive and offensive predictions could also be seen in the relation to aspects that could be viewed as external to the predictions.

Many predictions methods assume that there are certain external factors that influence the issue being predicted. In the PEST method, for example, such external factors are categorized as Political, Economical, Social, and Technological factors. In a defensive mode of predicting, these external factors are seen as given with the underlying assumption that the issue being predicted is not capable of influencing these factors themselves.

Many recent technological innovations seem to challenge this assumption. Technology, for instance, is one of the key factors that constantly interacts with other factors and influences politics, economics, and social behavior simultaneously. An offensive strategy therefore would also consider some of the external factors as variables, i.e., as something that can be changed through new technologies.

3 Innovation

Innovation is one of those elusive terms that is easy to use but very hard to define. This paper will not try to make any new definitions of innovation, but it is inevitable that we must explain how the term is used.

All aspects of our lives — the products and services we use, the way we organize ourselves, the ways we express ourselves, and many more — are undergoing constant change. One way to define innovation is to simply claim that this change happens as

the result of innovation. This interpretation is actually close to the meaning of the origins of the word innovation, the Latin word *innovatus*, which is the noun form of *innovare*, “to renew or change”. (Innovation, n.d.)

In this paper we will adopt this very simple view of innovation. Consequently, one also needs to introduce different grades of innovation. A small, very incremental change is induced by a “*small*” (amount of) innovation while a more radical change would be produced by a “*big*” (amount of) innovation.

Instead of calling innovations *small*, the term “incremental” is often used. This indicates that the change produced is somehow controllable in its step-size compared to the previous state.

Sometimes innovations are not just simple incremental changes. Instead the change is surprising and could have a significant impact on a market into which it is introduced. This is not necessarily because the innovation is “bigger” but because it takes a new direction, perhaps going for a new market segment or by redefining the way success is measured. If innovation has this element of surprise, it is often called either radical or disruptive innovation.

One problem with terminology such as incremental or disruptive innovation is that it gives the impression that there exist these singular characteristics; that an innovation is either incremental or disruptive.

This is of course not the case. Instead we must think of a continuum of innovations where at one end we have very unsurprising, incremental innovations and at the other end are innovations that we could not foresee. It then becomes a rather arbitrary exercise to decide where along the spectrum of innovations the incremental suddenly changes into the disruptive.

3.1 Innovation Impact

Innovations – regardless of whether they are incremental or disruptive – can have different types of impact.

Traditionally, innovation has been looked upon from the perspective of a given market and the players in that market. In this view, the innovation impact is mainly measured as the success or failure of companies active in the given market.

However, it is evident that the impact of new technology innovation is by no means limited to only the relative success of the players in the market. Innovation can (and often will) have a strong impact outside the market.

Technologies can impact user behavior, create social change, or even drive political decision-making. These external impacts are often ignored in business-oriented discussions about technology.

Looking first at the impact of disruptive technologies inside a market, we can identify two types of disruptions. The first type displaces an incumbent technology within a particular market.

An example of an analysis of the disruptive dynamics inside a market is the paper by Shood and Tellis. The paper further classifies disruption inside a market into three different types. These are technology, firm, and demand disruptions. The types are defined based on the extent to which a technology overtakes the other technologies in a given market.

A second class of disruptive technologies creates a new market or capability where none had previously existed.

Let us take a simple example. Assume that there is a market where product X is produced. A and B are two companies active in that market producing product X.

As a result of successful innovation, company A comes out with a new version of the product. As the result of a new production method, the price of product X is reduced by 75%. From the point of view of the market, this is a disruptive change as it renders the products developed by competing companies obsolete.

The impact of company A's new product is, however, mainly limited to inside the market, as the product X is still the same.

In the meanwhile, company B is doing something very different. Company B is not looking to compete with A on price; instead B is redefining product X in a way that significantly alters how customers would use product X.

Customers fall in love with the way they use product X as produced by company B and start buying company B's product even though the product is more expensive than company A's. From the perspective of the market, company B's product is just as disruptive as company A's product. Again the market leader will change and this time perhaps even A has to leave the market because they can no longer compete.

The disruptive power of company B's product is, however, different than company A's. Company B changed the behavior of the users of product X.

At a minimum, company B's product created a new market. As company B's product also changed the associated user behavior, company B's product has a significant potential for a more powerful change that can also have an impact outside of the strict confines of one or two product markets.

3.2 Categorization of Innovations Based on Their Impact

By combining complex systems theory and Everett's theory on the impact of communication channels, four different types of Internet-related innovations can be identified. These types could be seen as having distinct characteristics when it comes to predicting the impact of Internet-related innovations.

Innovations could be divided into the following categories:

1. Incremental innovations
2. Disruptive innovations inside a market with little or no impact on customer behavior

3. Disruptive innovations that create new markets and therefore new customer behavior
4. Innovations that change the communication patterns of the society and thereby increase the likelihood for innovation diffusion and impact

From the list, items 1 and 2 – incremental and disruptive innovations that do not change human behavior – would mainly affect businesses. As these innovations do not change the behavior of the nodes of a society, complex system theory would predict that these innovations would not have a significant impact on the overall behavior of a society.

Things get more interesting when one considers item 3 on the list. Innovations that change human behavior do impact the behavior of the nodes of society and could therefore have a significant impact on the overall - emergent behavior - of society. Thus we could infer that there is a potential connection between innovation and – possibly surprising – changes in society when innovation changes human behavior.

The second observation is that technologies that change how the nodes of the system are connected would also have a significant potential for change. The Internet, mobile phones, and social networks have created new and powerful ways for people to interact with each other, thus speeding up the complex system of our society. Recent political events such as the Arab Spring seems to provide some evidence that this is actually the case.

4 *Waves of Innovation*

Literature describes technological long-wave cycles, which have occurred every 50 years [O1]. In the cycles, different areas of technology have seen innovations occurring at the same time. Typically, this has fueled even more technological development. These long-wave cycles are depicted to last for 50 years each, and currently we are supposed to be in the fifth long-wave cycle that started in the 1980s, having computers, telecommunications, and biotechnology as the main driving technologies.

The long-wave cycles are described as following a regular bell curve pattern, where technological activity is highest in the middle of the cycle. At the end of the cycle, the technological advance has reached its limits and the markets experience increasing price competition.

4.1 **Innovation Impact Cycle**

When looking at the evolution of technology over the last decades, one cannot avoid getting the impression that technical development has become much more rapid. Figure 2 illustrates this by showing how long it took for a number of Internet and communications-related services to reach their first billion users. Even disregarding

the population increase during the time span shown in the graph, the change has been remarkable.

At one extreme we have fixed-line telephones, which took roughly 120 years from its introduction in the late 19th century to reaching 1 billion users around the year 2000. At the other extreme, we have Facebook, which has been predicted to reach 1 billion users in 2012. If the prediction turns out to be correct, it would have taken Facebook only 8 years to reach that goal.

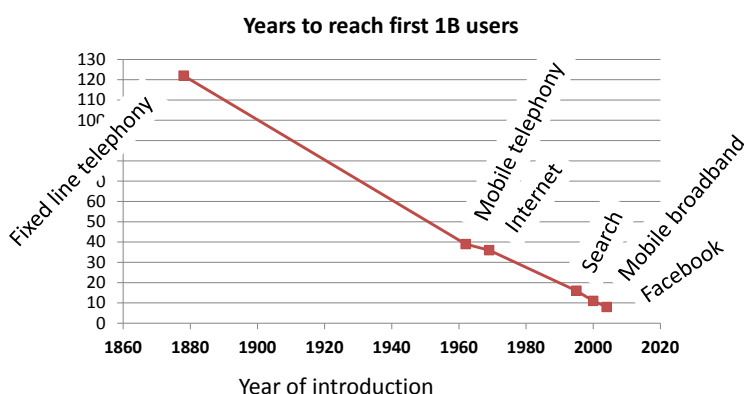


Fig. 2. Number of years needed for certain services to reach 1 billion users

The accelerating change is interesting from a number of perspectives. One perspective is that of trying to predict technology innovations. A rather normal, perhaps even modest prediction span, even in high-tech industries, is 5 years. If we take the example of Facebook, which has gone from a small technology player to a global one with 1 billion users, then the success in the span of a 5-year prediction cycle illustrates the challenges that the action of predicting changes in the Internet age faces.

The above example shows that a disruptive service/product can reach mass-market popularity nearly from the beginning and in a very short time span. This means a product can become disruptive in the mass market almost without going through any tangible phase of being introduced to a niche market.

4.2 Diffusion of Innovation

What is perhaps even more perplexing is that Facebook has been able to create such a significant change in user behavior during such a short period of time.

In order for an innovation to be successful, the innovation must be spread and adopted. This is referred to as the diffusion of innovation.

In his book on innovation diffusion, Everett M. Rogers [B11] notes that the type of communication channel used to spread information has a profound influence on how impactful an innovation is. Rogers argues that mass media channels (one-to-many) spread information and can change weakly held attitudes. On the other hand, interpersonal (2-way) communication is needed to change strongly held attitudes.

As the communication nature of the Internet has changed more and more towards interpersonal communication, one would expect that Internet-mediated diffusion of innovations would have a bigger impact faster.

Rogers also notes that (interpersonal) communication can be either cosmopolite or local, where these terms are defined in relation to the social system in which a user is embedded. Rogers argues that local communication channels have a stronger persuasive impact on the adoption of innovation.

Also here the strong impact of the Internet and social media can be proposed. By enabling people to build social systems that are not bound by geographic boundaries, the 2-way communication capabilities of the Internet and social media should speed up the diffusion of innovation.

One can imagine that even the founders of Facebook could not have foreseen the success of Facebook when they started the service. If we look at Roger's theory, it would seem that Facebook itself might have been one of the main factors explaining its own success.

To clarify, let us look at the figures 2 and 3. As already mentioned, there are many factors/drivers that affect a prediction. At any point in time and with regard to any prediction, there always existed a few factors that played major roles in shaping researchers' perception on the future and affected their predictions. Figure 4 shows the effect of such main factors in shaping ones' perception of the possible trends and developments regarding one technology/ market surface. As can be seen in this figure, until recently there were always a few countable (mainly one) major factors that affected the technology/ market surface. If one knew the current status of the market and the main factors and drivers inside or outside of the sector targeted by the prediction, one could at least figure out the possible future trends.

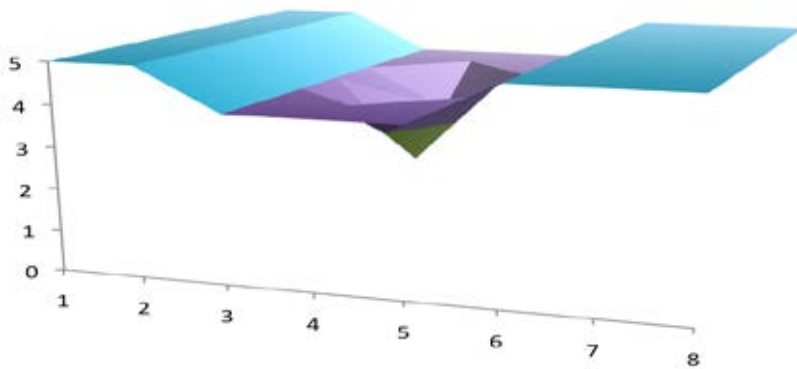


Fig. 3. One major driver shaping the environment

However, today things are different. There are way too many factors that can affect/shape the technology/ market surface and their future trends. As can be seen in figure 5, once there are many factors and unknown sudden forces shaping the

technology / market surface, the surface would not be able to keep a stable shape or movement trend. Therefore, predicting what would happen next in such an unstable surface would be really difficult.

Of course any such surface during the course of time and after categorizing the shaping factors can become stable. The problem, however, is the fact that when things happen in a shorter time period than one can process, it seems that the surface is always unstable because the unknown factors continuously affect each other and shape other new unknown factors. This makes things complex and does not allow drawing predictions over possible trends in the shape of this surface.

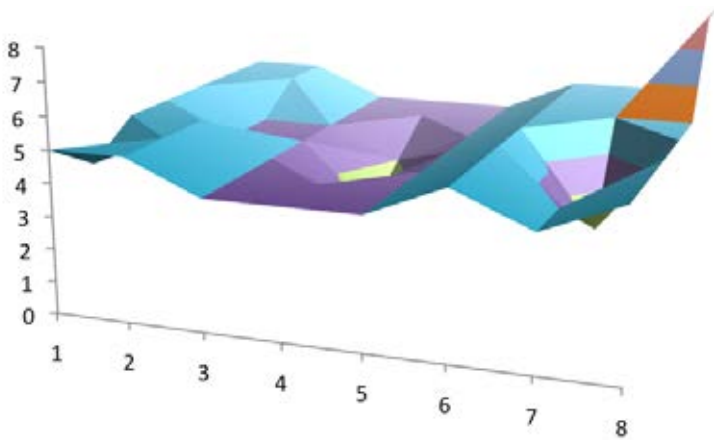


Fig. 4. Multiple drivers shaping the environment

5 Innovation Prediction Methods

In the 1940s Isaac Asimov wrote three of his most famous books, the Foundation trilogy. The trilogy contains insights into predicting future events that are still valid today.

The trilogy is placed far in the future where civilization has spread across the galaxy, interstellar travel is the norm, and a benevolent Galactic Empire rules the galaxy. The main character of the trilogy is a social scientist, Hari Seldon, who invents a mathematical model to predict the actions of large groups of people. This creates a tool for predicting the future. The future evolution becomes incremental in the hands of Seldon.

With his new tool, Seldon foresees the fall of the Empire and a 30,000-year long (sic!) interregnum of disorder and terror. Seldon cannot prevent the disaster but discovers an alternative future path where the interregnum can be shortened to a mere

1,000 years. Seldon sets up a foundation to guide the universe on its path towards the shorter catastrophe after his impending death.

As one can guess, not all goes completely smoothly. Seldon's grand plan is eventually almost overthrown by an unpredictable, disruptive event. Somewhere in the Galaxy, a mutant – called the Mule – is born. The Mule has unpredicted new mental powers. Seldon did not foresee these powers and therefore the Mule becomes the disruptive factor that was not predictable with the tools devised for predicting an incremental evolution.

In the end, the Mule and the disruptive new development he created are neutralized and there is a happy end to the trilogy.

Asimov's trilogy is a great example of the dilemma of prediction: How to account for the unaccountable, that is, the surprise? The situation is however not quite as black-and-white. As the NAS report notes, disruptive technologies are not necessarily disruptive because they are totally new, but rather because the majority of players grossly misunderstood or underestimated their impact or applications.

From the previous discussion, we can identify at least three different questions related to the prediction of future innovations:

1. Predicting incremental innovation
2. Predicting disruptive innovation as such
3. Predicting the impact of innovations on human behavior and the society.

In the following, the first two are described in more detail.

5.1 Predicting Incremental Innovation

Technological prediction and forecasting as a structured knowledge has been developed after World War II. A forecast is developed using techniques to extract data and draw conclusions based on that data. The difference between forecasting methods come from the way the data is collected and analyzed. Most of the early forecasting reports have been created using judgment-based methods, which rely on the opinions of technology experts in the area in which the forecast is conducted.

Judgment-based methods have been developed and became more mature during the years after World War II. The main judgment-based method is the Delphi method. The Delphi method, introduced in the late 1940s, offered a more structured way of collecting expert's opinion. A series of questioning and answering, summarizing, feed back, and revising are used to form the forecast. This method is widely used even today.

Extrapolation is a lesser known method that relies on the common sense notion that the past is a good predictor of the future. As used in statistics, extrapolation requires researchers to collect some data about previous events and plot them to figure

out a pattern. After a pattern has emerged, the researcher/expert can use his judgment to extend the pattern to the future.

The difference between the Delphi method and extrapolation is the nature of the data they use for forecasting. While the Delphi method relies more on qualitative expert opinions, extrapolation uses quantitative statistical data.

Other forecasting methods are based on scenario building and analysis. Scenarios are tools for understanding possible futures based on the interactions of a variety of factors. The need for this kind of forecasting method becomes obvious, as forecasts based on early methods have failed to hit the market. For example, forecasts about early cell phones and personal computers missed the market as forecasters did not imagine that falling prices and network value would combine to increase the value of technology [B1].

Technology forecasts are not designed to be accurate, but they try to aid in better decision-making. As long as a forecast is able to reduce surprises and are helpful in making well-informed decisions, it is considered to be successful even if it is not accurate. Based on these criteria, the above forecasting methods have had an acceptable success rate until now. This could be because the number of disruptive technologies have been limited in the past. Therefore, the number of innovations that have created new markets and value networks have been limited.

Today, however, rapid advances in engineering in surprising directions sometimes cause major discontinuities in potential forecasts. Forecasting methodologies are in transition to a new paradigm that can cover the growing complexity of problems, accelerating the rhythm of evolution and changes in the role of different actors in evolution. The introduction of new forecasting methods is evidence of this transition.

Prediction markets represent a new judgment-based model forecasting technique that is developed based on the Delphi methods. Prediction markets, however, instead of only relying on expert's opinions, rely on a large number of individual's opinions and forecasting. Prediction markets, with the help of the Internet, allow continuous forecasting activities. Some believe, however, that prediction markets, although useful for short-term forecasts, are not that beneficial for long-term predictions [B1].

Obsolescence Forecasting is a scenario analysis based model, which tries to answer the question how current key technologies might become obsolete. For example, what would make cell phones obsolete? Answering these questions could help to predict the possible discontinuity in current predictions.

Based on our discussion above, we are in a transition phase where the rapid growth in complexity makes predictions based on traditional methods more and more irrelevant. This means the evolvement of disruptive technologies will rapidly continue to surprise decision-makers. To us, it looks like new methods should be sought to overcome the rapid changes in the technology environment and the increasing complexity of the problems.

5.2 Predicting Disruptive Innovation

As Asimov already understood, predicting very radical change is difficult precisely because of its surprise nature.

Predicting disruptions inside a market. In their paper, Jay Paap and Ralph Katz [C1] develop a comprehensive model for understanding the impact of disruptive innovation within a single market. This model provides a highly useful model for understanding the fundamental factors impacting disruptive change.

The basic tenet of Paap and Katz is that innovation is a response to an unmet user need. If we refer back to our example of the mobile telephone, the initial unmet need was that of businessmen needing to place or take urgent phone calls with a high business impact. Technology is then used to satisfy that unmet need with products or services or other suitable means.

Paap and Katz further argue that the adoption of a technology to meet a given user need is based on two key concepts. The first concept is called the leverage minimum. This is the point where the technology reaches a minimum level of performance and price so that early adopters will take an interest in the technology.

Once a technology has passed this leverage minimum, a key technology driver decides the uptake. The driver is the main criteria that potential users of the technology are considering when making their purchase or uptake decisions. Perhaps a more descriptive term for the term driver would therefore be purchase or adoption criteria.

In this model, incremental innovation typically occurs as the gap between the current state of the technology and the unmet user need is being closed. The model also helps us to identify two major sources for disruptive innovation.

The first source of disruption happens when the unmet user need becomes fulfilled or even surpassed. In this case, correctly identifying and addressing new unmet user needs can introduce new technologies.

The other manner in which disruptive technologies can be introduced is by identifying new drivers, i.e., purchase criteria for a technology.

The model proposed by Paap and Katz is very useful as it does not focus predictions on the capabilities of a technology (“technology push”), but rather on the user needs that create the demand for the technology (“user pull”).

Predicting the disruptive impact of a technology. For the purposes of this paper, the Paap and Katz model has one shortcoming. It is very well-suited for analyzing a specific market and the potential development inside that market, but it does not address the impact of the technology outside the market, on the surrounding society.

The report by the National Research Council discusses technology prediction more from the angle of analyzing its potential impact.

The common trait of both the forecast method proposed by the NRC project, as well as the existing methods proposed, is that they are long-term project-like efforts

rather than simple methods that are intended for focused analyses projects.

Two examples of long-term forecasting discussed in (C1) are TechCast (C2) and Sigtific (C3, C4).

TechCast is a web-based technology forecasting solution. It has two main dimensions. One dimension is the number of forecast projects being driven by the site. These projects focus on predicting critical milestones for selected technologies. Typical milestones are either the introduction of the technology or a 30% penetration corresponding to mainstream adoption.

The other dimensions of the site are support tools and technologies for users to conduct their own, independent forecasting.

The site is open to member subscriptions at a current annual fee of \$950. Members get full access to information about ongoing forecast projects and to the tools offered by the site.

Another key player in the technology forecasting landscape is the Institute for the Future (IFTF) organization. The IFTF offers a number of tools and services for predicting the future of technology. One of the more unusual offerings is the Sigtific forecasting platform.

Sigtific is an exciting way to predict technologies. It employs a combination of open-source thinking, social media, and gaming-like characteristics to create a highly dynamic forecasting platform.

6 Case studies

In this section, three cases are analyzed. First, the mobile handset market is considered, then online shopping is examined and finally the computing industry is analyzed.

6.1 Mobile Handset Market

For this use case, we are going to cover the time period from the 1990s until 2011. For such a short time period (in the scale of predicting time), we would like to look at the drivers and trend analysis from the prospect of companies present in the market—what have been considered predictable and what became disruptive.

We briefly explain the market situation and possible drivers/factors that matched the future trend of that market during these years.

Mobile handsets: the beginning. Mobile handsets and the wireless industry in itself have been considered disruptive technologies that have started to replace landlines in many places in the first decade of the 21st century [B6]. This has made the mobile handset market a stable, promising, and growing business opportunity around 2005–2006.

How mobile handsets became disruptive and formed a growing stable market is a complicated story. But in brief, after the invention of the telephones and the cars, it was always known to the people and the industry that the increasing need for connectivity and mobility would result in a future in which at least for some niche market users it would be possible to use the phones everywhere, even in moving cars. The vague point for the industry, however, was to figure out when such a change would emerge and in what form.

The first mobile handsets were introduced to the public in the early 90s. Logically, at the time they entered the market, mobile handsets should have been considered disruptive technologies as they have changed the bases of competition in the phone market. Mobile handsets introduced the new dimension of competition – mobile performance.

However, the call quality of mobile handsets was not that impressive for normal landline users in the beginning. Therefore, mobile handsets were not considered to be competitive enough with landlines to gain a significant share of the telephony's mass market users. Why would a normal user want to use a mobile handset instead of landline, especially if the sound quality in the mobile handset is bad? It was not clear for the industry whether mobile phones would be a threat to the fixed-line phone companies in the near future or whether they would just co-exist.

The case for mobile handsets is a classic case of a technology that was superior in a new dimension (mobility) that appealed to a niche, but inferior in a dimension (sound quality) that appealed to the mass market and improved on the latter dimension to meet the needs of the mass market. By the time call quality improved and mobile handsets become a threat to landline phones and incumbents in that market, it was already late for the existing players to play a significant role in the mobile handset market compared to the newcomers.

When the penetration of mobile telephony had reached a sufficiently high level, mobile (voice) telephony started to create a large-scale change in user behavior that would not have been possible with fixed telecommunication. Examples of such behavioral changes include new practices for setting up meetings with other people as well as the capability to handle work-related tasks “on the run”. The disruption in the mass phone market happened fast and gave new entrants to the mobile handset market the sweet taste of success.

The fast takeover of the mobile handsets over landlines matches the fact that what makes a technology disruptive is introducing new criteria for competing, where the existing incumbents in the market cannot easily compete with it, either because the existing market is slow or because it is incapable of competing.

Mobile handsets: beginning of 2007 to 2011. By the end of 2006, everything seemed promising in the mobile handset market for the incumbent players. However, as we have discussed earlier in the paper, only looking at the existing factors is not the only case in predicting the future. In an existing market, there is a need for continu-

ous checking of the market status and user experience and other emerging factors that are the result of interaction between various factors and do not necessarily exist in the market from the beginning.

By the beginning of 2007, one of the established main differentiation factors between different handsets have been their features. The more features a phone had, the pricier it was. A consequence of this pricing trend was that users often had sophisticated smart phones with many features that were not useful for them.

In early 2007, disruptive technology came to the mobile handset market. Using the existing need in the market for a simpler user interface, or the “user pull” as Paap and Kaatz call it, Apple has introduced the iPhone, which later on proved to change the competition criteria in the handset market. The true power of the iPhone was its ability to influence the design and delivery of digital content. Adding Internet connectivity to mobile phones and introducing more and more features and services to the handsets, formed a force against the very pioneers that introduced broadband connectivity on mobile phones and featured smart phones. The interest of users in having new and pricy smart phones had created a large user community eager to buy smart phones, but confused about how to use the glut of features and services.

What was unique about Apple’s iPhone was the work that Apple put into making the user interface so intuitive, especially the way it exploited technologies such as the touch screen and the accelerometer. The diffusion caused by instability of the prediction horizon and innovation diffusion made it hard for Apple’s competitors to foresee the arrival of the iPhone.

Using the already existing need/gap in the market that was continuously fed by incumbent players in the market, Apple turned the iPhone from just another device into something groundbreaking and disruptive. As described in figure 4, what has made iPhone a disruptive technology was the change of the pricing trends it has introduced to the market. This new trend (the dashed-line in the figure) was totally against the general market intelligence (the solid line in the figure) and took the market by surprise.

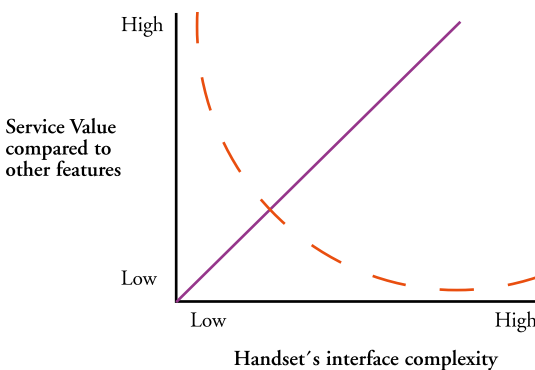


Fig. 5. Service value vs. the handset interface complexity

The introduction of the iPhone has created and strengthened other drivers and factors besides those that were previously envisioned in prospect. Benefiting mainly from the need for simplification in the user interface, the iPhone originally introduced a new competition criterion that put Apple above all the incumbent players in the mobile handset market for some time after it entered the market. There were, however, other drivers that emerged from the combination of a simple user interface and the added value of services. These new and suddenly emerging drivers/factors, which have been formed by interactions between the already existing factors and the simple user interface, can be summarized as follows:

1. The world started to move from products to services much faster than before. The money will be generated from selling the services, not the handsets.
2. Mobile services are low-cost but require continuous upgrades (time and work-force).
3. There are more and more opportunities to exploit the mass-market labor force to work for your product. Once the mass market is in control, no one else can compete with you in reducing the costs.
4. Services are cheap compared to handsets, so there is a need for a strong user community to produce and use more and more services.
5. If there is no other differentiation factor compared to services, then hiring people to produce the services might become expensive compared to the demand on the market and what this labor can produce.
6. Content (and service) creation will be more user-driven.

Apple, aware of the emergence of these new trends, introduced the AppStore at the same time as the iPhone. Benefiting from the large user community formed around the AppStore, Apple managed to gain the market share of other incumbent players in the handset market.

Not all the factors that were strengthened or introduced by Apple's touchscreen smartphone and AppStore were previously unknown. But these factors were not considered important in the perspective of a short future time span. For example, even in the predictions from 2003, it was known that services would be more user-driven, but in 2006 it was still not obvious whether this would be the case in the near future. As far as 2006, handsets and their services were still strongly in control of the handset-producing companies; there was no incumbent in the market who knew exactly how services would be more user-driven.

Discussion. The loss of market share by successful players in the existing handset market matches the argument that big players have difficulty justifying themselves to quick changes in the market. Therefore, adapting to a disruptive change that did not match their planned predictions is not easily possible. Any disruptive technology needs an environment/demand/driver model that helps it survive. Throughout

the history, big players could avoid surprises by studying the drivers that affect their market more clearly and eventually make better predictions. In a stable and shaped market, such predictions are not that difficult. For example, in when introducing mobile phones to the mass market, the incumbent players in the fixed-line telephony market could have avoided losing the phone market by taking mobile phone telephony more seriously.

This trend of avoiding surprises, however, based on our previous discussion, seems to have gotten more sophisticated nowadays. This is especially clear in the case of iPhone, which marks the disappearance of the niche market introduction cycle from disruptive technologies' life cycles and shows the shortened impact life cycle of the new innovations. The case for iPhone shows an era of introducing disruptions to *unshaped* markets, in which avoiding surprises is much more difficult than before.

To clarify, in 2003 there were some general trend predictions: development will be more user-driven. This trend seemed to have been ignored in short-term market predictions by handset makers. As a new entrant to the handset market, Apple had the chance to provide the means to match this general trend predicted around 4-5 years earlier. Other incumbent players during these 4-5 years, however, were still trying to manage the other trends that were already supported by their products affecting the pricing condition. The question remains: if the other trends were not predicted, introduced, supported, and maintained by incumbents in the handset market, would it be even possible for Apple to overtake the existing mass market this easily without even targeting the niche?

To us, the answer to the question above seems to be no. An important point is that if the global mobile connectivity was not there in the first place, such a disruption by the iPhone's unified user interface would not have been not possible. Thus, the interactions between *shaping* market opportunities and user habits have provided the possibility for this disruption mainly by "user-pull" drivers.

From the prediction prospective, it seems to us that if it were not that easy for new competitors to enter the mobile handsets mass market or at least use its wide-scale user community, and if the time span between the introduction and the impact life cycle of the new innovations in this market were not this short or in other words if there were less innovation diffusion, there would be a bigger chance for the pioneers in the mobile handset market to see these emerging factors and predict it. And if not successful in prediction, at least they could have had enough time to react to the market change if the impact life cycle of iPhone adaptation itself was not that short.

6.2 Online Shopping

The rapidly increasing web presence in the lives of people across the globe has had a huge impact on the way people carry out various tasks. Among these big transformations is the effect of the Internet on people's shopping habits for goods and services.

Consumers across the globe are increasingly swapping crowded stores for one-click convenience, as online shopping becomes a safe and popular option.

The thrill of visiting a shop and getting a feel of the different products before making a purchase still exists, but the convenience of online shopping cannot be understated. Online transactions have rendered some services, such as booking travel and buying concert tickets, much easier and more efficient. This has the effect of pushing the retailers to embrace an online presence. But to be successful in this domain, companies or retailers must first understand the attitudes and behavior of its potential customers. There is also an ever-increasing segment of online shoppers who are much more technologically competent, looking for the most convenient experience, and are willing to pay a small charge or premium if they successfully find what they are searching for. However, this has not always been the case. It took a while for consumers to get comfortable with divulging their personal information online.

In the early days of online shopping, the web as a new channel for marketing was capable of accommodating many different kinds of products and services. However, people are browsing the Internet more for information than for buying online. In [L1], Johnson pointed out three barriers to online shopping: purchase failures, security fears, and service frustrations. Hoffman et al. [L2] also highlighted that the reason more people have yet to shop online, or even provide information to web providers in exchange for access to information, is that there is still today a fundamental lack of faith between most businesses and consumers on the web.

In developed economies like the US where there was a mature market and an honest management system, online shopping started as early as the '90s, with PayPal as one of the most popular third-party online payment tools. The business of online shopping effectively kicked off in China in the late '90s but developed at a very rapid pace thereafter. According to data estimates from IResearch, online payment transactions in 2008 alone amounted to 274.3 billion RMB with a growth rate of 181% [L3]. This phenomenal growth was also seen in different parts of the world as shown in a survey conducted by the Nielsen Company, where the number of online shoppers grew from just 10% of the world's online population in 2005 (627 million) to a staggering 875 million by 2007, a jump of over 40%. Today, according to IMRWorld estimates [L4], two billion consumers access the Internet (a quarter of them in Europe) and over 85% of consumers who go online, do shop online. This generated a total of €550 billion globally in 2010, with Europe accounting for about €200 billion (35%). This number was already apparent in the 2008 Nielsen Company survey as shown in figure 8.

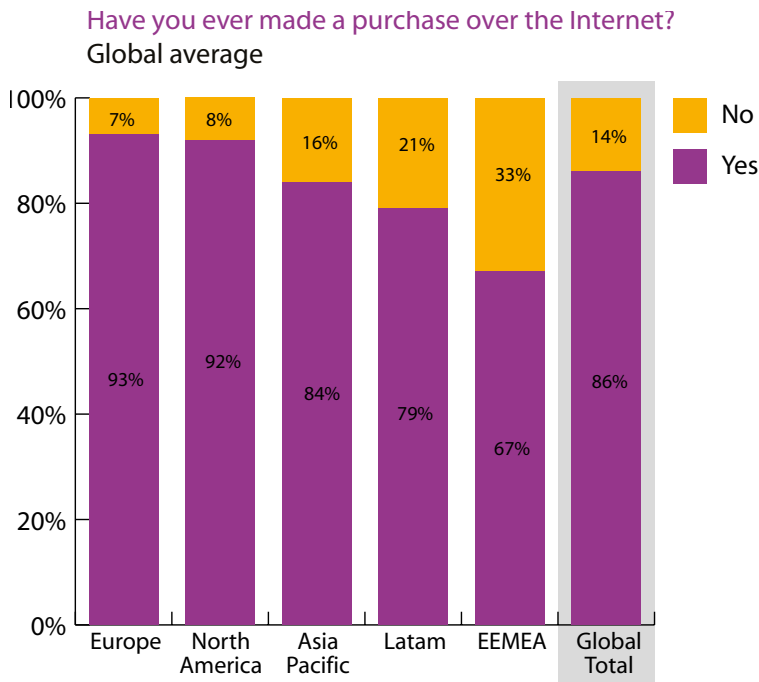


Fig. 6. A global survey of online shopping trends [L5]

The rapid adoption and continuous growth of online shopping shows no sign of slowing down as more and more people become connected and trust is built between e-tailers and consumers. Looking back at how this all came about, it is hard to say how this will play out in the future and hard to deduce where this might lead. The next parts of this paper will seek to clarify whether the online shopping phenomenon could be described as an incremental or a disruptive innovation and whether it was or could have been successfully predicted.

Online shopping as a disruptive innovation. According to Prof. Clayton Christensen of the Harvard Business School, two types of innovation can be identified: sustainable (or incremental) innovation and disruptive innovation. While the former involves new and better technology to help leading firms consolidate their hold on a market (e.g., new car models), the latter typically offers lower functionality in terms of customer's requirements and are of little use or interest to the mainstream market (e.g., pocket calculators). Typically, a disruptive innovation will eventually provide some new performance attributes that will make it prosper in a new niche market. As improvements are made along the normal performance expectations, this innovation will subsequently displace the former technology.

Disruptive innovations can also be classified as low-end, whereby they provide a low-cost alternative to the original (e.g., fake fashion designs) or new-market, whereby new user groups are formed (e.g., cell phone users). The main driving forces

determining the success of a disruptive innovation can be listed as Cost, Compatibility, and Convenience. The cost must be comparatively cheaper than the original, compatibility with a higher-end technology, and it must be convenient to use. Ensuring the long-term survival of a disruptive technology also requires it to be profitable, productive (i.e., users find it worthy), and preemptive (i.e., moves away from traditional business goals).

Now, looking all these factors, can we truly say that online shopping is a disruptive innovation? There is no doubt that the massive growth of online shopping has been accompanied by the fast pace of technological developments since the creation of the World Wide Web. This has resulted in the proliferation of the necessary devices (PCs, laptops, and now handsets) for consumers as well as the technology required to implement secure, dynamic, and end-to-end solutions on the part of the companies. Based on the trends presented earlier with regards to the growth and forecasts of online shopping, it could be said that online shopping was truly a disruptive innovation.

There are a great number of new opportunities that can stem from the online shopping phenomenon, but how does one go about deciding, let alone predicting, what kind of business solution might succeed in this vast space full of unknowns? The question being asked is whether the uptake and wide adoption of online shopping and various business models that have stemmed from it could have been predicted. What are the key drivers sustaining the rapid expansion of this sector of the market? While we admire the great successes of pioneers in this area like Amazon and eBay, it is important to also note that many companies fell by the wayside due to over-speculation or what could be considered false prediction at the time. The next section addresses some of these issues.

Key drivers and predictions of online shopping. The Internet promised to be a technology with unlimited applications that would have the potential to radically transform modern day life — from the way we communicate with one another and access information to the way we purchase goods and services. Industry observers claimed the Internet could enlarge and shrink time, help businesses reach vast numbers of customers from every corner of the world, reduce information asymmetries between buyers and sellers, and lower the costs of conducting business transactions [L10]. With all these predictions, venture capitalists scrambled to fund Internet-based startups, seeking to cash in. In 2000 and 2001, all these dreams came crashing down as the online shopping (e-commerce) failed to live up to expectations. In the US alone, according to Webmergers.com, 225 and 537 Internet companies failed in 2000 and 2001, respectively. Globally, between 7,000 and 10,000 Internet-based firms collapsed [L11]. Some of the key drivers of the online shopping phenomenon are listed below along with short descriptions of some failed firms, as we try to understand whether bad prediction or just bad luck led to their downfall.

In discussing the key drivers of online shopping, we revert once more to the old PEST analysis framework to list the political, economic, social, and technological factors that signify the level of advancement on online shopping at any given time.

Political:

- P1 - Number and type of government incentives and programs to support the use and development of new technology
- P2 - Legislation or number and type of supportive or restrictive laws and policies that govern electronic data, contacts, and financial transactions
- P3 - Public policies such as government support for the growth of electronic transactions and processes

Economical:

- E1 - Growth of the economy or GDP as well as average income
- E2 - Cost of technology, including hardware and software
- E3 - Cost of access to telecommunications infrastructure (i.e., pricing structures and rates)
- E4 - Commercial infrastructure including an advanced banking sector and payment systems
- E5 - Innovative business models

Social:

- S1 – Skilled workforce, computer literacy, and IT skills
- S2 – Willingness and ability to adopt new technologies
- S3 – Rate of PC penetration and the number of online users

Technological:

- T1 – Adequate telecommunications infrastructure including backhaul, pricing structures, ISP, and range of services available and ownership
- T2 – Bandwidth availability
- T3 – Speed of development and implementation of new technologies as well as access to these new technological developments

In the case of predicting whether a technology or innovation will succeed, we consider the case of online shopping in a 1997 paper by Alba J. et al. [L13], in which they introduced the concept of Interactive Home Shopping (IHS), whereby consumers will be able to quickly and easily search for specific items, screen them and make comparisons based on their idiosyncratic desires. Basically, it will be a two-way communication between the consumer sitting in front of her personal electronic shopper and the seller's search engine (possibly operated by a third party), using electronic media and hence fast response time. In the same paper, it was projected that IHS sales will range from \$5 billion to \$300 billion by the year 2000. These were stagger-

ing numbers given that Internet sales in 1996 were estimated at just \$500 million, less than 1% of all non-store shopping. While acknowledging that online shopping as a disruptive innovation continues to see tremendous growth, the ride hasn't always been smooth, and in the year 2000 there was the now-famous dot.com bust. Some of the most popular companies that suffered this fate include:

- Boo.com (1998 - 2000), a fashion retailer specializing in designer sportswear. After a high profile and exorbitant ad campaign costing over \$50 million, it closed its doors less than two years in business after losing \$160 million.
- Webvan.com (1999 – 2001), an online grocery shop raised \$375 million in its IPO, expanded to eight major US cities within a year and a half and invested \$1 billion in high-tech warehouses. With razor-thin profit margins, barely a year and a half later, it closed down, with 2,000 workers losing their jobs and share prices at 6 cents compared to \$30 when it started.
- Pets.com (1998 – 2000), a pet food and supply company also spent heavily on ad campaigns involving a dog sock puppet and a Super Bowl commercial costing several million dollars. Backed by Amazon.com, they raised \$82.5 million in early 2000, but barely nine months later, its shares traded at \$1 compared to its peak at \$14. Also, 300 employees lost their jobs.

Discussion. What we've seen from the events of the previous section makes it clear that it's never an easy task to predict or make forecasts on a disruptive innovation, in this case online shopping. Whether all the drivers of this innovation are present or not, the impact time could be extremely short in some cases, and there are still a lot of unknowns that might have a massive effect on the outcome or success of any business model based on the innovation. As in the case of the dot.com bust, a number of external factors, especially user behavior, played a significant role in determining whether online businesses survive or not.

As early as 1995, when the online shopping phenomenon was just beginning, predictions were mixed as to whether this might signal a whole new trend or if it was just hype. Some heralded it as the next big thing that would transform the way people carry out business, while others saw this as just another oversold idea that would never catch on. See, for example, the 1995 Newsweek article [L14], in which the author questions how the local mall next to his home can do more business in one afternoon than the entire Internet can handle in a month. The trend certainly lived up to its hype as it continues to transcend every aspect of B2C as well as B2B transactions.

The future looks even more exciting as a result of the great strides made in advancing technology as well as connectivity. Coupled with the social media blitz, mobility and a new generation of tech-savvy young adults who are beginning to settle in their own dwellings, this is probably going to lead to even more disruption within traditional online shopping as we know it today. Deal seekers will rely more and more on

their trusted acquaintances for advice and tips on different products rather than use the traditional search engines. This will require a total shift of strategy for businesses moving forward. At this point however, just as before, only time will tell how this plays out.

6.3 Computing Industry: Future as Seen in the Past Decades

The computing industry has seen a tremendous growth over the past decades. This growth was not only attributed to the growth in the technological space (e.g., growth according to Moore's law) but was also impacted by the increasing use of computing in our daily life. Over the past decades, the computing industry experienced some major shifts such as mainframe to mini-computers, mini- to personal computers, personal computers to mobile computers, mobile computers to ubiquitous computing, on-premise computing to cloud computing, and so on. In some cases, the shifts become too obvious as a linear change over time, while in some cases disruption was unpredicted against the market foresight of that time. To better understand the accuracy of market prediction, we are going to analyze a couple of those shifts and evaluate the market foresight against the adoption of technology.

The initial emergence of personal computing. The successful emergence of personal computing industry during 1970 to 1980 was not completely unforeseen. In 1962, John Mauchly, the co-inventor of ENIAC, argued that the present emphasis on miniaturizing the components of missiles and spacecraft will inevitably result in developing small and inexpensive computers within the reach of almost everyone [A11]. We can obviously argue that the introduction of personal computers in 1980s was a disruptive innovation. This has impacted and changed our behavior, daily life, and business environment in many aspects beyond the possible imagination limit any one had thought during the early phase of computers. As with many other disruptive technologies, none of the established players in the mainframe era were able to play a major role in the personal computing industry due to lack of awareness rather than failed market foresight. This why IBM failed in the personal computing industry although it was the leader in the mainframe era.

Major predicted trends after the emergence of personal computing. This section presents a couple of major historical predicted trends collected during the period 1988 to 2000. This was clearly an era when “the growth of end-user computing (of which personal computing appears to represent a fair share) is one of the significant phenomena of the 1980s in the information management field” [A6]. This is also the time during which network computing was established to an unprecedented level. This revolution was fueled by the low cost per transaction, the cost of automating office and desktop processes, and the low cost of network bandwidth.

Trend 1: The present form of PCs and laptops will be replaced by ubiquitous devices. Ubiquitous computing is a model of computing in which processing is integrated with objects around us [A1]. During 1988, Mark Weiser from the Xerox lab coined the idea of ubiquitous computing. In this form, computing will not only involve some special device; but rather all surrounding objects will have computing and communication connectivity. Soon after that, others joined this concept and it became one of the hot predicted trends starting from 1990.

Trend 2: The dominant form of computer looks like a tablet or pocket PC. The dominant form of the personal computer in the year 2000 will be the tablet on which people can draw and write text using their hand or a stylus [A2]. According to the prediction, these tablets will have a high-resolution touchscreen, a non-rotating disk with a high power processor, infrared interfaces to connect to nearby smart devices, and high speed cellular links mainly supported by high-speed ISDN connections. A major aspect of this trend is that the increasing device mobility and development of the communication network will allow people to work not only from home but also from any place. The device, coupled with the mature service industry (e.g., video conferencing, voice communication), will lead towards a mobile lifestyle.

Trend 3: Digital convergence - convergence of computing, communication, and entertainment. Digital convergence - combining computing, communication, and entertainment into one conglomerate enables the best multimedia experience for consumers. During the '90s, there was a clear trend and need in the industry in this direction [A4]. The growing consumer needs towards multimedia combined with a mobile lifestyle creates a major demand for digital convergence. The major implication of this trend is to blend and redirect the functions, products, and cultures of many existing industries with computing.

Comparison of trends with the current situation. In the current context, the trends described in Section 1.2 hold for most of the cases. While not all of these trends have seen their full potential, in general they hold true and they are moving in the defined directions. It is true that in some cases the trends become too futuristic. For example, the rise in ubiquitous computing is an inflated trend, while mobility (enabled by pocket computing) can be considered a non-inflated trend.

The following figure provides our understanding of two trends against the present reality. (Note that the figures are based on a subjective analysis.) In the figure, the predicted line is blue and the reality line is green. The figure illustrates that the market has shown an almost exact impact according to the mobility prediction, while pervasiveness (i.e., ubiquitousness) was a more inflated trend during this time period.

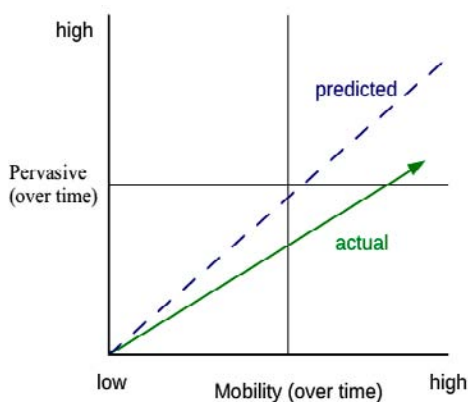


Fig 7. Predicted vs. Reality against two major market trends

Market forecasts towards web computing and the disruption of cloud computing.

Around 1998 and 1999, the market had a strong belief in web computing, a form of computing in which everything took place in the web [A12][A13]. This was predicted as a new shift of computing and was called the fourth generation of computing, following the main frame batch processing, time-sharing (personal computing), and the client-server computing generations. The widely predicted belief was that business data processing intranets, electronic commerce, and business-to-business communication would shift towards the web. At the outset, this was happening throughout the beginning of the year 2000. Big companies, such as Google (e.g., Gmail), Yahoo (with their portal), Salesforce, and Microsoft started to bring new business and consumer services to the market. During 2000 to 2006, the Software-as-a-Service (SaaS) based cloud platform incrementally evolved based on favorable technological (e.g., connectivity, client-server, presence of web, and virtualization) and market conditions (e.g., low CAPEX cost).

Unlike many big players, Amazon, an online retailer platform, foresaw business opportunity from a different angle. Over the years, Amazon has built a huge infrastructure for their online retailing business. Amazon saw the opportunity to lease its infrastructure to third-party customers. In 2006, it comes with a completely new business plan to rent its virtualized hardware infrastructure to consumers. The technical benefits (e.g., on demand, resource-pooling nature) couple with business demand (e.g., low upfront cost, ease of use, utility model) makes cloud as a major computing model for small and medium enterprises (SME) and big enterprises. Soon, Gartner and other big companies saw enough opportunities in this market to create a bandwagon effect. The introduction of IaaS has a purely disruptive impact over the market and it is a form of disruption that was not in foreseen in the market. Although the idea of utility computing was there for many years, the exact form, shape, timing, and delivery model was vague until Amazon came up with its business plan. So we

can conclude that it is a disruptive innovation which has a large impact on the market and was not foreseen by the market.

The following two figures illustrate the prediction verses the disruptive nature of cloud. The first figure illustrates the prediction during the beginning of 2000 and the second figure describes the reality curve plus the future of cloud.

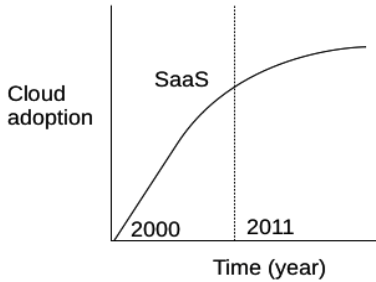


Fig 8. The prediction during 2000

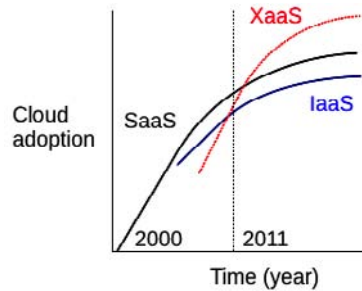


Fig 9. The reality and prediction 2011

Discussion. From the computing case study, we conclude that the market was able to predict the major future trends. In most cases, market developments followed in a linear fashion the predicted trends (e.g., increased computing power, miniaturization, and cost reduction). In some cases (e.g., IaaS cloud computing), disruptive adoption of technology occurred without a clear market foresight. This disruption resulted from a combined force (e.g., favorable market condition, mature technology in the other fields) that is difficult to predict.

7 Conclusion

It is often argued that predicting disruptive innovation is difficult. The difficulty has been considered a natural and unavoidable consequence of the “surprising” nature of the what is – after the fact – described as disruptive.

In our analysis, we have found two aspects of disruptive innovation that have an impact on the predictability of innovation. By identifying these trends, it could be possible to improve predicting innovation.

Our first observation follows the analysis of Paap and Katz. The analysis of innovations is often done from the perspective of technological opportunity, “technology push”. Instead of a technology push, Paap and Katz argue that the role of the user of the technology is the critical factor. In order to become successful, new technologies must address real user needs and appropriate technology drivers. Our interpretation of the technology drivers are that they could be equated to purchase or adoption criteria as seen by the users of the technology.

At least one of the cases analyzed in the paper would seem to confirm the analysis of Paap and Katz. In the case of the iPhone, the market (incorrectly) believed that the technology driver for mobile devices was the increase in features. This seems to have been the case during the first years of the mobile revolution, but once the number of features crammed into a mobile device reached a certain saturation point, the user needs and hence the technology drivers shifted. This shift was recognized only by Apple, and hence the iPhone enjoyed unprecedented market success for a number of years.

The other observation we make is that the Internet and in particular social media services based on the Internet have created a platform for the very rapid diffusion of (new) user behavior. It is simply astonishing how a social media service like Facebook has spread in less than 10 years. Not only has the service been adopted but it has had a profound impact on the behavior of its users. Sharing of personal events, opinions and preferences has suddenly become a very strong norm.

Most methods used for predicting innovation seem to assume that the environment in which the technology operates is not affected by the technology itself. The environment can be volatile, but the volatility is attributed to factors external to the technology itself.

The fact that services such as Facebook have been able to not only spread but also impact the environment in which the technology itself operates is to us a clear indication that new technology diffusion can have a feedback impact into the market in which it operates within a time span used in typical technology predictions.

With the benefit provided by hindsight, adopting a much more user-centric view also to technology prediction would seem to be a way to improve predictability. The lack of methods to actually do this would then be the next hurdle to overcome.

References

1. Weiser, M.: Ubiquitous Computing. Xerox Corporation. [A1]
2. Mel, B.W., Omohundro, S.M., Robison, A.D., Skiena, S.S., Thearling, K.H.: Tablet: personal computer of the year 2000. *Communications of the ACM*, 31, 6 (June 1988), pp. 638-648. [A2]
3. Gates, B.: *The Road Ahead*. Viking Penguin (1995) [A3]
4. Nagel, D.C. et al: Keeping the U.S. Computer and Communications Industry Competitive: Convergence of Computing, Communications, and Entertainment. National Academy Press (1995) [A4]
5. Flament, M., Gessler, F., Lagergren, F., Queseth, O., Stridh, R., Unbedaun, M., Jiang Wu, Zander, J.: An approach to 4th generation wireless infrastructures - scenarios and key research issues. 49th IEEE Vehicular Technology Conference, vol.2, pp.1742-1746 (1999) [A5]
6. Guimaraes, T., Ramanujam, V.: Personal Computing Trends and Problems: An Empirical Study. *MIS Quarterly*, vol. 10, 2, pp. 179-187 (1986) [A6]
7. York, J., Pendharkar, P.C.: Human-computer interaction issues for mobile computing in a variable work context. *International Journal of Human-Computer Studies*, vol. 60, 5-6, pp. 771-797 (2004) [A7]
8. Castells, M.: *The Rise of the Network Society*. Wiley-Blackwell (1995) [A8]
9. Bower, J.L., Christensen, C.M.: Disruptive technologies: Catching the wave. *Harvard Business Review* (1995) [A9]
10. Smith, D.K., Alexander, R.C.: *Fumbling the Future: How Xerox Invented, Then Ignored the First Personal Computer*. William Morrow (1988) [A10]

11. Louie, G.G. et al.: Persistent Forecasting of Disruptive Technologies. National Academy Press (2010) [B1]
12. Gaponenko, N.: Methods and tools for future exploration and decision making in multidisciplinary and fast developing technological domain: A case of nanotechnology. Second International Seville Seminar on Future-oriented Technology Analysis, Seville (2006) [B2]
13. Sood, A., Tellis, G.J.: Demystifying Disruption: A New Model for Understanding and Predicting Disruptive Technologies. *Journal of Marketing Science*, vol. 3, 2 (2011) [B3]
14. Fingar, T. et al.: Global Trends 2025: A transformed world. Available at http://www.dni.gov/nic/PDF_2025/2025_Global_Trends_Final_Report.pdf. National Intelligence Council (2008) [B4]
15. Danneels, E.: Disruptive Technology Reconsidered: A Critique and Research Agenda. *Journal of Product Innovation Management*, vol. 21, pp. 246-258 (2004) [B5]
16. Fox, M.: Nearly a quarter of U.S. homes only use cell phones. Available at <http://www.reuters.com/article/2010/05/12/us-cellphones-usa-idUSTRE64B6F620100512>. Reuters (2010) [B6]
17. Isaacs, A. et al.: NOKIA – It's tough being #1. Available at http://bwrc.eecs.berkeley.edu/People/Grad_Students/rcshah/documents/Nokia_Report.pdf. UC Berkeley (2001) [B7]
18. Eran Dilger, D.: Smartphones: iPhone and the Big Fat Mobile Industry. Available at <http://www.roughlydrafted.com/RD/RDM.Tech.Q1.07/BEC05CE1-D5EB-4E48-B46C-7385D5AADCFE.html>. (2007) [B8]
19. Nokia Leading Smartphone Market with 56%, While Symbian's Share of OS Market Is Set to Fall. Available at <http://www.abiresearch.com/press/826>. ABI Research, London (2007) [B9]
20. David, R.A. et al.: Avoiding Surprise in an Era of Global Technology Advances. Available at http://www.nap.edu/openbook.php?record_id=11286&page=R1. National Academy Press (2005) [B10]
21. Rogers, E.M.: *Diffusion of Innovations* (5th ed). Free Press (2005) [B11]
22. Paap, J., Katz, R.: Anticipating Disruptive Innovation. *Research-Technology Management*, vol. 47, 5, pp. 13-22(10) (2004) [C1]
23. Kadtke, J.: Smart Phones -30% SB. Available at <http://www.techcast.org/BreakthroughAnalysis.aspx?ID=69>. TechCast (2011) [C2]
24. Sigtific. Available at <http://www.iftf.org/node/939>. Institute for the Future [C3]
25. Johnson, D.: Who is on the Internet and why. *The Futurist*, 11 (Aug/Sep 1999) [L1]
26. Hoffman, D.L., Novak, T.P., Peralta, M.: Building consumer trust online. *Communications of the ACM*, vol. 42, 4, pp. 80-85 (1999) [L2]
27. IResearch: 2008 180% growth rate of China's online payment transaction size up to 274.3 billion. Available at http://www.iresearch.com.cn/html/Consulting/online_payment/DetailNews_id_89636.html (translated). IResearch (2008) [L3]
28. Roper, J. et al.: 2 billion consumers are now online, a quarter of them live in Europe. Available at <http://www.imrg.org/ImrgWebsite/User/Pages/Press%20Releases-IMRG.aspx?pageID=86&parentPageID=85&isHomePage=false&isDetailData=true&itemID=45&pageTemplate=7&specificPageType=5>. IMRWWorld (2010) [L4]
29. Trends in Online Shopping February 2008. Available from <http://th.nielsen.com/site/documents/GlobalOnlineShoppingReportFeb08.pdf>. Nielsen (2008) [L5]
30. Kwei-Jay, L.: *E-Commerce Technology: Managing the Web of Money*. University of California, Irvine (2004) [L6]
31. Webb, C.L.: Google's IPO: Grate Expectations (SIC). Available from <http://www.washingtonpost.com/ac2/wp-dyn/A14939-2004Aug19>. Washington Post (2004) [L7]
32. Afuach, A., Tucci, C.L.: *Internet: Business Models and Strategies*. McGraw-Hill, New York (2003) [L10]
33. Whitman, J.: Declining Failure Rate Suggests a Modest Dot-Com Comeback. *The Wall Street Journal* (Oct 16 2002) [L11]
34. A year in E-commerce: The Winners and Losers of Online Shopping. *InfoWorld* (Dec 4 2000) [L12]
35. Alba, J. et al.: Interactive Home Shopping: Consumer, Retailer, and Manufacturer Incentives to Participate in Electronic Marketplaces. *The Journal of Marketing*, vol. 51, 3, pp. 38-53 (1997) [L13]
36. Newsweek article, "The Internet? Bah!: Hype Alert – Why Cyberspace isn't and will never be, nirvana" 1995. Available online: <http://www.thedailybeast.com/newsweek/1995/02/26/the-internet-bah.html> [L15]
37. Smith, D.: *Exploring Innovation*. McGraw-Hill Education (2006) [O1]

From Democratizing Innovation to Innovating Democracy

Wael Soliman¹, Pyry Kivisaari², Henna Warma³, Vilen Looga⁴, Petri Saarikko⁵,
Yang Deng⁴, and tutor Andrea Buda⁶

¹ Aalto University School of Economics, Center for Knowledge and Innovation Research
PO Box 21255, FI-00076 Aalto

² Aalto University School of Science,
Department of Biomedical Engineering and Computational Science
PO Box 12200, FI-00076 Aalto

³ Aalto University School of Electrical Engineering,
Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

⁴ Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

⁵ Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

⁶ Aalto University School Engineering, Department of Engineering Design and Production
PO Box 14100, FI-00076 Aalto

{Wael.Soliman, Pyry.Kivisaari, Henna.Warma, Vilen.Looga, Petri.Saarikko, Yang.Deng,
Andrea.Buda}@aalto.fi

Abstract

The Internet is more than just layers of hardware and software designed to create a network of networks. The Internet has become a philosophy about the effectiveness of decentralized bottom-up innovation, or democratizing innovation. Among other things, this philosophy has encouraged corporations to allow customers to participate in their product development process in order to better understand the needs of the market. We believe that the same principle should be applied to democracy. In this chapter, we explore what democracy is and how the Internet has impacted it so far. Then we discuss the impact of democratizing innovation on businesses, and how the same approach could be used to create better democratic functions. Finally, we

present a scenario of the future where citizens can use multiple channels, independent from the government, to achieve their goals.

Keywords: E-democracy, open innovation, participation

“The Internet is driving an unstoppable political change that in theory could lead to a collapse if the transition to participative democracy is not made smoother through a genuine political will to let and make it happen.”

- Douglas Holmes 2001

“The Internet isn’t really a technology. It’s a belief system, a philosophy about the effectiveness of decentralized, bottom-up innovation. And it’s a philosophy that has begun to change how we think about creativity itself.”

- Joichi Ito 2011

1 Introduction

This is a book about the future of the Internet. This chapter, however, concerns the future of democracy. At first glance, they might seem two entirely separate topics, but as we will show, the two are intertwined and at their very core they share one fundamental aspect: participation. Without equal access opportunity, the Internet loses its value as a medium for connectedness. Similarly, without true citizen inclusion in decision-making, democracy loses its value as the people’s governance model. We believe that democratic forces have been shaping the Internet and that the Internet will shape the future of democracy. Were we to summarize the message we want to deliver from this chapter in one sentence, it would look like this:

The future of the Internet is dependent on the future of democracy, and both are dependent on governments’ ability and willingness to embrace citizens’ participation in the society.

The eminent American philosopher John Dewey describes politics as “*the shadow cast on society by big businesses*” [1]. In this sense, corporate power has reached the point that politics are being steered in directions that are not necessarily in people’s favor. Chomsky [1] illustrates this idea by the U.S. debate over the U.S. deficit, and he points out that 72% of the population favors addressing the deficit by taxing the very rich, while cutting health programs is opposed by an overwhelming majority (69% Medicaid and 79% Medicare). It does not come as a surprise to reach an outcome that goes against the majority’s opinion. Ironically, this ill-designed system bears within it the seeds of its own destruction. Chomsky explains how corporate power is now concerned that the extremists they helped put in decision-making

positions may ruin the base on which corporate wealth relies; or as he describes it, “*the powerful nanny state that caters to their interests*” [1]. Unfortunately, this can be exemplified by the European Union as well. The Innovation Union and Digital Agenda strategies are two pillars around which Europe’s competitive future will be based [2]. However, neither of these strategies has enough support in the EU agenda. For instance, copyright reforms have been blocked by the French representatives. This means that French citizens have to pay significantly more digital tax than their peers in other European member states like the Netherlands. This raises the question: to what extent does this decision represent the needs of the population of France, as contrasted by French corporations?

As we will show later by several examples, people in modern societies, connected as never before, will take matters into their own hands when they see self-serving representatives, in their pursuit of serving power groups, fail to remedy societal challenges. Examples include, but are not limited to, the Tunisian revolution, the Egyptian revolution, and the Occupy Wall Street movement. All of them are people-driven, Internet-enabled, and real-democracy-aspiring initiatives. In this sense, we witness what has been prophesied over a decade ago by Douglas Holmes [3]: “*The Internet is driving an unstoppable political change that in theory could lead to a collapse if the transition to participative democracy is not made smoother through a genuine political will to let and make it happen*”. Fearful of the Internet as a dangerous tool in the hand of irrational crowds, many governments have been using different techniques of control. We believe that governments need to empower their citizens and most definitely not control them.

Interestingly, profit-driven corporations have understood that their own proliferation and existence lies upon satisfying their customers’ needs and desires. Methods have been devised to systematically integrate humans’ collective intelligence into corporate R&D processes in what is referred to as user-driven innovation, crowdsourcing¹, or open innovation. No matter what you call it, it is a call for democratizing innovation [4]. Governments need to learn the same lesson. In the same manner, we argue that democratic thought requires serious revisiting by utilizing the available technological tools to facilitate societal innovations beyond traditional voting mechanisms. ICT can enable a new form of democracy that empowers people to identify their own problems, collaborate to solve them, and participate in implementing those solutions. Indeed, this envisions a new form of power reallocation, something we call innovating democracy.

This chapter is divided into five sections. In Section 1, we presented the overall theme of the chapter. In Section 2, we elaborate on why democracy is one of the fundamental bases for a functioning society. In Section 3, we present some governmental attempts at utilizing the Internet in managing the relationship with the citizens, which in most cases is utilized to merely digitize governmental services (e.g.,

1 For a fuller discussion on Crowdsourcing, kindly refer to the next chapter - chapter four.

tax filing, document issuing, etc.). In this sense, there is very little evidence that the governments are exerting genuine efforts to broaden citizen involvement in their societal matters. Thus, we move on to Section 4 to show how profit-driven corporations, for the sake of their survival, have democratized innovation by opening up their product development processes to their customers. We then show in Section 5 how governments, for the sake of their survival, need to innovate democracy by giving some of the power back to the citizens. In doing so, the Internet becomes a ubiquitous platform for systematic societal participatory innovation, delivering solutions by the people, for the people.

2 Democracy – Why?

In the cradle of the European civilization, ancient Greece, all citizens (except women and slaves) were eligible to speak and vote about decisions affecting their lives. This was the first form of democracy which today we call ‘direct democracy’. The first manifestations of representative systems were seen in the medieval age when people from different democratic states were selected to advise monarchs. Representative democracy, as we know it today, emerged in the post-industrial age, when large number of people showed interest in common decision-making but neither technological nor population figures supported direct democracy anymore. Since then, the representative democracy has been the most accepted form of society. However, it seems that an increasing number of people are unhappy with the current system and long to reform the democratic process, as can be seen by recent studies [5].

We try not to look at the term “democracy” strictly from the viewpoint of the history and the modern age of Western democracies, but try to be more inclusive to societies with different cultural, religious, and historical backgrounds. Indeed, even in our world of diverse political systems from all colors of the spectrum, it is still possible to find common things that almost any person in the world aspires to, such as a safe environment to live in, the right to voice one’s own opinion, freedom to pursue happiness and other values in life. Instead of looking at the current representative democracy as a best practice, we should be able to learn and improve the existing system. Thus, to answer the question “why?”, we argue that democracy prevails because it is a basic human need; and that regardless of authoritarian imposition attempts, democracy will find a way.

2.1 Because Democracy Is a Basic Human Need!

Although a citizen might be considered the smallest particle of the magnificent machine known as the democratic process, his motivations are by no means simple. Indeed, in every aspect of a human being’s life, one can distinguish several distinct and veiled layers of needs that drive human behavior. Perhaps the most popular model

to this day that tries to explain the psychology of what makes a human being tick is Maslow's hierarchy of needs. First described in 1943 by J. Maslow, this model divides the needs of human beings from the most basic ones such as food and security, to the feeling of belonging to a group and all the way to the joy of self-fulfillment. However, the biggest insight of Maslow's model is that it can be applied not only to the broad idea of a general emotional state of a person, but also to more specific scenarios where needs drive the decisions of a human being. This model has already been successfully applied with context-specific modification in areas such as management, advertising, and politics. There are adaptations of Maslow's model suitable for analysis of specific topics, such as client-service provider or employer-employee relations. For example, Conley [6] describes how applying the Maslow's model to several aspects of his hotel business allowed it to flourish in economically difficult times. By understanding the emotional needs of his employees and hotel customers, he was able to transform his business into a successful one, with an environment that provided emotional satisfaction to all participants.

The general Maslow hierarchy presents five layers of needs starting from the bottom: physical, safety, social, esteem, and self-actualization. It is assumed that before a person can achieve satisfaction on the upper layers, the needs on the lower layers must be fulfilled. For example, a basic need such as food and shelter has to be fulfilled before the person acts to fulfill his need of good self-esteem and self-actualization. We will use the Maslow model as a basis for describing the different needs driving citizens when they interact in a society, with the focus on democratic functions or the lack thereof. Before we continue, though, it should be noted that Maslow's model has received its fair share of criticism. It has been noted that as of now there is no strong research to validate the model in real life. Also, the term 'need' might be too vague in its scope to meaningfully explain a specific aspect of human behavior. Finally, a lot of examples from real life have been brought up to show how the rules of the model do not necessarily apply in every situation. A notable example would be a starving artist who chooses to spend his money on creating art rather than buying food for himself because it provides him with the feeling of self-actualization, while the basic physical need (food) is neglected. Also, there are many cases where people do not strive for whatever reason to go beyond fulfilling their basic needs. However, despite various criticisms, the model has not been disproved and to this day remains a good framework, albeit *a priori* in its nature, to analyze human behavior.

To the extent of our knowledge, the Maslow model has not been used before to frame a research topic similar to ours. Thus, adapting the work of Amin et al. [7] and Conley [6], we set out to look at the factors that contribute to the relationship between a citizen, society, and the government at the different layers of needs. Our model simplifies the five categories of the general Maslow hierarchy into three, by grouping physical and safety needs together, social and esteem needs together, with self-actualization forming the third layer of needs. For each category, we will provide the analysis of the general needs and, where possible, give real world examples of how this particular category of needs was either fulfilled in the society or neglected.

Physical, Safety. This is the basic layer and in the context of this model can be translated as containing the basic needs of a person who uses services provided in a democratic society. The needs in this layer require that the democratic process is consistent and carried out as set by the laws of the country. In this sense, there is clear separation of power in the government; the voting process is transparent, universal and regular, and there is a plurality of political views and freedom of speech is upheld.

Social, Esteem. This need is directly related to a feeling of community. This means that people feel that they live in a society of like-minded people, a feeling of belonging, mostly expressed as a form of patriotism. This means that as a member of the community, you are recognized and appreciated. You have the responsibility to follow the rules and laws of the community, but you can also expect other members to do so. Also, this means that there are ways to engage in discussion on issues that affect the community.

Self-actualization. One way to satisfy this need is to provide people the possibility to directly act upon the issues that they are interested in. People need to feel that their input matters, that it is considered and acted upon. This means that people are capable of directly changing the society for the better of everybody, thus contributing to a higher cause. Quite often this need is neglected when a service is designed only as a source of user input without a feedback loop. For example, Frey and Stutzer [8] observed that by giving the residents of Switzerland² the possibility to participate more directly in the decision-making process, the government was able to increase the level of happiness significantly. On the other hand, Kitsing [9] notes that the Estonian government's attempt at citizen participation is not a real success story because people didn't feel that their input was valuable.

2.2 Because Democracy Happens, Whether You Like it or Not!

Social networking sites (SNS) were initially developed to allow people to stay connected with each other, share their thoughts, pictures, music, etc. However, recent events have shown that social media has a completely new function, allowing efficient participation in political discussion, steering political movements, and forcing professional politicians to react to what is discussed online.

The series of events (which are happening while writing this chapter) in the Middle Eastern states, commonly known as the “Arab Spring”, are the most recent examples of self-organized democratic processes that were initiated by citizens' dissatisfaction. What makes the Arab Spring very interesting from the point of view of our study is the large role of social media, thus earning it the nickname “Twitter revolutions” (see for example [10]). Although the Arab Spring is an interesting case when discussing

² Switzerland is a country that follows a form of direct democracy.

the role of the Internet in today's political events, it should be noted that many peaceful revolutions have taken place before the invention of the Internet, such as the fall of the communist states in Eastern Europe in 1989. Therefore, it is important to take a cautious stand when claiming the role of social media in the events.

The most notable critic of the supposed impact of social media, Malcolm Gladwell [11], states that true social change is based on risky and meaningful activism. He argues that participation in social media is not an instance of this. Thus, participation in social media lacks organization and sufficient devotion to what is being done, and also leads to a shorter span of attention for a particular event. In contrast, those who believe in the impact of social media, notably Clay Shirky [12], argue that social media is an important tool in promoting social change. In his article in *"Foreign Affairs"*, Shirky refers to events where social media has been used both in making political change successfully (e.g., Moldova in 2009) and unsuccessfully (e.g., Iran in 2009). Shirky argues that for a favorable political change to be possible, people have to be literate, aware, and able to communicate with each other. In addition, he states that access to discussion is even more important than access to information. Access to information only provides knowledge of facts, but access to discussion provides the relevant arguments and a wide range of different opinions, which are essential for an individual when forming a personal opinion on the topic. Shirky concludes that *"Internet freedom helps to advance civil society in the long run, while helping to prevent abuses of power in the short term"* [12].

A quantitative way of looking at the role of the Internet in the Arab Spring can be found in the report by authors at the Dubai School of Government [13, 14], which presents interesting background data about social media in the Arab world prior to January 2011. The report looks at the correlation between social media usage and increased political activity by analyzing data about Facebook users in 22 Arab-region countries. Their findings show that the total number of Facebook users in the Arab world grew a staggering 78%, from 12 million to 21 million, during 2010. This and the follow-up report show [14] that this growth continued in the spring of 2011, e.g., in Egypt by almost 2 million compared to January 2011. Egypt alone had 22% of the total number of Facebook users in this region, while 75% of all the users in the Arab world were under 29 years of age. The report also shows that active Internet filtering in a country does not seem to impact the number of Facebook users there. The study also points out that in both Tunisia and Egypt, people regarded social media as the most important source of information about the events during the uprisings, while private and public mainstream media were regarded as notably less significant sources of information. Interestingly, thorough censorship measures, or even a complete shutdown of the network hint that the Internet and social media are perceived by the governments to have an essential role in a political movement. Recent studies on the Internet disruptions in Egypt and Libya show that governments tended to have a reactive approach to political movements emerging on the Internet [15].

Information presented so far suggests that the Internet and social media played a

very important part in the Arab Spring. However, social media itself cannot be the reason for these pro-democracy movements. Because the events started as grass-root protests against the present rulers, the fundamental reasons for the protests must lie in governments' failure to address the needs of its citizens. To get a better understanding of the motivation of these protests, we should look at key events in the Arab Spring timeline [16].

Tunisia was the first country to witness demonstrations in the Arab Spring, when an unemployed graduate Mohamed Bouazizi set himself on fire after an incident with a local police. Bouazizi died later and the incident sparked protests throughout the country. In the beginning of 2011, Algerians protested against unemployment and rising food prices. Soon after, citizens in Algeria and in Egypt set themselves on fire in protest against the reduced living standards caused by the economic conditions. By following the time line of the events, it can also be seen that the events in different countries aggregated each other.

Based on this very short examination of the beginning of the Arab spring, it would be attractive to claim that the economic conditions and unemployment sparked the protests, even though the actual reason may be long-term disappointment with the current rule and a common thought among citizens that a complete regime change was needed. When the economic situation got sufficiently bad, seriously affecting peoples' basic needs, people set to the streets and started demanding change. In all those cases, social media enabled the citizens to become aware of their common feeling of being neglected by the government. In a way, social media played the role of the second layer of needs, as defined in our model, by creating a community around a common problem. In a developed country, it is usually the role of the media to point out problems in the society, but in the countries of the Arab Spring, the media usually ignored that role, thus becoming useless to the citizens.

A very much related example of a self-organized democratic movement is the ongoing series of demonstrations called *Occupy Wall Street* (OWS). According to their own words, OWS is a human-based movement started on September 19, 2011 in Freedom Square in Manhattan, which soon afterward spread to several cities around the globe. The movement states that it “*is fighting back against the corrosive power of major banks and multinational corporations over the democratic process, and the role of Wall Street in creating an economic collapse that has caused the greatest recession in generations*” [17]. OWS has gained inspiration from the uprisings in Egypt and Tunisia, and their intention is to show that the richest 1% is writing the rules of an unfair global economy. People, faced with worsening economic conditions, do not trust the representative governments anymore to solve their problems and instead want to participate in decision-making themselves. Again, we can see that the basic needs of people are not fulfilled and the social media addresses the need to create a community around a common problem, since the government failed to do so.

It can be concluded that social media is a very important tool in aggregating many-to-many discussions today, and in that sense is an essential tool for (1) deliver-

ing information that mainstream media fail to deliver; and (2) letting people discuss and interact freely. In addition to delivering information, social media facilitates opinion formation by efficiently presenting to the public the essential pros and cons and letting people participate in the discussion.

To sum up, in this section we looked at and discussed the types of needs citizens in modern societies have. We approached this question by using Maslow's hierarchical model of needs, and also by discussing on a more general level how people's expectations from their government have evolved. When governments fail to meet these expectations, people tend to take matters into their own hands. We illustrated that by real life examples from developing and developed nations alike. We chose these cases because they are recent and because they enabled us to see what role the Internet and social media had in them. As a conclusion, we claim that governments can only function properly when people are sufficiently satisfied with it. Otherwise, it is only a matter of time before people find a way to organize themselves and bring down the system in aspiration for an equal society through a true democracy.

3 *Democracy — How?*

This section discusses the role and possibilities of the Internet from the point-of-view of a government. We show how governments react to potential grass root Internet-enabled political change. On the one hand, a negative reaction from the government might include censorship and other countermeasures. On the other hand, a positive reaction is to enable more open decision-making for the citizens with access to information and discussion. The second part of the next section describes what kind of positive actions selected governments have done so far with Internet-based tools to enable a society that effectively fulfills the needs of its citizens.

3.1 Negative Reactions towards Online Democracy

The Internet has always been seen as a great bastion of freedom of speech, and it is evident that it has positively affected people's lives, both locally and globally. Unfortunately, this has not happened in every corner of the world. Some governments have started to restrict freedom of speech online, partly with the help of commercial companies [18]. In addition to China, other countries have been engaged in Internet censorship – Saudi Arabia, Iran, and Burma, to name a few. Web censorship can be in two basic forms: censorship by laws or censorship by active filtering.

In censorship by laws, certain online actions are criminalized, usually for logically declared reasons. For example, child protection laws include the U.S. Communications Decency Act (CDA) [19] and the Electronic Frontiers Australia (EFA). These acts have also been criticized since the definition of inappropriate material is vague. For example, is the fulmination against the government inappropriate?

However, the more vicious method for Internet censorship is active filtering. This approach was very visible during the events of the Arab Spring. Dainotti et al. [15] present an extensive analysis of Internet outages in early 2011 in Egypt and Libya in terms of the number of visible IPv4 prefixes in these countries and packet traffic from them. Saudi Arabia is another clear example of a government exercising Internet censorship by active filtering. Saudi Arabia did not even allow public access to the Internet until 1999. But after that, its filtering policies have remained unusually open [18]. The local Internet Service Unit (ISU) maintains public information about what is filtered and how [20]. ISU also maintains records on which users are online and what content they access. In contrast, Iran and Burma have notably strict and closed active filtering systems.

As of now, China is the state with the most sophisticated and effective censorship system. It has a very complex set of laws, technology, and human oversight with very strict regulations and extensive technical control [18]. Notable in China's case is the involvement of commercial companies, which have a very important role in China's Internet censorship. Cisco and Sun Microsystems have large sales in China, and both have contributed to Internet filtering one way or the other. Yahoo! provides restricted search results, and in 2005 allowed the government to convict a Chinese journalist for leaking state information to a foreign web site [21]. Similarly, Google offers "google.cn" service which displays only results that are allowed by the government [22].

Another type of governments' negative action towards political movements online is to track the formation of movements in social media and try to influence them. In July 2011, DARPA announced its *Social Media in Strategic Communication (SMISC)* program. The purpose of this program is to develop a tool for detecting emerging movements in social media and responding to them in the early stage [23, 24]. The program has two objectives: (1) to help the military to better identify in real time what is happening in a region where, e.g., troops are employed, and (2) intervene in the forming of movements by doing counter-propaganda in an early stage. The aim is to detect and follow the forming, evolving, and spreading of ideas and concepts, and to see what kind of ideas are emerging in the region of interest. A very interesting aspect is that officially this is aimed to be used abroad, since this kind of action would be illegal inside the US. It should be noted that this is not the first case of using public social media data for military purposes. Earlier, NATO used Twitter data to help in choosing the best bombing locations in Libya [25].

In addition, governments may disrupt information and discussion in the web by active manipulation using fake identities. The Guardian newspaper published an article claiming that the US military is developing software to secretly manipulate social media services with fake identities [26]. According to this article, a California-based corporation has been assigned by the US Central Command to develop software to allow a single US worker to control 10 different identities. The software is meant to be used abroad with postings in Arabic, Persian, Urdu, and Pashtu. Although these

tools could be utilized to influence the discussion regarding domestic issues of the US, so far there is no evidence of it.

As a counteraction to censorship, laws for global Internet openness have been proposed. The Global Internet Freedom Act (GIFA) [27] was introduced in the U.S. in the House and Senate in 2002. Its purpose was to develop and deploy technologies for “Internet jamming”. It would insist on a global strategy to ensure international Internet freedom despite oppressive governments. The Global Online Freedom Act (GOFA) [28] was a bill proposed in 2006 that would prevent U.S. companies from working with repressive governments to implement technologies for Internet censorship. As of now, neither GIFA nor GOFA have been passed, and to our knowledge there is no similar laws being proposed or implemented so far.

3.2 From Web Presence to E-Democracy

Governments have tried silencing the people’s voice over the Internet, leading to radical self-organized movements aiming at toppling regimes. Alternatively, governments can support the development of Internet-enabled democracy. The possibilities to exploit ICT in governmental processes are innumerable, as seen in recent e-governments initiatives, for example [29]. ICT should be adapted according to the needs of each nation and depending on the “democratic status” of the society. When developing e-governmental processes, a structured way to approach this complex question is needed. The US government has presented different domains for e-government in its strategic vision [30]. It states that e-government can span from internal processes to external processes and appear either between organizations or individuals. These domains constitute the four major areas of e-government: government-to-citizen (G2C), government-to-business (G2B), government-to-government (G2G), and government-to-employee (G2E). Siau and Long [31] elaborated on each domain and presented their objectives. These domains are summarized in figure 1 and it also shows the focus area of this study.

External	G2C Objective: To provide satisfactory services to citizens in order to improve interaction between the government and citizens	G2B Objective: To provide satisfactory services to businesses in order to improve the business environment
	G2E Objective: To improve internal efficiency and effectiveness of government administration	G2G Objective: To enhance cooperation between governments and municipalities but also between governments of different nations
Internal	Individual	Organization

Fig. 1. Four domains of e-government (adapted from [31])

Activities in the G2E domain aim to increase the efficiency within the government administration by increasing the employees' usage of electronic tools and communication. G2G domain is about increasing the usage of ICT between governments on different levels (e.g., state government and municipalities), or even between different nations. In this chapter, however, we will only focus on the external domain which focuses on individuals (i.e., G2C), since it is the key area which aims to improve democracy. Although the G2B domain covers the initiatives to facilitate companies' business environment, the companies can also be beneficial to governments by providing electronic tools to further improve service in other domains. Note that the G2B domain does not mean that businesses are expected to influence the governmental decision-making process.

In addition to segmenting e-governmental activities, the government also needs tools to measure the development of their e-governance. Several different stage models have been proposed for governments to follow up the development. The models have been developed by private consulting companies and market research companies as well as non-profit organizations and academic researchers. Siau and Long [31] made an effort when streamlining all the existing stage models into one comprehensive and general model of e-government. This model has five stages spanning from web presence to e-democracy. The model proposed by Siau and Long is illustrated in figure 2.

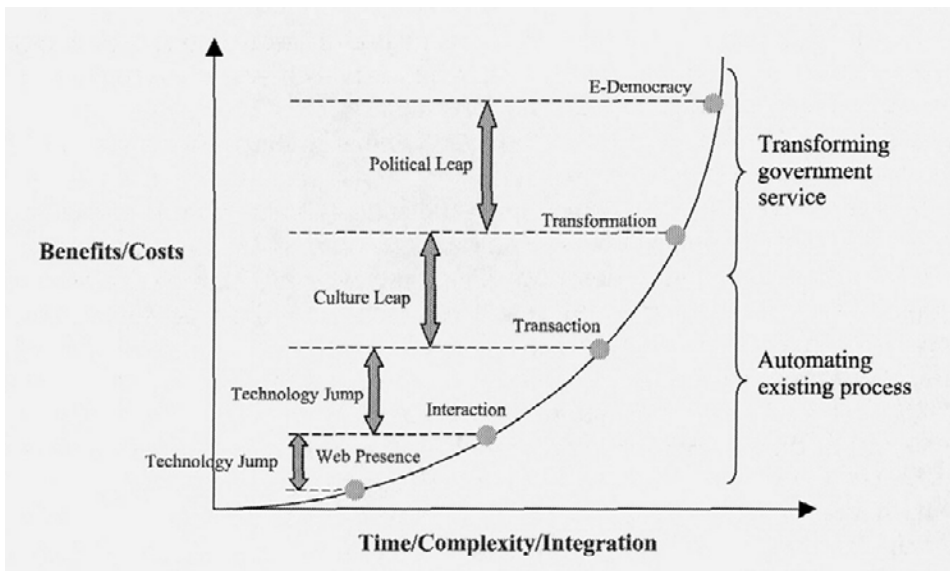


Fig. 2. E-Government Maturity Model – Source [31]

The model consists of two main areas: the automation of existing processes and the transformation of government services. Moving from automating to transforming the processes represents a major leap in e-government development. The transition towards e-democracy not only requires technological but also cultural and political changes. The benefits gained in the different stages are relative to the system complexity and effort that has to be made in order to advance e-governmental processes. The first stage, called *web presence*, is the most basic form of e-government. In this stage, governments only provide relatively static information or regularly updated information online, but no interaction is involved. The second stage, called *interaction*, provides the simplest mode of interaction between the government and citizens (e.g., search information, inquire about public services, etc.). The third stage, called *transaction*, enables individuals and organizations to complete online transactions (e.g., tax filing). The fourth stage, called *transformation*, represents a major leap compared to the previous three stages. In this stage, the government has a more integrated view of online services and they are provided through a single portal instead of many fragmented services. According to the model, *E-democracy* represents the most mature level of e-government development. The government utilizes all kinds of ICT tools for increasing citizen (and possibly also organizational) participation and political transparency. We see that in this stage, the government systematically utilizes the input it gets from the citizen as an integral part of its decision-making.

Insua et al. [32] took a slightly different perspective when evaluating the user involvement and responsibility. They proposed that the user's role in governmental processes can be *informing*, *consulting*, *participating*, and *deciding*. As in the e-government maturity model, these stages are distinct from each other based on the level of

user participation, and all these concepts as well as other similar categorization can be embedded in the different levels of the model shown in figure 2.

As seen in the e-government maturity model, the essence of ICT in the development of more democratic societies is that novel communication technologies and platforms enable breaking the one-dimensionality in decision-making. Orr [33] proposes in his manifesto that people have the right to vote on *every* political issue, which does not happen in a representative democracy. Technological advancement could provide the means to establish a direct democracy again, for example, through e-voting. This can be called one-dimensional decision-making where people are only voting about pre-settled issues. This one-dimensionality was first criticized by Carson [34], who stated that the quality of democratic decisions can be improved by taking people's views into account when preparing a political agenda, which could be called multi-dimensional decision-making. Obviously, implementing multi-dimensional decision-making adds complexity to democratic processes, as it is expected to increase bureaucracy among citizens. Additionally, if it is not designed properly, it is very likely to have no effect on the society, and thus ICT must not be implemented wantonly. When developing the e-democratic practices towards multi-dimensionality, however, there are five aspects [35] that need to be taken into account:

- 1) Contextual pressures and challenges to democracy
- 2) Institutional mediation mechanisms
- 3) Technological mediation tools
- 4) Varieties and levels of political issues
- 5) Different phases of a democratic process

The first task is to identify the changes in social structures, institutions, and mentalities. This means understanding the context where the processes and outcomes of a democratic system take place [36]. The second and third tasks are to determine what the institutional and technological mediation mechanisms in democratic system are. The preceding issue means considering how and to what extent people control the collective decision-making process, while the latter issue considers what the technological tools used for enabling e-democracy are. Since politics deals with practically anything that has a social dimension, it should be understood that people's willingness and ability to affect certain things vary a great deal. Therefore, specific institutional and technological mediation mechanisms do not apply everywhere. Finally, the whole process in the collective decision-making process – from agenda setting and planning to the actual decision-making, implementation, and evaluation – should be considered when developing new forms of democracy, since each stage may require different degrees of user participation.

E-government and collective decision-making have been a research interest for a long time and many concrete tools have been proposed to enhance e-governmental services for citizens and to break the one-dimensionality in decision-making. For a

comprehensive review, see [32]. Web presence and transaction activities – varying from digitizing simple governmental processes [29] to fully fledged e-voting processes [37] – are becoming more and more a commodity, especially in the western countries, but they are also increasingly seen to be used in developing countries.

One of the first participatory e-government initiatives was the Minnesota Electronic Democracy project [38], which enabled online deliberation of political issues as early as the mid-1990s. People were able to have online discussions during candidate debates in different governmental elections. In its early phase, the tools were based on email. But since then, they have evolved into online portals, which include different kinds of features and ways for citizens and representatives to interact. A non-profit organization called “*e-democracy.org*” [39] currently incorporates online participation tools not only for Minnesota, but also for 14 other communities in New Zealand, the UK, and the US. Although such portals seem to have relatively active discussions, it should be noted that the Minnesota e-democracy forum has approximately 500 members while Minnesota has around 5 million inhabitants. This shows that these types of forums attract a relatively small fraction of constituents. In a similar example, Estonia – which is considered one of the most developed countries in regard to e-services – has carried out many different e-government projects to increase citizen participation; but not all of these initiatives succeeded in attracting enough citizens [9].

Despite many initiatives, some small success stories, and good theoretical understanding, a truly participative e-democracy organized by the state has not been realized yet. The current political climate indicates that governments are not capable of fulfilling the needs of the people in practice. Just this December, a Finnish newspaper published the results of the European Social Survey, which indicates that happiness and trust in politicians has decreased in Finland during the last ten years [5]. At the same time, self-organized movements have been able to achieve a significant change in the Middle East. Many countries in Africa have hardly any web presence tools. Nevertheless, they are making a societal difference through social media. These examples and others provide clear evidence that in the information age, political change is possible with already existing tools and without governments putting much effort into it. Could it be possible that e-democracy would not be the peak of the e-government model as suggested by Siau and Long [31]? In this case, ICT-enabled democracy would be the natural next step to take by all governments.

We now turn to the new ways for businesses to enhance their innovation and enable the participation of individuals. We ask what the forces driving people to participate in open innovation projects are and how this could be incorporated in governmental decision-making with the help of new technologies.

4 Democratizing Innovation³

Whether you believe the New Public Management (NPM) theory is still valid [40] or not [41]; and whether you believe that the private sector provides a good guide for public management reforms [40] or not [41], we argue that it is not a bad idea to take a glimpse at how the private sector has adopted democratic practices in its own management philosophy. Corporate survival lies upon its ability to renew, develop, and innovate. In recent years, both large and small corporations have come to realize that working in silos and relying solely on their own intellectual resources does not guarantee sustainability. Alternatively, open innovation suggests opening up a company's boundaries in order to make use of the rich source of knowledge from the outside – be it in the form of other companies or individuals. In this section, we show how corporations use the essence of democracy by involving their customers in the innovation processes. Then in the next section, we will show how, in the same manner, governments should be innovating their relationship with its citizens; hence, innovating democracy.

4.1 Innovation and User Participation

Innovation is a broad concept and has been conceived differently depending on the perspective taken. Innovation is often an information-intensive activity in terms of both information collection and information processing [42]. Taking a historical lens on innovation, it is argued that innovation has witnessed four consecutive waves: the first wave was technology-driven (i.e., technology push), the second wave was market-driven (i.e., market pull), the third wave represents a mix of both, and finally, the fourth wave of innovation marks the dominance of open innovation [43]. The form that open innovation takes varies immensely from one firm to another. Although there has not been a consensus [44] on whether open innovation represents a management fashion, a new theory, or just a framework [45], there is no doubt that open innovation represents a paradigm shift from a closed model. By opening up, companies are advised to not rely exclusively on their own R&D (i.e., a call to open up for inbound innovation). Similarly, companies can look for external organizations with business models that are better suited to commercialize their own innovations (i.e., a call to open up for outbound innovation) [46].

Henry Chesbrough's work [47] has been widely cited as the founding of open innovation. In his seminal 2003 article, "The Era of Open Innovation", he advocates opening up a company's boundaries in order to make use of the rich source of knowledge from the outside. Attention to user participation in the innovation process could be attributed to Eric von Hippel [48], who presents a different approach to open innovation by emphasizing the importance of user integration in the innovation

³ The term 'Democratizing Innovation' is coined with Eric von Hippel [4]

process, calling for democratizing innovation [4]. In this sense, manufacturers should include users in their product/service development. Other streams of research that highlight the high importance of user involvement include work on crowdsourcing [49-51] and the development of open source software (OSS) [52]. In these efforts, user participation in innovation activities is a mode of value creation, as suggested by Chesbrough [47].

We say “a picture is worth a thousand words”. Actually, the following graph (figure 3) is worth even more. It portrays the proportion of developed innovations brought to markets by users as compared with manufacturers.

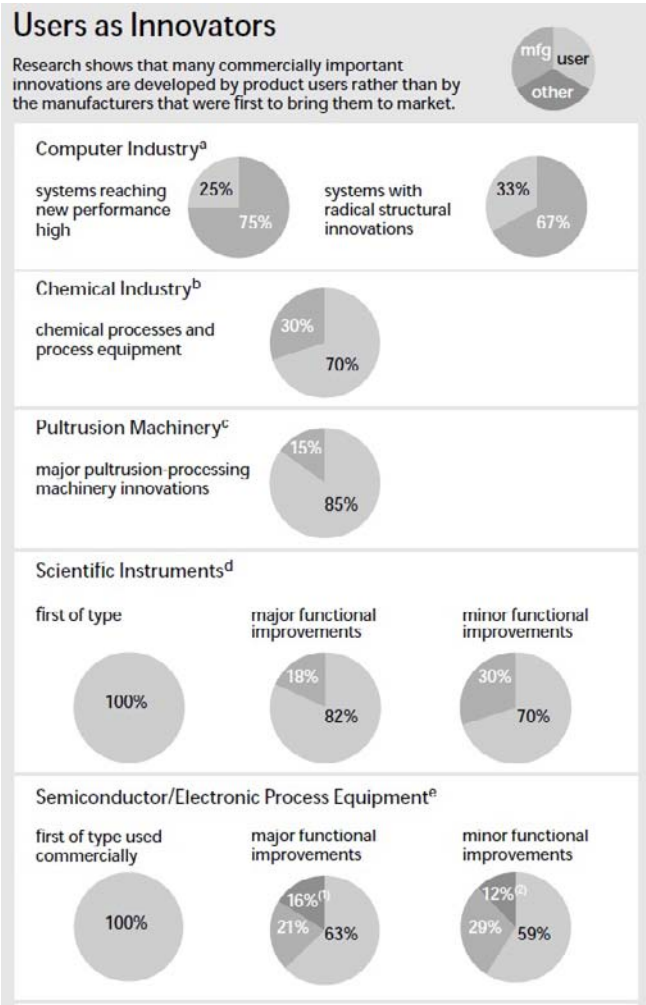


Fig. 3. *Innovations by Users vs. Manufacturers* [53].

The “Lead User” process is one of the early recipes that call for user involvement in the product development process. According to von Hippel [48], lead users are “us-

ers whose present strong needs will become general in a marketplace months or years in the future. Since lead users are familiar with conditions which lie in the future for many others, they can serve as a need-forecasting laboratory for marketing research . . .". He continues to explain that *"since lead users often attempt to fill the need they experience, they can provide new product concept and design data as well"*. In this sense, lead users create innovative products to gratify their needs in ways that are ahead of their time. Thus, firms willing to be on the innovation edge are advised to identify these lead users, listen to them carefully, and take their suggestion seriously into account.

In his later work, *"Democratizing Innovation"* [4], von Hippel explains that the user-centered innovation process is in sharp contrast to the traditional innovation model (in which products and services are developed by manufacturers in a closed way). In this traditional model, a user's only role is to have needs, which manufacturers then identify and fulfill by designing and producing new products. In an interview with Eric von Hippel [54], he explained that innovating users can develop exactly what they want rather than relying on manufacturers to act as their (often imperfect) agents. Moreover, individual users do not have to develop everything they need on their own. Alternatively, they could benefit from innovations developed by others and freely shared within user communities.

Although this concept of democratization is highly visible in the open source software (OSS) development, democratized innovations can be found in physical products as well. The innovation of kitesurfing equipment is one interesting example. Kitesurfing is a water sport in which the user stands on a special board, somewhat like a surfboard, and is pulled along by holding onto a large, steerable kite. Von Hippel [4, 54] explains that early kitesurfing equipment was developed and built by enthusiasts up until around 2001 when an MIT PhD student with a long-time interest in kitesurfing decided to create an Internet-based kitesurfing community where he could share his designs and construction tools. The website started attracting kitesurfing enthusiasts, and other members were invited to download this information for free and contribute their own improvements. The scale and quality of the collective user effort grew to exceed that of equipment manufacturers. Eventually, those free-to-download designs were clearly better than the designs developed by manufacturers. Consequently, manufacturers started realizing the high potential of the designs suggested by the community and began to actually use these designs in their own production. In this sense, free, user-generated designs were driving the production process of manufacturers.

4.2 Innovation and Value Proposition

One central assumption in user-driven (i.e., user-generated) innovations is that users constitute a goldmine of ideas for miners, who can exploit this large pool of users for commercial purposes. In the lead user method for instance, it is assumed that most lead users would be willing to give detailed information to manufactur-

ers for free, and if a lead user expresses any hesitation to share his/her idea due to intellectual property rights concerns, the company should not waste time on him/her and move on to the next [53]. In a similar vein, commercially-oriented crowdsourcing platforms are thriving on the crowd's contributions. In this practice, users' contributions are usually rewarded for a fraction of what the firm actually profits, if rewarded at all [55]. For instance, Amazon mTurk workers earn between \$1-\$2 per hour [56]. Indeed, there are ethical issues in treating users' inputs in profit-oriented firms, but they are usually masked by a notion of a smart business model. However, in an economy of participation, we need to see a shift from a perspective of exploiting one's knowledge by the firm to a perspective of knowledge co-creation; and in doing so, users are treated as a partner in innovation [57]. As studies show, individuals who feel that they are being treated as true partners in innovation are more likely to contribute innovative ideas [58].

To highlight the importance of knowledge being freely revealed in open innovation networks, von Hippel and von Krogh [59] argue that *"a central tenant of open innovation is free revealing of the detailed workings of novel products and services, so that others may use them, learn from them, and perhaps improve them as well"* (p. 295). In other words, when an innovator freely reveals proprietary information, all intellectual property rights to that information are voluntarily given up by that innovator and all parties are given equal access to it. In this sense, the information becomes a public good, available for all to reveal and consume [59]. Here, the situation is quite fair. People innovate, freely reveal their knowledge and share their findings, provided that this knowledge will subsequently will be available for all. No doubt, the best example to illustrate this phenomenon, once again, is open source software (OSS) development. Many OSS developers license their work under the GNU General Public License (GPL), which grants the public the right to use, study, modify, and distribute the software to others at no cost. However, the GPL license does not give the right to incorporate the software into proprietary software, thus forcing companies to contribute to the public good. Quite interestingly, Nambisan and Baron [58] studied users' behavior in the IBM and Microsoft virtual communities (i.e., online customer forums). The study revealed that users behaved differently based on who would benefit from their contributions. It was found that users' contributions concerning product support were strongly associated with their sense of responsibility to the community. This implies that members of a certain community will be willing to freely share their knowledge if they know that other members of the community will benefit from their contributions, even when a 'for-profit' organization would benefit from their contributions.

4.3 Innovation and Rewarding Models

There are two major models that characterize how an innovation gets rewarded in industry and society: the private investment model and the collective action model.

Von Hippel and von Krough [59] summarize these two models and introduce a new hybrid model that combines the best of both worlds: the *'private-collective'* model.

The private investment model. This model is based on the assumption that innovation will be supported by private investors expecting to make a profit. To encourage private investment in innovation, society grants innovators some limited rights to the innovations they generate via patents, copyrights, and trade secrecy laws. These rights assist innovators in getting private returns from their innovation-related investments. At the same time, the monopoly control that society grants to innovators creates a loss to society relative to the free use by all of the knowledge that the innovators have created. Von Hippel and von Krough [59] point out that in order to increase innovators' incentives to invest in the creation of new knowledge, societies are usually willing to take this social loss.

The collective action model. This model assumes that innovators relinquish control of knowledge to a certain project and in doing so, make it a public good. This requirement enables collective action projects to avoid the social loss associated with the restricted access to knowledge of the private investment model. However, at the same time, it creates problems with respect to recruiting and motivating potential contributors. As contributions to a collective action project are considered a public good, those who will benefit from that good have the option of waiting for others to contribute, and then free-riding on what they have done. Thus, it is of utmost importance to find the right incentives to motivate contributions for this sort of projects. Von Hippel and von Krough [59] explain that science often mentioned as an example for this model, where a mix of material (e.g. research funds) and immaterial (e.g. honorary awards) are essential for attracting scientists, which in turn leads to producing good science.

The private-collective model. In this model, free riding is not discouraged. In open source software, anyone is free to download code or seek help from project websites, and no apparent form of moral pressure is applied to make a compensating contribution (e.g., 'If you benefit from this code, please also contribute . . .').

The private-collective model for innovation incentives is a very rich and fertile middle ground where incentives for private investment and collective action can coexist, and where a *'private-collective'* model for innovation incentives can flourish.

It is imperative that generating the best solution for a particular problem, solvers (i.e., innovators) should be motivated to reveal their knowledge. Von Hippel and von Krough [59] argue that free revealing can make good economic sense for innovators and, more importantly, for society as well. A *'private-collective'* model of innovation incentives combines elements of the private model with elements of the collective action model. It occupies a middle ground that appears to offer society *'the best of both worlds'* – public goods created by private funding. Although the

‘usual suspect’ that is used to exemplify this phenomenon is OSS development, we argue that there is still room pushing the envelope a bit more. Other examples of the ‘private-collective’ model could and do exist in the area of societal innovation, where both private investments and public interest and knowledge merge to produce groundbreaking solutions. Solutions that are economically feasible (i.e., maximizes profit and/or reduces cost), while at the same time solving societal problems in a way never before achievable.

5 Innovating Democracy

To most people, democracy is equal to voting. When people are asked how they think democracy could be improved, the answer most likely will concern improving the voting process. This one-dimensional, centralized governance model had been accepted due to practical reasons. However, we live in different times now, in which the Internet transcends being a mere technology. The Internet has become a *“belief system, a philosophy about the effectiveness of decentralized, bottom-up innovation”* [60]. We have a strong belief that the Internet and democracy go hand-in-hand, and we envision an Internet-enabled democratic model that goes beyond the traditional one-dimensional relationship between governments and their citizens.

5.1 Examples of Using Open Innovation for Democracy

So far, we have argued for our vision of a new model of democracy. This vision, however, is not entirely based on future projection or science fiction. It is rooted in a comprehensive literature review and a careful scanning for actual implementations. As was pointed out in the previous section, crowdsourcing represents one form of open innovation, in which individuals are invited to participate in problem solving. One recent form of crowdsourcing for societal betterment can be exemplified by the Aalto Camp for Societal Innovation (ACSI). ACSI works as a platform that connects institutions facing challenges with potential solvers from the society. ACSI’s first round (i.e., prototype) took place between June 28th and July 5th, 2010. It had three thematic societal challenges and two cases for each theme. In this example, we take a closer look at the case ‘Versatile Services for Older People’ in terms of who was involved, what the challenge was, what the objective was, and what kind of solution was proposed.

Solvers were invited, and for each case, a group was formed from the attending crowd. The challenge was to propose innovative solutions for services that enable older people to continue living in their own residential areas, taking into account their increasing need for personal assistance, support, and care. During the eight days of the event, activities included brainstorming about the topic, identifying the target group of the service, visiting an operating center for the elderly, collecting data,

categorizing potentials and challenges, and more discussions. Eventually the team promoted the most innovative and feasible solution to be presented on the exhibition day. The detailed solution could be accessed in their published 11-page report [61]; however, for illustration, we present a graphical model of their solution in figure 4.

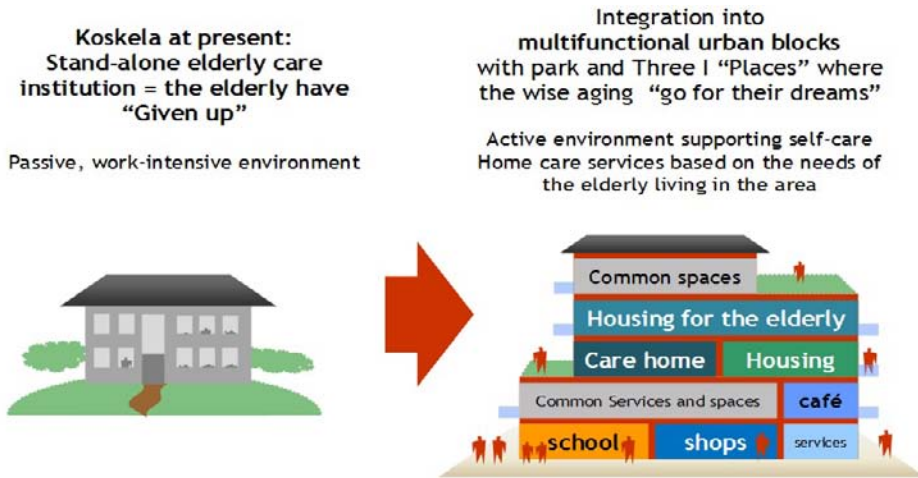


Fig. 4. Envisioned Solution for Elderly Services – Source: [61]

One major ingredient that is missing from the ACSI recipe, however, is the exploitation of the full potential of the Internet and web technologies to widen the participation rate. So far, participation is limited to those who are physically present in the event vicinity. In doing so, it offers little more than the traditional representative democracy. We believe that the Internet plays a central role in pushing the democratic envelope even further. In agreement with Brabham [62], we believe that governments need to take a risk with new and innovative models such as crowdsourcing. In doing so, small scale, low-risk experiments with crowdsourcing are a good starting point for piloting and concept proofing.

One interesting example is FixMyStreet.com, which is a website through which citizens can report problems with streets and roads in England, Scotland, and Wales to their local council or a related organization and see what reports have already been made. This service is an initiative made by the e-Democracy charity called MySociety. FixMyStreet.com takes the report and routes it automatically to the right place, which means that people don't need to waste time finding out which utility company to call or which number in which department in council to call. This example shows that simple and innovative ICT solutions could be utilized to empower citizens to have a more active role in their societies. In this example, the crowd is willingly investing their time and effort for improving the society. The government, on the other hand, plays an enabling role instead of a controlling role.

AdvanceMichigan [63] is another state initiative with the aim to include the citi-

zens in deciding how the public budget should be allocated. Eventually, the initiative came out as a social media platform, which failed to attract enough participants in it. The study reports several technical and social challenges that are worth considering when designing this type of platform. Just to mention a few, (1) the platform failed to make clear how participants would benefit from participating; (2) the social media was not the right tool to connect with the target audience; and (3) the software was too hard to use for those not familiar with how social media platforms operate.

5.2 Conclusions for Innovated Democracy

Based on the positive results from the presented examples, we argue that open innovation is a key tool in transforming democracy to be more participative, where the participation of the people matters and thus motivates them to take part in common decisions. In addition, innovating democracy with open innovation will be cost-effective and easy to deploy, and it will benefit a lot from the use of ICT. Every citizen should not be deciding on every issue, but instead, a reasonable allocation of issues based on the individual willingness and competence would increase the motivation to participate as well as the quality of the decisions.

The remaining question is: how to make the final decisions based on these online polls, mashups and other discussion platforms in the e-democracy of open innovation? There still has to be a body that makes the eventual and conclusive decisions after common discussion and solution proposing. This question opens up a completely new topic which in a larger context is outside the scope of this work. However, we believe that those responsible for the final decisions will be the embodiment of the current representative democracy. That is, we would still have representative democracy in innovated democracy, but the role of politicians would be switched from being individual players to being people who efficiently discuss with citizens through mediating technology that efficiently presents them with the views and solution proposals of the people. That is, the representative democracy will not be displaced by participation. In the future, we will have still professional representative politicians who efficiently study the collected views and proportions of the people, and who make their action proposals based on these. The state, government, and professional politicians themselves will not become useless because of participatory e-democracy, just as businesses themselves are not going to die because of open innovation. But the work of a politician will change. When decisions are made based on a common open solution-proposing mechanism, the responsibility of both good and bad decisions will be borne by every citizen. The representative politician will in the future be more of a mediator from citizens to the final actions of the state.

In the final part of our work, we present an e-democracy landscape where participation is easy and effective, information is available to everyone, communication technology is ubiquitous, and peoples' participation is channeled with intelligent and open mechanisms. Open innovation models from the industry have been adopted by

the state, so that the state releases information about the upcoming problems in the form where it is easy to access without the need to search all of the different, possibly untrustworthy sources.

5.3 Scenario of the Future: Omni-Channel Democracy

The discussion here focuses on sketching the technology mediated democracy landscape of the future where social and technical challenges regarding the ownership of the system, data, personal security, and privacy issues would have been solved. Here, the utility of the Internet has been mundanely weaved into our everyday lives so that the best parts from both the physical and virtual worlds can establish a trustworthy and more equal decision-making process. An ideal state would acknowledge and fulfill our needs through a ‘contoured ubiquitous’ mechanism that would somehow ‘recognize, negotiate and facilitate’ our subjective needs and values with other individuals and the society-at-large [64]. Once the needs of self-actualization become satisfied, they would become reworked as more advanced virtual needs. In order to approach plausible forms of e-democracy, the understanding of needs as binding has been utilized through this essay as a uniting and separating social factor. In the current system, basic needs, their exchange, and the value of things is merely measured through quantified, capitalist logic [65].

Networked online presence, privacy, and trust have enabled a new type of intangible value basis such as social capital and bartering. Participatory systems such as social media have become integral for economic decision-making, and according to Nigel Thrift, information technology plays a vital role in the emergence of a new kind of networked value. Thrift describes the change through the activity of generalized outsourcing (i.e., crowdsourcing) where the online roles of information producers and consumers can be switched and configured dynamically. Thrift suspects that such practices establish a form of ‘efficacy’ which may produce new interactive senses of causality ultimately challenging the linearity of globalized capitalism.

In practice, what can be automated can be measured and tuned to correspond to both individual needs and the consensual needs of the masses. The virtualization process of basic needs attempts to primarily emulate our basic individual needs. This loop can be reworked to loop basic needs back to the individual as higher level needs. Following Thrift’s idea regarding the production of value, the process could be described in terms of individualized mass customization or the end of the innovation economy, postulating the emergence of a post-material experience economy and the maturing of true e-democracy where more open and sustainable sharing of limited goods and information would become the core value in aggregating interdependent needs within an e-democracy.

The trust in the one-dimensional democratic decision-making process [35] is maintained by the surrounding state [66]. People only have to trust in whatever system the government chooses to impose on them when sampling collective intent

[9]. By adding more dimensions to the decision-making process, more inclusive participatory mechanisms have been explored especially in state level decision-making. The five key types of mechanisms are: citizen juries, stakeholder workshops, deliberative opinion polls, town meetings, and referenda [32]. Models originate from arcane political human-to-human interaction models that have now been amplified and shared through the process of digitalization. Here, state-implied systems compete increasingly more with commercial social media services and personal everyday attention. Motivation to use additional formal systems conflicts with the popular use of informal social media.

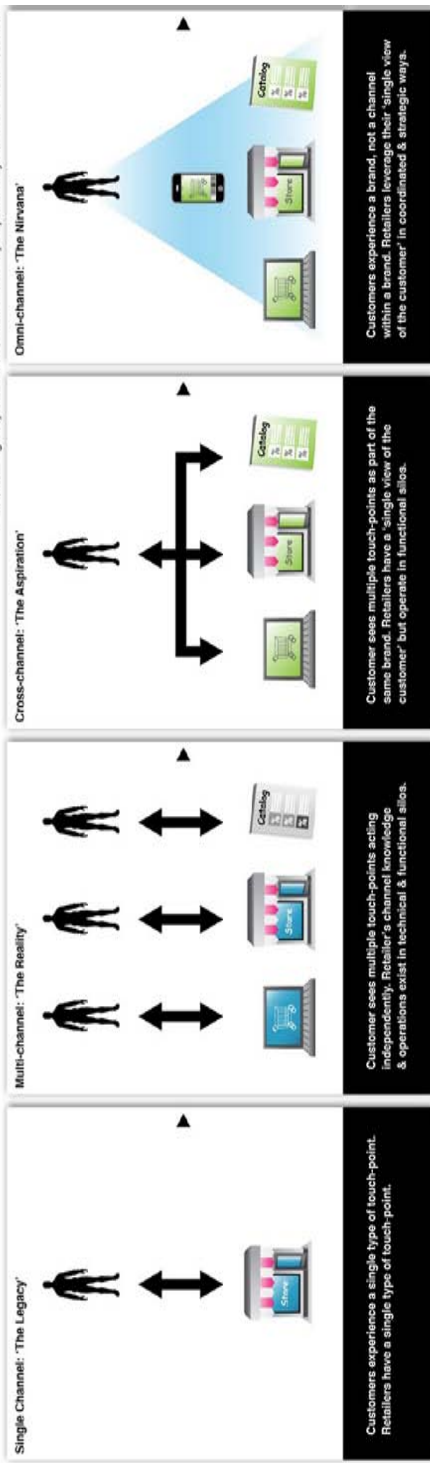
Parallel to temporary state enabled voting practices, free online tools for sampling and syncing everyday activities and decision-making can offer new spheres of participatory confluence. Micro-blogging services such as Twitter and the schedule management service Doodle are both proprietary by nature and designed to carry out contextual tasks such as publishing status and syncing tasks. The proprietary services compete with state democracy in unseen ways as private companies can accumulate more information about individuals than the state can. Next to state-driven mechanisms, social media services can offer a dynamic alternative for supporting and augmenting ad hoc decision-making, causing strange paradoxes of entailed ownership of private data. In the current situation, 'statistical consent' can be extracted from the Internet through search engine analytics and aggregated as a real-time value. Reducing human consent and (in a certain sense) the democratic process in a quantified online representation appear to evoke anti-technology reactions such as Wall Street demonstrations opposing the current state of and aftermath of the promised digital economy. Original luddites attacked machines by breaking them out of fear of losing their jobs.

The problem in deploying a systemic design approach to so-called wicked problems such as politics and the economy lies in their inherently complex interdependencies. In order to design an elegant e-democracy landscape, both public and private decision-making mechanisms would need to be allowed to exist and compete. Figure 5 shows the evolutions from single to omni-channel e-democracy.

In the novel omni-channel e-democracy, different kinds of tools, such as electronic mash-ups and online polls, are actively used as a part of governmental decision-making, and the data is synchronized as well as portable between different channels. The time consumed by a certain decision-making process is remarkably decreased and the state can leverage and negotiate decision-making power in real-time whenever needed.

Multi-Channel Retail Evolution of Customer-Retailer Touch Points

Mobile Retailing Blueprint, 2011/10/04 A Joint White Paper sponsored by the National Retail Federation.



Multi-Channel Democracy Evolution of Citizen-State Participation Points

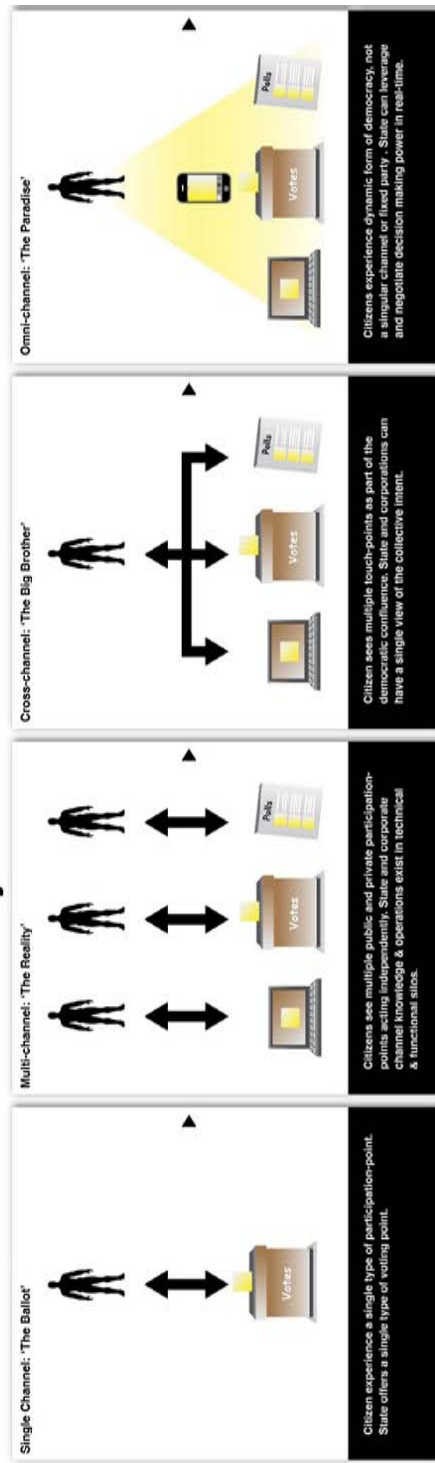


Fig. 5. Evolution from single to omni-channel e-democracy.

The use of Twitter and Facebook among the civil population in organizing meetings and reporting abuse during the recent Arab upheaval have proved useful for self-organizing during the political unrest [67]. The problem in using non-approved proprietary services during the governmental turmoil can conflict their users with state approved mechanisms. Thus, we look to the future to provide a multitude of equally valuable channels, with the choice being up to the user to pursue the best way to solve an issue. The multitude of ways and their social nature will attract bigger audiences at the cost of lower privacy. It seems that the Internet will transform yet another area of human life, perhaps the most important so far.

6 Conclusions

In this chapter, we argued that democracy should be transformed to be more participatory by adopting the open innovation model from the business world. Using the methods of open innovation enables a cost-effective and easy-to-deploy way of allowing citizens to have an influence on important decisions made in the society. Using information and communications technology is a vital part of the proposed democracy model.

We showed that it is a matter of time before people eventually resort to democracy, especially when considered as a basic human need. We also stated that the current model of representative democracy is not the optimal way and that the Internet of today enables democracy to be innovated to reflect people's needs better. Our claims were supported by several real-life examples, including the events of the Arab Spring in 2011.

We presented ways on how governments have tried to make democracy more participatory and we saw that major problems lie in making the system effective at a reasonable cost and in motivating people to participate. For comparison, we presented the term 'open innovation', which has been harnessed in the business world with positive results.

Finally, we presented examples of how society has been using methods of open innovation to enable effective participation of their members. Based on this, we argued that open innovation is the key for innovate democracy to become more participatory without completely disbanding representative democracy. Finally, we presented a future scenario where people are free to choose from multiple channels to discuss and solve issues.

References

1. Chomsky, N., American Decline: Causes and Consequences; The Chomsky Website; Available at <http://www.chomsky.info/articles/20110824.htm>; Accessed on 2.12.2011. 2011.
2. Ormalä, E., European Jobs Are Being Created In North America; Available at <http://financialguy.blogactiv.eu/2011/06/16/european-jobs-are-being-created-in-north-america/>; Accessed on 1.12.2011. 2011.
3. Holmes, D., eGov: eBusiness Strategies for Governments. 2001, London: Nicholas Brealey Publishing.
4. von Hippel, E., Democratizing Innovation. 2005, Cambridge, Massachusettes 02142: The MIT Press
5. HS, Helsinki Sanomat: Trust in Politicians and Happiness Have Decreased in Finland “Luottamus poliittikkoihin ja onnellisuus vähentyneet Suomessa”. Found at <http://www.hs.fi/kotimaa/Onnellsuus+ja+luottamus+poliittikkoihin+laskenut+Suomessa/a1305550751058>; Accessed on December 6th, 2011. 2011.
6. Conley, C., Peak: How Great Companies Get Their Mojo from Maslow” Jossey-Bass; 1st edition (September 21, 2007). 2007.
7. Amin, P., et al., Bit Bang 3: Service Innovation Based on Maslow’s Hierarchy of Needs; Available at: <http://lib.tkk.fi/Reports/2011/isbn9789526035734.pdf>. 2010.
8. Frey, B. and A. Stutzer, Happiness, Economy and Institutions; Economic Journal, 110(446), pp. 918–38. 2000.
9. Kitsing, M., Success Without Strategy: E-Government Development in Estonia; Policy & Internet: Vol. 3: Iss. 1, Article 5. 2011.
10. Greenfield, R., Measuring the Twitter Revolution Effect Is Pretty Hard. Yahoo! News, September 23, 2011. Available at <http://news.yahoo.com/measuring-twitter-revolution-effect-pretty-hard-170033805.html>. Accessed November 3rd, 2011. 2011.
11. Gladwell, M., Small Change. Why the Revolution will not be tweeted. Published in: The New Yorker, Oct. 4, 2010. 2010.
12. Shirky, C., The Political Power of Social Media. Foreign Affairs, vol. 90, 28-41, 2011. 2011.
13. Salem, F. and R. Mourtaä, Facebook Usage: Factors and Analysis. Arab Social Media Report, vol. 1, No. 1. 2011a.
14. Salem, F. and R. Mourtaä, Civil Movements: The Impact of Facebook and Twitter. Arab Social Media Report, vol. 1, No. 2. 2011b.
15. A. Dainotti, C.S., E. Aben, K. C. Claffy, M. Chiesa, M. Russo, and A. Pescapé, Analysis of Country-wide Internet Outages Caused by Censorship. Published in: Proceedings of the IMC, 2011. 2011.
16. Blight, G., S. Pulham, and P. Torpey, Arab Spring: an interactive timeline of Middle East protests. The Guardian, November 21, 2011. Available at <http://www.guardian.co.uk/world/interactive/2011/mar/22/middle-east-protest-interactive-timeline>. Accessed November 27th, 2011. 2011.
17. OWS, Occupy Wall Street Movement; available at <http://occupywallst.org/about/> ; Accessed on 6.11.2011. 2011.
18. Stevenson, C., Breaking the Great Firewall: China’s Internet Censorship and the Quest for Freedom of Expression in a Connected World. Boston College International and Comparative Law Review, vol. 30, 2007. 2007.
19. Barrage, R.H., Reno v. American Civil Liberties Union: First Amendment Free Speech Guarantee Extended to the Internet. 49 Mercer Law Review, vol. 625, 1997-1998. 1998.
20. ISU, Internet Services Unit - Online document. Available at <http://www.isu.net.sa/saudi-Internet/content-filtring/filtring.htm>, accessed October 16th, 2011. 2011.
21. Kahn, J., Yahoo helped Chinese to prosecute journalist. The New York Times, 2005. Can be found at <http://www.nytimes.com/2005/09/07/business/worldbusiness/07iht-yahoo.html>. Accessed 16th 22. October, 2011. 2005.
22. Whitling, M.D., The Great Firewall of China: A Critical Analysis. Graduate Research Paper, Air Force Institute of Technology. 2008.
23. Rawnsley, A., Pentagon Wants a Social Media Propaganda Machine. Wired, 2011. Can be found at <http://www.wired.com/dangerroom/2011/07/darpa-wants-social-media-sensor-for-propaganda-ops/>. Accessed 16th November, 2011. 2011.
24. DARPA, DARPA. Social Media in Strategic Communication. Can be found at https://www.fbo.gov/index?s=opportunity&mode=form&id=6ef12558b44258382452fcf02942396a&tab=core&_cview=0 Accessed 16th November, 2011. 2011.

25. Ackerman, S., NATO's Newest Bombing Tool: Twitter. *Wired*, 2011. Can be found at <http://www.wired.com/dangerroom/2011/06/natos-newest-bombing-tool-twitter/>. Accessed 16th November, 2011. 2011.
26. Fielding, N. and I. Cobain, Revealed: US Spy Operation That Manipulates Social Media. *The Guardian*, 2011. Can be found at <http://www.guardian.co.uk/technology/2011/mar/17/us-spy-operation-social-networks>. Accessed 16th November, 2011. 2011.
27. GIFA, Global Internet Freedom Act; GovTrack.us. H. R. 2216; Available at <http://www.govtrack.us/congress/bill.xpd?bill=h109-2216>; Accessed on 27.11.2011. 2011.
28. GOFA, Global Online Freedom act of 2009; GovTrack.us. H. R. 2271; Available at <http://www.govtrack.us/congress/bill.xpd?bill=h111-2271>; Accessed on 27.11.2011. 2011.
29. Soliman, W. and V.K. Tuunainen. Critical Business Process Management Issues in Electronic Government Projects – A Case Study; Proceedings of the 34th Information Systems Research Seminar in Scandinavia – IRIS (2011), August 16th – 19th; (711-725) Turku, Finland. 2011.
30. Forman, M., White house, Office of Management and Budget - E-government Strategy. Available at http://www.usa.gov/Topics/Includes/Reference/egov_strategy.pdf. Accessed November 4, 2011. 2002.
31. Siau, K. and Y. Long, Synthesizing e-Government Stage Models – A Meta-Synthesis Based on Meta-Ethnography. *Journal of Industrial Management & Data Systems*, 2005. 105(4): p. 443-458.
32. Insua, D.R., Krsten G.E., Rios, J., Grima, C. , Towards decision support for participatory democracy. In F. Burstein, C. W. Holsapple (Eds.) *Handbook on Decision Support Systems*. pp. 161-191, Springer. 2008.
33. Orr, A., Direct Democracy Manifesto. Politics for the 21st Century. Direct Democracy Forum; Available at <http://lpc1998.com/forum/NPS/Misc/NPS-misc0005.html>. Accessed October 6, 2011. 2000.
34. Carson, L., Building deliberative capacity. *Worldwide Direct Democracy Newsletter* 2, 2 (June 2000), 1-2. 2000.
35. Anttiroiko, A.V., Building Strong E-Democracy - The Role of Technology in Developing Democracy for the Information Age, *ACM Magazine of communication*, Volume 46, Issue 9. 2003.
36. Nardi, B.A., Context and Consciousness: Activity Theory and Human-Computer Interaction, The MIT Press. 1995.
37. Staeuber, R. and U. Gasser, Politicians' Personal Communication on the Internet: E-Voting; March 2009; Internet & Democracy Case Study Series; Berkman Center Research; Harvard University; Publication No. 2009-03.1 2009.
38. Aikens, G.S., A Personal History of Minnesota Electronic Democracy. *J Gov Inform*, 25(1), 1998, 1-9. 1998.
39. E-democracy.org, E-democracy.org. Organization web page. Available at <http://forums.e-democracy.org/>. Accessed November 18, 2011. 2011.
40. Lane, J.-E., *New Public Management*; Routledge, London. 2000.
41. Dunleavy, P., et al., New Public Management Is Dead—Long Live Digital-Era Governance; *Journal of Public Administration Research & Theory*, 1/3/2006, Vol. 16 Issue 3, p467, 28p. 2006.
42. Ahuja, G., Collaboration Networks, Structural Holes, and Innovation: A longitudinal Study. *Administrative Science Quarterly*, 2000. 45: p. 30.
43. Berkhout, A.J. and P.A. van der Duin, New Ways of Innovation: an Application of the Cyclic Innovation Model to the Mobile Telecom Industry. *Int. J. Technology Management*, 2007. 40(4).
44. Lindegaard, S., *The Open Innovation Revolution: Essentials, Roadblocks, and Leadership Skills*. 2010: John Wiley & Sons, Inc., Hoboken, New Jersey.
45. Lichtenthaler, U., Open Innovation: Past Research, Current Debates, and Future Directions. *Academy of Management Perspectives*, 2011. 25(1): p. 19.
46. Chesbrough, H. and A.K. Crowther, Beyond High Tech: Early adopters of Open Innovation in Other Industries. *R&D Management*, 2006. 36(3).
47. Chesbrough, H., The Era of Open Innovation. *MITSloan Management Review*, 2003. 44(3).
48. von Hippel, E., Lead Users: A Source of Novel Product Concepts; *Management Science* Vol. 32, No. 7. July 1986. 1986.
49. Howe, J., The Rise of Crowdsourcing, in *Wired Magazine*. 2006.

50. Ebner, W., J.M. Leimeister, and H. Krcmar, Community Engineering for Innovations: The Ideas Competition as a Method to Nurture a Virtual Community for Innovations R&D Management, 2009. 39(4).
51. Leimeister, J.M., M. Huber, and H. Krcmar, Leveraging Crowdsourcing: Activation-Supporting Components for IT-Based Ideas Competition. Journal of Management Information Systems, 2009. 26(1).
52. van de Vrande, V., W. Vanhaverbeke, and O. Gassmann, Broadening the scope of open innovation: past research, current state and future directions. Int. J. Technology Management, 2010. 52(3/4): p. 221-235.
53. von Hippel, E.T., Stefan; Sonnack, Mary, Creating Breakthroughs at 3M. Harvard Business Review, 1999.
54. von Hippel, E., An interview with Eric von Hippel, MIT, on Democratizing Innovation, in Mass Customization & Open Innovation News. 2005.
55. Brabham, D.C., Crowdsourcing as a Model for Problem Solving. Convergence: The International Journal of Research into New Media Technologies, 2008. 14(1): p. 17.
56. Schulze, T., et al. Exploring Task Properties in Crowdsourcing – An Empirical Study on Mechanical Turk. in 19th European Conference on Information Systems (ECIS). 2011. Helsinki, Finland.
57. Sawhney, M. and E. Prandelli, Communities of Creation: Managing Distributed Innovation in Turbulent Markets. California Management Review, 2000. 42(4).
58. Nambisan, S. and R. Baron, Different Roles, Different Strokes: Organizing Virtual Communities Environments to Promote Two Types of Customer Contribution. Organization Science, 2010. 21(2).
59. von Hippel, E. and G. von Krogh, Free Revealing and the Private-Collective Model for Innovation Incentives. R&D Management, 2006. 36(3).
60. Ito, J., In an Open-Source Society, Innovating by the Seat of Our Pants; The New York Times; Available at http://www.nytimes.com/2011/12/06/science/joichi-ito-innovating-by-the-seat-of-our-pants.html?_r=2; Accessed on 6.12.2011. 2011.
61. ACSI. Case 6: Versatile Services for Elderly People. 2010b; Available from: <http://acsi.aalto.fi/binary/file/-/id/1/fid/114>.
62. Brabham, D.C., Crowdsourcing The Public Participation Process For Planning Projects; Planning Theory 2009 8: 242; Published by SAGE. 2009.
63. Lampe, C., et al., Inherent Barriers to the Use of Social Media for Public Policy Informatics. The Innovation Journal: The Public Sector Innovation Journal, 2011. 16(1).
64. Weiser, M., The Computer for the Twenty-First Century; Scientific American, pp. 94-10, September 1991. 1991.
65. Thrift, N., Re-inventing invention: new tendencies in capitalist commodification; Economy and Society Volume 35 Number 2 May 2006: 279-306. 2006.
66. Kohn, M., Trust: Self-Interest and the Common Good, Oxford University Press, USA 2008.
67. Joseph, S., Social Media, Human Rights and Political Change V.1. Unpublished paper. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1856880. 2011.

Proliferation of the Crowdsourcing Phenomenon

Raisa Halonen¹, Mohammad Hoque², Mokter Hossain³, Gautam Raj Muktan⁴,
Tuomas Ritola⁵, and tutor Meri Kuikka⁶

¹ Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

² Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

³ Aalto University School of Science, Department of Industrial Engineering and Management
PO Box 15500, FI-00076 Aalto

⁴ Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

⁵ Aalto University School of Engineering, Department of Engineering Design and Production
PO Box 14100, FI-00076 Aalto

⁶ Aalto University School of Economics, Department of Information and Service Management
PO Box 21220, FI-00076 Aalto

{[raisa.halonen](mailto:raisa.halonen@aalto.fi), [mohammad.hoque](mailto:mohammad.hoque@aalto.fi), [mokter.hossain](mailto:mokter.hossain@aalto.fi),
[gautam.muktan](mailto:gautam.muktan@aalto.fi), [tuomas.ritola](mailto:tuomas.ritola@aalto.fi), [meri.kuikka](mailto:meri.kuikka@aalto.fi)}@aalto.fi

Abstract

Crowdsourcing is a growing phenomenon, which has been strikingly boosted by the advent of the Internet. Despite its vibrant presence in the popular press, extant literature has limited academic studies on it. Most crowdsourcing-related studies are based on single case studies. Incentive structures and motivational factors vary from one platform to another because the activities are different from one to another. The objective of this study is to understand the overall crowdsourcing platform phenomenon by considering issues such as incentive, inception, motivation, key activities, and the country of platform origin as well as the global evolution of crowdsourcing platforms. Data has been collected from over 400 online platforms. The overall structure of incentive, inception, and motivation are revealed. Moreover, geographical dispersion of online platforms shows very interesting insights.

Keywords: Crowdsourcing, incentive, motivation, online platforms, proliferation

1 Introduction

Crowdsourcing refers to engaging crowds to solve problems which would otherwise be performed by internal or external employees [2]. Crowdsourcing, the term for which was coined by Wired magazine journalist Jeff Howe in 2006, is a growing phenomenon, and has become a dominant means for accomplishing work online. It is a distributed problem-solving model that has emerged in recent years [1]. However, the concept of crowdsourcing goes back to the 18th century when the Oxford dictionary was crowdsourced by volunteers providing word definitions on paper slips. Similarly, in 1715, a contest called the Longitude prize was held to find a navigation solution. The concept encompasses widely distributed problem solving in which tasks are posted on a website to crowds as an open call. Interested crowds solve posted problems in return for incentives. Crowdsourcing helps organizations to improve productivity and creativity and minimize research expenses [3]. Firms have been traditionally relying on internal staff for innovation [4]. Organizations are outsourcing creativity to get fresh ideas [5]. One way of idea outsourcing is “crowdsourcing”. Many firms have been successfully using online crowdsourcing platforms to tap the wisdom of crowds. For example, Lego (design), Starbucks (coffee), and Threadless (t-shirts) attract thousands of consumers to suggest, discuss, and vote on new product ideas [6]. Crowdsourcing is an important development in the past decade for technological and social innovation. Innovation is no longer limited in a closed wall because good ideas can come from outside the company [10]. Over the past years, numerous ideas have come out based on the contribution of huge numbers of crowds [7]. Wikipedia is a classic example of this kind. Crowdsourcers use project-oriented volunteers and/or contestants and these crowds are flexible, self-trained and self-maintained [8]. Even though crowdsourcing contests attract tremendous attention, there are limited theoretical and empirical studies on it [9].

Open source software is initial evidence of this phenomenon [11]. There are numerous applications for crowdsourcing facilitated mainly by the Internet. The most common applications include compiling the efforts of multiple people to solve a problem or to create, for instance, a new product, facilitating the participation of people in democratic decisions, building general knowledge bases and wikis, or collaborating to create art or music. Vukovic presents a categorization for existing crowdsourcing platforms [12]. According to Vukovic, the different functions of crowdsourcing are design and innovation, development and testing, marketing, and sales support. The platforms found in the support category include Amazon Mechanical Turk, FixYa.com, GetSatisfaction.com, and Askville by Amazon. These represent examples of community information-centric systems that are newer versions of online help systems developed from user groups and discussion forums. So far, almost all (if not all) of the studies on crowdsourcing are based on a single case study. The incentives vary from one platform to another. Hence, we tried to see the global holistic perspective of crowdsourcing platforms. The definition of crowdsourcing given by

Howe is very broad [13]. It is not possible to distinguish what is crowdsourcing and what is not from his definition. Brabham tries to draw a boundary between what is crowdsourcing and what is not [1]. For the sake of simplicity, we considered platforms where unknown people engage, contribute, and share to generate some kind of new ideas and contributions as a whole.

The objective of this study is to understand the overall crowdsourcing platform phenomenon by considering incentive, inception, motivation, countries of origin, and the evolution of crowdsourcing platforms. To accomplish this objective, data from over 400 online crowdsourcing platforms was collected by visiting each platform. The names of the platforms were found from literature and several websites where platform names are listed. Each platform website was visited and information on incentive, inception, country of origin, and type of task performed in the platforms was collected. In some cases, several visits were needed to get adequate information. Moreover, press releases, news, and people working with platforms are considered as additional information sources. The data was collected mostly between October and December 2011.

The rest of this paper has been structured as follows. Section 2 describes various facets of the crowdsourcing phenomenon. In this section, we discuss issues such as requirements, value, incentive, risk and failures. Section 3 contains the analysis and discussion. Finally, the conclusion is drawn in section 4.

2 Facets of Crowdsourcing

2.1 Requirements

Crowdsourcing has changed the basic method of problem solving. Instead of relying on a single person or a small group of professionals, it allows for the distribution of the problem globally to different kinds of users, from professionals to amateurs. Therefore, it is also considered as a distributed problem-solving model [1]. The first and foremost enabler of crowdsourcing in general is the development of the Internet. The web provides the perfect technology for aggregating vast amounts of disparate, independent inputs. However, in order to make crowdsourcing successful for any organization with such potential support, it is necessary to define some default requirements. In this section, we define and discuss five basic requirements.

Model. Though crowdsourcing itself a problem-solving model, this model can vary depending on the problem, the degree of challenge involved in solving it, time requirements, incentives to be provided to the crowd, etc. For instance, Innocentive is an intermediary crowdsourcing platform where the challenges are scientific and require a long time devoted to solve them. On the other hand, companies like LG, BMW, and Nokia have platforms where, in many cases, challenges do not demand

a long scientific process to solve and non-monetary incentives are used for innovations. There are also some problem areas where user involvement is completely self-motivated. The Wikipedia and Transcribe Bentham projects exemplify this kind.

Platform. After defining the proper crowdsourcing model, organizations should provide a platform for the users. Although discussion groups can be seen as the first means of online collaboration and the first precedent of crowdsourcing, they are widely utilized in organizations as a knowledge-sharing technique since they are an established and familiar way of interacting online. Therefore, dedicated crowdsourcing platforms might be a way to manage problem solving and learning in organizations. More importantly, a specific platform might provide a gateway through which crowds and organizations can communicate and continue transactions in a transparent and safe manner. Sometimes, it might also be necessary to create and maintain intra-organizational interaction to increase the robustness of the platform or enhance its knowledge bases. For instance, “Wiki Loves Art” is a collaborative project that was initiated by a consortium of UK/USA museums in 2008 to increase the number of pictures in the Wikimedia Community [19]. Wikipedia and other platforms use these images from Wikimedia.

Marketing. The concept of crowdsourcing is already a buzzword and is gaining general recognition. Nevertheless, there is little evidence of any communication channels to attract crowds and to market services provided by different platforms. Therefore, creating awareness among potential participants to engage in innovation platforms is an important issue. To understand the marketing and communication of online crowdsourcing innovation platforms, it could be worthwhile to consider the community of open source software, where word-of-mouth and peer-to-peer interactions play pivotal roles. A similar kind of marketing and communication pattern is prevalent in online innovation crowdsourcing communities. Seminars, class lectures, conferences, and exhibitions inform people about different platforms. Besides, the Internet provides the opportunity to introduce platforms both regionally and globally. Therefore, advertising by any means and applying multiple language support in the platforms can help increase traffic. Although it is difficult for start-up or less popular platforms to involve global communities, interested organizations can leverage some existing popular social media platforms (such as Facebook and Twitter) or search engines (such as using Google Ad). Information sharing or collaboration with other platforms can also help. For instance, collaboration with Wikipedia has helped increase visitors to the British Museum’s website because the Wikipedia pages have links to it [20].

Management. Any kind of crowdsourcing platform comes with an added set of management tasks as well. The complex relationship established between the project

owner and the crowd needs to be well-managed. Providing the right motivating incentives to the participants is of great importance. Collecting feedback from the users keeps the project on track and also open up new thoughts. Trying to engage the audience as participants is one way, while getting the existing data and knowledge into some form of art is another way. There are delicate matters to be addressed while providing direction and guidance to the large mass of participants. Scholars, journalists, and practitioners are continuously trying to develop a consistent list of factors for successful crowdsourcing applications. Surowiecki believes that the crowd must be diverse in opinions to provide the best mix of solutions to a problem [5].

Quality. The potential of crowdsourcing has already been proved with the great success of Innocentive, Wikipedia, and Threadless. However, it does not guarantee the quality of the work done by the crowd. It is the responsibility of the organization to ensure that. For instance, Wikipedia maintains a proper knowledge base by validating user-generated content by itself or by allowing other users to validate it, in other words, crowdsourcing quality control. This is also followed by some other projects, such as Amazon. Along with the productivity, attention in a community may also help to improve the quality of the products. It is also possible to accept solutions from multiple users and then reward the solution that works according to the problem description. However, this method is not necessarily good because it may create unfair competition between users, which might waste user time and diminish user motivation, thus decreasing the quality of work.

2.2 Value

Crowdsourcing relies on the wisdom of crowds [5], a concept according to which a diverse collection of independently deciding individuals can yield better results than individuals or even experts. Simply put, groups are often smarter than the smartest people in them. Furthermore, the value of the wisdom of crowds does not come through averaging, but rather through aggregating the inputs of a crowd [1, 5]. Organizations can benefit from crowdsourcing in several ways. In the following, we divide the value of crowdsourcing into four categories: labor, creativity, knowledge, and content. In practice, value is often gained in multiple categories simultaneously. The platforms described in the following are not tied to one category either, but are used as representatives of their primary value.

Labor. Amazon Mechanical Turk [38] is a platform for crowdsourcing work that requires human intelligence. Typically the tasks are simple, such as translating texts, recognizing objects, or removing duplicates from data. The collective power of Mechanical Turk has also been used extensively by artists to produce their visions as pieces of art. Examples like The One Million Masterpiece [39], Explodingdog [40],

and The Sheep Market [41] prove that art renditions arising from crowdsourced projects are equally profound and representative of human civilization. Furthermore, the digitization of information is a blessing for organizations that cultural heritage, e.g., libraries, archives, and museums, as it enables them to preserve information longer as well as share it online. In addition to knowledge exchange, the Internet provides the means to crowdsourcing information-related work, such as validation, selection, classification, and collection.

Creativity. Numerous successful cases of creativity and innovation through crowdsourcing exist; both corporate and intermediary platforms are ubiquitous. These platforms seek creative solutions for a wide spectrum of challenges ranging from research and development to design and marketing. Crowdsourcing platforms can operate on a continuous basis or for definite periods of time, for instance in the form of contests. Innocentive [27] is an example of an intermediary online platform that facilitates companies to tap into the global talents of innovation in research and development. On the platform, seeker companies post their research problems, solvers in the community submit solutions, and finally the best solution is awarded.

The value of crowdsourcing for creativity and innovation is clear: the more people that are reached through the Internet, the bigger the potential of crowdsourcing proliferation. With the aid of web tools, creative processes incorporate a wider range of participants, giving way to new forms of products and services. The third chapter of this book, “From Democratizing Innovation to Innovating Democracy”, described in detail how the voices of the crowd have been and how they can be more creatively and effectively incorporated into the operations of the government. Lessons from crowdsourcing projects can be very helpful in building a framework for e-democracy. Crowdsourcing has also redefined the role of artists and changed business models supporting artistic works. For example, the music industry has benefited a great deal from crowdsourcing mechanisms. In addition to the introduction of collaborative music, music production contests have helped create new interesting music genres and unveiled new promising artists.

Knowledge. Perhaps the best-known crowdsourcing project, Wikipedia [42], is an example of knowledge acquisition powered by crowds. Wikipedia is a public, collaborative, multilingual encyclopedia with over 20 million articles maintained using wiki software. In addition to the plethora of similar wiki-based knowledge bases and the apparent link between innovation and knowledge, other endeavors for knowledge crowdsourcing exist. One such promising application area is help desks [15]. Advantages of creating a vast knowledge base to replace a traditional help desk include a broader base of knowledge, better use of resources, and support outside desk hours. A prime example of a successfully crowdsourced help desk is the Indiana University information technology knowledge base [43].

Content. The Internet boasts a remarkable amount of user-generated content in a number of platforms like Facebook [44], Flickr [45], iStockphoto [46], YouTube [47], and Twitter [48]. While the content itself is of great value for the platforms, even greater value can be achieved by its further use. For example, the rich imagery available in the Internet provides unseen opportunities in various fields. Geometrically registered imagery can be used in a number of applications, from visualization and localization to image browsing [17]. On the other hand, the use of photo collections has been suggested for future forecast [18]. Global trends and sentiments are explored by analyzing sharing patterns of the user-generated content in order to uncover the underlying trends of change in politics, economics, and marketing.

2.3 Incentives

Why people participate in online innovation platforms is important to know because participants play crucial roles in innovation. A myriad of factors have been revealed from studying different platforms. When searching for a solution to a problem, crowdsourcing can be an effective option as long as it is a popular phenomenon [21] and as long as people keep on being active and providing their input. Rewarding users for successful submissions is one of the key factors in maintaining the popularity of crowdsourcing in a specific application. The wide range of motivations that attract innovative people to participate in platforms can be broadly divided into two categories – intrinsic and extrinsic.

According to Ryan and Deci [22], intrinsic motivation means doing something because it is inherently interesting or enjoyable, and extrinsic motivation means doing something because it leads to a separable outcome. Examples of extrinsic motivators include monetary rewards, user needs, career concerns, skill development, and reputation, whereas intrinsic motivators can include fun, autonomy, intellectual challenge, identity, addiction, etc. [2, 23, 24]. Extrinsic incentives, such as monetary rewards, might be easier to manage, but intrinsic incentives appear to often be the deciding reason for an individual to get involved in crowdsourcing [25, 26]. Intrinsic motivation is often related to fun, meaning that the task is worth doing for its own sake. According to Kleemann et al. [25], the central characteristics that make a task fun include autonomy, creativity, and the importance of the task.

From the above definitions, we derive the following classification for incentives in this article: (1) Extrinsic-monetary, i.e., monetary rewards (£, \$, € etc.); (2) Extrinsic-other, i.e. extrinsic, separable rewards other than monetary (gifts, reputation, career boost, etc.); and (3) Intrinsic, i.e., the inherent interest, fun, or pleasure in the task.

The most often used extrinsic incentive is a monetary reward. For instance, the rewards Innocentive pays its users range from US\$ 5,000 to US\$ 1,000,000 per problem [27]. However, studies on monetary rewards in crowdsourcing projects reveal interesting phenomena. Mason and Watts [28] found that monetary incentives

definitely increased participation, i.e., the quantity of work, but not the quality of the work. Further, they state that the compensation scheme, the scheme according to which monetary incentives are paid, can have an effect on the quality of work even to the extent where better work can be accomplished for smaller incentives [28].

There should also be a clear correlation between the size of the reward and how demanding the solution to the problem is. The problem-solving task can be demanding in two senses, either regarding the workload or the expertise of the problem solver. Other factors related to the popularity include, for example, that users are able to find the kind of problems that they can solve and that are related to their field of expertise. According to Yang et al. [21], there is often a core group in a crowdsourcing platform that submits most of the winning solutions to the problems. These users should be both identified and rewarded in order to maintain their presence on the platform.

One important point to note related to crowdsourcing participation is that female participation in online crowdsourcing platforms is strikingly low [24, 29] and a great barrier in involving full human resources in innovation.

2.4 Risks and Failures

Crowdsourcing, like any other process, comes with various risks. If these risks are not handled properly, the whole effort might be futile. While many success stories have come from crowdsourcing, several of them have failed as well. Prominent examples of failure include Crowd Spirit [35], President Obama's "Open For Questions" [36], Coca Cola's "New Coke" [37], Cambrian House [33], and numerous others. Thus, every crowdsourcing project should be carefully evaluated for the risks associated with it, so as to design the project accordingly and to be prepared to face the adversities.

Causes. It is not only the uncertainty of the crowd that induces risks in crowdsourcing but also from the way a project is designed and implemented. Initially, a project's goals should be concrete and should guide the crowd along the way. The project should find the right crowd, whose members are able to contribute. The project platform should be made as simple as possible since usage difficulty drives members away easily. The project should also set the right incentives to attract and retain contributors.

After the project begins, members should be adequately briefed about the project's needs and goals. People contribute more to online communities when they believe that their contributions will be unique [31]. Participation and motivation of the members should be evaluated regularly against the incentives, the ease use of the platform, and other parameters. Subsequently, changes should be made for member retention and expansion. It is easy to come up with a substandard product if one tries to incorporate everyone's ideas. So, a proper filtering process for quality control has

to be implemented. Regular briefing of the overall progress of the project helps to motivate the contributors.

The product outcomes of the projects should be well catered to in order to keep the members' trust in the platforms. Cambrian House [33] produced around seven thousand ideas but only a few of them actually became successful due to a lack of continuing support. Having the crowdsourced project inside an ecosystem or creating one around it is a sustainable strategy. These are the requirement aspects of successful crowdsourcing that help prevent failures. Despite these, one has to prepare for several impacts coming from a crowdsourced project.

Impacts. Raza [34] describes some negative impacts of crowdsourcing. Sometimes, the crowd can give you a very different result than originally anticipated. For instance, when NASA called for a vote of public opinion for naming a section of NASA's international space station, the name "Stephen Colbert" won the poll by a huge margin because of marketing by the host of the TV show. Keeping the right to make the final selection with the project owner is a good risk management strategy used by NASA [32]. Also one can't always rely on the wisdom of the crowds because the crowd also consists of members with malicious intent and also one's rivals. Targeting the right crowd is essential for sustainability as well as quality control. The wrong crowd might easily destroy the credibility and reputation of the project. When Obama launched his "Open for questions" platform, it was overwhelmed with enthusiasts on the legalization of marijuana, shadowing other concerns of health, jobs, education, environmental and other reforms [36]. As highlighted in the earlier chapter, "Are we all criminals?" , one has to be aware that the human psyche plays differently given the anonymity provided by the Internet.

Quality control. Fundamental to any knowledge base is the quality of information submitted to it [15]. Quality can be ensured by using a ranking system for the contributions or contributors. A content approval system can also be adopted before making the information public. This is backed up by several knowledge base vendors that implement wiki-type tools for managing the support efforts and information. The quality of information also depends on the personal incentives of the contributor; motivations can be the desire to share knowledge, to gain recognition, or to win prizes.

Risk of losing value. Crowdsourcing brings several risks to society, such as a disregard for the value of experts. There lies an eminent risk that the creative works will lose its value in terms of an individual's endeavor due to the participation of many [30]. The roles of the artist and the audience are being redefined and might devalue the traditional recognition that artists get. Instead, the voice of the crowd might be preferred over expert knowledge. This can change the ecosystem as we know it.

Though Robert Wilensky stated in 1996 “we’ve heard that a million monkeys at a million keyboards could produce the complete works of Shakespeare; now, thanks to the Internet, we know that is not true.” [49], we have to be fairly optimistic about the potential of the crowdsourcing phenomenon. It is paving the way for newer forms of creative outlets and building alternate ways of doing things. With due recognition to traditional ways, the new crowd-production methodology is definitely a phenomenon worthy of observation.

3 Analysis and Discussion

3.1 Incentives and Motivations

The overall incentive categories used in different platforms have been collected. We broadly classified them into two categories: (1) financial incentives, and (2) non-financial incentives. Financial incentives are one-time incentives, perpetual or based on revenue from the idea generated. The range of financial incentives is very wide and largely depends on the task accomplished. They can range from several hundred US dollars to one hundred thousand US dollars. On the other hand, non-financial incentives are numerous, and it is challenging to array them into different clusters. So, the size of incentives not only varies in different platforms but also within a single platform. It includes both financial and non-financial incentives. Extrinsic incentives are mostly used in the online platforms for crowdsourcing. Extrinsic incentives are used in 72.4% of the platforms, and intrinsic motivation is used in the remaining 27.6% (figure 1). It has been revealed that in 49.6% of the considered platforms, financial incentives are used. Moreover, within extrinsic incentives, financial incentives include 50% of the total platforms considered. Several platforms listed more than one incentive with the emphasis on financial incentives. Half of the platforms utilized financial incentives, whereas intrinsic and non-financial incentives were primary incentives in about a quarter of the platforms.

Users’ motivation to participate in online platforms is numerous, as shown in figure 1. In the vein of the incentive classification, motivational factors are primarily classified into two categories: extrinsic and intrinsic. Moreover, extrinsic motivational factors have been divided into two segments, financial and non-financial. The list of motivational factors is very wide and consists of a large range of factors. Financial motivational factors are relatively lower than non-financial and intrinsic factors. Financial motivational factors include compensation, bonus points, free products, free use of development products, lower transaction cost, free trips, etc. On the other hand, non-financial extrinsic motivational factors include peer recognition, status, reputation, power, awards, credits for contributions, skill enhancements, trust, social ties, social exchange, additional information, career opportunity, reciprocity, etc.

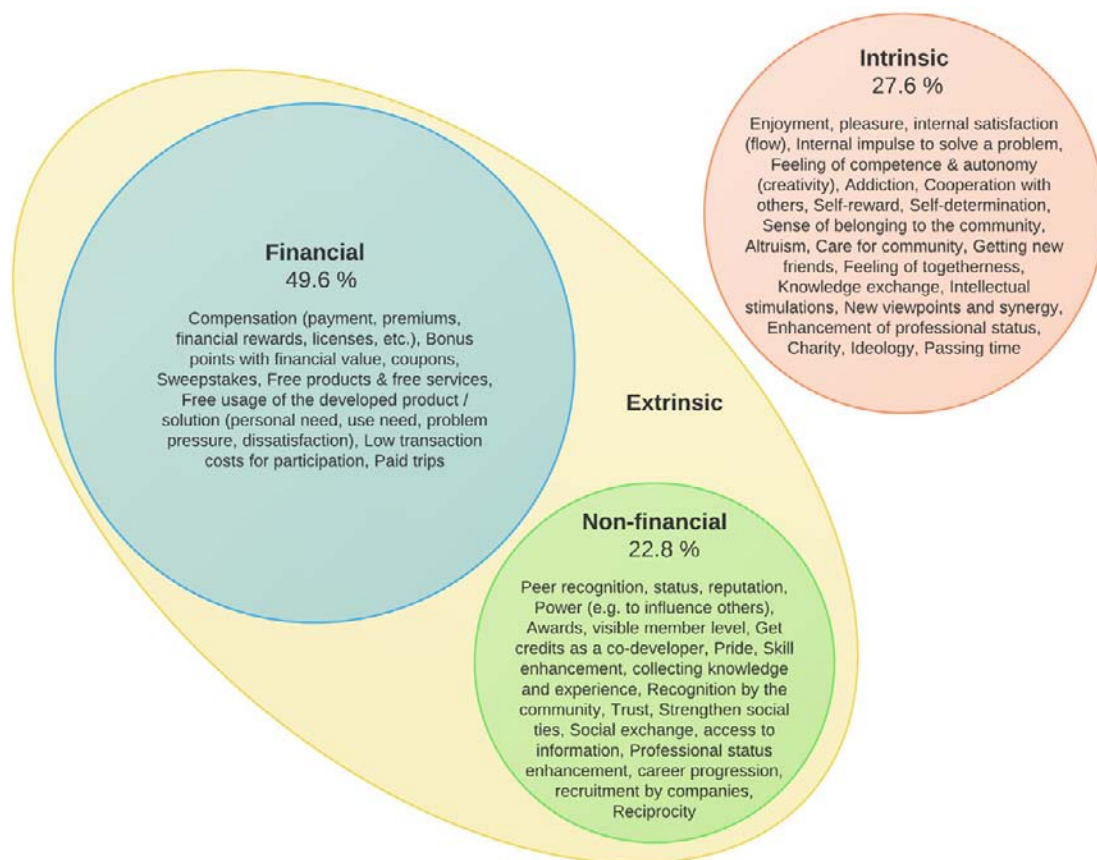


Fig 1. Primary incentives and prevalent motivation for participation in online crowdsourcing platforms (n= 268)

Intrinsic motivational factors consist of enjoyment, pleasure, internal satisfaction, having the guts to solve problems, feeling competent, autonomy, addiction, self-reward, self-determination, altruism, care of community, getting new friends, a sense of belonging, knowledge exchange, killing time, and ideology, among many others. Extrinsic motivational factors are more dominant in crowdsourcing platforms.

3.2 Geographical Origins of Platforms

In the age of the Internet, many people believe that the geographical location of people and country of origin, language spoken, etc., are not issues to consider. Our study revealed a strikingly different picture.

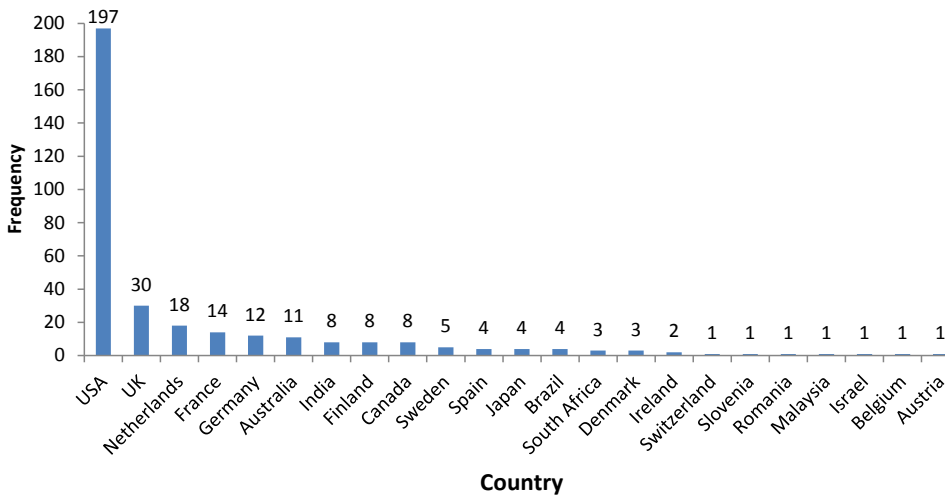


Fig 2. Countries of origin of crowdsourcing platforms (n= 345)

Among the platforms considered for this study, a total of 197 online platforms originated from the USA (figure 2). The UK is the second most common location of platform origin, though the number (30) of platforms in the UK is much lower than the number of platforms in the USA. The Netherlands (18), France (14), Germany (12), Australia (11), Finland (8), and India (8), are the other dominant countries of online platform origin. In addition, the idea of online platforms is present in most of the other developed and highly developing countries.

3.3 Value of Crowdsourcing on the Platforms

The value gained in the crowdsourcing platforms was divided into five categories: labor, knowledge, creativity, content, and funding (figure 3). The first four of these are considered to be the main categories. Among these four main categories, creativity, knowledge, and labor are almost equally present in crowdsourcing platforms. 57% of the crowdsourcing tasks in the platforms involve creativity. Knowledge was crowdsourced on approximately every second platform (55.2%). Labor crowdsourcing follows the previous two categories (51.8%). Content was crowdsourced in nearly every sixth (16.5%) platform. Typically, value was gained in more than one category at a time. The most common case was crowdsourcing knowledge, creativity, and labor, e.g., arranging an open call for innovative products. Crowdfunding was used in 3.7% of the platforms.

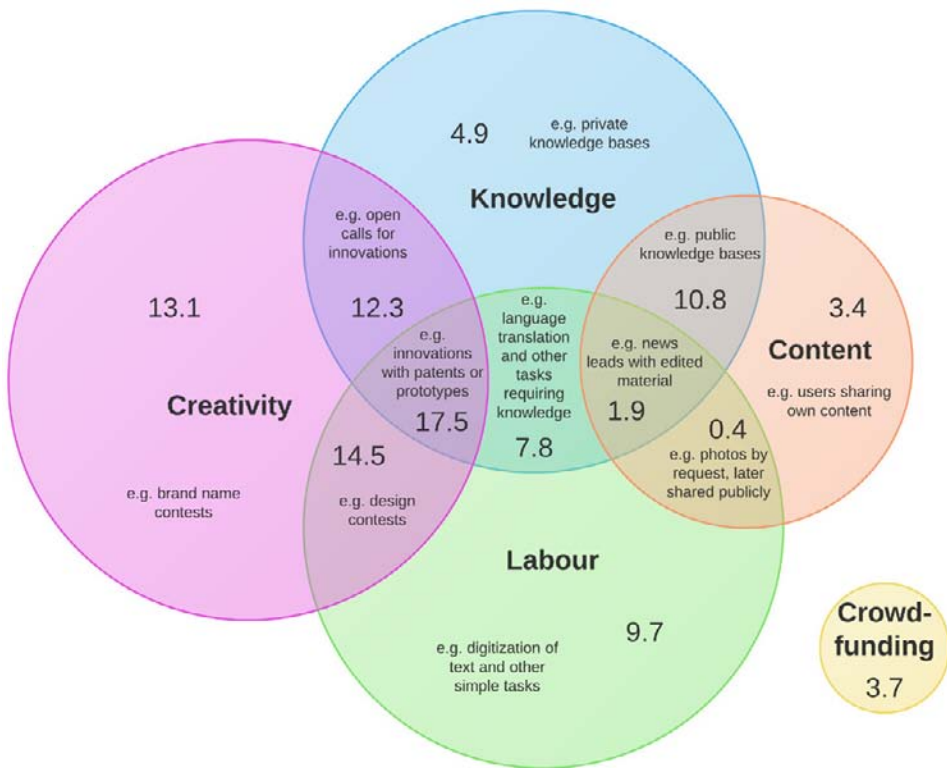


Fig. 3. Value of crowdsourcing in percentages (n= 268) and examples of the categorizations

Many of the platforms crowdsource several types of value (figure 3) simultaneously. On the other hand, some of the platforms are heavily involved with only a single category of crowdsourcing. As we see in the above Venn diagram, value gained overlaps in many of the four major categories.

Moreover, in the categorical relation, creativity and labor (32%), creativity and knowledge (29.8%), and knowledge and labor (27.2%), are almost equally prevalent. However, the content category has most relation with the knowledge category (12.7%), followed by the relation with the labor category (2.3%). The relation among creativity, knowledge, and labor is remarkable at 17.5%.

3.4 Evolution of Crowdsourcing Platforms

How the trend of crowdsourcing platforms evolved over the years has been analyzed. The launching of crowdsourcing platforms is very noticeable in 2007 and 2008. In 2009 and 2010, the launching of crowdsourcing platforms plummeted, with only nine platforms being launched. As 2011 is still ongoing, analyzing the number of platforms launched this year is not possible. Overall, the last several years have been a booming time for crowdsourcing.

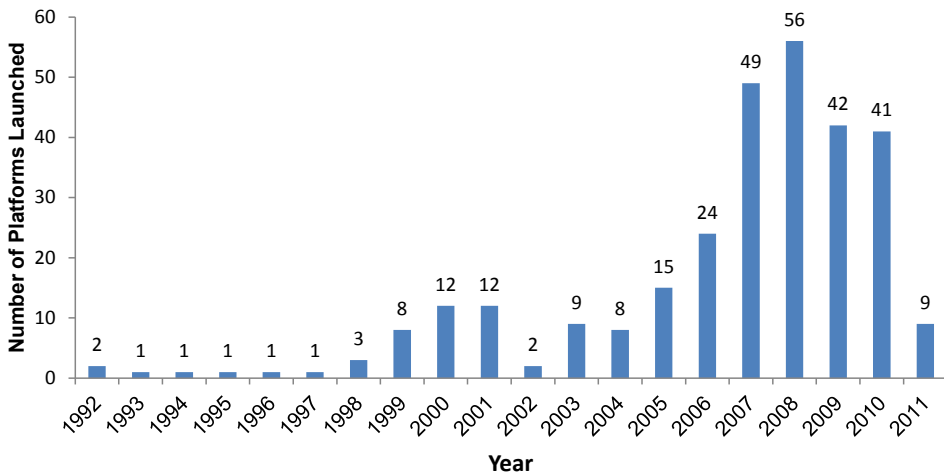


Fig. 4. Year of launch of crowdsourcing platforms (n = 296)

Even though online crowdsourcing platforms have been used since the early '90s, the movement has gained attention primarily in the late '90s and early 2000s. From the early 2000s, the number of crowdsourcing platform launches has been continuously increasing.

4 Conclusions, Limitations, and Future Exposure

This study is the first of its kind because to the best of our knowledge, no study has been conducted to determine the overall motivational factors and incentives used in different platforms, geographical locations, and value gained thorough crowdsourcing in different categories and the sectors where the crowdsourcing phenomenon is more widespread. Both financial and non-financial incentives are almost equally important. However, incentive largely depends on the type of activity to be accomplished. Generally, in time consuming, scientific problem-solving tasks, financial incentives are predominantly used. Moreover, in tedious tasks, the presence of financial incentives is evident. Both financial and non-financial motivations are almost equally dominant in crowdsourcing platforms. Extrinsic motivation is more dominant than intrinsic motivation. Geographical origin of the location of the crowdsourcing is heavily concentrated in the USA, followed by some European countries. The presence of crowdsourcing platforms in developing countries is not as evident.

The values gained thorough online crowdsourcing platforms, under four categories – creativity, content, knowledge, and labor – are almost equally present. Value gained in the content category is less prevalent. Crowdfunding is a relatively new and

growing phenomenon in the crowdsourcing arena. The evolution of crowdsourcing platforms started primarily in the early 2000s, and is growing at a striking pace.

This study has several limitations. The information has been collected from various sources, which may not be fully reliable. There might be many platforms that use languages other than English to communicate, so collecting information from those platforms is beyond our scope. Future studies may consider more detailed information, such as considering variables such as the number of employees, turnover, profit margin, growth, challenges, etc. Moreover, platforms that use languages other than English could be included so that more platforms can be included.

As the study shows, the crowdsourcing phenomenon has proliferated considerably during the last decade. Various tasks from small, mundane work to creative, industrial problem-solving can be outsourced even in a small scale to a vast pool of labor often at a relatively low cost. As a phenomenon, this is an interesting research subject, since in addition to studying the development of the phenomenon in the past, it might be extremely interesting to study the possible future developments that crowdsourcing may have.

Perhaps the most radical, although not the most far-fetched consequence of the crowdsourcing phenomenon, could be a profound change in the concept of work for the modern society. Crowdsourcing could enable a change in not only the mundane, mechanical working tasks, but also in the creative and knowledge-intensive tasks such as research and development in a company. And, as we see from the results of this study, this is already a reality in many fields although not in a full scale. But still, there is a substantial possibility, be it a risk or an opportunity, that crowdsourcing enables a similar revolution to knowledge-intensive workers than industrial automation did for blue collar workers in the 20th century.

References

1. D. C. Brabham, "Crowdsourcing as a Model for Problem Solving", *Convergence: The International Journal of Research into New Media Technologies*, vol. 40, no. 1, pp75, 2008.
2. D. C. Brabham, "Moving the crowd at iStockphoto: the composition of the crowd and motivations for participation in a crowdsourcing application", *First Monday*, vol. 13, no. 6, June, 2008.
3. J. Alsever, "What Is Crowdsourcing?", 2007.[Online] <http://www.bnet.com/article/what-is-crowdsourcing/52961>. [Accessed Sept. 14 2011]
4. A. Schulze and M. Hoegl, "Organizational Knowledge Creation and the Generation of New Product Ideas: A Behavioral Approach", *Research Policy*, vol. 37, no. 10, pp. 1742-1750. 2008.
5. J. Surowiecki, "The Wisdom of Crowds: Why the Many are Smarter than the Few and How Collective Wisdom Shapes Business, Economics, and Nations", New York: Random House, 2004.
6. S. Ogawa and F. Pillier, "Collective Customer Commitment: Reducing the Risks of New Product Development", *Sloan Management Review*, vol. 47, no. 2, pp. 65-72, 2006.
7. F. Alt, et al., "Location-based Crowdsourcing: Extending Crowdsourcing to the Real World", *NordiCHI*, October 16–20, 2010.
8. M. N. Wexler, "Reconfiguring the sociology of the crowd: exploring crowdsourcing", *International Journal of Sociology and Social Policy*, Vol. 31 No. 1/2, pp. 6-20, 2011.
9. N. Archak and A. Sundararajan, "Optimal Design of Crowdsourcing Contests", *The International Conference on Information Systems*, ICIS, 2009.
10. K. R. Lakhani and Z. Kanji, "Threadless: The Business of Community", *Harvard Business School Multimedia/Video*, Case 608-707, 2008.

11. E. V. Hippel, "The sources of innovation", Oxford University Press, 1988.
12. M. Vukovic, "Crowdsourcing for Enterprises", Congress on Services, IEEE Computer Society , 2009.
13. J. Howe, "The Rise of Crowdsourcing", Wired, 14(6), 2006. [Online] <http://www.wired.com/wired/archive/14.06/crowds.html> [Accessed Oct. 14 2011]
14. H. W. Chesbrough, "Open Innovation: The new imperative for creating and profiting from technology", Boston: Harvard Business School Press, 2006.
15. D. Latimer, K. Rose, J. Sipher, M. Woo, "Crowdsourcing the IT Help Desk: A Cloud Approach to Mass Intelligence", ECAR Research Bulletin, 2009.
16. P. Singh, et al., "Open Mind Common Sense: Knowledge Acquisition from the General Public", Proceedings of On the Move to Meaningful Internet Systems, 2002.
17. N. Snavely, S. M. Seitz, R. Szeliski, "Modeling the World from Internet Photo Collections", International Journal of Computer Vision, vol. 80, no. 2, 2008.
18. X. Jin, et al., "The wisdom of Social Multimedia: Using Flickr for Prediction and Forecast", Proceedings of the international conference on Multimedia, 2010.
19. Commons Partnerships, Wikimedia Commons, http://commons.wikimedia.org/wiki/Category:Commons_partnerships.
20. L. Wyatt, "Wikipedia and GLAMS", November 2010. [Online] <http://prezi.com/fdjjl0tfgphu/wikipedia-glams> [Accessed Oct. 14 2011]
21. J. Yang, L. A. Adamic, M. S. Ackerman, "Crowdsourcing and knowledge sharing: Strategic User Behavior on Takcn", Proceedings of the 9th ACM conference on Electronic Commerce, 2008.
22. R. M. Ryan, E. L. Deci, "Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions", Contemporary Education Psychology, vol. 25, pp. 54-97, 2000.
23. K. J. Boudreau and K. R. Lakhani, "How to Manage Outside Innovation", MIT Sloan Management Review, vol. 50, no. 4, 2009.
24. L. B. Jeppesen and L. Frederiksen, "Why do users contribute to firm-hosted user communities? The case of computer-controlled music instruments", Organization Science, vol. 17, no. 1, pp. 45, 2006.
25. F. Kleemann, K. Rieder and G. G. Voß, "Un(der)paid Innovators: The Commercial Utilization of Consumer Work through Crowdsourcing", Science, Technology & Innovation Studies, vol. 4, no. 1, pp. 5, 2008.
26. B. Luthiger Stoll, "Spass und Software-Entwicklung: Zur Motivation von Open-Source-Programmierern", Ibidem, 2007.
27. Innocentive, Facts and Stats, 2011. [Online] <http://www.innocentive.com/about-innocentive/facts-stats> [Accessed Oct. 15 2011]
28. W. Mason, D. J. Watts, "Financial Incentives and the Performance of Crowds", SIGKDD Explorations, vol. 11, no. 2, pp. 100-108, 2010.
29. L. B. Jeppesen and K. R. Lakhani, "Marginality and Problem-Solving Effectiveness in Broadcast Search", Organization Science, vol. 21, pp. 1016-1033, September, 2030. D. Linver, "Crowdsourcing and the Evolving Relationship between Artist and Audience", Masters Capstone, School of Architecture and Allied Arts, University of Oregon, June, 2011.
31. K. Ling, et al, "Using social psychology to motivate contributions to online communities", Journal of Computer-Mediated Communication, volume 10, number 4, 2005. [Online] <http://jcmc.indiana.edu/vol10/issue4/ling.html> [Accessed Sept. 23 2011]
32. J. Lister, "NASA nixes Stephen Colbert space station", Tech.Blorge, April 15, 2009. [Online] <http://tech.blorge.com/Structure:%20/2009/04/15/nasa-nixes-stephen-colbert-space-station/> [Accessed Sept 23 2011]
33. E. Schonfeld, "When Crowdsourcing Fails: Cambrian House Headed to the Deadpool", TechCrunch, May 2008. [Online] <http://techcrunch.com/2008/05/12/when-crowdsourcing-fails-cambrian-house-headed-to-the-deadpool/> [Accessed Sept 23 2011]
34. S. M. Raza, "Social Media and Crowdsourcing: Cons", Social Media Club, October, 2011. [Online] <http://socialmediacub.org/blogs/from-the-clubhouse/social-media-and-crowdsourcing-cons> [Accessed Sept 23 2011]
35. Y. Roth, "Lessons from the failure of social product development-platform CrowdSpirit ", May 2011. [Online] <http://yannigroth.wordpress.com/2011/05/13/lessons-from-the-failure-of-crowdsourcing-platform-crowdsprit/> [Accessed Sept 23 2011]
36. Open for Questions. [Online] <http://www.whitehouse.gov/OpenForQuestions>, [Accessed Sept 23 2011]

37. C. Esposti, "Crowdsourcing's Seven Deadly Sins" , December 2010. [Online] <http://www.crowdsourcing.org/editorial/crowdsourcings-seven-deadly-sins/1900> [Accessed Sept 23 2011]
38. Amazon Mechanical Turk, [Online] <https://www.mturk.com/mturk/welcome/> [Accessed Sept 23 2011]
39. The One Million Masterpiece, [Online] <http://www.millionmasterpiece.com/> [Accessed Sept 23 2011]
40. Explodingdog, [Online] <http://explodingdog.com/> [Accessed Sept 23 2011]
41. The Sheep Market, [Online] <http://www.thesheepmarket.com/> [Accessed Sept 23 2011]
42. Wikipedia, [Online] <http://en.wikipedia.org/wiki/Wikipedia> [Accessed Sept 23 2011]
43. Indiana University Information Technology Services - Knowledge Base, [Online] <http://kb.iu.edu/> [Accessed Sept 23 2011]
44. Facebook, [Online] <http://www.facebook.com/> [Accessed Sept 23 2011]
45. Flickr, [Online] <http://www.flickr.com/> [Accessed Sept 23 2011]
46. iStockPhoto, [Online] <http://www.istockphoto.com/> [Accessed Sept 23 2011]
47. Youtube, [Online] <http://www.youtube.com/> [Accessed Sept 23 2011]
48. Twitter, [Online] <http://twitter.com/> [Accessed Sept 23 2011]
49. The Parable of the Monkeys, [Online] http://www.angelfire.com/in/hypnosonic/Parable_of_the_Monkeys.html, [Accessed Sept 23 2011]

Internet, Find Me a Job!

Evgenia Litvinova¹, Vilen Looga², Håkan Mitts², Gautam Raj Moktan³,
Olli Mäkinen², Suleiman Ali Khan⁴, and tutor Meri Kuikka⁵

¹ Aalto University School of Science, Department of Media Technology
PO Box 15400, FI-00076 Aalto

² Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

³ Aalto University School of Electrical Engineering,
Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

⁴ Aalto University School of Science, Department of Information and Computer Science
PO Box 15400 FI-00076 Aalto

⁵ Aalto University School of Economics, Department of Information and Service Economy
PO Box 21220, FI-0007

Illustrations by Anastasiia Gulimonova

Abstract

The Internet has revolutionized work and is transforming the job markets. With the aid of some illustrative case studies, we analyze and discuss how the Internet has changed the job market and its impact on society. We identify the impact of the Internet on traditional job markets and show how a number of new, Internet-based online job markets have emerged. For the traditional job market, the Internet increases access to employment-related information and expands the geographic span of the job market. The new online markets have the potential to significantly transform work where knowledge and digital content is produced.

1 Introduction



Work is recognized as the foundation for the well-being of the society and its individual members [1]. In our age of technical advancements, the Internet being one of the most important ones, work and the way it is organized are undergoing a significant transformation. Serving as a ubiquitous, comprehensive and high-speed medium of communication, the Internet is altering the dynamics of work by allowing unprecedented opportunities for job advertisements, job-seeking, remote working and even new forms of work.

In this chapter, we will discuss how work is being transformed by the Internet. We will look at the issues mainly from the perspective of an individual trying to earn income. Thus, the discussion will focus on aspects related to finding (new) employment, both with an employer or as self-employment. The reason for choosing this perspective is our initial assumption that the process of looking for a job has seen dramatic changes because of the Internet.

We will approach the issue using the concept of *job markets* [2] where employers, employees and self-employed contractors enter into various forms of contracts in order to get some work done.

One very interesting trend is the emergence of a number of globalized markets for work, where employers and mostly self-employed contractors conduct work even if physically located on different sides of the globe. We will refer to these markets as *online job markets*.

To analyze changes in the job markets, we will define a number of job market characteristics and discuss how these characteristics are affected by the Internet. The set of characteristics used in the analysis are a subset of the characteristics that define the concept of a *perfect market*, in which participants have equal, perfect access to market information, no participant has the power to set prices, there are no barriers to entry or exit, and all competitors have equal access to production technology. By analyzing the job markets in this way, we can deduce the impact of the Internet in relation to the concept of perfect markets, i.e., whether the Internet is moving the job market in the direction of a perfect market or not.

We will discuss the notion of job markets and the set of characteristics used in the

analysis in Section 2. Armed with tools for analysis, we will discuss the impact of the Internet using a number of real-world cases. The cases have been selected so that they demonstrate changes in one or more of the chosen job market characteristics. In Section 3, we will discuss cases related to traditional job markets. In Section 4, we will discuss cases illustrating the dynamics of the online job markets. In Section 5, we analyze the changes in the job markets using the set criteria. Section 6 concludes the chapter by making some observations on possible future trends.

2 The Characteristics and Evolution of Job Markets



In this chapter, we consider work to be an activity involving two actors: an entity offering the work, i.e., having some work that needs to be performed, and an entity doing the work, i.e., exchanging efforts for an income. The two actors meet in some form of “market”, where those entities seeking labor services (companies or individuals, often referred to as employers) can find and make contracts with those parties offering labor services (workers or companies).

When the party offering labor services is a single person, we will refer to the “market” where the parties meet as the job market. For the purposes of this paper, we will adopt a view attributed by Pillai to the labor researcher Orme Phelps in [2], where the structure of a job market is claimed to consist of

“.. the set of formal rules, which determines how people qualify for jobs, get jobs, hold their job or advance in and what their rights are while employed.”

To view the job market as a single market would mean that any worker could apply for any job. In practice, everyone cannot apply for every job because the person applying does not have the required skills. As a result, the job market is subdivided into a number of mainly skills-based job markets.

The focus of this chapter is the relationship of an individual (a person applying for work) to the job market. This relationship is usually defined by the type of contract

between the employer and the worker. From this perspective, the job market can use two main types of contractual models [3]:

- Employment contracts: when an entity (typically a multi-person company) hires a person to work on a permanent or temporary basis to perform a specific task or act in a specific role. The employer controls both the work performed (what should be done) and the work process (how it should be done).
- Sales contracts: where the entity selling the labor services is seen as an independent contractor, and the scope of the contract typically specifies only the work performed (what should be done). Sales contracts are often made on a temporary basis and are typically project-based.

We further identify another contract model, which is close to the sales contacts:

- Artist/artisan: when an entity selling the labor sells not the service, but the resulting product directly to the buyer. For example, handicraft goods and work of artists, such as photographers, fit this category.

The sales and artisan contract models are used either in freelancing or when the person offering the labor services has the status of a company. A single worker acting in the role of a company is referred to as self-employment.

The Internet has introduced a new type of a job market, the online job market [4]. The online job markets consist of Internet-based marketplaces that connect sellers and buyers and where people can earn an income. Even though online job markets have their roots in the freelancing business, they also have other characteristics that set them apart from traditional freelancing, such as new ways of finding the contractor, job participation, work control process, etc.

Online job markets can be divided into two categories called “spot” and “contest” [4]. Spot markets emulate traditional freelance markets. Here the customer wanting to hire a worker posts a project on the market and invites people to bid on the project. The customer chooses the best bid for the job and the work begins once a winner has been chosen. The market risk primarily lies with the hiring customer, due to the possibility of a bad hiring decision.

In contrast, the “contest” market requires the freelancer to develop the actual deliverable (or at least a prototype) as part of the bidding processes. As the customer chooses only the best proposal and pays the winner, the market risk lies mainly with the freelancer. Such practice has become especially easy for products that can be transmitted as digital information over the Internet.

In addition to the above scenarios, the Internet has created a large number of “work-like” situations, where people work but do not earn a (direct) income from that work. Examples of this are open-source software projects and a number of crowdsourcing activities, where people would appear to be working but do so for

free. For more information on these kinds of work-like activities, the reader is referred to the “Proliferation of the crowdsourcing phenomenon” chapter of this book.

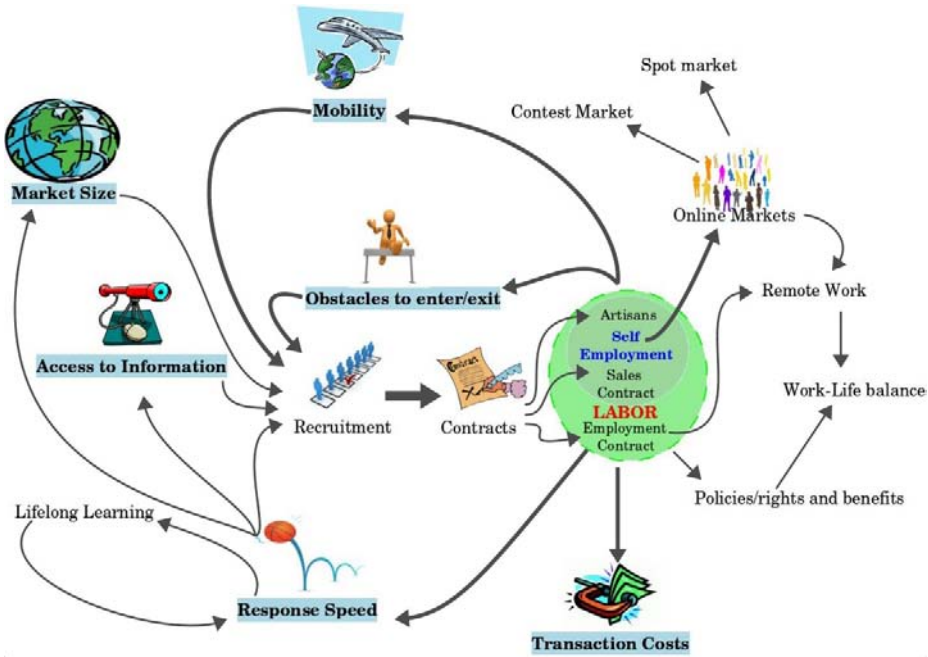


Fig. 1. Job market dynamics

2.1 In Search of a Perfect Job Market

The concept of perfect market is a theoretical model for a market with perfect competition [5]. While it is commonly agreed that few, if any, markets have perfect competition, the notion of a perfect market offers a benchmark against which real markets can be compared.

Beck [6] has demonstrated how job markets can be studied using the concept of a perfect market. We will use a subset of the perfect market characteristics listed by Beck as a basis for our analysis of the impact of the Internet on job markets.

The characteristics chosen are:

- Market size (in terms of number of participants)
- Access to information about the market
- Worker mobility
- Speed at which the market responds to changes
- Obstacles to market entry and exit

The concept of a perfect market will be complemented by another concept, that of “transaction costs”. In [3], the transaction costs are defined as the costs incurred “.. *through the contracting process – specifically the negotiation, execution and administration of formal and informal contracts*”. In the case of employment, the transaction costs relate to negotiating the employment contracts and in the case of self-employment, to negotiating the sales contracts.

3 Internet Transforming Traditional Job Markets



In this section, we explore the effects of Internet on the hiring process, the availability of an applicant's Internet footprint/CV, and the remote working scenario enabled by the Internet.

3.1 Global Recruitment

In the pre-Internet era, people predominantly worked in local enterprises. The Internet has made *global recruiting* easy by allowing people to look for jobs that are on the other side of the globe: apply, get hired, and relocate. From the employer's perspective, they can use the whole *global pool* of applicants to select the best candidates.

Today, individuals can submit their applications globally and the companies hire globally. Monster.com, hotjobs.com, Freelance Nation, etc., are some of the websites that serve job openings based on the location. This allows a job candidate to profile his or her search according to their preferred locations around the world.

Hiring in a *global job market* implies that there will be significant competition. This applies both to employers and job seekers. People looking for a job have to stand out from other applicants from all over the globe in order to be selected.

From the employers' perspective, there is a risk that the hiring process will take a lot of time and resources due to the overhead related to processing applications. There is also an inherent danger that famous companies would get the largest amount of applications and from more skilled people compared to lesser known companies, who would not receive as much interest from job applicants.

Case Study: The Best Job in the World. Tourism Queensland launched a campaign to hire an island caretaker for the Great Barrier Reef in Queensland, Australia, in January 2009 [7]. The job was a six-month package with AUD 150,000 salary for the period. While the primary purpose of this marketing stunt was to promote tourism in that area, it also reflects the growing global job market span.

The job ads were posted on several job sites, and there was extensive coverage by the media. The website received around 8 million visits, and around 200k blog posts were written about it. 34,684 applications came in from practically every country in the world. After several rounds of selection, 16 finalists were flown to Queensland for further interviews. Ben Southall from the UK landed the job on May 2009 after 4 rigorous days of final selection. The extent of the hiring process indicates that the cost of the hiring transaction was not reduced by the use of Internet.

3.2 Role of Online Presence in the Hiring Process



One thing that has not changed is the way any employment begins: applying for a job and getting hired. Although this part of the process still exists, its very nature has been radically altered, and anyone who wants to get hired in the future has to be aware of the changes.

Looking for information about prospective hires on the Internet and on social networks has become an integral part of the hiring process. A study conducted by CareerBuilder, an Internet-based job hunting site, indicated that nearly 45% of employers admitted to using social networks to gather information about their potential employees [8]. A more recent study by Reppler [9] indicated that over 90% of hiring managers used social networking sites to screen job applicants. Half of the time, the social network screening was done before meeting the candidate for the first time, illustrating how the Internet can be used to access *information* for better decision-making.

According to the CareerBuilder survey, positive findings were mostly personality traits, such as creativity, good communication skills, etc. Interestingly, these were reported to have a relatively weak effect on improving a candidate's chances of get-

ting hired. Only 18% of employers decided to hire someone based on their social network profile.

Negative findings had a much stronger impact on the hiring decision. Any findings that showed inappropriate behaviour caused 35% of employers to decide against the candidate. The most frequent negative thing found in a candidate's profile was inappropriate content. The other negative aspects found by employers are more specific and contain the usual suspects: depiction of drug and alcohol use, negative work-related comments, discriminatory comments, etc. Thus it seems that social networks are becoming an important method for job candidate elimination early in the hiring process.

The focus on the personality of candidates when mining his or her social networking profile is validated by a recent study by Golbeck [10]. The study found that the social networking profile is a good way to predict the owner's personality. In that study, the researchers scored test subjects' personality traits by using algorithms fed with information from Facebook profiles. The results had only an average deviation of 11% compared to results from traditional personality tests.

The legal status of online background checks varies between countries. When the US Federal Trade Commission dropped the investigation of Social Intelligence Corporation (SIC) in 2011, a company offering background checks of potential employees online profiles, it effectively allowed employers in the US to use information gathered in social networks as part of the hiring process [11]. On the other hand, in Finland it is illegal for companies to search information about online profiles of job applicants [12]. Nevertheless, the policies for work structures of traditional jobs remain highly regulated everywhere.

Case Study: Online CV. Employers usually have very few resources to gauge the potential candidate, so if there is a possibility to quickly get a good understanding of the candidate, then surely it will be used. Paul Bragiel, a start-up investor, who has to deal with finding talent for fast-moving companies put it bluntly: "Don't bore me, show me what you built" [13]. And it seems that a lot of ambitious professionals have already realized that the Web offers an excellent opportunity to showcase their talent in a way that fulfils such urgency. Many young professionals, instead of sending a traditional CV, prefer to create the CV 2.0, a personal website that allows them to showcase their creativity and technical skills [14] [15] [16]. A well-designed website with witty text also has the added side benefit of becoming a viral phenomenon, spreading through the social networks and attracting the attention of the potential employer.

3.3 Remote Working

There was a time when getting a job in a distant place implied relocation. Thanks to the Internet, this is no more the case. A multitude of jobs exist today where the *work can be conducted remotely*. The Internet-based job markets are a good indicator about what types of jobs are well-suited for online and remote work. The example list of the 25 most sought-after skills on elance.com in April 2012 (table 1) is rather telling: programming, writing, media production, etc., are all very well-suited for full-time Internet-based modes of working.

Table 1. 25 top Elance work profiles

Rank	Skill	Rank	Skill
1	PHP Programmers	14	Web Design
2	WordPress Programmers	15	iPhone Programmers
3	Article Writers	16	Logo Design
4	Graphic Designers	17	Academic Writing
5	HTML Programmers	18	Admin Assistant
6	CSS	19	.NET
7	MySQL	20	Research
8	Photoshop	21	AJAX
9	Blogs	22	Joomla!
10	JavaScript	23	SEO
11	Business Writing	24	HTML5 Programmers
12	Data Entry	25	jQuery
13	Illustrator		

There are several communication tools that allow workers to be a part of the workflow from the comfort of their local domicile. Communication tools such as Instant Messaging, Email, Skype, VoIP conferencing, and collaboration tools such as WebEx, OfficeMedium, etc., can facilitate remote working [17]. Security mechanisms such as VPNs connect the office network with employees' remote devices. Using less office space means that remote working can result in significant savings for the employer as well. In general, altered spatiality of work and telecommuting are a rising trend [18].

The possibility of working remotely and being online 24 hours a day eliminates the boundaries between working life and family life, which may have both positive and negative side effects [19]. In their book, Näswall et al. argue that nowadays people tend to do more overtime work, have more responsibilities and less delineated demands, and thus are more stressed about their work in general. On the other hand, according to a study conducted by Philipp Döbeli [20], telecommuting and telework allow flexibility in working hours for the employees so that they can have a better work-life balance. This leads to healthier employees who are more attached to their jobs.

Case Study: Microsoft “Work without Walls” Survey Report. In 2011, Microsoft published the results of a remote working survey [21]. Of the 4,523 U.S information workers surveyed, more than half (57%) indicated that their company had a formal policy allowing remote work. More than three-quarters of the employees say that their companies provide access to technology that facilitates remote work. The qualms with remote work are lack of face-to-face meetings and lack of quick responses. Social networks are very much used for remote work, and several in-house social networking tools are also prevalent.

The complex and fast-paced modern business requires that the workforce of a company has a high diversity of skills. Remote working fits easily in many of the workflow positions since there are many jobs that can be easily handled remotely through the use of Internet technology.

4 Emerging Online Job Markets



In this section, we discuss some aspects of the emerging Internet-based job markets, including mechanism of participation and policies.

4.1 Labor Participation

Online job markets provide new work opportunities for people who might otherwise have problems finding a source of income, such as housewives, students, people with health problems, etc. Nowadays, they can find an online job and work remotely with flexible working hours, combining the work with other duties. As a result, the *market size* increases because people traditionally not considered part of the workforce can become active participants.

With the online markets, the *entry barrier* to start working and earning income becomes lower for several reasons. Firstly, the Internet provides a lot of information, guidelines and how-to's on practically any subject, so anyone can start learning new skills. Using newly acquired skills, one can, for example, start making products or provide some useful service. At first it can be a hobby, which later can turn into a

full-time occupation if it brings enough income. Secondly, the Internet is a great sales channel where sellers and buyers can easily find each other.

On the other hand, low entry barriers, lack of professional education and quality control lead to the situation where there are many similar and low-quality products and services on the market. For end consumers, it becomes more difficult to find a product they need with the desired level of quality [22].

Case Study: Social network vk.com. Vk.com is the most popular social network in the Russian-speaking countries. People use it for common social networking activities. Moreover, many people are starting to actively use it as a platform for selling their products and services. Services and products sold through vk.com include different types of handicrafts, cakes, photo sessions, clothes or folk costumes, distribution of products bought on wholesale prices, etc.

The market places are organized with the help of the vk.com groups, which were initially meant for people to share their photos and follow discussions. Sellers create groups to showcase their products and find potential buyers. When a seller and a buyer agree on the price, the payment is made using an electronic money system, like PayPal, or by direct payment to the seller's mobile phone account, which *yield small transaction costs*, eventually lowering the price of the end product.

One can find several benefits of having a market built on top of the social network platform. First of all, a seller doesn't need to have any technical skills to establish his own website or to maintain an account on an e-commerce website, such as etsy.com. Instead, a seller can use the same interface that he or she uses daily. Secondly, the seller needs to spend less effort to find customers, since in a social network, one can immediately start advertising their products to friends and can easily enlarge the group of potential customers by asking friends to spread the information to their friends. Recommendations and customer's reviews are incorporated, since these are native features of a social network.

4.2 Entering Internet-based Job Markets

As we stated in Section 2, entrepreneurial markets are mainly of two types, spot and contest. A large number of spot online markets (including the well-known elance.com, odesk.com and ifreelance.com) have been quite successful. Elance.com has over 1.3 million registered freelancers (0.04% of the world's 3 billion workers), who bid on projects to sell their skills. The customer base is highly diverse, including business giants like Google, Microsoft, Cisco, Dell, HP, as well as individuals who need a personal website.

These online markets allow not only listing and bidding projects, but also include reputation systems for freelancers and hiring customers. Besides previous history, the reputation systems also include competence tests. When the work contract is made, the system offers comprehensive solutions that allow the customer to communicate

with the freelancers, monitor work progress and receive the contracted work. Some markets support several freelancers working as a team. Once the work has been completed, the secure payment solutions protect the rights of freelancers and the companies who hire them.

All of the online job markets that we surveyed operate mainly in English. This has enlarged the *market size* and boosted self-employment opportunities in developing countries, especially those where English is widely used, such as China, India and Pakistan. Considering the case of Pakistan, it currently hosts over 100,000 English-speaking IT professionals, with global sales revenue of around US\$1.6 billion [23]. Many of Pakistan's over 1,500 software development companies started as *self-employed individuals* and entrepreneur startups. We present here our discussion with the founder and current CEO of SORCIM Technologies [24], Mr. Imran Lodhi, on the history of his entrepreneurial startup.

Case Study: SORCIM/Pakistan. Mr. Lodhi recognized the opportunities of the globalized market on the Internet and started SORCIM [24] technologies in 2005. Realizing the lack of venture capitalists in Pakistan, he aimed to become a successful online outsourcing service provider, with the future goal of establishing a product-based company. Using Internet-based outsourcing platforms like Elance and Odesk, he managed to enter the market easily and achieve the first goal in just four years, with annual sales of up to US\$1 million.

Mr. Lodhi attributes his rapid success to the Internet: "Startups and self-employed people are heavily relying on the Internet, as it has lowered the barriers of entry into the market. Each successful digital media business model in the developed countries will eventually take root in the developing economies. Use of digital media will increase, which will result in several different online business models creating hundreds of thousands of jobs in a relatively short time frame."

With the income made from the online job market, Mr. Lodhi switched to a product-based business model in 2009, developing PC/Mobile utility software. In this new business, global sales across the world still heavily rely on the Internet. The reason for that was a need for digital marketing and sales, including search engine marketing, search engine optimization, content marketing and online advertising. One of their major products, "Reginout", has been downloaded on more than one million PCs around the globe. His company now has over 20 employees and income is up to almost 70% of revenue.

Mr. Lodhi notes the importance of English as the lingua franca of these online job markets: "The Internet is of prime importance in the growing economies of developing countries. It can not only allow them to foster their local market growth but also play an important role in the global online economy."

4.3 Labor Rights on the ‘Net’

Trade or labor unions protect traditional workers’ rights by negotiating labor contracts with employers, trying to improve working conditions, etc. However, they do not necessarily protect the rights of workers working on the Internet.

Legislation for cross-border employment doesn’t exist, and the only international trade unions (called Global Union Federations) work by negotiating with multinational enterprises. Additionally, a study indicates that some freelancers prefer to use independent discussion networks to seek advice rather than taking part in traditional trade unions, though the study concludes that such networks are *not capable of representing workers* in a similar way [25].

If the unions only focus on national interests, then who protects the freelancers working across borders? At the moment, it ultimately falls to the freelancers to represent themselves. Working on the Internet usually involves a middleman organization, an agent between the employer and employee.

In comparison to the traditional trade unions negotiating with the industry associations, the situation for a freelancing middleman organization is completely different. It is their core business to be able to connect employers and employees together, and a successful business brings them their profits through royalties. Naturally, it is of great interest for the organizations to find a good way to meet the requirements of both parties. Most high-profile online freelancing middleman organizations provide some kind of *in-house policy frameworks* such as methods to store the freelancing job payment while the job is conducted. An escrow agreement gives the freelancer some level of security that they will get paid in the end. Additional services provided by middleman organizations can include tax-filing services for the freelancer. Traditionally, employers have taken care of this but freelancers usually have to do it by themselves.

Usually, these sites provide “dispute resolution” as an independent intermediary between the parties, hoping to reach an agreement on completing the job payment in a satisfactory way. If the dispute resolution fails to achieve a mutual agreement, the problem becomes very hard to solve if the employer, agent, and client are not from the same country.

Table 2 below lists several well-known middleman organizations.

Table 2. Services offered by sites supporting online work.

On-line work sites	Country	Escrow agreements	Tax filing services	Dispute resolution
eLance.com	United States	Yes	Yes	Yes
Guru.com	United States	Premium service	Yes	Premium service
oDesk.com	United States	No	Some	Yes
vWorker.com	United States	Mandatory	Some	Yes

Case Study: Second Life. The employers are interested in having independent contractors do work for them, since they do not have to provide paid vacations or other benefits or pay employer taxes. Moreover, it is sometimes difficult to define or prove if a person is working as employed or self-employed. For example, in the US, the worker status can be considered as employment if the customer or employer has the right to direct and control the employee. In the case of self-employment, the customer can only check the result of the work, not the process.

In 2008, the IRS (the US federal tax authority) ruled that part-time virtual greeters who worked in Second Life, a virtual reality world on the Internet, were actually employees and not independent contractors, and that they have to pay the appropriate social security taxes [26]. The employer, Electric Sheep Company (ESC), claimed that, due to the greeters being able to submit times when they wanted to work and using their own equipment, they were independent contractors instead of employees. According to ESC, the *US employment law is not crystal clear on this issue*, though it's easy to understand their point of view due to the cost savings involved with independent contractors.

5 Internet – Transforming Job Markets towards Perfect Markets



Sections 3 and 4 illustrated some developments related to work that have been triggered by the Internet. In this section, we will discuss the impact of the Internet on work using the perfect market characteristics as a framework.

5.1 Job Market Size

According to the theory of perfect markets, the size of the market is an important consideration. If there are many buyers and sellers in a market, the risk that some of the players can control the market is reduced.

Traditionally, job markets have been localized. The geographic span of the accessible job market, as seen by a person looking for a job, has been limited by factors such as the availability of information on work opportunities (e.g., via newspapers). The Internet expands the size of many job markets as it allows both employers and workers to act globally.

The need to relocate in order to accept the job can still limit the effective size of a job market. Here the Internet can also expand the job market size by providing the possibility for remote work. Jobs where the product is a digital artefact, be it a computer program, music, a photograph or similar, can replace relocation by remote or online work.

We conclude that the Internet can increase the size of certain job markets. The impact of the Internet is bigger when the work can be done remotely over the Internet. For work that requires relocation, the impact will be lower. In both cases, the job markets are pushed towards a perfect market, but job markets, where remote work is possible, will be affected more.

5.2 Access to Information

In section 5.1, we already discussed how access to Internet-based information on employment opportunities expands job markets. Information on available jobs is not the only type of information needed in a well functioning job market. Information on job conditions, policies and legal issues, salaries, and the cost of living are also important factors when searching for a new job.

On the Internet, work-related information flows in many directions. If we look at questions related to employment, we can identify at least three important categories of information:

- Information on compensation levels. Information on salaries is widely available from many sources such as Statistics Finland, the OECD, and other government organizations.
- Company information. When people look for jobs on the Internet, they do not only look at the job postings, they also have access to lots of information about the company that is hiring and about their hiring process.
- Résumés. People looking for a job are not limited to just applying for jobs. The Internet also provides many opportunities for people to actively propose themselves for job positions by creating an attractive Internet presence.

The Internet drives both traditional and emerging online job markets towards perfect competition because market-related information is readily available to all market participants.

5.3 Worker Mobility within the Market

Worker mobility, the speed at which the market responds to changes, and the obstacles related to job market entry and exit are all very closely related.

In the context of employment contracts, worker mobility mainly implies physical mobility of the workforce. While physical mobility has increased, there are still significant barriers to worker mobility, particularly across national borders. Key barriers include:

- National or regional policies related to immigration and job permits
- Language barriers
- Qualification and other competence and skills criteria
- Lack of housing and high housing prices

We have found little to no impact of the Internet on these mainly policy-based barriers to worker mobility. Thus we argue that the Internet does not have a significant impact on worker mobility *within a job market*.

5.4 Response Speed to Market Changes

A perfect market should respond very quickly to changes in supply and demand in a given job market. This implies that workers need to move very quickly between different job markets. As job markets are often defined by the required skills, a worker might need to learn new skills in order to move to a new job.

The Internet can help workers move between job markets in at least two ways. The first way is to provide access to the training needed to enter the new market. Free online education on the Internet is removing many barriers to switching job markets by providing the necessary education.

Access to online training has improved in recent years, as evidenced by the emergence of high-quality online education [27]. Examples of this can be found at all levels of education:

- Online university education. Highly respected universities, such as Stanford, are putting more and more educational material online as well as organizing online courses.
- Basic training is moving to the Internet. The Khan Academy is an excellent example of a free online service where people can study a wide variety of subjects at a number of educational levels.

The other way in which the Internet is changing the conditions for market entry is by changing how worker skills are assessed. The Internet is turning some job markets into meritocracies where formal education has a lesser role. On the Internet, people

can demonstrate skills and knowledge in new ways, e.g., by showcasing the outcome of their own work.

Stock photography is a good example of that [28]. When a customer chooses a photo from a stock photo agency, the formal training of the photographer is irrelevant. The only thing that matters is whether the buyer likes the result. This shows that self-training with the help of Internet-based resources is becoming a much more viable option to learn the skills needed to enter a new job market.

5.5 No Obstacles for Market Entry or Exit

The traditional job markets have been very regulated. Regulation concerns both market entry as well as exit. Market entry has been controlled by a number of different types of permits [29], such as the required level of education, work permits for foreigners, permits required to work in certain professions such as various legal and medical professions, etc.

The Internet-based markets can circumvent some of these policies. The policies mainly apply to people crossing borders. However, if the work is done online, the movement of people is replaced by the movement of goods and services, which are much less regulated.

While market exit is rarely directly limited, various policies related to labor rights provide significant incentives to stay within a job market even when demand in that job market is going down. For instance, policies regulating unemployment benefits can encourage people to look for work in their own field and stay in the same job market.

As people working online are mostly self-employed and therefore seen as entrepreneurs, many of the labor benefits do not apply and the incentives to move from markets with low demand to other markets would be higher.

5.6 Transaction Costs

For the job market, obvious transaction costs include the cost of hiring (advertising, the selection process, etc.) and the costs of managing the hired person.

However, there are also a number of hidden costs related to employment. These costs are mainly related to various policies protecting labor rights and may include the costs related to possible future layoffs and the costs related to health and other benefits.

Kaufman [3] consequently argues that the notion of a perfect job market is impossible due to the transaction costs related to employment. Our findings agree with Kaufman, as it seems that the Internet does not significantly impact the transaction costs of traditional employment.

Kaufman, however, indicates that when independent contractors are used, the transaction costs related to work are lowered. While Kaufman does not believe that

the job market could be totally based on independent contractors, our findings do support the notion that Internet-based online markets do have lower transaction costs than traditional employment.

The lower transaction costs are due to the fact that the workers in the online markets do act as companies and hence many of the transaction costs related to labor policies do not apply. Also, the online job markets use platforms for offering and contracting work that try to minimize the transaction costs related to hiring a person. This is done by making the platforms very easy to use and supporting the full contract cycle within the platform.

Thus the emerging online job markets on the Internet seem to be much closer to perfect markets than traditional employment-based job markets in terms of significantly lower transaction costs.

5.7 Summary

In general, the cases presented in sections 3 and 4 indicate that the Internet is pushing job markets in the direction of perfect markets. However, the impact on different types of jobs varies a lot. At one extreme, we have jobs that require physical presence, have a strict regulation on competence, and that are mostly done under traditional employment. For a market of this type, the impact of the Internet is rather low and the market is only mildly pushed in the direction of a perfect market.

At the other extreme, we have jobs where knowledge or digital artefacts are produced and for which there are established online markets. These job markets are seeing an increase in online working and are strongly pushed in the direction of perfect (and therefore highly competitive) markets. Table 3 summarizes our findings.

Table 3. Traditional and online job markets vs. a perfect market.

Characteristics	Transforming traditional job markets	Online job markets	Perfect job market
Market size	Growing due to global recruiting.	Still very small but global from the start.	Large market of homogeneous participants.
Access to information	Access to job market information on the Internet.	Very transparent markets with very good access to compensation and other information.	All market players have full access to all relevant information.
Worker mobility	Internet has little direct impact on worker mobility.	As work is always done remotely, worker mobility is nearly perfect but language and other barriers still limit.	Full mobility so that any open job can be filled with any unemployed candidate.

Speed at which the market responds to changes	Some impact of the Internet via access to training and education, slowness introduced by policies such as unemployment benefits and qualification requirements.	Lower formal competence requirement and access to training means that workers can react faster to changes in market conditions.	Markets react to changes at immediately.
Obstacles to market entry and exit	Highly regulated markets, very little impact of Internet on current labor policies.	Legislation for online markets is largely missing, thus very little policy impact. Online job markets regulated by trade laws.	Policies do not prevent the market dynamics.
Transaction costs	Little or no Internet impact on the labor contract transaction costs.	Online job markets have significantly lower transactions costs due to lower levels of regulation and effective online markets.	In a perfect market there are no hidden transaction costs.

6 Discussion and Conclusion



The Internet has had a profound impact on work. It has changed how to look for and find work, where to work and even the nature of work itself. For some, the Internet has created new opportunities to earn an income, while for others it has brought severe competition in the job market.

In many professions, the Internet has increased the size of the job market. Many companies as well as prospective employees now search globally for that perfect match of work and skills. Today people can apply for a position with the best of the companies located anywhere on the globe.

The new possibilities for remote work mean that when the match is found, the employee often does not even have to relocate but can work remotely. As more and more people do work remotely across many time zones, working hours and habits have changed to accommodate cooperation with international workers.

In other professions, the Internet has created new, global job markets. These job

markets integrate all aspects of work into a single online package: looking for a job, getting a contract, doing the actual work, invoicing and getting paid and hopefully also resolving work-related issues. With these new online workplaces, anyone can easily set up a small business that can reach customers even on a distant continent.

While the number of people earning their primary income in these new online jobs is still small, these new job markets provide a glimpse of how some job markets might evolve over time. In our study we found that the Internet pushes traditional employment based job markets in the direction of perfect markets. The new, Internet-based job markets are even closer to perfect markets with perfect competition.

But is the more perfect market perfect for everyone? The push towards freelancing, over the Internet or locally, means that more and more workers are regarded as individual contractors and hence receive few if any employment benefits. As the social security system in many countries is built around the employment model, what will be the effects on society if a growing part of the population is not employed but rather self-employed as a contractor?

On the other hand, a contractor is much less constrained by national labor-related policies such as restrictions on immigration and work permits. National and international labor policies don't seem to have caught up with the new ways of working introduced by the Internet. Because of their status as contractors, people that would not be permitted to work for a company locally, can easily do so remotely over the Internet.

From a bird's eye view, one can see that the Internet has shifted the job market from its traditional state. It is still unclear what (possibly unexpected) impact the new ways of working could have on society. Will it bring more welfare to the economy and the society? **Only the future can tell if a perfect market is indeed perfect for everyone.**

One thing seems certain. The Internet will continue to change the job market, and right now we are only at the beginning.

References

1. Hodson, R., Sullivan, T.: *The Social Organization of Work* 5th ed. Cengage Learning, Belmont, CA (2011)
2. Pillai, R.: *Labour Market Structure: A Brief Literature Survey.*, Munich (2010)
3. Kaufman, B.: *The Impossibility of a Perfectly Competitive Labor Market.* Working paper, Andrew Young School of Policy Studies, Atlanta (2006)
4. Horton, J.: *Online Labor Markets.* In: *The 6th Workshop on Internet and Network Economics (WINE)*, Stanford (2010)
5. Robinson, J.: What is Perfect Competition? *The Quarterly Journal of Economics* 49(1), 104-120 (1934)
6. Beck, H.: Jobs on the wire: In search of the perfect labor market. *Netnomics* 1, 71-88 (1999)
7. In: Best Job In The World. (Accessed April 2012) Available at: <http://www.ourawardentry.com.au/bestjob/>
8. CareerBuilder, In: Forty-five Percent of Employers Use Social Networking Sites to Research Job Candidates, CareerBuilder Survey Finds. (Accessed April 2012) Available at: <http://www.careerbuilder.com/share/aboutus/pressreleasesdetail.aspx?id=pr519&sd=8%2F19%2F2009&cd=12%2F31%2F2009>
9. In: Managing Your Online Image Across Social Networks. (Accessed April 2012) Available at: <http://blog.reppler.com/2011/09/27/managing-your-online-image-across-social-networks/>
10. Golbeck, J., Robles, C., Turner, K.: Predicting personality with social media. In : *Proceedings of the 2011 annual conference extended abstracts on Human factors in computing systems (CHI EA '11)*, New York, pp.253-262 (2011)
11. Hill, K. In: Social Media Background Check Company Ensures That Job-Threatening Facebook Photos Are Part Of Your Application. (Accessed April 2012) Available at: <http://www.forbes.com/sites/kashmirhill/2011/06/20/now-your-embarrassingjob-threatening-facebook-photos-will-haunt-you-for-seven-years/>
12. In: *Henkilötietojen kerääminen internetistä hakukoneen avulla ns. Googlaamalla työnantajan toimesta ja tietojen poistaminen google-hakukoneesta.* (Accessed April 2012) Available at: <http://tietosuoja.fi/48526.htm>
13. In: So you want to work in a startup? (Accessed April 2012) Available at: <http://startuplife.in/so-you-want-to-work-in-a-startup-2/>
14. Marshall, N. In: I wanna work at Instagram. (Accessed April 2012) Available at: <http://iwannaworkatinstagram.com/>
15. Rehms, J. In: 37signals needs another Jason. (Accessed April 2012) Available at: <http://37signalsneedsanotherjason.com/>
16. Chouinard, D. In: Hi, I'm David. (Accessed April 2012) Available at: <http://davidchouinard.com/khanacademy/>
17. Good, R.: Robin Good's collaborative map. (Accessed May 15, 2012) Available at: <http://www.mindmeister.com/12213323/best-online-collaboration-tools-2012-robin-good-s-collaborative-map>
18. Hardill, I., Green, A.: Remote working - altering the spatial contours of work and home in the new economy. *New Technology, Work and Employment* 18(3), 212-222 (November 2003)
19. Näswall, K., Hellgren, J., Sverke, M.: *The individual in the changing working life.* Cambridge University Press (2008)
20. Döbeli, P.: Bachelor's Thesis: Skype Dad - How do international managers organize their work-life-balance? School of Management and Law, Zürich University of Applied Sciences, Zürich (2011)
21. Microsoft 'Work Without Walls' Report: U.S. Telework Trends 2011.
22. Palfrey, J., Gasser, U.: *Born digital: Understanding the first generation of digital natives.* Basic Books (2008)
23. PSEB: Industry Overview. In: Pakistan Software Export Board. (Accessed 2012) Available at: <http://www.pseb.org.pk/industry-overview.html>
24. Sorcim In: Sorcim Technologies. (Accessed April 2012) Available at: <http://www.sorcim.com/>
25. Saundry, R., Stuart, M., Antcliff, V.: Broadcasting discontent - freelancers, trade unions and the Internet. *New Technology, Work and Employment* 22(2), 178-191 (July 2007)
26. IRS Says Virtual Greeters Are Real Employees. In: *The Alphaville Herald.* (Accessed April 2012) Available at: <http://alphavilleherald.com/2008/05/irs-rules-in-wo.html>

27. Kolowich, S.: Massive Courses, Sans Stanford. (Accessed May 27, 2012) Available at: <http://www.insidehighered.com/news/2012/01/24/stanford-open-course-instructors-spin-profit-company>
28. Reid, B.: Stockpiling trouble: How the stock industry ate itself? (Accessed May 28, 2012) Available at: <http://www.bjp-online.com/british-journal-of-photography/opinion/2072022/stockpiling-trouble-stock-industry-ate>
29. Bouras, S., Stamouli, N.: UPDATE: Greek Lawmakers Pass Closed-Professions Reforms Bill. (Accessed May 28, 2012) Available at: <http://english.capital.gr/news.asp?id=1389654>

Gamification of Life: the Rise of Gaming and Its Effects on Society

Abu Shohel Ahmed¹, Andy Best-Dunkley², Raisa Halonen³, Mokter Hossain⁴,
Pyy Kivisaari⁵, Nam Vu Hoang⁶, and tutor Andrea Buda⁷

¹ Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

² Aalto University School of Arts, Design and Architecture, Department of Media
PO Box 31000, FI-00076 Aalto

³ Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

⁴ Aalto University School of Science, Department of Industrial Engineering and Management
PO Box 15500, FI-00076 Aalto

⁵ Aalto University School of Science,
Department of Biomedical Engineering and Computational Science
PO Box 12200, FI-00076 Aalto

⁶ Aalto University School of Science, Department of Information and Computer Science
PO Box 15400, FI-00076 Aalto

⁷ Aalto University School of Engineering, Department of Engineering Design and Production
PO Box 14100, FI-00076 Aalto

{abu.ahmed, andy.best, raisa.halonen, mokter.hossain, pyry.kivisaari, nam.vuhoang, andrea.buda}
@aalto.fi

Abstract

This paper examines the growth of gamification in peoples' lives in the Internet era and its effects on society. It is suggested that due to the emphasis on intrinsic motivations, gamification may increase engagement and productivity in society. On the other hand, there are adverse effects of gamification, which include addiction and the

possibility of negatively affecting peoples' actions. The study is conducted by defining games and gamification, making an extensive literature review on the evolution of electronic games and the use of games in today's society, and collecting and discussing views from selected experts in the field about the future of gamification.

Keywords: Gamification, electronic games, motivation, society, worklife, positive psychology

1 Introduction

Over the last half century, we have witnessed the birth and rise of video gaming in society, and with this an awareness of gaming and game culture. Along with traditional board and card games, new types of games have appeared, such as live-action role playing and pervasive games, which combine computer technology with real-world game play. We have also seen a blurring of the boundaries between real life and fantasy life with the rise of celebrity and the phenomenon of reality TV. In the past, school children used to dream of becoming a fireman or a nurse when they grew up. Nowadays, they want to be a celebrity – a fantasy character, almost a game character!

As you walk around any developed city, you will see evidence of gaming, whether it is kids playing video games on handheld consoles, old people gambling on slot machines in the supermarket, or businessmen passing time playing *'Angry Birds'* on their smartphones. While play and games have always been a vital part of the construction of society, they are at last acceptable to all. Due to this new awareness of gaming, we have seen the adoption of game-like activities in other areas of life, so-called gamification. This is a term used to describe game-like mechanics applied to non-game situations in order to drive people's participation, i.e., encourage them to do something they might otherwise find uninteresting.

In the business and marketing worlds, gamification is regarded by some as the "next big thing", while others are highly critical, stating that it is actually nothing new and is just an attempt to use the popularity of video games as a premise for making money. Gamification uses strategies such as badges and ranking lists to encourage users to compete to gain social status within the peer group. Some of these mechanisms are taken straight from social media platforms and applied in other contexts such as enterprise platforms for businesses.

This paper has been structured as follows. Section 2 describes games, play and gaming in general. Section 3 shows how the electronic game industry has evolved and been popularized in societies and how games affect our individual lives and society. Section 4 covers the growing integration of gamification in various activities such as business, worklife, social media, and the military. In Section 5, particular emphasis has been given to the effects of gamification on society. Section 6 discusses the views of selected experts in the field. The final section presents the paper's conclusions.

2 Games, Play, and Gaming

Play and games have been with us, as humans, since the dawn of time. At least observation of behaviour amongst young animals shows that play is an essential part of growing up. What better way to learn social behaviour than through safe and playful interaction with your siblings? And humans are no different from other animals in this respect. Johan Huizinga, writing in his *'Homo Ludens'* [1], outlined the significance of play for the development of society:

"Here we have at once a very important point: even in its simplest forms on the animal level, play is more than a mere physiological phenomenon or a psychological reflex. It goes beyond the confines of purely physical or purely biological activity. It is a significant function – that is to say, there is some sense to it. In play there is something "at play" which transcends the immediate needs of life and imparts meaning to the action. All play means something."

Play has evolved as an essential ingredient of our social development. But competition – whether for food, a mate, land or just "fun" – has become a very "serious" business. Games, sport and war are all essentially the same activity: playing against an opponent with the intention to win. Accounts of war exploits are full of "gambles" and "risks" taken – high stakes where the winner takes all. The rhetoric of capitalism is also full of the same "risk-taking" language, illustrating that business is no different. Many on the political left are naturally against competitive sports for this reason – they find the similarities between the ideologies of sport and business too similar. But there is of course the possibility to play a game for fun alone! And this, as Huizinga states, is what makes play so unique [1]. In the 1970s, Stewart Brand and others started the New Games movement to counter the overly competitive ethos of regular team sports, with the understanding that everyone enjoys competing against others, at least some of the time, and if it is for fun. As the book *'New Games'* states [2]:

"...you'll discover that what's new about these games is the way you play them. You can choose to compete because competition is fun, not because you're concerned with who wins."

Contemporary game theorists and developers also understand the serious nature of games. Besides being a training ground for the young, games also function as an escape from the "real world". Games exist for entertainment, for passing the time, and for fun. They are a diversionary activity, meant for relaxation or distraction - a "not-work" space where players are free to engage in fantasy narratives, amazing feats, and rewarding tasks [3]. This is particularly true when we think of video and computer games, where we can adopt fantasy characters that exceed our everyday physical realities. We escape into other play worlds, where we can fight, die, fly, conquer, build,

and destroy – all without real-world consequences. Or is it really so divorced from reality? We are more and more often faced with extreme examples of game players becoming so immersed in this alternate reality that they literally forget to function in their real lives.

Any game or play exists within a magic circle, within which certain rules are obeyed and reality is suspended. This is the same for a children's schoolyard game as it is for an online multi-player role playing game. The players must keep "in character" – you must stay in the right area, use the correct words, move in an accepted way – in other words, you must "stick to the rules". If you break the rules, you are inventing a new game or play. Although play is a universal characteristic of growing up and learning about the world, certain characteristics are dependent on the society within which the play is taking place. The theorist Brian Sutton Smith has identified seven *rhetorics of play* [4], which show that forms of play are heavily dependent on the underlying values of the local society. Games can therefore serve to reinforce or undermine the dominant culture.

According to Sutton Smith, play activities can be grouped into four categories: play as learning, play as power, play as fantasy, and play as self. Play is a fun and exciting activity that we take part in through free will. We can't be forced to play – it just doesn't work. Play is a fundamental part of "being human" and "plays" an important role in shaping our character and development, as well as fostering relations within the societal hierarchy. Huizinga states that play "lies outside the antithesis of wisdom and folly, and equally outside of truth and falsehood, good and evil." So play occurs in its own mental or physical space, the "magic circle" that defines the limits of the play area, within which the players believe in the play.

Reeves and Leighton Read state that play is "a substantial force in how people think, feel and learn and in how groups collaborate, share identity, and produce culture" [5]. Similarly to Sutton-Smith, they identify many different types of play (figure 1).



Fig. 1. There are many different types of play according to theorists such as Brian Sutton Smith [4] and Reeves & Leighton Read [5].

So are play and gaming the same thing? Games are play, but they are a specific type of play with rules and often (but some argue not always) with the goal of “winning”. Game researcher Greg Costikyan defines games as something where the participants make decisions that affect the game play [6]. Playing the game a second time and making a different decision will have a significant effect on the game. Thus a puzzle is not a game – a puzzle has one correct answer, whereas a game should develop and evolve according to the player’s decisions. Katie Salen and Eric Zimmerman [7] state that a game has the following features:

- a game is a system
- it is artificial
- it has players
- it has conflict
- it has rules
- it contains a quantifiable outcome/goal, an ending state in which players can either be considered the “winners” or the “losers”.

3 *The Rise of Electronic Game Industry*

3.1 Evolution of Electronic Games

Early days of electronic games. The history of computer-based games goes back to the 1940s. The pace of development of electronic games was slow at least until the late 1960s. In 1966, a simple video game named ‘*Chase*’ was created and was the first to display on a standard television set. However, creation of the world’s first home video game console brought a dramatic change in the electronic game industry [8]. Early video games consisted of arcade video games, first generation consoles, and games for mainframe computers. Development of the first home console was begun in 1966 and a working prototype was completed by 1968 [9]. The electronic game industry gathered momentum during the 1970s. However, in the late 1970s, the console manufacturing industry experienced a remarkable setback to their business [10].

1980s. Various innovative games were released early in the 1980s. The mid-1980s witnessed the success of third-generation consoles [11]. These were the dominant devices of the decade. At the same time, video arcade games gained commercial success, which led to other manufacturers’ entering into the electronic game market [10]. Electronic games received media coverage through television, newspapers, and magazines and became a mainstream hobby industry [12]. Online games started to emerge. The 1980s is considered a very innovative period for the video gaming industry.

1990s. The fourth-generation console was introduced in the early 1990s, and the fifth generation came to the market in the late 1990s [13]. Handheld gaming started to become more popular, whereas arcade games began to lose their popularity. This decade witnessed several factors such as large consolidation publications, high budget games, production teamwork, collaboration between motion picture and music industries, etc. In the late 1990s, mobile phones emerged as video gaming platforms, with ‘Snake’ being installed in Nokia’s products. Other manufacturers adopted the idea, and mobile phone platforms for gaming became popular. The games were, however, of limited size and with little variance.

2000s. Innovation in game console features continued along with PC development. Portable game systems became popular. Users were modifying games, and game designers realized that the scope of mods and content added to the value of games. For example, ‘Counter-Strike’ [14], ‘Half-Life’ [15], and ‘Unreal Tournament’ [16], were very prominent games that allowed users to modify and customize based on their preferences.

In the early 2000s, Japan pioneered mobile game platforms that became widely popular. This was followed by similar developments in the USA and Europe. Games such as puzzle games and virtual games started to use advanced technologies and facilitated an optimum platform for arcade-style games. Soon thereafter in Europe, Namco took the initiative to launch the mobile gaming culture [17]. Nokia’s ‘N-Gage’ phone, launched in 2003, accelerated mobile gaming. Subsequently, the launching of Nokia’s ‘N-Series’ smartphones in 2005 and Apple’s ‘iPhone’ in 2007 increased mobile phone gaming intensely. Console gaming gained new energy with Microsoft’s release of ‘Xbox 360’ in 2005, followed by Sony’s ‘PlayStation 3’ in 2006. Nintendo also came back on track by releasing the ‘Wii’ console. Several years later, in 2009, Sony launched the ‘PSP Go’ globally [18]. Gamers’ interaction with games changed radically. China came into the gaming industry mostly with social networking games such as ‘Happy Farm’ in 2008, followed by other prominent games such as ‘Frontier-Ville’, ‘YoVille’, ‘Mafia Wars’, and ‘Mob Wars’.

2010s. New introductions in the 2010s are gaming without controllers and eighth-generation consoles. In this decade, game companies focus more on motion-based consoles and peripherals such as Sony’s ‘PlayStation Move’, Microsoft’s ‘Kinect’, and Nintendo’s Wii. Companies strive to increase the lifespan of their video games as both Microsoft and Sony announced that their seventh-generation consoles should have a lifespan of more than a decade. In the eighth generation, ‘Nintendo 3DS’ and the ‘PlayStation Vita’ are dominating the handheld gaming industry. These eighth-generation consoles are expected to compete strongly with tablet and smartphone-compatible gaming markets [18] along with emerging online games in social networking sites [19]. In 2010, the electronic game industry sales revenue was US\$ 15.6 billion [20].

3.2 Popularity of Electronic Games

As presented so far, electronic games have been gaining popularity since the very first system was introduced decades ago. The number of fans of video games increases not only day by day, but minute by minute [21]. Today, people from all walks of life can be considered gamers. We list several important reasons for this phenomenon identified by different researchers.

Today's sophisticated video games are more interactive than movies or books because they require players to pay constant attention to the game, rather than passively watching or reading [22]. Electronic games are widely distributed and can be played in different forms available at home or in public places for affordable prices. Boys and girls can easily find in the Internet many different types of computer games that fit almost any kind of interest.

Virtual game worlds become more realistic because of the continuously improving quality of visual graphics, sounds, and physical feedback, thanks to the millions of dollars and many years invested by game developers [23]. Players of role-playing video games are able to change the behaviour of characters and impact on the virtual world. This kind of power makes players feel confidence and pleasure as the victories of the game heroes are projected onto the players themselves. Fantastic games also provide players with some of the fabulousness and miracles that people need in their grey everyday life.

Massively multiplayer online games (MMOG) offer a very deep social interaction with other players, not just because they are multiplayer, but because they are endless. Players feel that if they stop playing, they will fall behind their comrades. An MMOG like *'World of Warcraft'* has many in-game artefacts that require months of work from a single player or a group of players to collect and so complete a level in the game. That motivates players to find like-minded friends and keeps players paying for the monthly subscription [23].

Thus, we can summarize that the reasons for the popularity of electronic games are their relatively cheap price and easy ability to bring strong feelings of happiness (figure 2).



Fig. 2. The joy of gaming. Boys enjoying older game consoles at Alternative Party, Helsinki, Finland, September 2009. Photo: Andy Best-Dunkley

3.3 Electronic Games Changing Society

Effects on physical and mental health. The consequences of playing games have been a topic of debate between specialists from many different fields. On the one hand, computer games are considered a waste of time and a promoter of violent, aggressive and antisocial behaviour. On the other hand, computer games are seen as valuable tools, permitting the acquisition of a vast amount of skill and knowledge, vital to healthy development and future success [24].

“Videogames change your brain,” argues psychologist C. Shawn Green at the University of Wisconsin, who studies how electronic games affect abilities. Video games change the brain’s physical structure in the same way as do learning to read, playing the piano, and navigating using a map. Just as exercise builds muscles, concentration during playing strengthens neural circuits and builds the brain [25-26].

Health care can be improved by the use of computer games, both for training staff and to be used in therapy. Games can provide distraction to prevent self-affliction, encourage exercise, expel violent and aggressive energies, and improve optical aptitude. Video games also give a child’s brain a real workout. In many video games, the skills required to win involve abstract and high-level thinking, some of which are not even taught at school, such as instruction following, problem solving, logical thinking, hand-eye coordination, fine motor and spatial skills, resource management and

logistics, multitasking, simultaneous tracking of many shifting variables and managing multiple objectives, quick thinking, making fast analysis and decisions, strategy and anticipation, developing reading and math skills, perseverance, pattern recognition, estimating skills, inductive reasoning and hypothesis testing, mapping, memory, improved ability to rapidly and accurately recognize visual information, reasoned judgments, teamwork and cooperation when played with others, simulation, and real-world skills [27].

Because computer games and their graphics are advancing all the time, games now seem to be more real than ever before, allowing players to accumulate life skills and knowledge for activities they would not normally experience in real life. “Serious games” created mainly for non-entertainment purposes and designed as a tool to train certain skills, and some off-the-shelf games, have shown positive results as employees have become more skilled through practice in the virtual world. Serious games are incredibly popular within sectors that provide jobs of high risk, for example the military. Serious games have also been used in health care to train staff, as therapy for patients, and as a tool to enhance therapy.

On the other hand, there are many negative effects of computer game play mentioned in the medical literature. These include hallucinations, enuresis, encopresis, wrist/neck/elbow pain, tenosynovitis and peripheral neuropathy. Some of these effects are very rare, and most of them are linked to excessive play resulting from addiction.

Effects on society. Computer games are no longer just a youth activity, and new game genres and forms are emerging, thanks to innovation in the game industry. However, computer games even now are easy to blame for current negative trends in society. Especially when it comes to children, computer games are blamed for poor academic grades, obesity, aggressive and bad behaviour, high teen pregnancy rates and even poor attention spans [24].

Violent computer games have been put under the spotlight in many past studies, and it is common knowledge that violent media affects behaviour in a negative way, encouraging aggressive thoughts and behaviour. However, Prensky states that such studies have only examined the short-term effects and there has been no evidence to suggest a long-term effect on behaviour [28].

Nowadays children not only increase their knowledge through game play but they also learn effective collaboration and social skills from massive multiplayer games which involve thousands of players playing simultaneously and communicating through clans and guilds. There are massive networks of players communicating in many different ways and not only about the game that initially brought them together. However, looking at the negative side of socialising in game worlds, in-game guilds show signs of discrimination and antagonism to non-members, something that is also present in real-life human behaviour. Besides, too much time spent in virtual worlds may also distract the players from communication with other family members and friends in the real world.

Youth today are exposed to a completely different mental diet compared to previous generations and are exposed to technology at a very young age. Children become so-called digital natives, and they do everything in new ways, developing complex collaborative and social skills. They are also required to deal with in-depth problem-solving, not through organised education at pedagogical facilities, but voluntarily in their free time through the popular culture and technology they use, including the computer games they play. Current education systems were designed for previous generations and may require updating for digital natives' needs. Prensky (2006) states that "the curriculum they are given feels to them like their mind is being put into a strait jacket" [28]. What they are taught and the way in which they are taught it does not motivate them because it does not challenge them in ways that popular culture does in their free time. Complex computer games challenge the masses, increases their intelligence and also incorporate Koster's "theory of fun" [29].

Even the current majority of learning technologies such as e-learning material and online educational social networks are not making the most of their potential and are not engaging learners like computer games do. Game-based learning is now emerging and trying to incorporate more elements of game design into pedagogical applications, and some learning technologies are proving to be very successful. Scientists at the University of Rochester have recently got interesting results showing some positive effects of computer game play on mental ability. This study compared three groups of workers: non-gamers, occasional gamers, and hard core gamers. The results showed that all gamers were consistently more confident, social and comfortable with creative problem-solving, with no signs of decreased attention spans.

To ease the control of games' adverse effects, most of the console games of the 2000s have been classified. The Entertainment Software Rating Board (ESRB) rates games based on their contents of violence, sex, strong language, etc. [30].

4 *Gamification of Life*

4.1 **Emergence of Gamification**

There are numerous examples of gamification in business, financial markets, work-life, social media, health, everyday life and so on, and also in areas such as military training and even crime and terrorism. To give an idea of the broad spectrum of gamification in our world today, we present news cases and case studies of gamification mainly in areas that affect everyone's lives. This chapter is not intended to give a quantitative and all-inclusive scientific picture of gamification, but to show where the phenomenon exists and how it is gaining more influence in society.

Many works on gamification stress that the rise of gaming is significantly affected by the change that has happened in children's playgrounds: whereas earlier generations spent their childhood playing together outside, the generation currently moving

to the worklife spent more and more of their childhood playing online video games. Many of them got some of their most rewarding experiences in that world, and looking for similar experiences in the real world starts to reflect on several areas of life, which we try to grasp in this subsection. Figure 3 illustrates significant moments in the emergence of gamification in society.

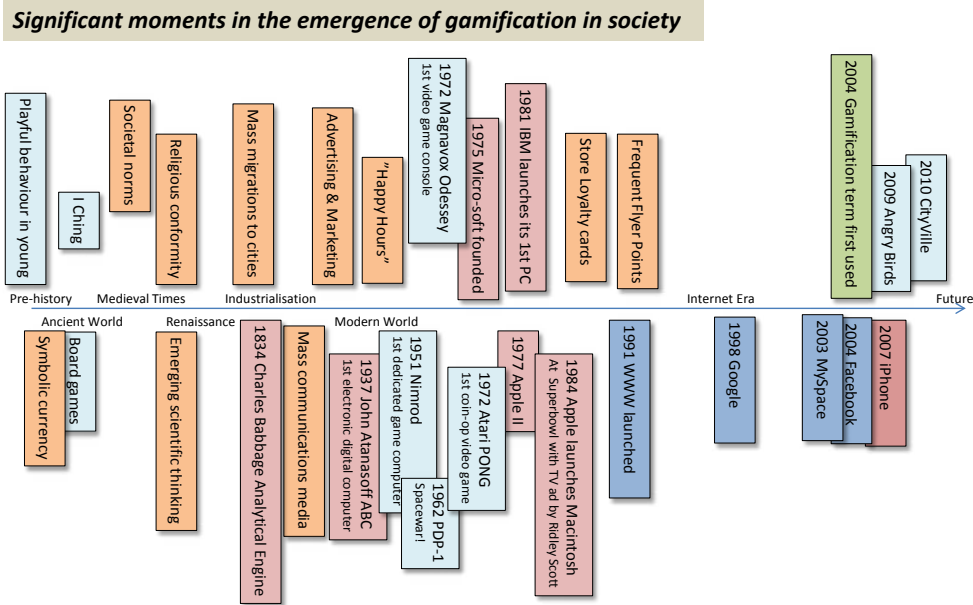


Fig. 3. Significant developments that introduced game-like ideas to society leading to the emergence of gamification as a phenomena

4.2 Education and Training

Education. Education is an area where gamification is thought to hold great promise. Some benefits of gamification for education are discussed by Jesse Schell in his book, *'The Art of Game Design'* [31]. He starts by stating that many aspects of our education system make it feel like a game. Students have a series of assignments for which they are rewarded with grades. In addition, the best students are possibly listed on the honour board or given scholarships. However, games are not yet used in education as extensively as they could be, because the education system has constraints that prevent gaming from being used very extensively.

Games have some advantages that make them very promising for education [31]. Firstly, videogames can be used to ease the memorizing of facts by adding visual aids to facilitate learning. However, a much more promising advantage is the additional value that gaming brings to problem-solving. Many games for problem solving require students to show that they can use a variety of different skills to solve problems.

This can be used for training skills where many techniques and know-how must be combined for solving a realistic problem. Schell mentions that some theorize that this will even lead to a generation that is much more skilled in solving problems than any previous generation, but this remains to be seen.

Another very important area of learning by games is the understanding of relationships. Traditionally, systems of relationships are taught by lectures, readings, and videos connected to exercises. Exercises may already contain elements where students can play with topics to be learned, but the use of games can take this to a higher level. One example of this is a simulator called *'Peacemaker'*, which simulates the conflict between Israel and Palestine [32]. The game was tested with natives of these nations who initially thought that the opposing side should do only a few simple things to end the conflict. Playing the game, however, showed them that the problem was so complex that their initial solution proposals were too simple. Learning this kind of a complex system certainly benefits from the possibility of playing with it. The remaining problem of course is whether the simulation is realistic and comprehensive enough to reflect reality.

'Quest to Learn', located in New York City, is an example of a public school that is based on gaming. Pupils are taught normal school subjects like math and history, but everything is implemented in the context of a game. For example, a pupil's day may start by trying to solve a mathematical problem that he or she has discovered, and the quest is to finish before any of his or her friends do. The first senior class will graduate from Quest to Learn in 2016 [33].

Games have also been used to facilitate legal disputes. When Japan adopted a lay-judge system in its courts in 2009, it triggered tremendous objections from the public [34]. Hardly anyone was willing to act as a juror, mostly due to cultural reasons. The Japanese were reluctant to express opinions in public, to argue with one another, and to question authority. Court officials started to soften the crowds already well in advance. Citizens were invited to participate in enacted trials to practise and some 500 mock trials had been held already in 2007. Computer games created for entertainment have also been utilized to train lay judges (see [35]).

Other topics that games can teach their players include new insights and curiosity. Games can possibly teach their players to see systems and even their own lives in ways they could not see before. For example, they let the player play the role of someone else, e.g. a leader of a big corporation. This may help children to aspire to ambitious goals already at a younger age. On the other hand, games help curious students get even more knowledge on the topics they are curious about.

Many of the following subtopics are highly related to education, e.g. training of traders and soldiers using game-like methods, but we left them as separate topics anyhow.

Financial markets. The work of stockbrokers and traders has already been very interesting for a long time from the point of view of gamification. If a trader is trading

stocks and other financial instruments for the employer, he is probably playing with huge sums of money that still are not his own money. Once he succeeds in making a profit, he will get a reward and acceptance from the employer but probably not the actual monetary profit. On the other hand, if the employer loses in trading, the trader will not lose his salary. This makes the question of how a trader reacts to stock trading very interesting. Is he always thinking that he is really dealing with huge sums of real money, or is it more of a game than real trading?

According to Gleadall [36], a training method based on gamification helps in training new traders of derivatives in the challenges of increasing risks related to financial derivatives. He mentions that traders have already for a long time been trained partly by using simple games, but that traditional game models have been too simplistic for the complex financial environment. Nowadays, however, versatile game software can be used that can somewhat realistically mimic the complex derivative markets. These software programs have the advantage that young traders can train themselves whenever they want without an instructor and that the game-like rewards motivate a trainee to learn faster. The author himself is the CEO of Volcube, a global derivatives simulation training technology provider.

'TraderPeople' is a platform to educate trading based on real-world live financial market prices without the risk of losing (or winning) real money [37]. It enables connected game play and multi-layered competitions and promises to offer learning-by-doing, e.g. for companies who want to train their employees. Most often the products of TraderPeople are tailored to customer's needs, but they have a product called *'Traderversity'*, which is a trade training game for students. The front page of Traderversity displays usernames of the 10 top players, just like any game site [38].

Military. The military has a long history of using games for training soldiers. The U.S. army has been using war simulators and war games for decades and according to Martin and Lin, the game industry was highly influenced by the military's own war games when starting to develop its own commercial war games [39]. After this, the military has again been influenced by the gaming industry in return, and so forth. War games have also been used to facilitate military recruitment [40].

Games are used in military training to train soldiers in an inspiring environment where they have already spent much of their childhood and youth, namely video games. This also enables effective training at a much lower cost than incurred when using real equipment. Of course, virtual training cannot totally substitute for real-world training, but it may make the training more efficient and bring totally new aspects to it.

One good example of military training using video games is the game environment owned by the Marine Corps called *'Virtual Battlespace 2'* (VB2). It has an open platform for adding new details and scenarios, and it can be used for adding details of a recent mission into the database. This means that, in principle, soldiers are able to study all the earlier missions before starting their own. According to officials in-

interviewed by Martin and Lin, playing earlier missions in VB2 has saved lives in real missions in Afghanistan [39].

This topic relates to the subject of our study from the point of view that when soldiers are trained for the battlefield in a virtual world, they learn to kill people in a very realistic environment that is still virtual however and essentially a game. Essentially this means that in the game, they are rewarded for the number of enemies they shoot, the number of missions they accomplish, and the number of times they stay alive. An interesting question is how this affects their behaviour in a real-world mission if they have learned to see their military missions only as games. On the other hand, according to Schell, in general people are relatively good at differentiating between violence in games and in the real world [31]. Soldiers, however, end up in very similar situations in their work as in the games they are trained with, which may change the case.

The use of America's army videogame by the U.S. for recruiting has also faced direct counter-reactions. One of the most visible of these was '*Operation Urban Terrain*' (OUT), where two women artists hacked into the online game and presented anti-military reflections there during the Republican National Convention in 2004 [41].

Worklife. While the previous sections on education, financial markets and military all gave examples of worklife gamification mostly by referring to training for different job, Reeves and Leighton Read [5] predict that soon some jobs will be done inside a game. They suggest that work should be redesigned with multiplayer games in mind, making work more engaging and workers more productive. Gamers are already performing every type of information work imaginable while playing: they schedule, organize, analyse, evaluate, create, operate, prioritize, buy, sell, negotiate, lead, follow and do countless other things. All this is done inside games, for personal and social reasons. Gamers are driven by achievement, immersion, exploration, competition, and socializing.

Reeves and Leighton Read [5] see that there are two trends that drive us towards using game-like mechanics to change the nature of work: the increasing need for worker engagement and the engaging nature of digital play. Digital games have long influenced work, but the recent development in games offers a means to re-engineer the entire human-computer interface.

The future generation of workers has adapted to the digital world already at early stages in their lives. They have been referred to as the digital natives [42] or even the gamer generation [43]. While this upcoming generation is undoubtedly ready for the gamified worklife, Reeves and Leighton Read [5] suggest that as a result of sophisticated game play, anyone can develop the same gamer sensibilities as the digital natives. Reeves and Leighton Read list ten features from games that can be employed in reshaping work: avatars, 3D environments, narrative context, feedback, reputation, marketplaces and economies, competition, teams, parallel communication systems, and time pressure. While these features have varying relevance and interconnectivity, particularly the use of virtual people, money, teams and leaders is suggested.

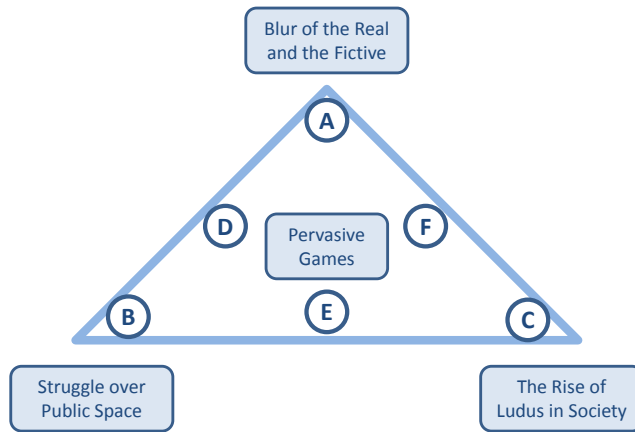
4.3 Personal Life

Gamification of personal life is the area that is somehow closest to what we are looking at. It will be interesting to see if gamification takes a significant role in peoples' lives strongly because of the Internet and what consequences it will have in that case. Another possibility is that people collectively get tired of gamification in their free time and it will die out. Whatever the future, today we see many instances of games penetrating peoples' real lives, and we present a couple of them here.

Health promotion. McHugh writes about gamification in tracking a healthy lifestyle by presenting an Internet-based app called *'Foodzy'* [44-45]. It rewards users for healthy choices and allows them to connect and share healthy eating habits with each other. It also has a database that can be updated by users by adding local food products and their data. The social aspect of Foodzy and the rewards encourage people to keep their lifestyle healthy. Foodzy is very elementary in the sense that it only counts calories. On the other hand, it gives additional rewards for eating lots of vegetables, fruit, and fish, and it also gives a Hangover badge for having too much alcohol in one night. However, software like this raises questions about the truthfulness and scientific justification of the healthy lifestyle it offers. In the extreme, it could increase the number of eating disorders. Another form of health promotion by gamification is the integration of activating computer games into physical education. An example of this phenomenon is a series of Konami video games called *'Dance Dance Revolution'*, which has been used in school fitness programs both in the U.S. and the UK [46]. New motion gaming platforms, such as Nintendo Wii and Microsoft Kinect, also promote possibilities for injury rehabilitation and health preservation.

Social status. *'Empire Avenue'* is an interesting gamification site [47]. It proposes a rating system for people using social media. Essentially, Empire Avenue allows anyone to "buy" other people with virtual currency based on the current market value of an individual. The market value of an individual is determined by his or her activity in all the social media sites and blogs where they are active and also by how many other individuals are investing in them. So far, Empire Avenue is only a game, but it could be used to much more than only playing, both for good and bad. One thing is that it could be used to measure the influence of an individual and head hunters could use it [48]. On the other hand, assigning a market value to every individual may also create societal problems such as very unhealthy competition and pointless stress.

Stern writes in the Reuters news site about SaveUp.com, which rewards people for making wise economic decisions [49]. A user gets points for paying a credit card bill on time, depositing money in a savings account, or watching a video about personal finance. It sounds like a trivial application, but some politicians already believe that this kind of application could be used to get people with lower incomes to take better care of their household. This would clearly be a valuable outcome.



(A) Blair Witch Project (B) Graffiti & Street Art (C) Kinect & Wii - gestural interfaces (D) Zombie walks (E) Competitive skateboarding (F) Reality TV & Rise of Celebrity

<http://pervasivegames.wordpress.com/beyond-the-book/>

Fig. 4. Game-like behaviour in society and the relation to pervasive games: Blur of the Real and the Fictive, Struggle over public space, and The Rise of Ludus in Society. A, B, C, D, E, and F are examples which lie between these three extremes.

Pervasive games. One concept related to gamification of everyday life is the concept of pervasive games, which are games or play that penetrate real spaces and blur the border between real life and game life. Pervasive games are discussed in the book by Montola et al. [50]. The main messages of the book can be found at <http://pervasive-games.wordpress.com>. Pervasive games are not only happening in virtual space; many of them are based on using mobile communication as an essential part of the game. Pervasive games are again easier to understand through examples.

'Cruel 2B Kind' is a pervasive game where participating teams move in public space and perform predefined acts of kindness to other people that they suspect of being participants in the game as well [51]. However, teams do not know who else is participating and they only have to try. When a team succeeds in performing the predefined act of kindness toward another group, that group will lose and join the winning group until only one group is left. The act of kindness may be, for example, praising the target's shoes. Most probably the team will be praising many outsiders' shoes before winning, and nobody knows the funny situations this will create. Hopefully it will also make many people happier in the city where the game is played, even though the actual target is only to kill other teams by performing acts of kindness.

The Serbian artist Tanja Ostojic is including very extreme pervasive games in her artist portfolio. In her project, *Looking for a Husband with EU passport*, she set up her own rules of play to find an EU-based husband by starting an open call displaying pictures of her skinny shaved body. She finally married a German media artist and applied for permission to live in the EU. The purpose of her game was to reveal and ironize the side effects of the current rules of border crossing, such as prostitution and pragmatic marriages [52]. Figure 4 illustrates game-like behaviour in the society and its relation to pervasive games.

Implications. As a concluding statement to this subsection, we present an interactive graph (figure 5) by Stanford Professor B.J. Fogg on how game mechanics alter human behaviour [53]. The publicly alterable graph illustrates the gameyness of a platform and how much the platform influences the off-line behaviour of its user. The size of the platform name relates to the relative popularity of the platform.

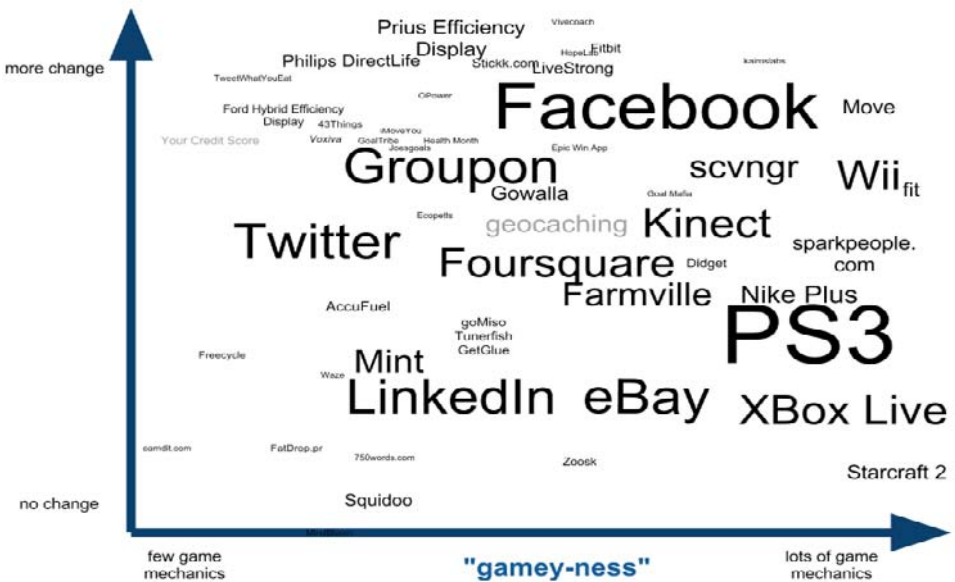


Fig. 5. Game mechanics changing the offline behaviour of users [53].

4.4 Crime and Terrorism

There are cases of gamification in the crime and terrorist scene, where game-like rewards can be used to motivate committing crimes but also to aggregate hostile thinking. This is an area very much influenced by the Internet, where the actual gamifica-

tion takes place. Brachman and Levine provide a good example of both of these by writing about gamification in hard-line Islamist forums and communities [54].

It is claimed in the article that all the social spaces of the Internet operate in the same way, i.e., using game-like mechanisms. This means that in some sense, online jihadists are motivated by similar reasons as, e.g., players of ‘*World of Warcraft*’. In a hard-line Islamist forum, they refer to *[forum name not provided]*, where users get points based on what other users think of their comments, news sharing, and so on. An important aspect is that users may be promoted according to their points. This can mean, e.g. a change in the colour of the username, the possibility to get an avatar, access to private groups, and a promotion to a higher class. Many of these rewards are known from the game world.

An essential question at this point is whether gamification increases crime and terrorism. According to Brachman and Levine, an obvious consequence of gamification is the increasing number of active participants in the forums [54]. However, some of the participants also extend their hostile activity to the real world, according to hearings of many arrested hard-line Islamists.

As an example of rewarding actual terrorist activity and not only sharing hostile thoughts and information, Brachman and Levine mention Anwar al-Awlaki. He succeeded in using gamification in the form of his personal affirmation as a prize for terrorist action. His followers then competed for this affirmation in their real-world actions. The important role of al-Awlaki in inspiring jihadists is also highlighted in obituaries for him, e.g. in the Guardian [55] and BBC [56].

The use of gamification in crime and hostile action is the most obvious adverse effect of gamification. The previous paragraphs provided an example of that, and more examples can probably be found. It is not clear how much more gamification brings to these activities on top of the traditional incentives, but its effect cannot be ruled out.

5 Effects of Gamification on Society

5.1 Adverse Effects of Gamification

The increasing demand and use of gamification in life can backfire on the motivation behind it. In his book “*Punished by Rewards*”, Alfe Kohn describes the phenomenon in which extrinsic benefits (e.g., money, status) can destroy the very purpose of gamification, i.e., engagement and happiness [57]. Many studies have shown that extrinsic benefits motivate people to do more things with lesser quality up to a certain point in time. When the extrinsic benefit has gone, people tend to dislike the activity. In fact, what is happening with many games and the gamification process can be described as pointsification in the name of gamification. These games are taking the least essential features (i.e., points) of games and representing those as the main objective of the game. Points are a good way to express progress, but they are not the core of

the game. The main objective of a game is to achieve inner happiness through hard work. But this is not the way many popular games are designed to work. As game designer Margaret Robertson pointed out, “Collecting enough My Coke Rewards for a Coca-Cola Telenovela Club Beauty Rest Eye Relaxation Mask is hard, but it isn’t interestingly hard. It’s just a wallet-emptying, artery-thickening endurance test. My Coke Rewards, despite being the poster boys of gamification (and despite both being in their own ways interesting projects and great successes) are in no way games.” [58].

The addictive nature of games can act as a tool for big brothers and big corporations. Let’s take a look at *FarmVille*, the third most popular game in Facebook, with millions of active users [59] and an exploitive nature using addictive game mechanics. The FarmVille game is all about harvesting crops on a regular schedule. Even with these simple mechanics, the game is very popular. Critics [60] pointed out that its popularity lies neither in gameplay nor in aesthetics. Its popularity lies in the tricky use of a web of social obligations. FarmVille players are not gamers, but it is the compulsion loop and reward mechanics that entangle a player in the game. When a user sees his Facebook friends sending him FarmVille crops and posting bonuses on their walls, it forces him to do the same for his friends. According to sociologist Marcel Mauss, gifts are a way of social obligation; it binds the giver and the receiver in a loop of reciprocity [61]. By exploiting this human psychology, Zynga, the maker of Farmville, is making a lot of money from its user base. At the same time, Zynga was accused of numerous “lead generation scams” – exploiting FarmVille customers by using advertising tricks to get them to buy virtual goods and third-party products. Time Online reported that one customer was charged almost two hundred dollars a month for unknowingly subscribing to it from a FarmVille advertisement [62].

Gamification can also become an evildoer against personal interests. One example could be loyalty cards from various shops. By providing loyalty cards, shop owners are following each of our moves and buying habits. Even though many people know this fact, we tend to accept the card to get a small return. According to Davis, this incentive is “illusion to voluntariness”, which conceals the big corporate hands. Gabe Zichermann pointed to these kinds of activities by saying that “games are the only force in the known universe that can get people to take actions against their self-interest, in a predictable way, without using force” [63].

Gamification has been criticized as a tool for capitalism and a way towards a massive consumption culture with hedonist behaviour. Symons describes reasons behind the success of right wing leaders (Berlusconi, Sarkozy, Merkel, Cameron) in Europe, compared to their leftist partners [64]. According to the article, as an individual and as a nation, we are becoming the pawn of global mass culture, fun, massive consumption, carnival style life, childlike behaviour, and media consumption. These changes in our behaviour allow us to be dominated by the sweet capitalist monster.

Gamification has been criticized from the moral ground – twisting reality similar to virtual games is a sort of deception. Engaging people in a game like manner can be considered a deceptive activity. The notion of an “AS IF” reality is a game; it can transform every activity into cheap, childlike fun and promote a hedonist culture. A

question has been raised about drawing a line between game-like and non-game like activity. More and more people within the game industry area are also concerned with ethical issues. Jane McGonigal and Gabe Zichermann are in favour of introducing ethics in gamification [33][63]. And like others, we also believe it is time to draw an ethical line within gamified activities. It is time to learn and know the difference between better and worse, to be aware of actions that can turn against ourselves, to know the limits of gaming and the big hands of corporations. As Patrick Liszkiewicz pointed out, “Citizens must educate themselves in the use of sociable applications, such as Wikipedia, Skype, and Facebook, and learn how they can better use them to forward their best interests. And we must learn to differentiate sociable applications from sociopathic applications: applications that use people’s sociability to control those people, and to satisfy their owners’ needs.” [60]

5.2 In the Search for Happiness

To many of us, reality is broken, depressing, too easy, disconnected, unrewarding, unambitious, and hopeless. However, it is also true that we live in reality and it is the only destiny. If this is the case, then we should seriously consider an enjoyable real life rather than an escapist mission. Thus, in this section, we narrate the positive characteristics (such as real positive emotions, real positive experiences, and real social connections) of gamification. Our objective is to find a link between gamification and happiness.

The recent study from the World Health Organization (WHO) named depression as the most serious threat to global health, surpassing heart disease, diabetes and asthma [65]. In the U.S. alone, more than 50 per cent of U.S. adults “lack great enthusiasm for life” [33]. Although as individuals and nations we have a higher standard of living than any other time before, happiness does not seem to follow the same pattern. Psychologist Daniel Gilbert in his book, *‘Stumbling on Happiness’*, suggests that money ceases to provide happiness after income reaches a certain level [66]. Studies have also shown that salaries do not increase happiness after a certain point of time if people do not enjoy the job and the network of people they work with. Based on these results, psychologists have coined the concept of “positive psychology” with an aim “to make life more fulfilling” [67].

Mihaly Csikszentmihalyi, one of the main proponents of positive psychology, has coined the idea of flow theory to define happiness. According to this theory, people become happier when they are in the state of flow [68]. He identifies ten factors during the state of flow:

1. Flow has defined and clear goals according to the challenge level.
2. The work requires high degrees of concentration.
3. It creates a lack of self-consciousness and a lack of awareness.
4. It creates a lack of sense for time.
5. It has an immediate feedback system.

6. The activity is challenging enough (not too easy or too hard).
7. The activity is intrinsically rewarding to a person.
8. The person feels control over the situation or activity.
9. The activity creates a lack of awareness of bodily needs.
10. The awareness totally focuses on the activity itself.

If we think of flow, we can also think about games that create addiction by maintaining flow characteristics. In a game, players engage with the world around us for intrinsic motivation. The flow nature of games and the intrinsic motivation to play leads to happiness. However, some of us may have contrary thoughts. We tend to describe some activities as relaxing or fun, e.g. watching television, eating chocolate, or shopping. However, many studies have shown that these fun activities are not engaging enough to make us happy [33]. In fact, when an activity is challenging enough, we feel positively engaged by the stressful situation. That is why it is much more interesting and fun to be part of sports, card games, or computer games. Now the question is, if games can remove boredom and provide happiness, why not design real life as a game-like activity. In the words of Csikszentmihalyi, “if we continue to ignore what makes us happy, soon we, as a people and a society, will be deep down in depression and boredom” [68]. The solution is to create real life activities as a game work. It is not an easy task, but if we fail to engage flow in people’s lives, there is a great risk that we, as a generation, will be in the dip of depression.

Based on the studies on positive psychology and flow, today’s game developers are equipped to change the world. Today’s game developers understand that the success of a game depends on the satisfaction and positive emotion it generates [33]. In other words, creating happiness is one of the targets for game designers.

5.3 Creating Happiness through Gamification

There are many theories about happiness, but there is one thing in common with all of them: an event, object, or achievement cannot provide happiness. We can make ourselves happy by making an activity intrinsically rewarding, which is hard to achieve [69]. The traditional belief that extrinsic reward systems (such as money, addictive drugs, alcohol or unhealthy foods) can make us happy is contrary to the findings of happiness experts in positive psychology. In fact, scientists have found the opposite to be true: sustainable happiness can be provided by hardworking, engaging, and satisfying work. The good news is that it is possible to train our brain to become happy [70]. Some of the activities that can make us happy are working towards a meaningful or an epic event, activities that generate social connections, and random acts of kindness.

Take for example ‘*World Without Oil: Play It Before You Live It*’, a multiplayer foresight game designed to solve an oil crisis in the future [71]. Players in the game develop their ways of living and change their behaviour to survive during the crisis. Players also try to perform their solutions in reality, i.e., living their daily life in a

simulated oil-shortage period. Through online tools, players can share with each other solutions towards alternate life styles. Games similar to this allow players to be part of a real world problem solving and a meaningful working towards the future, which in turn makes them happy.

'*Lexulous*' is an online board game with an option for online chat [72]. The game is easy for players of all ages. What is interesting is that most of the players in this game play against their near and dear ones, e.g. parents and friends. Basically it provides a platform for connecting with their near ones every day. This is also evident from the players comments: "I live in Atlanta, and my mom's in Texas. We love to have game night across the miles. Although I am sure she needs a break from me kicking her butt all of the time. (Love you, Mom!)". '*Cruel 2B Kind*' is an alternate reality game (ARG) which inspires players towards random acts of kindness [51]. It encourages players to praise and show kindness and gratitude towards other players and strangers. This activity can train us to become courageous, social and in turn, happy individuals.

Games can not only harness happiness but can also be effective platforms for solving real world problems. Currently the world is facing various hard-to-solve problems: poverty, hunger, malnutrition, gender inequality, resource shortage, unsustainable development, and so on. It may be that traditional methods are not enough to solve these global scale challenges. Games combined with crowdsourcing can become a perfect platform to engage millions of people in solving these problems.

Take, for example, '*Free Rice*', a crowdsourced game to feed hungry people around the world [73]. The game is simple. It asks vocabulary questions with multiple-choice answers. Each player earns ten virtual grains of rice for the correct answer. Virtual rice points are then converted to actual rice grains by online advertisement companies that display advertisements during the game. At the time of writing, the game has been able to generate 69,024,128,710 grains of rice, which is equivalent to more than 10 million meals worldwide [33].

6 The Future of Gamification

Figure 6 shows some areas of society that are moving towards using more game-like strategies. It also suggests that excitement is generated both in having a real motivation or reward and employing gamification. The upper figure represents the traditional world, where politics and crime (for example) employ game-like strategies, whereas factory work (for example) is only about getting a small reward without gamifying the workplace. The lower figure presents a phenomena created by the Internet, such as social media and e-mail. It also suggests that in the future, factory work would be gamified even if the actual reward remains small.

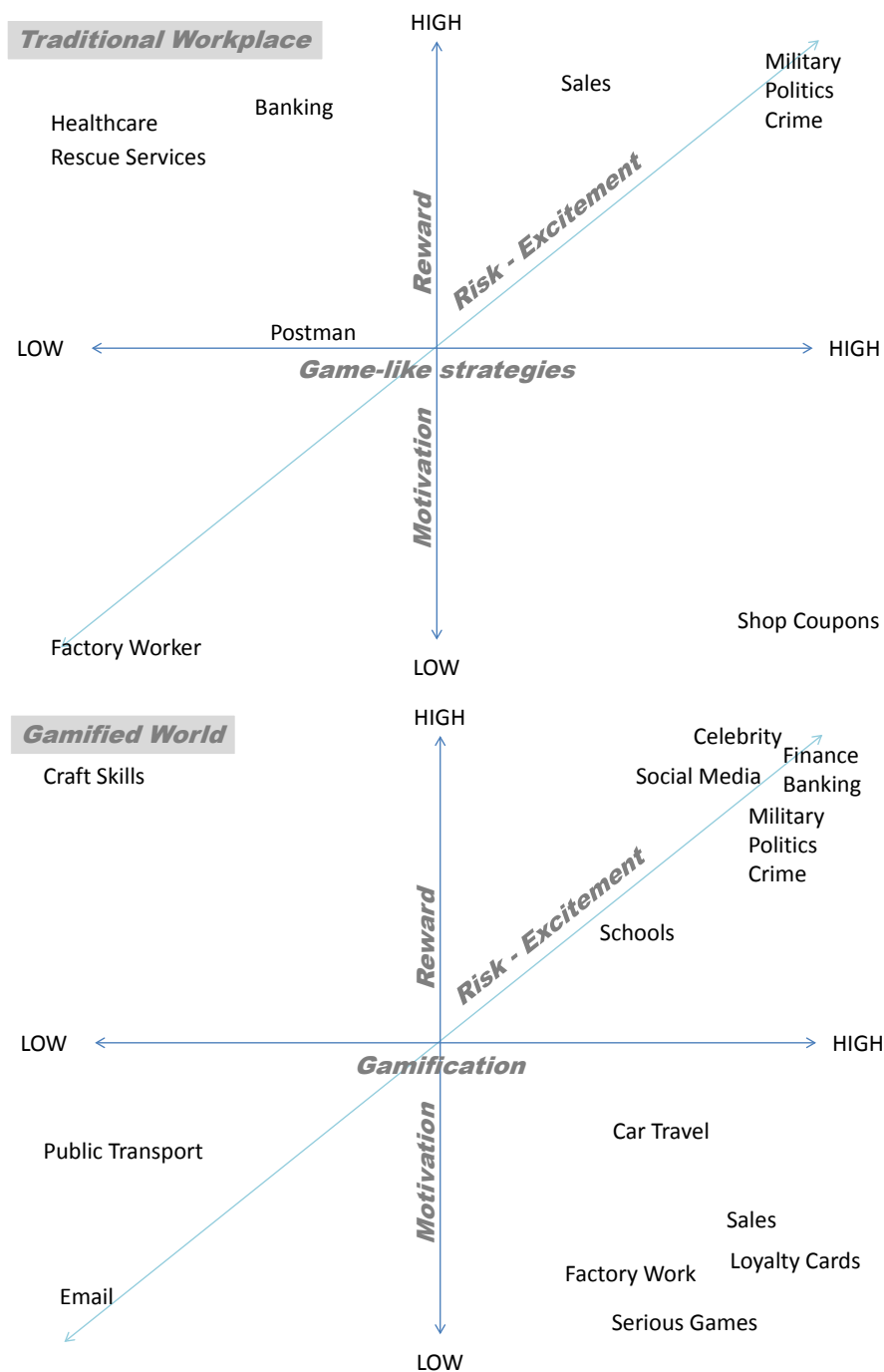


Fig. 6. Traditional workplace (upper figure) vs. potential scenario for a future gamified world (lower figure).

To enrich the discussion of this chapter, we set up a couple of related questions and sent it to selected experts in game research, game development, and digital culture. The names of the respondents and short summaries of the answers we got can be found in Appendix 1. The replies included very wide-ranging views, and together they give a good starting point for further discussion on the effects of gamification.

What we found most interesting about the replies was the wide range of views of our respondents. The most pessimistic arguments called for total removal of gamification, whereas the most optimistic ones called for an extensive effort to increase gamification. It seems that gamification raises many thoughts and that the main attitudes are that it is either (1) artificial and harmful to human activity or (2) a very useful way to emphasize people's most important needs and intrinsic motivations.

The main positive effect gamification brings is its emphasis on real intrinsic motivations that people already have. This has become very clear, both in our literature review and in the interviews. Taking education as an example, the intrinsic motivation would be gaining more knowledge to feel good, and the extrinsic motivation would be to use the knowledge for making money. Incorporating game-like behaviour in education may facilitate the mentioned intrinsic motivation but not this extrinsic motivation. However, based on many studies, intrinsic motivations are those that make us happy, and happy people are more likely to take care of themselves and their environment, that is, have a positive effect on society.

Ironically, the most serious adverse effects of gamification lie very near to this emphasis of already existing intrinsic motivations. Earlier we mentioned pointsification, where the game does not reflect any true motivation but instead points are taken to be the core element of the game. Due to their addictive nature, games are also a powerful tool to make people do things they consider wrong or harmful to themselves or their environment (e.g. giving personal information by using loyalty cards). This makes it fairly easy to exploit people by using games. It seems that gamification can have a positive impact only if it is used to emphasize already existing intrinsic motivations. Otherwise the game itself may become the main motivation for activities, so that the real reason for working towards something is lost.

Gamification in the Internet era is still in its early stages and therefore it is too early to say what its future and most important overall consequences will be. However, based on our study, we can say that gamification has gained significant influence in society in the Internet era and that it has both positive and negative effects. To get more concrete answers, detailed studies of the overall effects of gamification in different contexts are needed in the future.

7 *Conclusions*

In this work, we studied the increase of gamification in peoples' lives in the Internet era and its effects on society. By gamification, we meant incorporating game-like behaviour into real life, e.g., in connection to hobbies, worklife, and social life. We conducted our study by making an extensive groundwork study on games and especially online video games, their evolution, their current extent and their current manifestation in peoples' everyday lives. We also collected views from experts in the field about the current extent of gamification, its good and bad sides, and its future.

For the groundwork, we collected definitions of games and found that the most important characteristics of games are that they are artificial, they have rules, and they contain quantifiable outcomes that separate "losers" from "winners". We also conducted a literature review on the evolution of electronic games in the 20th and 21st centuries and saw the recent vast increase of playing video games, surpassing all generations and genders, and the increasing role of the Internet. We presented instances of gamification in several areas of modern human activity and saw that gamification is already visible to a large extent in society. To enrich our own discussion, we collected views of selected experts in the field on how gamification is affecting society and what its future will be.

We found that the most important positive effect of gamification in human activity is that it emphasizes intrinsic motivations and thus makes activities feel more engaging. Because gamification emphasizes intrinsic motivations, we argued that it may increase the feeling of satisfaction and compensate for the loss of meaningful human activity in modern society, where people feel distracted due to the lack of real challenges. As adverse effects of gamification, we discussed addiction, the encouraging of ill or artificial motivations, and the possibility to use gamification for exploiting people. However, we conclude that gamification in the Internet era is still in its early stages, and therefore it is too early to say what its future and most important overall consequences will be. Detailed studies of the effects of gamification in different contexts are needed.



*Fig. 7. Hacked game screen, Alternative Party 2009, Helsinki, Finland.
Photo: Andy Best-Dunkley*

References

1. Huizinga, J: *Homo Ludens*, a study of the play element in culture. Beacon Press, Boston (1955)
2. Fluegelman, A.(ed.): *The New Games Book*. The Headlands Press (1976)
3. Flanagan, M.: *Critical Play*. MIT Press, Boston (2009)
4. Sutton-Smith, B.: *The Ambiguity of Play*. Harvard University Press, Cambridge (2001)
5. Reeves, B., Leighton Read, L. *Total Engagement*, pp. 274. Harvard Business Press, Boston (2009)
6. Costikyan, G.: *I Have No Words & I Must Design: Toward a Critical Vocabulary for Games*. <http://www.costik.com/nowords2002.pdf>
7. Salen, K., Zimmerman, E: *Rules of Play*. MIT Press, Boston (2004)
8. Hilbert, M., López, P.: The World's Technological Capacity to Store, Communicate, and Compute Information. *Science* 332, 60—65 (2011)
9. The 'Father of Video Games' Reflects on His 40-Year-Old Invention – The Atlantic, <http://www.theatlantic.com/video/archive/2012/03/the-father-of-video-games-reflects-on-his-40-year-old-invention/254408/>
10. Whittaker, J.: *The cyberspace handbook*, p. 122. Routledge, London (2004)
11. Katz, A.: 1984: The Year That Shook Electronic Gaming. *Electronic Games* 3 35, 30—31 (1985)
12. CBC Archives, http://archives.cbc.ca/arts_entertainment/media/clips/15869/
13. FX-Entertainment: The 1st Issue of Nintendo Power Magazine!, <http://x-entertainment.com/articles/0751/>
14. Counter-Strike Update History, http://www.steampowered.com/platform/update_history/Counter-Strike.html
15. Half Life on Steam, <http://store.steampowered.com/app/70/>
16. Unreal Tournament (Video Game) - IMDb, <http://www.imdb.com/title/tt0284592/>
17. Hermida, A.: Japan leads mobile game craze. BBC News (2003), <http://news.bbc.co.uk/2/hi/technology/3186345.stm>

18. Plunkett, L.: PSP Go Is Officially \$249. Kotaku (2009), <http://kotaku.com/5275971/psp-go-is-officially-249>
19. Fiegerman, S.: 7 Gadgets That Won't Be Around In 2020. Yahoo, <http://shopping.yahoo.com/articles/yshoppingarticles/7177-gadgets-that-wont-be-around-in-2020/>
20. Claussen, J., Falck, O., Grohsjean, T.: The strength of direct ties: Evidence from the electronic game industry. *International Journal of Industrial Organization* 30, 223—230 (2011)
21. Epan, V.: The Popularity of Video Game Systems Around the World. *EzineArticles* (2008), <http://ezinearticles.com/?The-Popularity-of-Video-Game-Systems-Around-the-World&id=1550744>
22. Norcia, A.: The Impact of Video Games on Children. Palo Alto Medical Foundation, <http://www.pamf.org/preteen/parents/videogames.html>
23. Houckham, V.: Video Game Addiction, <http://en.allexperts.com/q/Video-Game-Addiction-3883/>
24. Matthews, A.: The Physical, Mental and Social Impact of Computer Games. Dissertation, University of Plymouth, School of Computing, Communications & Electronics (2008)
25. Hotz, R.L.: When Gaming Is Good for You. *The Wall Street Journal* (2012), <http://online.wsj.com/article/SB10001424052970203458604577263273943183932.html>
26. Winegarner, B.: WSJ: video games are good for you (even kids). *Backward Messages* (2012), <http://backwardmessages.wordpress.com/2012/03/09/ws-j-video-games-are-good-for-you-even-kids/>
27. The Good and Bad Effects of Video Games. *Raise Smart Kid* (2011), <http://www.raisesmartkid.com/3-to-6-years-old/4-articles/34-the-good-and-bad-effects-of-video-games>
28. Prensky, M.: Don't Bother Me Mom – I'm Learning! : How Computer and Video Games Are Preparing Your Kids For 21st Century Success and How You Can Help!. Paragon House, Minnesota (2006)
29. Koster, R.: A Theory of Fun for Game Design. Polygraph Press (2004)
30. Entertainment Software Rating Board, <http://www.esrb.org/index-js.jsp>
31. Schell, J.: The Art of Game Design. Morgan Kaufmann, Burlington (2008)
32. PeaceMaker Game Site, <http://www.peacemakergame.com/>
33. McGonigal, J.: Reality Is Broken: Why Games Make Us Better and How They Can Change the World. Penguin Press, New York (2011)
34. Onishi, N.: Japan Learns Dreaded Task of Jury Duty. *The New York Times* (2007), http://www.nytimes.com/2007/07/16/world/asia/16jury.html?_r=1
35. Namco Bandai Gets Serious With Courtroom Drama Games. *Siliconera* (2009), <http://www.siliconera.com/2009/03/06/namco-bandai-gets-serious-with-courtroom-drama-games/>
36. Gleadall, S.: Derivatives Market Gamification Technology Comes of Age. *Wall Street & Technology* (2011), <http://www.wallstreetandtech.com/career-management/232300303>
37. TraderPeople: Building social fantasy trading games, <http://www.traderpeople.com/about>
38. TraderVersity: Learn how to trade and win real cash prizes, in the new student game, <https://www.traderversity.com/12.03-3>
39. Martin, A., Lin, T.: Keyboards First. Then Grenades. *The New York Times* (2011), <http://www.nytimes.com/2011/05/02/technology/02wargames.html?pagewanted=all>
40. America's Army (AA): Game site, <http://americasarmy.com/aa/>
41. OUT: Operation Urban Terrain: a live action wireless gaming urban intervention, <http://opensorcery.net/OUT/index.htm>
42. Palfrey, J., Gasser, U.: Born Digital: Understanding the First Generation of Digital Natives. Basic Books, New York (2008)
43. Beck, J.C., Wade, M.: Got Game: How the gamer generation is reshaping business forever. Harvard Business School Press, Boston (2004)
44. McHugh, K.: Sorry, You Ate 500 Calories Over Your Limit Today – Foodzy Turns Dieting Into A Game. *Social Times* (2011), http://socialtimes.com/sorry-you-ate-500-calories-over-your-limit-today-foodzy-turns-dieting-into-a-game_b60575
45. Foodzy, <http://www.foodzy.com>
46. Dance Dance Revolution, http://en.wikipedia.org/wiki/Dance_Dance_Revolution#Use_in_schools
47. Empire Avenue, <http://www.empireavenue.com>
48. Harbison, N.: What's all the fuss about Empire Avenue? *TNW Social Media* (2011), <http://thenextweb.com/socialmedia/2Stern>, L.: Banks start playing games with your money. *Reuters* (2012), <http://www.reuters.com/article/2012/01/13/us-usa-gamification-idUSTRE80C19M20120113>

49. Stern, L.: Banks start playing games with your money. Reuters (2012), <http://www.reuters.com/article/2012/01/13/us-usa-gamification-idUSTRE80C19M20120113>
50. Montola, M., Stenros, J., Waern, A. Pervasive Games. Morgan Kaufmann, Burlington (2009)
51. Cruel 2 B Kind, <http://www.cruelgame.com/games>
52. Tanja Ostojic, <http://www.van.at/see/tanja>
53. Games to change real behaviour. <http://bit.ly/gamescape>
54. Brachman, J., Levine, A.: The World of Holy Warcraft. Foreign Policy (2011), http://www.foreignpolicy.com/articles/2011/04/13/the_world_of_holy_warcraft?page=full
55. Burke, J. Anwar al-Awlaki obituary. The Guardian (2011), <http://www.guardian.co.uk/world/2011/oct/02/anwar-al-awlaki>
56. Obituary: Anwar al-Awlaki. BBC News (2011), <http://www.bbc.co.uk/news/world-middle-east-11658920>
57. Kohn, A.: Punished By Rewards: The Trouble with Gold Stars, Incentive Plans, A's, Praise, and Other Bribes. Houghton Mifflin Co., New York (1999)
58. Can't play, won't play. Hide & Seek (2010), <http://www.hideandseek.net/2010/10/06/cant-play-wont-play/>
59. FarmVille, <http://en.wikipedia.org/wiki/FarmVille>
60. Liszkiewicz, A.J.P.: Cultivated Play: Farmville. Media Commons (2010), <http://mediacommons.futureofthebook.org/content/cultivated-play-farmville>
61. Mauss, M.: The Gift. Cohen & West Ltd, London (1954)
62. Luscombe, B.: The Troubling Rise of Facebook's Top Game Company. Time (2009), <http://www.time.com/time/magazine/article/0,9171,1940668,00.html>
63. G. Zichermann, Fun is the Future: Mastering Gamification, Presentation, (2010), http://gamification.org/wiki/Fun_is_the_Future
64. Symons, E.K.: The Decline of the Left. The Wall Street Journal (2010), <http://online.wsj.com/article/SB10001424052748704129204575506032115561668.html>
65. Moussavi, S., Chatterji, S., Verdes, E., Tandon, A., Patel, V., Ustun, B.: Depression, chronic diseases, and decrements in health: results from the World Health Surveys. The Lancet 370, 851—858 (2007)
66. Easterlin, R.A., McVey, L.A., Switek, M., Sawangfa, O., Zweig, J.S.: The happiness—income paradox revisited. PNAS 107, 22463—22468 (2010)
67. Compton, W.C.: Introduction to Positive Psychology. Thomson Wadsworth, Belmont (2005)
68. Csikszentmihalyi, M.: Beyond Boredom and Anxiety: Experiencing Flow in Work and Play. Jossey-Bass Inc., San Francisco (1975)
69. Lyubomirsky, S., Sheldon, K.M., Schkade, D.: Pursuing Happiness: The Architecture of Sustainable Change. Review of General Psychology 9(2), 111—131 (2005)
70. Achor, S.: The Happiness Advantage: The Seven Principles of Positive Psychology That Fuel Success and Performance at Work. Crown Business, New York (2010)
71. World Without Oil, <http://www.worldwithouthoil.org>
72. Lexulous Crossword game, <http://www.lexulous.com>
73. Free Rice, <http://www.freerice.com>

Appendix 1: Interview answers

We sent the following questions to our respondents:

1. Currently many real life activities have been gamified, such as sales and marketing, ecological, and health awareness campaigns. What are your opinions about gamification: does it bring benefits to society, or is this just a short term fad?
2. Do you know of other activities that reflect game-like behaviour? Please describe.
3. What is the role for serious games in education and training? Do game elements trivialise the learning process, or do they help reinforce the subject matter?
4. Many tasks in the workplace have been gamified. Is this exploitation of the worker, or rather a liberation from boring, tedious work? Please discuss with examples.
5. How do you see the development of gamification and other game-like strategies in the future? Do you think we will still be gaming in 2050? Why or why not?
6. Please give additional comments or observations which you believe are important to consider when discussing “the Gamification of Life”.

We received replies from the following people:

- Juho Hamari – Researcher at Helsinki Institute for Information Technology HIIT, research in gamification, game design, and virtual economy
- Sonja Kangas, Games researcher, IGDA Finland and private game companies
- Teemu Leinonen – Media Lab professor, Aalto University ARTS
- Junichi Nomura – Associate Professor, Faculty of Business Administration, Seijoh University, Japan & Keiji Amano, Associate Professor, Faculty of Business Administration, Seijoh University, Japan; serious games research
- Jari Takatalo – Research Scientist at University of Helsinki, Institute of Behavioural Sciences, Head of the Psychology of Digital Life (PDL) project.
- Bruce Wilcox – Senior game developer and programmer, USA
- Sue Wilcox – Author and chat bot writer, USA

The replies are summarized below under all the six different areas. We decided to wrap the replies together to make the main ideas easier to grasp. We also left the names out of the summaries.

Benefits of gamification to society

One respondent considered the discussion on gamification relating to human behaviour and motivation to be naive and stated that it is only a continuation of positivism and rationalism, which had started already when industrialization began. Continuing this, gamification makes humans objects of the system. Based on this, the respondent believes that gamification won't last long and will not produce expected results

because people will eventually refuse it. Another argument was that gamification is a short-term fad that gives benefits only for short-term activities such as promotions and campaigns. However, long-term effects are seen more in connection with pervasive games.

On the contrary, some respondents see gamification more positively. It can be seen as one instance of the current development phase of digital services. As games turn into services, online and mobile services borrow motivation and structural logic from games. In this view, gamification is not merely a fad. Having more and more information available, service providers must figure out ways to attract and motivate people to use their services, and gamification is one way to do this. In addition, some presume that gamification will eventually succeed in areas where educational games did not.

There were many views between these extreme views. One of the respondents said that whether gamification benefits society depends on many things. For example, simulations are useful as exercise elements, and creating games for promotional purposes is okay. On the other hand, as an artificial rewarding system, gamification may work in the short term in real life because of the added novelty, but not in the long-term.

According to another respondent, gamification is not in essence a new phenomenon. For example, customer relationship marketing has long had game elements (e.g. frequent flyer programs), and in many cases the success of these fairly old systems can be attributed to gamification. Continuing this, there is nothing wrong with gamification as long as gamification makes actions more engaging and valuable.

One respondent predicted that even if the use of the word “gamification” remains short-term, the phenomenon itself will continue. Accordingly, gamification is a term that puts together and makes understandable services, systems, and institutions that have existed already before it.

One respondent sees gamification as beneficial if an enthusiastic, long-term and cross-disciplinary research community is built around it to reveal its full potential. On the whole, gamification can be seen as part of the continuum of extending the persuasive technology paradigm. In this view, if people can be engaged in something so deeply, this should be utilized in other contexts as well. The respondent calls for a thorough inspection of gamified activities and issues that make games engaging, so that these two could be combined taking into account motivations, emotions, and cognitive processes.

Other human activities with game-like behaviour

All the respondents found direct connections with human activities and game-like behaviour. One respondent argued that one will find many connections between gamification and child’s play, and that child’s play has been known for a long time to be essential in learning new things. Connections between human behaviour and

game-like behaviour can also be sought by looking at motivation theories. Gamification can be used to motivate people, when the motivational factors are based on fundamental human characteristics. Another respondent began by mentioning that imagination is needed for being human and that play is an essential way for training that. Life and games cannot be separated from each other: to develop, the brain must play, make mistakes, and learn – that is, play games.

A very interesting point was that in essence, gamification tries to base human's motivation more on intrinsic than on extrinsic motivators and make a task feel better that way. Thus gamification is a pervasive decision facilitating system that tries to bring additional value to activities and decision-making. However, determining whether or not an activity reflects game-like behaviour depends on the actor, because playing is a subjective experience dependent on the individual's mentality, goals and voluntariness.

One respondent admitted that any human behaviour can be thought as a game and described with game terminology, but this is dangerous because human behaviour is always complex. The respondent wondered why people working with gamification consider human nature, life, and culture very simply, thinking that it can be explained with mathematical models and that games can be designed to directly affect human behaviour.

One view was that seeking challenges and new levels was one of the factors that made people move and adapt to new environments. Today's world lacks natural challenges such as hunger and cold, and this may makes it feel boring, which is probably one of the reasons for games becoming so popular in our society. Gamification strategies may also be useful for several types of people: those lacking challenges and those lacking the competencies to meet the challenges of a complex world.

Role of serious games in education and training

This issue is difficult to discuss since the concept of serious games is problematic: some serious games are more simulations than games. However, one respondent believes that simulations can be used as elucidative tools, which makes them good. Using educational games works in areas that can already be considered games, e.g., trade, accounting, and the military. The respondent would also like to see educational games become more serious and realistic, so that they would also show the harm that might result from making a fortune (for example).

Many respondents believed that simulations are always useful as part of the learning process; and they added that because repetition is important for learning, a game that enables repetition also enables better learning. Also, if real life can be disguised to be a game, people might play it with more enthusiasm (e.g. gold miners in *WoW*). Also importantly, games enable integrating fragmentary knowledge to form a more complete knowledge.

A slightly different view was that learning is often about rehearsing and memoriz-

ing basic concepts. Using games as simulations is a fine way to make this process interesting. The respondents did not think that using games would trivialize the learning process, but that the question is more closely about efficiency and retaining an interest in learning.

One respondent believed that serious games are still a marginal phenomenon and that their effect is hard to estimate as long as so few educational institutes are using them for education. Traditional educational games have been used already from the 1970s and 1980s, but these games are simple “drill games” and their role in educating is marginal.

One respondent again raised the issue here of intrinsic motivations and mentioned that as learning is heavily influenced by intrinsic motivation, using game-like strategies will have a positive impact on learning.

Gamification of worklife

This issue raised many differing thoughts about motivation and exploitation. One respondent presumed that gamification in this context simply means a fake rewarding system, which is not done for the benefit of the workers and thus becomes exploitation. If, on the other hand, the rewarding currency is something of real value, then gamification gives only an additional rewarding system on top of the earlier ones. Particularly using “social comparison” is usually exploitation even though initially effective. In the long term, however, it divides workers into upper and lower classes and is counterproductive.

Another respondent started by mentioning that the issue is delicate and complex. The answer depends on the type of gamification, whether participation is mandatory, and the already existing motivators. Adding mandatory gamification to work that is already engaging could be very harmful, whereas using a voluntary game system in tasks that people do not like could be very valuable. Also, the result may be terrible if work efforts for stupid goals are maximized. A trivial example of this would be rewarding help desk workers for the hours they spend on the phone instead of the number of issues solved during the day. One respondent touched this same issue by claiming that many workplaces have been gamified with oversimplified definitions of expected results. From the company’s point of view, gamification may win in the short-term but probably will lose in the long term.

A more optimistic view did not agree that many tasks were already gamified at workplaces, but much pressure was felt to gamify tasks because of the many important routine tasks that did not motivate workers. Gamification could be one way to sustain work quality by keeping workers more engaged in routines. Gamifying routines would still require radical changes in how tasks are done at workplaces. Gamification could be a way to make some of them more efficient.

One respondent noted that people will always try to escape boredom one way or another if the work is not interesting enough. This may mean, e.g., using Facebook

or other social media while working. The problem with work gamification is that its benefit disappears once people get too familiar with the game, and a new game must be invented every now and then.

One respondent asked that if people really need to work, why not make them enjoy it. There is a lot of evidence about happy people being in better condition and more productive. Rather than gamifying, making people work twelve hours a day six days a week for a minimum wage is exploitation. Learning from phenomena such as the open source community could be beneficial because the same kind of atmosphere would probably be a win-win situation for both the employer and the employee at the workplace.

Future of gamification and gaming in 2050

All the respondents were sure that games will be around in one way or another. One respondent answered by arguing that mankind has been gaming for millennia and that animals in general learn from play. Based on this, we will still be playing for millennia from today. Some mentioned that the world uses game mechanisms naturally in all aspects, and that with the development of ICT technology and miniaturization of sensor technology it has become much easier to facilitate gamification. Another belief was that gamification will evolve and become a more widely used design tool for some digital services. Either digital gamification will only remain a continuation of long-established competitive activities (e.g., school sports competitions and their rolls of honour), or gamification templates and content will be developed by professionals to be used in learning new things in a social interaction with others in the Web or a common space. The first alternative is already feasible, but the second one needs political decisions to facilitate the forming of the needed material. On the whole, play has always been an essential part of human nature, and continuing this trend, digital game is a new approach to facilitate play and human creativity.

One respondent hoped that the technological singularity (that is, intelligent computing) will already by 2050 be mature enough to tell us that gamification does not work because both people and computers are so smart. One respondent did not see why gaming would suddenly end but still hoped that before 2050 we understand a lot more about motivations, decision making, games and their interaction.

One of the respondents was less sure that we would still be gamifying our lives in 2050 but instead, gamification of life would be replaced by something different. It could be using visual overlays on real life: in the future, we could choose to see the world in the form of information we are interested in. According to the respondent, this kind of action will instead be very popular in the future instead of gamification.

One very interesting view was that nowadays we want even education to be gamified and fun, and we make up challenges to save us from a boring life. Thus we will probably develop even bigger challenges for using games if the environment does not provide us with them.

Other important aspects of “Gamification of life”

One respondent simply stated that instead of gamification, we should un-game society.

Another respondent wanted to add that basic playing has always included leader boards and high scores. To some, this has given an incentive, and to others it has made no difference. The current gamification trend, which involves giving badges for arbitrary stupid things and promoting rewards in social media sites, is a fad that reflects the current atmosphere where everyone should feel good about themselves for fake reasons.

To get more information about the positive sides of gamification, one respondent suggested taking a look at the book ‘The Happiness Project’, which includes many games, assignments, agreements, and processes that help make everyday life more rewarding. This is also very relevant to our own discussion on happiness through gamification in the previous section. Other interesting sources are ‘Rules of Play’ by Eric Zimmerman and the website <http://games.soe.ucsc.edu/>, where the game design department of UC Santa Cruz shows how they invent the future of games.

One respondent added that game designers must focus on how to make players still want to continue playing the game when they have matured in playing it.

One respondent took a very broad view and urged a thorough understanding of human nature and history. As an example of not taking human nature into account, one can think of multitasking, which was a hot topic a few years back. It was argued that together with all the new media channels, it would revolutionize the human mind. What happened, after all, was that multitaskers ended up struggling with their knowledge base filled with superficial information and a short attention span. Thus we may gamify our education and work but not life itself. Serious relationships, raising kids, and building a house are parts of life that require handling unexpected situations and incomplete controllability, and that make life multidimensional and not predesigned.

How to Control the Internet? – A Complexity Perspective

Kari Visala¹, Wael Soliman², Henna Warma³, Mário Costa⁴,
Lionel Reya⁵, Tuomas Ritola⁶, and tutor Kristi Grišakov⁷

¹ Aalto University School of Science / Helsinki Institute for Information Technology HIIT
PO Box 15400, FI-00076 Aalto

² Aalto University School of Economics, Center for Knowledge and Innovation Research
PO Box 21255, FI-00076 Aalto

³ Aalto University School of Electrical Engineering, Department of
Communications and Networking
PO Box 13000, FI-00076 Aalto

⁴ Aalto University School of Electrical Engineering, Department of Signal Processing and Acoustics
PO Box 13000, FI-00076 Aalto

⁵ Aalto University School of Electrical Engineering,
Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

⁶ Aalto University School of Engineering, Department of Engineering Design and Production
PO Box 14100, FI-00076 Aalto

⁷ Aalto University School of Engineering, Center for Urban and Regional Studies
PO Box 12200, FI-00076 Aalto

{Kari.Visala, Wael.Soliman, Henna.Warma, Mario.Costa,
Lionel.Reya, Tuomas.Ritola, Kristi.Grisakov}@aalto.fi

Abstract

The Internet is a complex network (i.e., system) that has enabled many things in the modern world. It enables fast-paced global businesses, modern communication technology, and makes our social lives easier. In its current form, the Internet is relatively free from regulation, and it has evolved into its current state in a rather ungoverned

and self-organized manner. Since the Internet has become practically a requirement for many aspects in most modern societies, the guiding aim of this chapter is to analyze how the Internet could be influenced or governed by adopting different perspectives (e.g. commercial or national interests). Is there a way for an actor, be it an individual, organization or nation, to take over the Internet or extensively control it? And what could be the concrete points in the context of the Internet through which power could be used to control the Internet or substantial parts of it? We first propose a conceptual framework for studying the potential power that different stakeholders could have over the Internet. Then we present examples of several *control points* that could be, or have been, used to exercise significant influence over the Internet.

Keywords: Internet, complex adaptive system, power distribution, control point

1 *Introduction*

The Internet started as a community with a few technologically oriented enthusiasts and has become fully intertwined in our society. From youngsters to elderly citizens, people use search engines and community-based knowledge resources, such as Wikipedia, for clarifying concepts. And they have accounts in social media platforms where much of their personal information is shared with the entire social media community. Internet users are now regular visitors of social entertainment websites where they can access network games, movies and music. For example, three billion Google searches worldwide and 8,000 new Wikipedia articles are estimated to be created each day. The idea that the Internet cannot be dissociated from our daily lives is a common one.

The lack of regulation in the Internet, as well as the inability of legislation in most countries to evolve according to such a communication medium, has led to users' behaviour in the Internet such that has had serious repercussions in our society. These include downloading of copyrighted material, sharing of confidential documents, organizing pro-democracy demonstrations, and allowing communication of rebel forces in civil war scenarios. The controversial SOPA/PIPA bills, Spanish and English social media clampdown proposals, and seizure of MegaUpload by Verisign are attempts to get control of the Internet. Many other entities, including countries, companies, and dictatorial regimes, currently aim at controlling the Internet as well [1].

The Internet has shifted from a purely technological infrastructure to a socio-economic system (i.e., techno-socio-economic), and potential points of control do not include only technological solutions [2]. In fact, any Internet service and platform such as Facebook, Google, and Wikipedia may be seen as points of control in the Internet. For example, Wikipedia's blackout may be interpreted as a motivation for demonstrations against SOPA/PIPA bills. In theory, any entity connected to the Internet may be seen as a potential control structure.

However, the Internet is a tremendously complex system where classic rules of cause and effect do not typically apply (see figure 1). Much of the Internet's dynamics is unpredictable and chaotic. Hence, the conventional reductionist approach for studying the Internet does not generally yield meaningful results, and any attempts to fully control the Internet are typically unsuccessful. However, even in the midst of chaos, patterns do emerge, e.g. Central Limit Theorem and Gaussian distribution, so that points of control in the Internet may in fact be identified and their dynamics can be understood. In particular, it is useful to devise relationships among control points in the Internet and in our society.

This chapter is organized as follows. In Section 2, we provide a brief summary of background material, namely complex adaptive systems, tussles in the Internet, the network effect, as well as power law and the hourglass model. Section 3 contains the proposed definition of control points in the Internet. Several illustrating examples of control points are given in Section 4. Section 5 concludes this chapter.

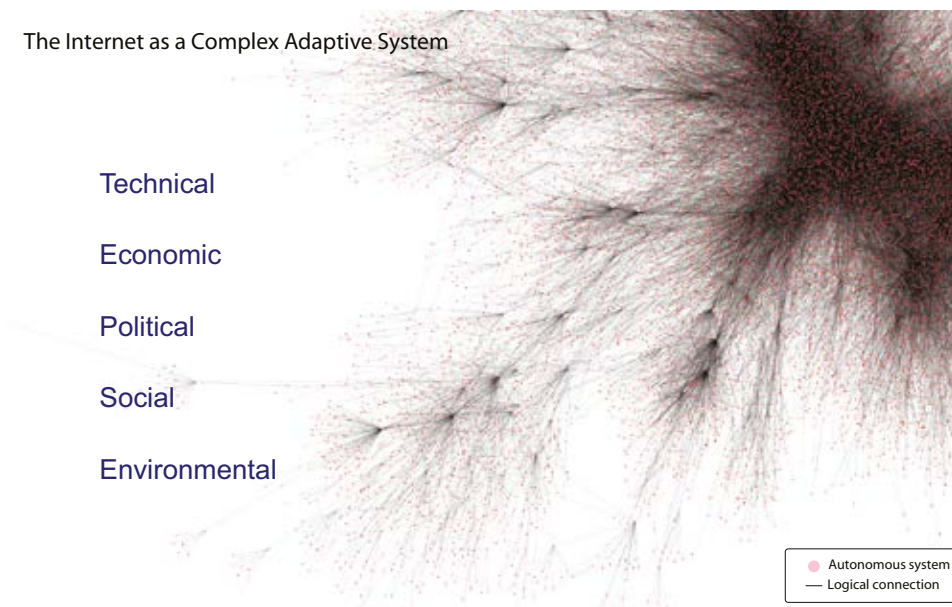


Fig. 1. Relationships of the Internet's autonomous systems based on CAIDA data.

2 Background

In this Section, we discuss the background theories that are seen as relevant when looking at the power distribution between the Internet stakeholders and conceptualizing the control points in the Internet. We provide a brief introduction to complex adaptive systems, tussles in the Internet, network effects, power law and preferential attachment as well as the hourglass model, which represents the technical structure of the Internet.

2.1 Complex Adaptive Systems

The Internet is seen as an ecosystem of inter-networked systems. Therefore, a natural starting point to understanding such a complex topic is in the work done on systems theories. Depending on the perspective taken, the Internet can be perceived in different ways. In nontechnical terms, the Internet is a global system of an interconnected network of networks that serve billions of agents worldwide. These agents may be organizations, governments, users, or machines. It is inarguable that the Internet has reached a level of complexity that calls for a different mindset when studying it: a mindset that acknowledges the interdisciplinary nature of the Internet phenomenon: technologically, socially, politically, economically, etc.; a mindset that acknowledges that adopting a single lens will only give a partial and misleading interpretation of the phenomenon. In the general sense, when a system has many actors that frequently interact and frequently change, we cannot talk of complicated systems, but reason, instead, in terms of complex systems. To highlight the difference, think of the difference between the *complication* of an internal combustion engine and the *complexity* of an ant colony [3]. The internal combustion engine is built of several components that work together in a mechanistic form without changing. Consequently, one may understand how the engine works and predict its operation by examining all the parts and their causal relationship. The operation of an ant colony, on the other hand, cannot be explained by accounting for each individual ant's behaviour. Rather, their continuous interaction, the feedback they receive from the environment and the change that occurs cannot provide a comprehensive representation of the colony's operation as a whole through causal linear patterns. The ant colony in this case represents what is widely known as Complex Adaptive System (CAS) [3].

Complex adaptive systems (CAS) are everywhere in the natural world ranging from relatively simple organisms (e.g. viruses to ant colonies) to more sophisticated creatures (e.g. mammals). CAS exist at the individual, team, divisional and group level and also in a much larger web of external complex adaptive systems – their economic, social and political environments. As Carlisle and McMillan [4] put it:

“CAS constantly seek to adapt to the environmental circumstances in which they find themselves. Thus they are able to undertake short-term exploitation activities as required and to invest in longer-term exploration as needed. Their activities are determined by the conditions in which the system finds itself, and it responds in a self-organizing reaction. A CAS does not ‘differentiate’ between the long term and the short term – it simply self-organizes appropriately.”

In this paragraph, we will present four basic assumptions from the field of complex adaptive system (CAS) that lay the foundation for the conceptual framework, based on which this chapter is organized. Within a business organization context, [5] gives an account of four basic assumptions that underlie the dynamics of complex systems, contrasting them with the usual assumptions that adopt a linear mechanistic

approach. In our opinion, these assumptions are compatible with, and applicable to, the phenomenon that we call the 'Internet'. These four assumptions are:

1) Change is constant. Complex adaptive systems are never stable, and they operate in an extremely dynamic state. According to [5], CAS researchers have adopted Prigogine's¹ notion that dynamic systems are dissipative structures (i.e. self-organizing structures) that are maintained through the dissipation of large resource flows (e.g. money, time, information). These flows happen in a non-linear manner with high velocity generating a constant pressure to change. This constant pressure for change is what explains why CAS self-organize. This can be observed in the Internet behaviour in the formation of new standards, communities, tools, technologies, adopters, etc. The Internet is in a constant state of change in ways that regular observers may or may not notice.

2) Emergent systems are not reducible to their elements. One of the prevailing traditional assumptions is that in order to understand a complex process, it is enough to analyze and understand the properties of its components. In contrast, the complexity paradigm proposes that complex dynamic systems are not fully decomposable. This gives rise to the concept of 'emergence'. Emergence is defined as a process by which patterns or global-level structures arise from interactive local-level processes, and that the combination of elements with one another brings with it something that was not there before [5]. This is particularly visible in the case of the Internet. No one can claim that he or she can provide an algorithm that explains how the Internet has reached its current state by accounting for its components, whatever these might be. The Internet follows what Garud et al. [6] metaphorically calls mixing ingredients together into a stew. What they highlight here is the fact that what comes out of cooking a stew is something more than just the mechanistic combination of its ingredients.

3) Causality is interdependent. According to complexity science, a linear causal logic of action-leads-to-reaction does not exist. In other words, in a dynamic system, each element is interdependent, and therefore it depends on the others for its identity and function [5]. Keeping this assumption in mind, it becomes clear that locating the cause in a CAS is much more complex than the traditional reductionist approach, in which directional causalities are assumed to be based on individual behaviour. Lichtenstein [5] explains that in a CAS, actions and structures are mutually constituting and arise simultaneously over time. This can be clearly seen in the dynamics of the Internet. One cannot clearly explain what action led to the other (i.e. what was the cause and what is the effect?).

1 http://en.wikipedia.org/wiki/Ilya_Prigogine

4) Behaviour is non-proportional. According to this dynamic systems thinking, output from an action is not necessarily proportional to its input. To simplify this assumption with an example, 50 Celsius is not twice as pleasant as 25 Celsius, and eight aspirins do not reduce a headache eight times as much as one aspirin pill (examples adapted from Goerner 1994, as cited in [5]). In this sense, small inputs to a system can have an immense impact. Similarly, large inputs exerted on a complex system can produce no effect whatsoever.

2.2 Tussles in Cyberspace

The Internet is the playground of many stakeholders, such as end users, ISPs, governments, content providers, etc. All these parties have different goals, and the technologies we see deployed in actual use are not the result of a top-down dictation by a single party, but the outcome of a tussle, as described by Clark et al. in [7], between multiple stakeholders in an open market regulated by laws. It is easy to design anything top-down and assume predictable consequences only from the technical perspective, but nobody needs to use the proposed solution if it is not aligned according to their incentives.

For example, Internet congestion control is implemented in a distributed way in the end nodes by their TCP implementations. It is difficult to force every party to use an algorithm that is provably stable because an individual node would benefit by breaking the common agreement and maintaining a sending rate higher than is TCP-friendly. This has led to operating system vendors to come in tweaking the congestion control algorithm used. Other examples include the failure to deploy multicast and quality of service (QoS) mechanisms for wider use in the Internet because they do not guarantee increased revenues for the ISPs. Similar cases can be ubiquitously found in the Internet.

The authors in [7] identify the “tussle for openness” as one of the most important tussles in the Internet because the Internet has traditionally been open to innovation. For example, ISPs would like to reduce the openness of the Internet to new technologies, which often increases competition. To this end, they might try to use the strategies of closed or proprietary interfaces and vertical integration.

Tussles can evolve over time and touch all aspects of a society. In the most general case, they can be analyzed in the conceptual framework provided by game theory, but the economical aspect is probably the most prominent one as providers compete with each other, and consumers have a tussle with providers to bargain as low a price as possible.

The study [7] also lays down guidelines for the design of new Internet technologies. Instead of aiming for a specific outcome, it is realistic to try to accommodate flexibility and user choices in the architecture. This allows innovation to happen while the existing tussle in the society finds a solution, balancing the preferences of

all stakeholders involved. The technology itself can only set constraints by forming a tussle space and the design should be modularized along the tussle boundaries. It can be said that there is no value-neutral design [7].

2.3 Network Effect

The network effect is when the total value of a network grows superlinearly as the function of the number of agents participating in the network. If there are two or more competing networks that are governed by network effect-like underlying economics, it follows that there is a positive feedback from the size of the network to the utility it can produce to its members and the number of new members it can attract. Therefore, the largest of such networks tends to get a natural monopoly for the market in question.

Telephone networks are often used as an example of the network effect. In figure 2, we show how the number of potential interactions between the users of a telephone network grows quadratically as the function of the number of its users. This increases the value of the network for each user because they now can reach more people. Clearly, the utility for each user is not linear to the number of other users in the typical case, as there is a limit on how many people a single user can know. Anyway, the effect can be considerable, taking into account that the total cost of building such a network typically grows only $O(n \cdot \log n)$, where n is the number of users.

A more recent example is Facebook, where the value of sharing information grows as one gathers more potential viewers for the information. Google+ tries to compete with Facebook and is backed by the huge resources of Google, but users are reluctant to migrate because they do not have a large network of friends following their posts there.

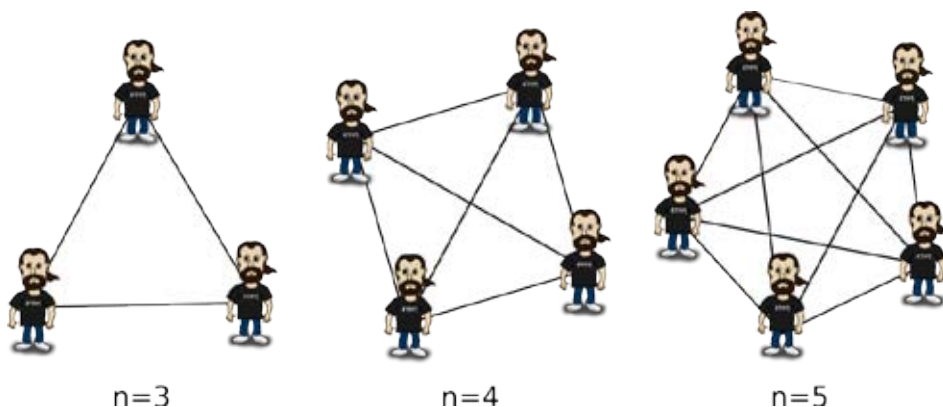


Fig. 2. The number of possible interactions grows quadratically as the function of the size of the network.

2.4 Power Law and Preferential Attachment

Many empirical distributions associated with networked systems follow the so-called power law². This is an important class of distributions and could be characterized as having a similarly important role as the Gaussian distribution in the 21st century in modelling of real-world phenomena.

Many large graphs in various contexts, such as social networks or Internet topology, can be characterized as complex adaptive systems. Their evolution is the result of aggregate actions of individual agents. Despite their apparent complexity, they possess recurrent emergent patterns not obvious from their starting conditions. A power-law distribution of the number of links starting from a node is a typical phenomenon seen in graphs. Such distributions are dominated by a small number of entities that form potential control points and are asymmetric to the otherwise complex system. For example, a hub in a social network probably has much greater influence than an average person. That is, large events are surprisingly common in systems governed by a power law.

The defining quality of a power law is its scale invariance, which means that the density function of the probability distribution following a power law has the form:

$$p(x) \propto L(x)x^{-\alpha} \quad (1)$$

where $x > 0$ is a constant and $L(x)$ is a slowly varying function that satisfies

$$\lim_{x \rightarrow \infty} \frac{L(tx)}{L(x)} = 1 \quad (2)$$

for all constants $t > 0$ (Wikipedia). It follows that all power laws can be simply produced by scaling with a constant factor from the others. Also, scaling the argument preserves the form of the solution, but on a different scale. A probability distribution following a power law is a line when shown on a log-log scale. In figure 3, the graph of a probability density function and the respective cumulative distribution function (CDF) of a typical Pareto distribution, which is a form of power law, is shown.

2 At least if the lower tail of the distribution is ignored.

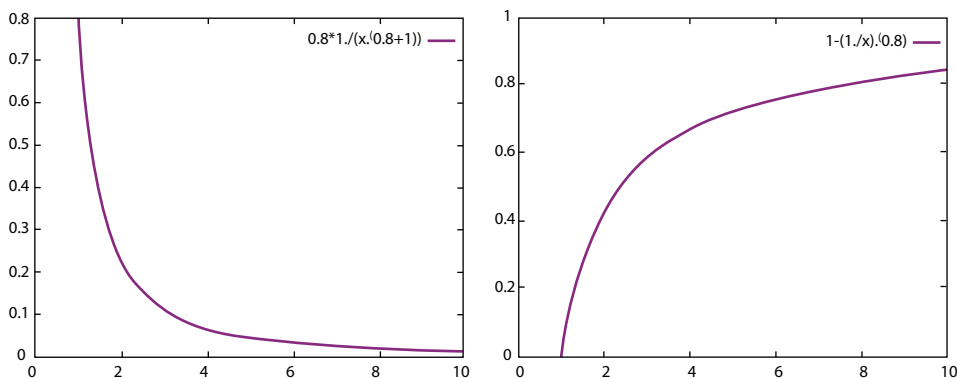


Fig. 3. The probability density function and CDF for the Pareto distribution $x > 1, \alpha = 0.8$.

When the asymptotic degree (number of edges connected to a vertex of a graph) distribution of vertices in a graph follows a power law, we call the graph a scale-free network. For example, Wikipedia is scale-free, with its HTML documents interpreted as vertices of a graph and hyperlinks pointing from one page to another as the edges [8]. Similarly, the degree distribution of early Internet autonomous system (AS) level connectivity [9] follows the power law and the same applies roughly to current AS business relationships based on our own computations from the CAIDA data [10] (see figure 1). Another dimension of the Internet that follows the power law is the popularity of content items, as reported for the YouTube videos in [11]. Many social networks are also conjectured to be scale-free.

The most prominent class of distributions following the power law is probably the discrete Zipfian distribution, which was originally found to describe the relationship between the frequencies of a natural language word to its position in the order of words sorted by descending popularity in typical texts. The frequency is inversely proportional to the word's rank in the popularity order. On the continuous side, there exists the corresponding Pareto distribution, often observed in wealth and income distributions, which states that 80% of the effects are produced by 20% of the causes.

The reason for the ubiquity of the power law is not fully understood. One proposed mechanism, which is known to produce distributions that are power law in their lower tail, is the so-called preferential attachment [8].

The preferential attachment is a process in which some unit of resource is added randomly to one container out of many, based on a probability that is proportional to the resource already in the container. As this process is repeated, the distribution of the resource inside containers approaches the power law asymptotically.

2.5 Hourglass Model

The Internet protocol stack has a hierarchical, layered structure, which has varying number of protocols in use at each level. Figure 4 depicts some of the protocols as boxes and implementations of higher-layer protocols as arrows starting from their substrates. On the network layer in the middle of the stack, there is basically only the Internet Protocol (IP) in wide use, but as we move either upwards or downwards in the stack, the number of technologies grows layer by layer forming an hourglass shape. For example, on the transport layer, both TCP and UDP offer different types of abstractions over the basic IP, and multiple protocols such as HTTP, SMTP, RTP, etc., use them on the application layer. Below IP, protocols such as PPP and Ethernet are used to carry IP packets on the link layer, and these can be transmitted, for example, in an optical fibre, twisted pair, or a coaxial cable on the physical layer.

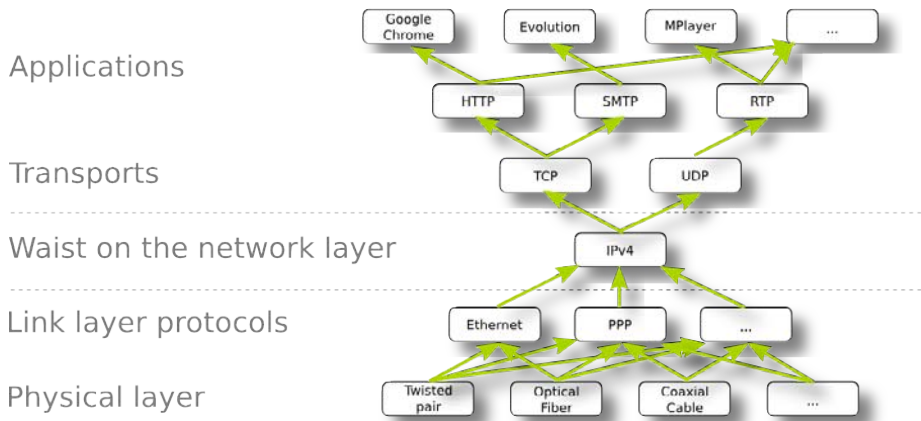


Fig. 4. IPv4 forms the waist of the current Internet protocol stack of dependent protocol implementations [12].

The influential waist of the hourglass has been ossified [13] for a long time. For example, IPv6, which is only an incremental update to the currently used IPv4, has not become widely deployed, even though it has already existed for 15 years and the current address space is almost exhausted. Instead, the problems facing the Internet have been patched with fixes such as the classless inter-domain routing and NAT boxes. On the other hand, on the application layer and below the network layer, innovation happens frequently.

From the point of view of control, it is a natural question whether somebody can control the waist of the Internet protocols or design a network architecture in such a way that the waist is not formed. The forming of the waist is also a good example of a result of a complex process that still produces highly influential components.

Understanding the mechanisms that produce a waist will probably shed light on the formation of control points in the Internet.

The question of what causes the hourglass shape to emerge was studied by Akhshabi and Dovrolis in [12]. They developed a model and simulated the evolution of dependent network protocols, taking into account the utility of protocols and modelling the birth and death of protocols in a competitive environment. The main result of their paper was that the hourglass shape is produced almost independently of the initial parameters used for the model and stable evolutionary kernels, that is, protocols located at the waist and whose lifetime spanned through the rest of the simulation, were formed. This finding remained true even after they added a quality parameter for each protocol, and often the evolutionary kernel was not the protocol of highest quality: an hourglass shape is to be expected in freely evolving architectures.

The interpretation for the results in [12] was that low layers in the stack have low death probability because of the generality of the protocols: basically any of them can be used to implement the protocols on top of them. At the higher layers, on the other hand, the functionality of different applications does not overlap much because of their lower generality, thus leading to less competition. Close to the waist, the generality is close to 50%, which produces few protocols with lots of users.

3 Control Points

The Internet may be considered as a complex adaptive system since it satisfies the four basic assumptions described in Section 2, namely constant change, irreducibility, interdependent causality, and non-proportional behaviour. The technologies and protocols we see deployed in the Internet are the result of a tussle among various Internet elements. Some of these technologies may become influential and lead to an hourglass shape of the Internet architecture. The Internet services and platforms may also become influential thanks to the preferential attachment and network effects. We argue that the distribution of influence over Internet technologies and protocols as well as Internet services and platforms follow a power law where a few technologies, protocols, services and platforms have most of the influence on the Internet.

In this section, Internet technologies and protocols as well as services and platforms are called control points. In fact, any physical, logical, virtual or even ideological element of the Internet has varying levels of influence; hence it is a control point in the context of this chapter. In the following, we propose a definition and characterization of control points and provide several examples of existing control points with varying levels of influence on the Internet.

3.1 Definition and Classification

In this section, we provide a working definition of control points as we see it in light of the previous discussion. We argue that any entity that is part of the Internet can be considered a control point since it influences, with varying degrees, the system's dynamics. We identified two effects based on which control points may be defined: endogenous effects (i.e. degree of freedom) and exogenous effects (i.e. continuity). Thus, the influence of a control point is a function of its degree of freedom and continuity. Furthermore, control points may be classified according to their influence as macro, meso, and micro control points. These concepts are illustrated in figure 5 and defined as follows:

Definition of Control Points:

- Degree of Freedom is an endogenous effect, caused by internal actions, that influences the Internet. A large degree of freedom means that a small action leads to a large influence over the Internet.
- Continuity is an exogenous effect, caused by factors external to the control point, which may contribute to its degree of freedom.

Classification of Control Points:

- Macro Control Points Conglomerate of entities that have a clear set of offerings in different domains with direct influence over the Internet (e.g. Google and Microsoft).
- Meso Control Points Single entities with a clear influence on the Internet (e.g. Facebook, Firefox).
- Micro Control Points The smallest level of analysis with considerable effect. This can be either an Internet user or an ideology (e.g. Anonymous group and Open source software).

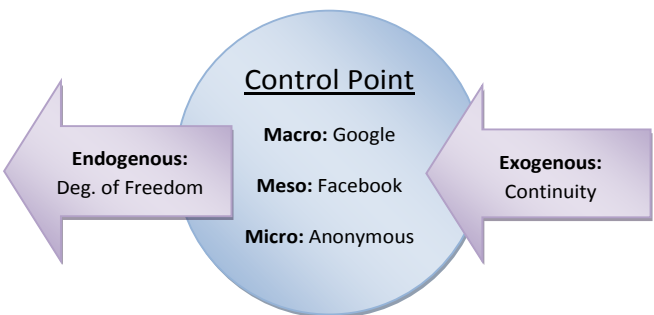


Fig. 5. Definition and Characterization of a Control Point

A comparison among control points in terms of their influence needs to be taken within the same class and requires determining their degrees of freedom and con-

tinuity. For example, comparing social media platforms in terms of their influence requires determining the changes that can be made to such Internet platforms (e.g. number and type of advertisements or graphical user interface (GUI) - friendliness), as well as the level of competitiveness (e.g. how many alternative social media networks exist) and the willingness of users to continue using a particular social media platform after a change has taken place. Prominent social media platforms, in terms of influence, are those that can make the most changes (endogenous effects) and maintain their users, or even attract new ones (exogenous effects).

The proposed model of control points may be useful in carrying out an analysis regarding the control of the Internet. It provides a general framework for studying the dynamics of entities on the Internet that have a large influence as well as understanding both their emergence and life span. For example, using the proposed model, one can explain the emergence of prominent control points as a consequence of preferential attachment and network effects.

Now that we have defined the control point, table 1 presents an example list of control points on the Internet, categories that they belong to, and the level at which these control points should be analyzed. Note that the list is not exhaustive; rather it is an attempt to illustrate the variety of perspectives and levels at which control points can be studied. Table 1 shows, for example, how Google can be seen as a control point on many levels and perspectives. Google as a conglomerate is inevitably an influential control point, but dividing the Google conglomerate into its service entities and its influence level may vary. Google currently has a high degree of freedom in its search function (Google Search), but when it comes to the social networking function (Google+), its relative influence compared to the other players is weaker (see Section 4). If the total influence of a macro-level control point is to be considered, the analysis should cover all the meso- and micro-level aspects in which the macro-level control point is active.

Table 1. An example list of Internet control points

Control point category	Example control points	Level of a control point
Internet conglomerates	Microsoft, Google, Apple	Macro
Cloud computing platforms	Amazon, HP	Macro
Legislation	US, China	Macro
Internet infrastructure	Cisco, ISPs	Macro
Social media networks	Facebook, Google+	Meso
Naming of Internet services	DNS	Meso
Operating systems	Windows, Android, iOS	Meso
Malware	Botnets	Meso
Internet search	Google, Bing, Baidu	Meso
Browsers	Chrome, Firefox, Internet explorer	Meso
Ideologies	Wikileaks, Anonymous group	Micro
Personal webpages	Politician's, Dalai Lama's online pages	Micro

3.2 Example Cases

Control points may emerge and vanish in many different layers of the Internet infrastructure. To get a more tangible idea about the characteristics of controls points and how they can change the evolution path of the Internet, we next discuss the real-life examples of Internet control points as we have defined them. The examples have been taken from different fields to get a wider understanding of the actions that can be done and the stakeholders who are capable to steer the Internet. We first cover points which, from our perspective, are currently seen as influential control points. Less influential control points are discussed at the end of this section.

Domain Name System. Domain Name System (DNS) [14] is used to name resources in the Internet by mapping domain names such as (www.wikipedia.org) into various types of information. DNS has been a central component of the Internet architecture as it is difficult to remember IP addresses and they cannot be used as long-term identifiers of companies in the Internet. If a new company wants to establish an online service, DNS is the only way of getting the service publicly available online.

DNS has a hierarchical, decentralized structure, where each domain is assigned an authoritative nameserver (NS). It can hierarchically assign other name servers to be responsible for their sub-domains. The namespace provided by the DNS follows this hierarchical tree structure and the mappings are stored in resource records, which are divided into NSs in such a way that for each domain the authoritative NS is responsible for the original records under that domain. In practice this means that when the page www.wikipedia.org is requested, first the DNS requests the address of the .org server from the root server. Then the address request of the wikipedia.org domain is sent to the .org server. Finally, DNS can request the address of the www.wikipedia.org domain from the wikipedia.org server, which is typically located in the company's own network. This means that if a company wants to change the name of its services, for example from www.wikipedia.org to en.wikipedia.org, no changes are needed in the root or .org servers. The DNS resolver that runs these queries is typically located in the ISP's network that the end user is connected to.

One might think that the role of DNS has been somewhat diminished by the success of Google search, which is currently the main way to find a website instead of remembering the URL containing the domain name of the site. However, domain names are still used in the web links and as the main method to identify services in a location-independent way in the Internet. The distributed nature of DNS makes it scalable and relatively robust against distributed denial-of-service (DDoS) attacks, which block a service by sending an enormous number of unnecessary service requests. Even though DNS is a distributed system, it has a hierarchical structure, which makes the power over it centralized and creates the continuity of the control point. DNS also fulfils the continuity condition for a control point as the human-

readable namespace of domain names basically has to have some kind of point where disputes over names are resolved. This is because some names are associated with countries and company names and good names have value as they are easier to use. The trust in names is based on the organization of the DNS system, where each level in the hierarchy manages its subdomains. This trust mechanism enables the names to be human-readable, and the trust and security mechanisms can be implemented orthogonally to the naming.

Internet Corporation for Assigned Names and Numbers (ICANN) is the non-profit corporation in the US that oversees the organization called the Internet Assigned Numbers Authority (IANA), whose responsibilities include the management of the DNS root zone. IANA co-operates with the top-level domain operators, the root name server operators, and ICANN. The US department of commerce also has an oversight function to make sure that IANA complies with its policies. An example of the degrees of freedom of DNS is ICANN's new policy of internationalized domain names (IDNs), which allow any kind of domain names, even those with non-Arabic letters [15].

Another example how stakeholders can affect the DNS is the seizure of the MegaUpload site (megaupload.com), whose domain registrar, i.e. the organization holding the .com registry, seized the company's DNS record [16]. ISPs also have the power of affecting DNS since they deliver the DNS queries to the end customers. A recent case of blocking a website by an ISP is the case in Finland where the court ordered a Finnish mobile operator to block the Pirate Bay site.

Cisco. Routers are the key components that enable the global connectivity of clients and servers in the Internet. Whenever you want to request a web page, the routers know in which part of the Internet the corresponding web server is located and are capable of forwarding the packets accordingly. The routers can be roughly divided into two categories: those that operate inside one domain (e.g. the ISP's network) and those that communicate at the edge of each domain (e.g. those that connect two ISPs). These two run different routing protocols depending on in which part of the network they are deployed. Although many standard protocols apply in the Internet, the router devices are best compatible and manageable with the routers and switches from the same vendor. Therefore, we see the router infrastructure as a control point.

Cisco has long been a major player in the router business. According to different sources, the market share of Cisco is estimated to be somewhere between 45 % and 50 %, although it has slightly been losing the market share to its competitors Juniper, Alcatel-Lucent and Huawei [17] [18]. Therefore, vast amount of Internet traffic flows through Cisco devices. This indicates that once a certain company has adopted Cisco devices it is relatively difficult to change the equipment vendor since the routers of the same vendor are best configurable together. The switching costs are high since the change of the equipment vendor would require the change of a number of devices.

Cisco as a major router vendor has a huge impact on which technologies get deployed in their devices. Imagine that there is a new technology feature available for routers. With the decision of deploying – or not deploying – the new feature in its router software, Cisco has a huge impact on how the Internet evolves. Cisco engineers are also active participants both in IETF and 3GPP standardization, which is another way of affecting the evolution of Internet technology.

In addition to the protocol development, there is another aspect how Cisco can be seen as a control point. Since large volumes of data flow through Cisco's network equipment every day, there is a possibility to get an extensive view of Internet data traffic as a whole. Therefore, Cisco is collecting data from networks, which can help them develop better network equipment compared to their competitors' solutions [19]. Cisco also compiles the data that it collects into a visual networking index that forecasts the data growth in the Internet [20].

Google. Google can be considered as one of the most prominent control points on the Internet. Google is first of all the most widely used search engine in the Internet. For example, in the USA, Google had a market share of 66.4 % for search engines in February, 2012 [21]. The significant point to note here is that by providing an extremely efficient and usable search engine, Google has altered the way the Internet is currently used. Internet users no longer have to memorize the web addresses they want to visit. They can merely type the name of the service or related keywords in the Google search field, or better yet, to the address bar of their browser, and Google will guide them to the desired web site.

But apart from being the most popular search engine, Google has developed and increased its service offering drastically during the last decade with services, currently ranging from social media to translating services, from advertising to web browsers, and from library content digitization to cloud computing services. The huge market share in search engines enables Google to advertise efficiently in association with the search results shown to users. This, in turn, makes it possible for Google to provide many of its services free of charge for the users. And further, this again increases the popularity of Google's services on the Internet.

In a nutshell, these two things put together makes Google one of the most interesting control points in the Internet: (a) the massive amount of users combined with having practically a monopoly in many fields, and (b) the possibility to manipulate the way the Internet is used. Merely manipulating the search results can be seen as a major control point; Google could (or can) alter the order of the search results displayed in favour of a company using Google's advertising services. That is, according the definition of control points, Google has an enormous degree of freedom. However, this kind of behaviour could, at least on a larger scale, be noticed by the users and negatively affect the popularity of the service in the long run, that is, affect its continuity. Another example of a Google-related control point is the massive amount

of data that Google has collected during its operation. A user can be recognized, even when cookies are turned off, by the browser's fingerprint [22] and IP addresses, and every single search, e-mail in Gmail, and many more, are known by Google. On one hand, this gives Google power over individuals, since it is possible for Google to track extremely personal information about practically everyone. On the other hand, this also provides Google with a huge competitive advantage, since they are able to provide even better services and search results due to the sheer volume of information they possess, and it is unlikely that another company could be able to gather an equal data base about consumer data.

Legislation. The Internet from its inception has generated a lot of discussion on whether it can be regulated or not. The fact that it exists “virtually” means there is a natural resistance towards regulation, but this has not prevented several nations around the world from enacting laws aimed at subjecting the Internet to “real” regulation. While the revolutionary nature of the Internet and its impact on transforming the way the world works is well appreciated, what is not very clear is how the world is affecting the universal nature of the Internet. There is an increasing amount of evidence that major changes are being undertaken in order to address some of the weaknesses and abuses of the Internet, as these have a potentially adverse effect on millions of users worldwide if left unchecked. Basically, the world is making the Internet less universal in one way or another in order to address various concerns, and legislation is playing a key role in this endeavour.

The problem with legislation in the Internet, however, is that it is often very difficult or even impossible to implement on a universal scale. Clearly, while international laws have been used successfully to deal with global problems, when it comes to the Internet, it is not sufficient in its own right. A mixed governance, whereby representatives from different countries meet to decide on the rules of certain Internet activities, as seen with ICANN, has been used in such cases where international law is difficult to implement globally. Nationally, it is possible to regulate the Internet, and this is evident in many countries around the world including the US and China as well as blocs of nations such as the EU. In the US, for example, there are laws regulating the Internet, including the contentious Net Neutrality law.

The manner in which Internet legislation is created and enforced varies from one part of the world to another. The universal surveillance capabilities of the Internet will increasingly be limited by democratic nations using privacy laws to protect individual liberties and democracy. Authoritarian regimes, on the other hand, will increasingly exploit the power of the Internet to universally monitor and control their citizens through the absence of privacy. For example, in March 2012, the Finnish Security Intelligence Service (SUPO) in its annual report said that some foreign governments were increasingly spying on their citizens living in Finland. Another example of this type of action includes the shutting down of Internet access during the early

days of the 2011 Egyptian revolution, involving the withdrawal of more than 3,500 Border Gateway Protocol (BGP) routes by Egyptian ISPs, according to Renesys, a networking firm. This aspect, whereby the actions taken by an individual nation can cause severe disruptions in the universality of the Internet, constitutes an exogenous effect. Imagine something similar happening in China. How will the firms whose networks, computers and software constitute the common global Internet react when Egypt or any other country attempts to pull out of the network?

Endogenous effects of legislation or degrees of freedom, as referred to in this chapter, could be attributed to how far-reaching a law is and how many people will be affected it. Legislation differs from the other control points in a way that it can significantly affect the other control points in the Internet, such as world markets, user behaviour and even how technology evolves. For example, legislation about personal details might significantly impact on the power of Google, Facebook or online shopping habits. Also, while some regions are more concerned with issues dealing with the distribution of harmful content (EU), others might be focusing their attention on matters dealing with free speech and privacy (US). This again highlights the difficulties in implementing Internet legislation on a universal scale.

Arbitron Mobile. During the past five years the usage of smartphones has increased radically. A mobile phone is used not only for voice and text messaging services, they support many daily routines of people. Therefore, smartphones reveal a lot of information about the user behaviour if collected by a third party. This has not been neglected by the Internet stakeholders, but many companies and universities look for solutions on how to get access to this data. A doctoral dissertation [23] discusses the analytics of handset-based measurements of mobile service usage. On a concrete level, the handset-based measurements require the installation of a specific application that communicates with data collection servers.

Arbitron mobile is a relatively new start-up which carries out on-device metering on selected markets [24] with the users who allow the installation of a specific application and get compensated for participating in the mobile usage panels. References do not reveal how many users have installed the metering software, but Arbitron is currently active in nine countries across Europe and North America. Therefore, Arbitron mobile seems to be still a small player when it comes to collecting data from the users compared to Facebook, for example, which is active in over 200 countries [25].

Just like Facebook, Arbitron mobile is an example of a company that collects masses of data from users and satisfies the definition of a control point. Since Arbitron mobile has not yet reached significant user volumes, we categorize it as a less influential control point. Potentially, if the user base grows, Arbitron mobile or similar players in the market may become a significantly influential control point in the Internet.

MySpace. MySpace was a very popular social networking platform and may be classified as a meso control point. It was founded in 2003 and experienced a steady growth during the years that followed. By the end of 2008, it achieved nearly 80 million unique visitors per month. However, in mid-2009, it was surpassed by Facebook, and since then MySpace has experienced a steady decline, including a shift from social networking toward social entertainment. Currently, MySpace is estimated to have about 20 million monthly unique visitors.

MySpace is a good example of the dynamics that control points may experience. Right after its creation it experienced a very rapid growth, in terms of unique visitors per month, until 2005. From 2005 to 2008, it was subject to various changes in its mode of operation (endogenous effects), including large amounts of advertisements and phishing. Despite those significant changes, it continued a steady growth until 2008 (exogenous effects), demonstrating that MySpace was effectively a greatly influential control point. However, by that time Facebook was experiencing the network effect, the same effect that MySpace experienced a couple years earlier. Shortly after, not only did Facebook overstep MySpace in terms of unique visitors, but also MySpace regular visitors steadily decreased from then on. MySpace shifted from a position at the maximum of the Power Law to its tails, and consequently its influence on the Internet decreased significantly, due to unpredicted endogenous effects.

Anonymous group. According to the definition we adopt in this chapter, anyone and anything could be considered a control point. As we suggested earlier, a control point at the micro level may be materialized in the form of an ideology (e.g. an Internet meme). An Internet meme [26] is “an idea that is propagated through the World Wide Web. The idea may take the form of a hyperlink, video, picture, website, hashtag, or just a word. The meme may spread from person to person via social networks, blogs, direct email, news sources, or other web-based services”. One of the best examples to illustrate this is the “Anonymous” group [27], which is generally considered to be “a blanket term for members of certain Internet subcultures, a way to refer to the actions of people in an environment where their actual identities are not known” [27].

From a control point perspective, Anonymous may be considered a heavily influential micro-level control point, since it satisfies the two major characteristics of the control point that we discussed earlier: degrees of freedom and continuity. Endogenously, Anonymous has a large user base, such that any action that is caused by Anonymous would eventually have a major influence on its members, as well as other Internet users. For instance, on April 8, 2012, it was reported that Anonymous crashed the British Home Office and Prime Minister’s website in protest against government extradition and surveillance policies [28]. While exogenously, Anonymous celebrates a wide range of adoption and acceptance, most notably because the group’s actions usually take a value position (equality, justice, neutrality, etc.). Another ex-

tremely important determinant of the Anonymous wide range of adoption is that it has no leader and relies on the collective power of its individual participants acting for net effect benefits for the group.

4 *Analysis and Discussion*

The manner in which networks and information systems interact today are very complicated and clearly exhibits traits of a complex adaptive system (CAS), as discussed in Section 2 of this chapter. This CAS, comprising individuals and computers linked into what eventually became the Internet as we know it today, continues to fundamentally and irreversibly change the world in which we all live. New communication patterns and modes of interaction are springing up as never before, and the stakeholders range from governments, corporations, the elites, individuals and even terrorists, each vying for some sort of control of one entity or the other.

In Section 3, we proposed that in order for a control point to be influential, it needs to have a certain degree of freedom and continuity in the Internet ecosystem and, therefore, the influence level should be elaborated as a function of both variables. How these variables are defined is a matter of scoping, and they can vary from case to case. The degree of freedom, for example, can mean the number of users globally or in a local area, ubiquity of the service or number of installed devices. To measure the influence level explicitly is very challenging, but various indicators from the market can be used to roughly estimate the relative influence level of a control point compared to the other control points in the same category.

Figure 6 shows a ranking between different globally active social networking sites based on Google data in December 2011 [29] [30]. It shows clearly how the popularity of the social networking sites follows the power law distribution. This indicates that whenever Facebook makes a change in its service, such as the launch of the timeline profile, it affects a much larger number of Internet users than MySpace making a similar change. The power law distribution of the social networking sites (figure 6) and also the time series data of Facebook users [31] indicate that Facebook currently has high continuity, i.e. some sort of inertia exists that keep people coming back to the site and masses are not rejecting the platform. Although alternative platforms exist, it is not easy for the users to change their platform, since they would not reach the same friends from the alternative platforms, which means that the network effect is weaker in other platforms. If Google+, for example, would get the same users registered as Facebook has, the degree of freedom would remain the same but the continuity of Facebook would be diminished.

Although the number of users, installed devices and so on can be seen as a potential way of analyzing the influence level of control points, they should be interpreted with caution. If we would only take into account the number of users in social net-

working sites, the graph illustrated in figure 6 would look different. China's biggest social media platform is QZone, which is claimed to have around 500 million active users and had 40 million daily unique visits in December 2011 [29]. This means that QZone is approximately the size of Google+, but the difference is that QZone is only active in China. Therefore, changes in the QZone platform would solely affect one local area instead of the global ecosystem of the Internet.

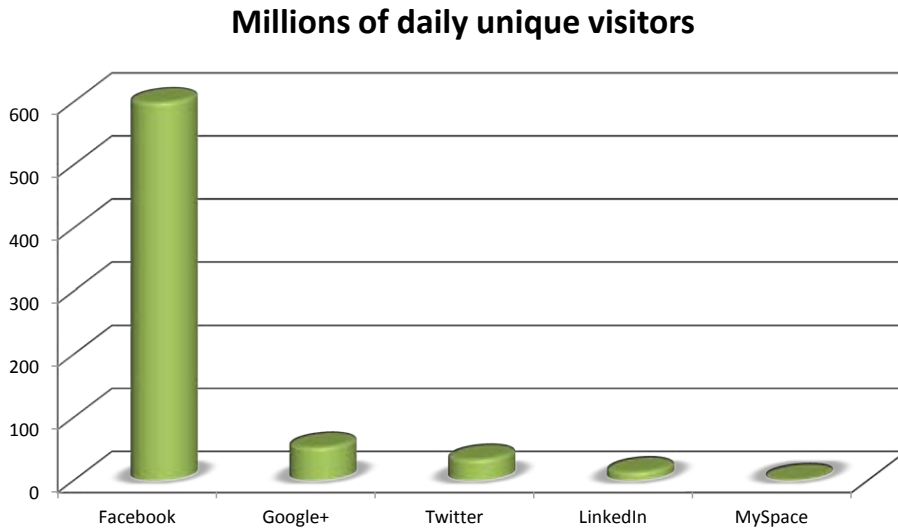


Fig. 6. Popularity of globally active social networking sites

The line between the highly influential and just slightly influential control points is vague, and the influence level of control points changes all the time. Therefore, the classification of control points should not be seen as an on/off type of thing but rather as a spectrum. Based on our example in figure 6, we can clearly argue that in terms of social media platforms, Facebook is more influential than MySpace. The control points in the middle are much more difficult to elaborate and their mutual ranking may vary depending on which factors are taken into account in a comparison.

4.1 Lifecycle of a Control Point

Based on our diverse examples in Section 3, we cannot find a simple model of how control points are born, survive, and finally disappear. However, there are recurring patterns that can be said to contribute to the lifecycle of control points in general that we will discuss in terms of birth, survival and vanishing.

Birth of a control point in a competitive marketplace has to be based on some type of positive feedback, such as the preferential attachment, that finally produces market shares following the power law. Sometimes this can be caused simply as a by-product

of how the services are advertised in the social network of users. Scale advantages and network effect are more concrete mechanisms that can produce the needed feedback.

In general, it can be said that the history of the environment of the developed control point affects considerably which entity will become the control point instead of simply the properties of the control point itself. For example, the first service to appear in the market can get the benefit of the network effect independent of its quality. Similarly, the hourglass shape of the protocol stack is produced relatively independently of the properties of the individual protocols. Typically, a new control point can only be born when it can somehow differentiate itself from the existing services and does not directly compete with them. In order to become successful, a new innovation needs to immediately answer some need in the environment as a part of a synergetic closed loop of existing components [32].

Another type of control point, such as DNS, is based on the technical architecture of the Internet or a natural monopoly stemming from the interdependencies of the potential control point.

Survival of a control point is typically supported by phenomena such as the network effect, especially when the control point allows communication between multiple users. Analogously, technological dependencies such as a large base of legacy code can allow operating system vendors to provide more value for new code that is backward compatible with the old functionality. This effect can be protected by maintaining complex standards that are difficult to use by smaller competitors, keeping the system closed-source, and even implementing proprietary solutions that intentionally break details of a standard. For example, if router implementation of the BGP protocol works well only with a few main vendors, it is difficult to deploy routers from other manufacturers, as they would need to be compatible with the particular implementations of the protocol.

Architecture and the environment can provide control points a natural monopoly, such as in the case of DNS. In addition to economies of scale, many services such as Search can be improved based on the information collected from current users. Large companies can also provide synergy to their different services, such as a single log-in to multiple sites, and in this way a monopoly in one application domain can be transferred to another.

Death of a control point is commonly based on functioning competitive markets, such as in the case of web browsers built on common standards. In such markets, the continuity condition for a control point is not satisfied, as users can easily migrate from one browser to another. The success of Facebook over MySpace could, on the other hand, be explained by the fact that they did provide a slightly different service and were thus not direct competitors even though they can be placed in the same category of services. Facebook probably better captured the actual user need that was sufficiently different from MySpace.

Some control points on the Internet may seem to have power, but utilizing that power might in fact significantly diminish the power, either instantly or over time. The effects of their own actions may not be well understood, and instead of intended consequences, an unintended effect may take place and diminish the power of a control point.

4.2 Benefits of the Control-centred Viewpoint

The conceptual framework provided by the definition of a control point and the viewpoint based on power structures is fruitful for understanding the dynamics of the Internet. Even though the definition is an abstract one and accepts various kinds of objects to be classified as control points, it is not artificial. We believe that any type of hierarchical classification of services, for example one based on different markets for Internet services, would not have produced a simple mapping of the complexities of the reality. In a sense, control points are the skeleton of the Internet, giving it much of its structure. According to the Pareto principle, 20% of the causes produce 80% of the effects. And recognizing control points allows us to study the Internet by selecting only the most influential subset of systems and thus simplify the problem. Because control points provide an interface for steering the Internet, recognizing them allows the protection of the Internet from malicious intentions. The effects of most prominent control points are not limited to the Internet. For example, Facebook could give the information about their users to a government.

As we have identified in this chapter, different motivating factors drive different stakeholders to seek control over the Internet, at least those aspects within their reach, and this can be done by tweaking certain elements that we refer to as control points. Changes in the control points, and/or in elements associated with it, will eventually lead to the emergence of an unpredictable, self-organized Internet structure. This complex adaptability of the Internet leaves us but to argue that the direction the Internet will take will be influenced by the interplay (tussle) of all the stakeholders, and that no single control point would really take over the Internet.

5 Conclusions

The Internet is widely a requirement for the modern life. Consequently, it would have significant effects if the Internet could be controlled according to the interests of a single stakeholder. In this chapter, we proposed a framework for studying the concept of power in the Internet, and we presented examples of potential points that could be used to control the Internet.

Due to the structure and the complex nature of the Internet, it can be concluded that a master control point through which the Internet could be taken over does not exist. Instead, there are an endless number of control points that vary according to

their degree of influence and continuity. A single control point might have significant locally restricted power or significant global power, but multiple potential enactments are put into operation in this case.

This chapter has discussed current examples of major control points, such as the Domain Name System, Google (with its vast range of services and data about Internet users) and Cisco routers. In our analysis, legislation is not regarded directly as a control point on the same level with the other control points, but instead it mainly controls how people and businesses operate in the Internet. As many other real-world phenomena, the degrees of influence of the Internet control points follow relatively well the power law that is characterized by a few extremely powerful players followed by a long tail of less powerful ones. The framework proposed here allows comparison of control points to some extent, but since the degree of influence is next to impossible to measure in quantitative terms, the comparisons should be limited to control points that are similar to each other.

The conclusion that none of the control points is able to govern the whole Internet is understandable considering the history of the Internet. The fact that the Internet exists and has developed into its current form as a multi-stakeholder system without actual governance could imply that it has a natural tendency to avoid structures that would provide significant power to a single stakeholder. The future will show whether or not the Internet is able to hold on to its online liberty.

References

1. Katz, I.: "Battle for the Internet", *The Guardian*, available at <http://www.guardian.co.uk/technology/2012/apr/15/web-freedom-threat-google-brin>, accessed May 27, 2012.
2. Zittrain, J.: "The Future of Internet and How to Stop It", Yale University Press (2008)
3. Viale, R., Pozzali, A.: "Complex Adaptive Systems and the Evolutionary Triple Helix", *Critical Sociology*, 36(4) (2010)
4. Carlisle, Y., McMillan, E.: "Innovation in organizations from a complex adaptive systems perspective", *Emergence: Complexity & Organization*, 8(1), pp. 2-9 (2006)
5. Lichtenstein, B.: "Emergence as a process of self-organizing: New assumptions and insights from the study of non-linear dynamic systems", *Journal of Organizational Change Management*, 13(6), pp. 526-544 (2000)
6. Garud, R., Gehman, J., Kumaraswamy, A.: "Complexity Arrangements for Sustained Innovation: Lessons from 3M Corporation", *Organization Studies*, 32(6), pp. 737-767 (2011)
7. Clark, D., Wroclawski, J., Sollins, K., and Braden, R.: "Tussle in Cyberspace: Defining Tomorrow's Internet", *IEEE/ACM Transactions on Networking*, 13, pp. 462-475 (2005)
8. Barabási, A.-L., Albert, R.: "Emergence of scaling in random networks", *Science* 286 (5439), pp. 509-512 (1999)
9. Faloutsos, M., Faloutsos, P., and Faloutsos, C.: "On power-law relationships of the Internet topology", 1999.
10. The CAIDA AS Relationships Dataset, available at <http://www.caida.org/data/active/as-relationships/>, accessed March 23rd, 2012
11. Cha, M., Kwak, H., Rodriguez, P., Ahn, Y.-Y., and Moon, S.: "I Tube, You Tube, Everybody Tubes: Analyzing the World's Largest User Generated Content Video System", *ACM SIGCOMM IMC'07* (2007)
12. Akshabi, S., Dovrolis, C.: "The Evolution of Layered Protocol Stacks Leads to an Hourglass-Shaped Architecture", *SIGCOMM'11* (2011)

13. Handley, M.: "Why the Internet only just works". *BT Technology Journal*, 24, pp. 119-129 (2006)
14. Mockapetris, P. V.: "Domain Names - Implementation and Specification", Internet Standard, RFC 1035, November (1987)
15. Kurbalija, J.: "An Introduction to Internet Governance. DiploFoundation, Malta (2010)
16. Torrent Freak - User enigmax post: "DNS 'Seizure' Takes Out MegaUpload", available at <http://torrentfreak.com/dns-seizure-takes-out-megaupload-111129/>, accessed March 15, 2012
17. Mitra, S.: "Sector Overview Networking", available at <http://seekingalpha.com/article/109717-sector-overview-networking>, accessed March 20th, 2012
18. Howard, M.: "Cisco continues to lose share in IP edge market; overall carrier router and switch market up 14%", available at <http://www.infonetics.com/pr/2011/2Q11-Service-Provider-Routers-Switches-Market-Highlights.asp>, accessed March 20th, 2012
19. Matias, G.: "Cisco plans to improve mobile Internet", online document, available at <http://www.toptechreviews.net/tech-news/cisco-plans-to-improve-mobile-internet/>, accessed March 27th, 2012
20. Cisco Systems, Inc.: "Cisco Visual Networking Index: Global Mobile Data Traffic" Forecast Update, 2010-2015, available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html, accessed January 13th, 2012
21. Flosi, S.: "comScore Releases February U.S. Search Engine Rankings", comScore press release, February 9, 2012, available at http://www.comscore.com/Press_Events/Press_Releases/2012/3/comScore_Releases_February_2012_U.S._Search_Engine_Rankings, accessed March 20, 2012
22. Lawton, G.: "Browser Fingerprints Threaten Privacy", online document, available at <http://www.computer.org/portal/web/computingnow/archive/news057>, accessed March 20, 2012.
23. Verkasalo, H.: "Handset-based Analysis of Mobile Service Usage", Doctoral dissertation. Department of Electronics, Communications and Automation. Helsinki University of Technology (2009)
24. Arbitron mobile: Web pages, available at <http://www.zokem.com/>, accessed March 28, 2012
25. Socialbrakers: "Facebook statistics", available at <http://www.socialbakers.com/facebook-statistics/>, accessed March 28 (2012)
26. Wikipedia, online document, available at http://en.wikipedia.org/wiki/Internet_meme, accessed April 30, 2012
27. Wikipedia, online document, available at [http://en.wikipedia.org/wiki/Anonymous_\(group\)](http://en.wikipedia.org/wiki/Anonymous_(group)), accessed April 30, 2012
28. Mirror News, online document, available at: <http://www.mirror.co.uk/news/technology-science/technology/hackers-group-anonymous-crashes-home-784250>; accessed April 30, 2012
29. Google Trends, web analytics, available at <http://www.google.com/trends/>, accessed April 3, 2012
30. Bordkin, J.: "Google claims 90 million Google+ users, 60% active daily", online document, available at <http://arstechnica.com/gadgets/news/2012/01/google-claims-90-million-google-users-60-active-daily.ars>, accessed April 3rd, 2012
31. Consenza, V.: "World Map of Social Networks", online document, available at <http://vincos.it/world-map-of-social-networks/>, accessed April, 12, 2012
32. Dovrolis, C.: "What would Darwin Think about Clean-Slate Architectures?", *ACM SIGCOMM Computer Communication Review*, ACM, 38, pp. 29-34 (2008)

Education Reloaded: From Socrates to Udacity

The Consequences of the Internet Changing Human Cognition and Work

Hendrik Hielkema¹, Somaya Arianfar², Petri Saarikko³,
Mohammad Hoque⁴, Yang Deng⁴, Jan Kallenbach³, and tutor Timo Kiravuo²

¹Aalto University School of Economics, Center for Knowledge and Innovation Research
PO Box 21255, FI-00076 Aalto

²Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

³Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

⁴Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

{Hendrik.Hielkema, Somaya.Arianfar, Petri.Saarikko, Jan.Kallenbach,
Yang.Deng, Mahmmd.Hoque, Timo.Kiravuo}@aalto.fi

Abstract

This chapter illustrates how the Internet changes human cognition and practices and skill demands at work. It contrasts these phenomena with the current goals and methods of education and advocates its resulting need to change. We first show that there have been many cultural and technological developments in human history that have strongly altered the way humans think and behave. We then explain how the Internet has changed cognition, much like mass media have in the past. We describe how the Internet has transformed work environments and required skill sets in the

information society. On the basis of Bloom's taxonomy of learning objectives, we then illustrate the incongruity between current educational goals and methods and the new and ever-changing demands at work. This illustration shows that the pressure on education to adapt to these developments has been increasing. Our proposal to alleviate this pressure is to adjust the priorities in learning objectives. We introduce three key aspects of future education: (a) Students will increasingly learn in a global classroom collaborating with other students from other countries; (b) students need to increasingly apply, evaluate and create new information and knowledge instead of just remembering it; and (c) students need to visualise and present complex data to make underlying interrelations understandable to others.

Keywords: Education, Internet, change, cognition, work, future skills

1 *Introduction*

Throughout human history, people have gone through different phases of evolution, both as individuals and as societies. The present stage of development is characterised by the utilisation of knowledge, skills and values that have been passed on to us from previous generations. Similarly, the future of human development depends on our current experiences, skills, values and what we pass on to the next generation.

Traditionally, education has served as a one-way bridge transporting knowledge, experiences, and values from the older generation to the new one. Educational systems themselves, however, are designed based on the knowledge, experience, and values of the older generation. For example, one of the main goals of education has been to strengthen the relation between memory and intelligence, i.e. by helping people to store information in long-term memory and using that information for problem solving later on. This model reflects how human cognition has worked for centuries as popularised as the Socratic Method, and how different goals of the educational system have been defined for different societies.

The Internet as a global tool for information access, processing, or communication has fundamentally changed the way we work, play, and interact. Google is one of the main inroads to this digital information highway. Google has brought us the collective knowledge of mankind to our fingertips. Whenever we want to know something we “google” it and we know it in milliseconds.

However, while the Internet has enabled these developments, their existence and utilisation also have far-reaching effects on the ways we think, process existing information and filter new information. The effects are so strong that our brains and the cognitive processes therein change as well. Not all of these consequences can be predicted accurately, and some of them may not even be beneficial for humans. Nevertheless, the changes in our brains influence on how we will pass on information to

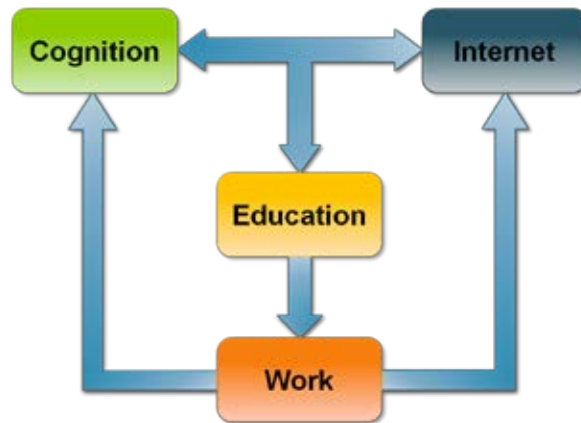


Fig. 1. The Influence of the Internet on Cognition and Work and the Mediating Role of Education

others and, consequently, on how we design and structure education and practice it in schools and universities. Therefore, how we will pass on our different experiences to the next generations depends, at least partly, on the information technology tools we use and benefit from today. So talking about the future of the Internet as the main topic of this book is almost impossible without considering the effects that it has on human cognition, work, and ultimately education.

The main questions that interest us in this chapter are questions regarding the effectiveness of the goals and methods that define and guide education today. Given the change and use of the Internet as a technology on an everyday basis, not all of the current and past values and structures in the educational systems hold anymore. New values, goals and processes should be defined that not only use the Internet as a technology but also leverage the effects it has on individuals and societies.

Figure 1 shows the elements and interactions that we discuss in this chapter. Section 2 highlights some historical examples of tools and technologies that affected the evolution of individuals and societies before the Internet. In Section 3, we first distinguish the concepts of data, information, and knowledge, and we also describe important processes of human cognition such as attention or memory. In Section 4, we describe how the Internet, as a tool for information processing, storage, and communication, impacts human cognition. In Section 5, our focus is on past and current work practices and the skills required to carry out modern work and we outline how the Internet is changing these practises and required skill sets as well. In section 6, we turn our focus on education and introduce Bloom's taxonomy, a model how to structure learning objectives in classrooms across disciplines and topics. We then explain how the changes in cognition and required skills at work create the need for education to change as well. We propose how learning objectives may be re-prioritised in order to leverage the current changes. We conclude this chapter by discussing three

key aspects of future education to give students the required skills for the future job market and to prepare them for continuous change in life.

2 Background

During human evolution, there have been numerous inventions that have changed our lives. Some of these inventions have had a profound effect on society and in many ways made our present life possible. While we will expand on the effects that the Internet has on us later in the chapter, we will first list some historical examples of inventions that have strongly shaped what we do and who we are.

2.1 Money

Money was one of the first inventions that truly changed society. Besides its function of making value discrete, its core purpose is to exchange and trade goods and services of equal value but different consumption patterns, for instance, trading a house in exchange for five years of labour. Having money allows people to specialise in activities that yield the most value. From a societal perspective, it can increase the total output much more strongly. This has also made a society possible in which some people control wealth far beyond their personal ability to create it, and they can utilise that to control other people.

2.2 Maps

Maps and more recently the use of GPS location systems have created the need for orientation, and with that the ability to orient has become obsolete. Reading a map and finding one's own location based upon environmental markers and features in the surroundings have always been difficult for many people. The introduction of GPS, however, has made that skill obsolete and very rare.

2.3 Calculator

Another invention that has solved problems for people is the calculator. Since the pocket calculator became a standard tool in education and work, the ability of students to make calculations or even estimations has been seriously degraded. In primary school, children still learn to do calculations by hand, but little of that is left by the time they leave high school, according to research done in various countries in Western Europe.

2.4 Reading and Writing

Reading and writing represent the means to remember without remembering and to understand someone else's memories. With the introduction of the printing press and movable type, it became possible to distribute knowledge to a larger audience. Up until the introduction of the printing press, people used to transfer knowledge orally, through stories, legends, riddles and songs.

The printing press also broadened the choice that people had, they were able to select what they wanted to read and not be limited to what others decided to tell. Information was more widely available and less filtered down. People could communicate the kind of information that was not easy to be transferred orally, for example scientific texts. Our memory and what we need to remember has changed because of this and has created a dependence on the written word. Our society could no longer function without reading and writing. Before print media, the choice of information input available to the human brain was more limited. Printed books have increased the amount of input to the human brain, offering more choice of what to remember.

2.5 Clocks and Measurement of Time

Time-keeping and the use of watches that provide accurate time have made a serious impact on our society. We now wake up at a specific time or carry out activities for a specific amount of time. In societies where clocks, watches or other timekeeping devices are not common, people agree to meet at a particular moment of the day (for instance, in the morning), shops stay open as long as the sun is up, and the whole daily rhythm of people is set to the sun. This has had as a significant impact on how we deal with our perception of time.

3 Cognition

3.1 Background

Cognition refers to mental processes such as attention, memory, producing and understanding language, solving problems, and making decisions. The ability to perceive and reason through a problem and its related information, the capability to learn, as well as the ability to find patterns and relationships based on prior knowledge and experiments can all be attributed to cognition.

The term cognition comes from the Latin verb *congnosco* (con 'with' + *gnōscō* 'know'), itself a loanword from the ancient Greek verb *gnōsko* “γνώσκω”, meaning 'learning' (noun: *gnōsis* “γνώσις” = knowledge), so broadly, 'to conceptualise' or 'to recognise' [1].

From a developmental perspective, the changing nature of cognition can be explained with the cognitive development theory developed by Jean Piaget [2]. It describes the developmental process by which an infant becomes an intelligent person and covers phases such as acquiring knowledge with growth and improving the infant's ability to think, learn, reason, and abstract. Goal-orientation is also part of cognitive development, which affects the whole concept of learning, problem-solving and intelligence.

3.2 The DIKW Hierarchy



Fig. 2. The DIKW hierarchy.

In information science and knowledge management, the terms *data*, *information*, *knowledge* and *wisdom* stand in a relationship with each other that form the DIKW hierarchy labelled after the first letters in these four terms. This hierarchy, shown in figure 2, illustrates the *value* that is *added* from one level to another.

A datum is a fact, a statistic, a recordable piece of text, number, value or other singular item that in itself has no particular meaning. Data can be stored and retrieved in information systems such as the Internet.

Once data is structured according to some schema, it becomes contextualised and thus is transformed into information as meaning, and its relevance may be derived for an individual, community or task. Information can be stored both in human minds and information systems such as the Internet. Then, when a person is not only able to derive meaning but also *utilise* that information in some way, e.g. to gain a deeper understanding or as an input for creative or thinking processes, it becomes knowledge. In other words, knowledge is different from information in that it represents *actionable* and *applicable* information for particular situations. While often used implicitly in the discussion of relating data, information and knowledge with each other, wisdom is a rather elusive concept according to Rowley [3]. Examples of definitions of wisdom would be “the use of information and knowledge and the ‘right judgment’ or the “attitude towards belief, values, knowledge, information, abilities and skills” [3, p. 176].

3.3 Cognitive Processes

Attention. In order to process information the brain needs to first prioritize and select information that it deems relevant from the myriad of irrelevant data

coming from the senses. This selection process is called attention. The time that the human brain spends paying attention to a specific task or a specific set of related data to that task is called the attention span. Learning has a direct relation with the attention span [4]; can only learn about a thing or task if one attends to that matter. An adult's attention span is usually short, and it is shortening more due to the Internet. The attention span can go down from a maximum of 20 minutes to a few seconds.

Continuous exposure of the brain with an almost non-stop flow of new data can dramatically reduce the attention span. For example, early exposure to TV can subsequently cause attention problems in children [5]. The Internet is likely to have a similar effect on an adult's attention span, as our brain is exposed to the flow of new data that changes within a few seconds with each click. Consequently, if one cannot pay enough attention, one cannot learn the patterns and structures represented in the stimuli well enough. Therefore, it does not matter how much similar data one has seen before if one is not able to learn anything from it.

Perception. Before information can be processed, it needs to reach the human brain. Perception (i.e. the process of transduction) transforms, filters and amplifies raw data coming from sensors in the human body (such as the eye, ear or skin) into mental representations. It is these mental representations that cognition operates on and that are commonly referred to as information, once they have been contextualised by cognition.

Perception itself is usually a *data-driven bottom-up* process, That is, external stimuli are processed until an interpretation emerges. However, perception is also heavily influenced by learned experiences throughout life that are abstracted over time and distilled into *schemas*. Schemas represent the sought-after patterns that guide perception in a *top-down* manner in reaching an interpretation of the sensory data. Expectations about structures or events in the world, such as shapes, functions, or outcomes of the latter, are examples of schemas.

Memory. Memory represents the repository for knowledge and experiences that a human accumulates over time. Memory is often divided into short-term and long-term memory. Short-term memory represents the working memory of the human brain in which currently important information resides in order to be processed against new information. While earlier research identified 7 ± 2 [6] as a typical number of items that can be stored in short-term memory, more modern and recent research corrected this number to 4-5 [7]. An item can be anything, such as a number, a word, or a concept in general that can be thought of as a whole. A significant increase in short-term memory can be obtained by chunking a given thing to memorise. For example, a telephone number can be chunked into the area code, then a chunk of three digits, and then a remaining chunk of four digits. Chunking hierarchizes information and allows more information to be stored in short-term memory at once.

Long-term memory acts as the long-term storage facility for associations between items and their context. Usually, the more someone knows about a specific object or event, the more presented entry points (cues) regarding that issue or topic can trigger the previously stored items and associations in long-term memory. That is, the more cues are present, the easier it is for the processing part of the brain to relate the new information with the prior knowledge. It is these processes that allow a person to find patterns in the external world and come up with solutions regarding a problem the new data may represent.

4 Internet and Cognition

4.1 Background

More than any of the aforementioned historical inventions, mass media have shaped our society in the way in which and what we think. Newspapers, radio and television have greatly influenced us, and the effect is still growing. Mass media have changed the way we get information, absorb it, and learn it. They enable but also limit our access to knowledge in many visible and invisible ways.

In the early days of print media, during the Gutenberg era, books limited the presentation of information to text and graphic arts. Nevertheless, printed books came as a revolution, given that humanity had for the first time combined two technologies – the printing press and paper – that allowed copying, reproducing, and distributing the same information at unprecedented speed. This new and unique combination of technologies creating a new medium revolutionised not only the work of individuals, it ultimately led to social revolutions, such as the birth of the protestant movement, the reorientation to and manifestation of more scientific and artistic freedom during the renaissance or, during the 19th century, industrialization.

The aforementioned developments could unfold partly because using a medium has an affect on the cognition of its users that remain usually unnoticed. The media scholar Marshal McLuhan was one of the first who observed and understood in-depth that people who use a medium attend to and care more about the contents that is conveyed rather than the technology representing and enabling it. People “get caught up in the information it carries.” In other words, the technology of a medium moves into the back of human minds throughout its use, is assumed to work flawlessly, and its existence is only noticed again once it denies service.

However, it is the very technology of a medium that fundamentally controls how content is delivered to its users. Media technology defines what content modalities (i.e. text, images, audio, or video) can be transported. And every modality requires different cognitive processes to process the information and to understand the content. Hence, while every medium is inseparably intertwined with its technology that

guarantees information and message distribution, that very technology alters “patterns of perceptions steadily and without resistance.”

4.2 The Internet and Cognitive Change

The Internet as a new but more universal and global medium has also altered patterns of perceptions and cognition. These changes, however, happen on an even larger scale than print media, the telephone, radio, and television have done it before. However, the cognitive change the Internet has brought about is, in many ways, more fundamental and consequential than any of the changes the classical media have caused before. This is because the Internet provides mainly two features that classical media do not offer in this particular style, features that are directly responsible for the alteration of the patterns of perceptions on information and knowledge. These properties have ultimately changed our behaviour in how we handle and deal with information and knowledge.

The Internet as an external memory and the Google effect. The first feature or property of the Internet that has changed human cognition is its role of being an external memory for people. Search engines, in particular Google as the most utilised one, influence our thinking as they provide an abundance of data for us. Sparrow et al. [8] appropriately termed this phenomenon the *Google effect*. In their seminal article, they describe how test subjects instinctively consider using search engines when confronted with difficult trivia questions and how test subjects erase memories based on the assumption that they will be able to retrieve it from the computer they are using.

Similar to the effect books had on our need to remember, search engines such as Google remove the requirement to remember as long as one is able to retrieve the data from the source. However, with many books, one would at least need to index the data in the books. For this purpose, one would first need to study some parts of the book, before he or is able index and filter the book contents in his or her memory. With search engines, all data is accessible through one unified Web interface. One only needs to know one index or interface to the data.

If search engines begin to replace people’s memories, they may also affect the human ability to associate information with each other. This change in cognition might not come from personal will or the ambition to develop in this direction, but from needs: once people start using these technologies, they will be dependent on them.

Considering the improved efficiency of having an extensive, easy to access memory that is not mainly filled by raw data but powered by different methods of reasoning and remembering concepts and structures, such as novel data-mining algorithms or machine-learning methods, the Internet seems to be the ultimate external memory that helps humans to solve problems more efficiently. The Internet remembers all

data and information for us. Ultimately, the only thing we need to do is to remember how to retrieve, filter and use this data for our problem-solving purposes. To this end, the Internet seems to be the ultimate good, but that is not all.

Interactivity. The other important feature of the Internet that is responsible for the change in cognition is called interactivity. Interactivity represents the possibilities that are available to a user to carry out actions with respect to content and/or its providers [9]. These action possibilities are present in almost all application areas of the Internet. For example, the World Wide Web is characterised by its use of hypertext. Hypertext offers not only the presentation of text and other modalities within the same document. It also provides one manifestation of interactivity that enables navigation across documents: hyperlinks. Hyperlinks allow users to navigate and visit large bodies of knowledge non-linearly and without delay. In other words, hyperlinks provide direct and immediate access to information with a click of a mouse button. A good example in this context is the online encyclopaedia Wikipedia. Unlike in print media or television, with hyperlinks users are not required to read or watch contents serially. Instead they have full control over the course of content consumption themselves. In a different context, Internet chats offer a similar kind of interactivity with respect to communication. Short text messages or even video chat allows people to interact over distances in nearly the same manner as face-to-face. Again, the immediate achievement of the goal, here the conveyance of information between two or more people, is given.

Interactivity changes cognitive processes as well. Here, it is the frequency and speed of fulfilling personal information and communication needs that cause the changes. The ease in which the Internet enables accessing currently required information or communicating with a friend at any point in time results in frequent and rapid experiences of success. Thus, every click a person performs to access needed information gives instant gratification and therefore stimulates the reward centre of the brain. Although disputed, findings about some online services exhibiting unique psychological properties that can cause distortion of time, escapism, and immersion, give rise to the debate on whether the Internet can become addictive or not.

Information Overload. For any Internet user, it is very easy to access large amounts of data and information. On the one hand, search engines, such as Google, provide more information than can possibly be absorbed by any person. On the other hand, how well a person is able to process all that data and information depends on several different cognitive processes. In this case, the person needs to be able to judge the data on its truthfulness and its relevance. To perform this, many different cognitive filters may be employed, some objective (such as the perceived trustworthiness of the source of the data) and some of them subjective (such as intuition).

The human brain can experience information overload fairly easily [10], especially

if it has to memorise raw data about everything. For example, a person required to remember the location of all the light switches in every single visited room from his or her childhood until now would rather probably cause information overload. Therefore, it is not only difficult to remember data but it also reduces a person's efficiency when faced with the problem of turning the light on in a room that he or she has never visited before.

5 *Internet and Work*

5.1 Background

A traditional working environment in an organization involves coming to the office on working days, physical presence in meetings and other individual or collaborative settings. Usually paper and printed media are used in order to share and store information.

The Internet has changed this by providing some effective ways of communication, such as email, video conferencing, social networking, blogging, job-related websites, etc. People can share their views or ideas via email or a company's internal social media. They can perform work remotely from home or abroad using laptops or desktop computers and communicate with co-workers and customers in real-time via videoconferences. All these activities had never been so easy and comfortable before. In summary, the Internet has changed the way people work, but it simultaneously also transforms existing and requires new skill sets.

In this section, we discuss the effects of the Internet on current ways of working and the skills people may need in the future to adapt to the accelerating changes in professional environments. Measuring individual abilities and social skills has been an important aspect in the recruitment processes, and there exist multiple ways to inquire and frame favourable team-working qualities from the employer's point-of-view [11]. Here, we employ Fleishman's taxonomy of human abilities that identifies 52 basic human abilities [12]. All these abilities are based upon combinations of multimodal skills to adapt and to carry out cognitive, perceptual, and motor tasks.

5.2 Effects of the Internet on Work

Web 2.0. The so-called Web 2.0 [13] introduced social information management tools that allow skimming, scrolling, searching, choosing, tagging, hashing and mashing up data. Most of the emerged activities are carried out to link and contextualise existing information, not always creating new information. While a horizontal association of existing information and vertical creation of unique information are at the core of individualised knowledge production [14], they also represent critical factors for the survival of the individual worker ethic in the Web [15].

Information management techniques. Widespread online information management techniques have evolved in the hands of common users [16]. So-called computer-supported cooperative work (CSCW [17]) identifies multiple dimensions essential for the development of cooperative work. The common character for the bottom-up utilization of Web 2.0 techniques [13] is their collaborative nature, i.e. people appropriate (for instance) an existing micro-blogging service such as Twitter hashtags to adapt it to their own communication needs. Usage patterns evolve the system-specific usability and extend the notion of information sharing activities, i.e., work. A central concern of information-intensive work is synchronicity, which allows users to articulate their focused awareness regarding the tasks in their hands and minds [17].

Technology-augmented work. E-business expert Peter Fingar approaches the development of information-intensive work practices through increased efficiency and a competitive edge by the category of workware, which intends to animate human work and collaboration similar to the way software animates the hardware [18]. Fingar's idea relies on the idea of extreme competition where the value creation is tied to the capital profit generation through improved utilisation of ICT. The complementary ideas of Human Interaction Management System (HIM) and business process management (BPM) reckon technology-augmented forms of digital work where virtual workspaces extend the cognitive abilities of an individual worker, thus benefiting the collective. While manual, industrial and information-intensive work remains as part of general social work palette – all the previous mode of work have the potential to become upgraded or augmented through synchronous process-driven technologies [19]. In practice, work becomes a synchronous and collaborative process that combines existing ICT metaphors ranging from virtual desktops to mobile-push notifications and other ubiquitous techniques by establishing dynamic working spaces to reconfigure both the processes and the tasks-at-hand [18].

5.3 Changing Skill Sets and New Required Qualities

Drivers of skill set change. Pink [20] identifies three background drivers for the evolution of human information processing: outsourcing, automation and the concept of abundance, also known as the post-scarcity economy. Both automation and massive outsourcing of work to countries that can more cheaply produce the same outcomes result in abundance [21]. However, when something becomes abundant, it also becomes cheap. A world awash in information is one in which information has very little market value. Abundant information then challenges the core of western digital literacy and thus the way people learn, think, create and work [22]. Thus, new skills are needed to synthesise, rationalise and emotionalise information intensive work in order to sustain the production and supply of the basic physical needs [23].

The Conceptual Age. Pink [20] claims that the milestone of the information age is the Conceptual Age. Its premise is the increased importance of creative humane artistic processes where value creation is based upon mutual trust and emotional engagement [24]. That is, logical thinking coupled with computer-based information processing and reasoning needs to level with creativity and other tacit human aspects to continue as the prime driver (and metaphor) for the perpetual progress of the human race. In other words, logical and linear (left-brained) thinking becomes fused with holistic and artistic (right-brained) thinking.

For example, IT-based tasks can be reproduced, commoditised and optimised infinitely. On the contrary, human qualities such as intuition, creativity and empathy cannot be quantified to an extent that they could be fairly replicated, automated and outsourced. The role of so-called six senses: design, story, symphony, empathy, play, and meaning are expected to grow among highly skilled expert workers and leaders [20]. In other words, in the post-production of added value physical beauty, experience and emotion, complement and support engineering, economic and humanistic traditions. In combination with people's socio-historical abilities to adapt, comply and tolerate using reason, these new skills set the pace and hallmark for the production of new values [25].

The main questions then are how intricate and inborn are these qualities and how can they actually be learned and harvested? On the one hand, cultures flourish that incorporate high levels of craftsmanship and technological skills with their appreciation for detailed design and beauty. The ability to nourish aspects of timeless yet contextual and sustained cultural practices freed from non-materialistic and appropriative agendas can produce unique beauty and intricate value [22]. On the other hand, cultures with a superficial non-systemic relationship to creativity (i.e. design and technology) may require more time to establish sustainable working cultures to survive [26].

Smart information filters. The future skill set of an individual worker could be augmented through the metaphor of smart information filters, which would provide both subjective and objective ways to deal with a multitude of situations. Contextual information regarding the situation, past preferences and necessary skills to deal with it would contribute an adaptive system. Today people already deal with a variety of interactions between each other as well as with devices. All these activities are increasingly managed as streams of tasks that require contextual support, such as additional information, human assistance or machine automation. The fact that context is a fluid and reconfigurable network of choices and preferences is a systemic phenomenon that could one day become a tactile agent-like process that would help people to challenge their preconceptions of work, skills and especially their customs. A system that would not free them from the idea of work but assist them in making meaning.

6 Education

6.1 Background

Merriam Webster [27] defines education as “the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life”. More narrowly, it can be defined as the process of receiving and giving systematic instruction at a school or university. In its most broad sense, education represents the activities and means of a group of people or a community to pass interests, goals, and habits from one generation to the next [28].

One important property of education is that it utilises defined structures and processes to teach students information and knowledge. Students benefit from these structures and processes in that they provide efficient means to learn information and to become aware of the goals and purposes of learning them.

6.2 Bloom’s Taxonomy of Learning Objectives

Bloom’s taxonomy of learning objectives has been one of the major cornerstones in defining classroom education [29]. It was developed in the 1950s by a committee of educators chaired by Benjamin Bloom to ease communication among them when defining proper learning goals for students. It reflects the understanding of employing a more holistic way to educate pupils and students.

In its core it is built upon three domains that address different aspects of human psychology in order to facilitate learning intrinsically within and holistically across them. Each domain distinguishes various levels that represent learning objectives, as shown in table 1. Higher levels can only be reached once a sufficient lower level expertise has been achieved.

Table 1. Bloom’s taxonomy of learning objectives

Cognitive domain	Affective domain	Psychomotor domain
<i>Knowledge</i>	<i>Attitude</i>	<i>Skills</i>
6.Evaluate (assess, judge in relational terms)		
5. Synthesise (create, build)	5. Internalise value system (adopt behaviour)	5. Naturalization (automate, become expert)
4. Analyze (structure, elements)	4. Organise personal value system	4. Articulation (combine, integrate, relate)
3. Apply (use)	3. Value (understand & act)	3. Develop precision
2. Understand	2. Respond (react)	2. Manipulation (follow instructions)
1. Recall data	1. Receive (awareness)	1. Imitation (copy)

The first domain of Bloom's taxonomy, and by far the most important one with respect to learning, is the cognitive domain. In this domain, a student learns essential skills that empower him or her to deal with knowledge, its comprehension, application and creation. First, knowledge needs to be recognised and recalled. In this lowest level of this domain, the simple learning of facts or procedures and their accurate recollection are central learning objectives. Comprehension of the learned matter follows in the next level. The understanding of meaning, interpretation and extrapolation of past trends into the future are common activities to be exercised. A student with comprehended knowledge is then qualified to apply it. The transformation of theory into practice by developing responses to real circumstances and situations, problem solving, or the management of an activity represent exemplary tasks in this level a student learns to master. However, the levels in the cognitive domain do not end there. The analysis follows, in which a student needs to meet the challenges of interpreting elements, structures, organizational principles, or internal relationships in a system. The deconstruction and qualitative assessment of parts of a system and their interactions are the core learning objectives in this level. Graphing, diagramming, or experimenting also belong to the set of activities and skills to be learned by a student. Finally, the synthesis level and the evaluation levels complete this cognitive domain of Bloom's taxonomy. While their order is sometimes a disputed issue in education science [30], their importance is not. In the synthesis level, a student develops unique approaches, structures, systems and their interactions. It involves creative thinking and covers real-world activities such as planning solutions, designing novel procedures to solve problems, or creating teams. In the evaluation level, a student evaluates his or her own creations using methods such as efficacy or viability analysis, or critical thinking. This translates to activities such as reviewing strategic options to proceed in a complex situation, performing a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, or carrying out a detailed cost/risk evaluation with recommendations and justifications.



Fig. 3. Cognition domain of Bloom's taxonomy of learning objectives

The affective domain deals primarily with building attitudes. Learning objectives that address the emotional identification with the learning topics and the learning process itself are as important as handling the social relationships with co-learners and teachers. In this domain, a student starts on the lowest level of reception in which openness to new experiences and the willingness to listen are central. The next level is the level of response in which reactions and participation are core aspects of the learning process. For example, group participation by developing interest in outcomes and taking part in discussions demonstrate a student's ability to master this level. In the next level of valuation, the student learns to attach personal values and person preferences to an issue. Opinion creation and decision-making for or against a particular topic represent the learning goals in this context. A level of organizing and conceptualizing values follows. In that level, the student should become aware of inner conflicts that may arise due to previously developed personal opinions and attached values pertaining to a particular topic or issue. The development of a value system is the final goal in this learning process and helps a student to formulate, prioritise and compare various values with one another that help him or her tackle problems or complex situations at hand. Finally, in the internalization level, the student is asked to characterise him or her own values and condense them into a belief system.

The third and final domain of Bloom's taxonomy is the psychomotor domain. It represents learning objectives and associated skills that originally reflect physical movement and manual tasks, but are also helpful in communications using IT equipment or in public speech. In this domain, a student learns first to imitate or copy others actions and behaviour. Manipulation of objects in a student's environment follows as a reflection of his or her ability to carry out instructions from memory. After that, psychomotor skills need to be more refined to achieve precision. Reliable execution without help is the key behavioural learning objective in this level. Once a student is sufficiently precise he or she needs to learn how to articulate himself or herself in a situation that is different from the learned one. His or her skills of adaptation and integration are needed. Finally, in the naturalization level, the learning objectives of the student are to internalise the learned behaviours so that they become more automated and subconscious or unconscious. This helps to free the mind to concentrate on using the skills in a more strategic manner.

7 Discussion

7.1 The Ineffectiveness of Current Education

The six levels of the cognitive domain of Bloom's taxonomy are illustrated in figure 3. The figure depicts them as a stack forming a pyramid, which is a common way to visualise them [29]. The width of the individual levels indicates their importance.

The most important level is therefore the lowest one, remembering followed by understanding, applying, and so on. Consequently, creating has the least priority at the top of the pyramid. Similarly, the affective domain and the psychomotor domain have priorities allocated to their respective levels in the same manner: the lowest levels receive the highest priorities whereas the highest levels receive the lowest priorities.

This priority distribution has certainly had its validity in the past when remembering and understanding were vital in professional life. However, in the light of on-going changes in cognition and skill demands at work that the Internet elicits, current learning objectives and their priorities in education become less effective. If the Internet is considered (and progressively utilised) as an external memory, it may be appropriate to consider the learning objective of remembering as a less important goal of education. Moreover, if the work demands skill sets involving more artistic and creative abilities, then the activities of applying, analysing, and creating information and knowledge should be given more attention and intensive teaching than they are now. In summary, we argue that the traditional distribution of priorities in learning objectives and methods become progressively a problem for the appropriate education of students with respect to their potential success at work.

7.2 Bloom's Taxonomy Revisited: Redefining Priorities

Given the incongruity between current learning objectives and future demands at work, which is likely to increase even more in the future, we propose a reprioritization of learning objectives that fit more to the current and, more importantly, the future demands that students will face. For example, the schooling of a person born in 2005 starts this year (2012) and finishes around 2030. Besides possible additional studies at universities or vocational schools, the working career will then last until approximately 2070, and there is no way to predict what kind of work that person will perform by that time. Therefore, it is vital to understand and conceptualise how learning objectives in education need to change in order to prepare pupils and students for the challenges to remain competitive. In the following, we therefore propose how Bloom's taxonomy (and not only its domain of cognition) needs to change. We also explicitly address the affect and psychomotor domains to reflect upon the increasing importance of the role of emotions and right-brain thinking as part of the learning process of a person.

Firstly, the cognitive domain is the one that would be subject to the biggest change. When knowledge is universally available, there is little need to learn it. It will not give anybody any advantage over anyone else. To be valuable, one must be able to take the existing knowledge that is all around one and make use of it in an original and critical way. The importance of the steps must change.

In figure 4, we can see how the focus of education must change. The present situation, shown on the left, demonstrates the attention that is mainly on the bottom

of the pyramid, where repetition of existing information is the main task. The figure on the right demonstrates the importance of the education of the future. The focus and gravitas of the educational system should shift from a focus on remembering to a focus emphasizing knowledge application, analysis and the creation of new solutions to novel problems. In the future, education must be focused on the utilization of existing knowledge, not on the repetition of it.

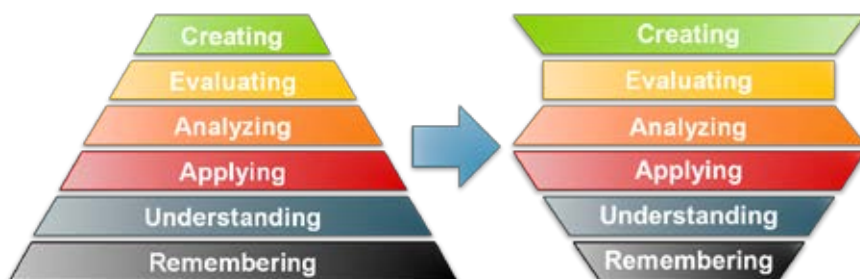


Fig. 4. Refined Bloom's taxonomy for the cognitive domain

Secondly, given the importance of collaborative work in multi-cultural teams, the often lesser priority of the affective domain now needs to be increased. We argue that emotional aspects are especially crucial when dealing with those who grow up in entirely different environments. While conflicts are unavoidable across cultures, students need to learn how to tackle and resolve them. This requires precisely the skills that the affective domain aims at developing: self-awareness, appropriate responses, and a strong value system, which the student is conscious about and is able to communicate. Only when value systems can be communicated free of mistrust and doubt, intercultural collaborative work is possible.

Finally, the psychomotor domain is also receiving increased attention. Given its validity beyond traditional physical movement by its importance in learning to use IT, or giving a public speech, this domain contributes to the aforementioned scenarios by supporting not only working with the Internet and its constantly renewing of tools, but also with respect to collaborative settings.

7.3 New Facets of Future Education

Given our proposed modifications to Bloom's taxonomy, how then could they be implemented in educational practice? In the following, we outline three aspects of teaching and learning in the future that illustrate how our modifications could be manifested.

Collaboration in Global Classrooms. The continuing globalization of economic, political, and social relationships will only solidify current management decisions requiring people to work in a close collaborative manner despite being located in (or coming from) different countries, cultures, continents, or time zones. This is already the case in most globally acting organizations and will continue to also penetrate mid-size and small companies. Especially start-ups that offer advanced IT-heavy products or services on the Internet drive this development from a bottom-up perspective, as the right combination of experts is often hard to find in local markets. As intercultural communication and interaction increases and gets more complex, the need for students to be educated in this domain also increases because companies will be getting less inclined to train entry-level personnel at their own cost.

In addition, the Internet also drives globalization of higher education. The Khan Academy [31], for example, is one of the popular educational channels that utilise the Internet to reach its audience. Lectures at the Khan Academy are presented in short 10- to 15-minute videos that address various topics in different fields. The videos are efficient in the way they teach various small and fundamental aspects in math and physics. Another opportunity of using the Internet for education is offered by different leading universities such as Stanford, Harvard, or MIT, which records a series of lectures and put them online as videos. A fairly recent trend in using the Internet for education is the establishment of strictly online universities, such as Udacity [32]. Such online education systems, in addition to lectures, try to provide students with various kinds of collaborative and individual problem-solving skills they need.

In summary, the Internet already provides tremendous amounts of resources that could already replace parts of traditional education in many countries. English, as the world language taught already in kindergarten along with its dominant role in the Internet, also contributes to the trend that children will learn and grow up in a more bilingual manner. Consequently, they will intensify complementing their school classes and homework with information and knowledge from the Internet, not only with information in their mother tongue but also with material in other languages. In the future, people will not necessarily receive all of their education in their home country but will almost certainly work in an intercultural environment.

Education needs to adapt to these trends. We therefore believe that ten years from now, education will include aspects of a much more global character, both in learning objectives and in procedures. Therefore, education needs to make basic steps in order to prepare students for a more collaborative way of learning involving other pupils and students from different countries at an early stage. Project work is one of the most common ways to tackle problems. By giving young pupils tasks to be completed in distributed teams, for example 2 Finns, 2 Australians, and 2 Brazilians, they get experiences in working together with people from different cultures, places and languages. This *collaboration in global classrooms* can be a very educational and exciting activity.

Analysis, Situated Problem Solving, and Creativity. Intercultural learning projects need to be handled in several languages and are influenced by different education systems via its team members. This results in new challenges that students have to overcome, e.g. data and information that is gathered across continents needs to be evaluated and analysed. However, the various sources and methods learned in a student's own country to gather, reflect, and analyse information might collide with the ones learned by another team member from another country. Moreover, a situation where information is also required to be collected from the Internet may amplify this challenge in data analysis even more. Therefore, students need to be also educated in mastering the gathering, understanding and analysis of information coming from a large variety of situations and reflecting a multitude of problems.

While the Internet makes it increasingly easier to access and gather data and information, students must learn the skills to utilise them. By giving them particular problems without fixed solutions, much like the "Harvard case study" exercises, students can learn how to analyse a problem, take it apart and isolate the relevant aspects. These aspects must then be reduced to manageable problems that can be solved within the context of the total problem.

Such an exercise in situated problem-solving can help teachers and other educators prepare students for their future work and life. Giving students the skills to access the vast quantities of knowledge on the Internet and training the students to apply this knowledge for new and original problems, done in distributed learning teams, will enable them to do the tasks that future employers will expect them to do. To achieve this kind of thinking and working, schools must abandon the traditional focus on the bottom levels in the three domains of Bloom's taxonomy. Instead, as we proposed earlier, they need to shift their attention to the middle, where the acquired knowledge is utilised and applied, evaluated, and then used for creating new ideas and thus creating value.

Visualization and Presentation of Information. Finally, based on the fact that the available information in the Internet will grow exponentially and that students' analytical skills will improve due to better training, they will also face the need to visualise and present the analysed data in novel and intuitive ways. Especially when different sources of data need to be combined, the chosen ways to interpret them can have a tremendous impact when making conclusions later based on that data.

Part of interpreting data and information is the ability to make interactive and creative presentations of data. In such situations, interactivity is an important aspect. If interactivity is involved, students will be able to understand, analyse and interpret much better the underlying correlations, differences and trends in large collections of data, and better conclusions can be drawn by others.

Currently developed online tools help in coping with this task, such as those advocated on bloomsapps [33] or VisualBlooms [34]. Gapminder software [35], which

can select different categories of data and show them together in a Flash-based graph, is a good example of such tools. Figure 5 shows the income per person (GDP/capita, PPP US\$, adjusted to 2010) on the horizontal axis and the life expectancy at birth on the vertical axis in 1940, the size of the bubbles represents the size of the population. By changing the year, you can see how these factors change over time and the relation between income and life expectancy becomes very clear.

This kind of information visualization helps to understand complex issues and gives access to the large amount of data that is inside the world's databases. Making simple to understand visualizations from complex data sets helps to communicate complex issues and that is a vital skill in the future work and life.

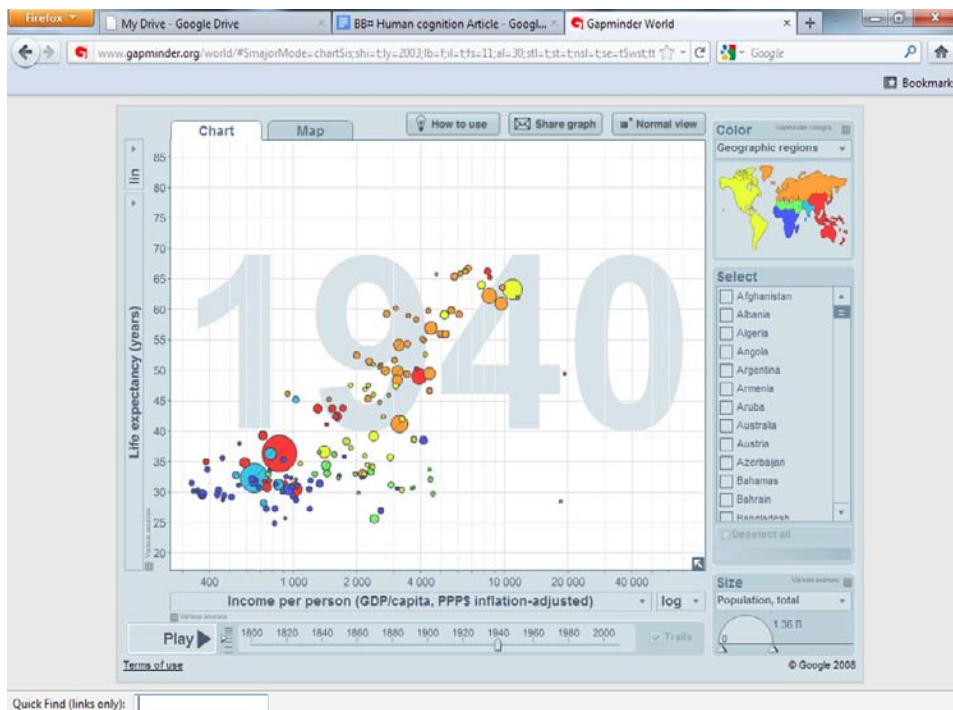


Fig. 5. Visualization from Gapminder World [35]

8 Conclusions

We have demonstrated that our mind changes due to the influence of the Internet. While these changes are not new in history, people's minds and societies have been adapting to these changes ever since. The fact that humans change is not the new element here. The new element is the direction and the intensity of the change.

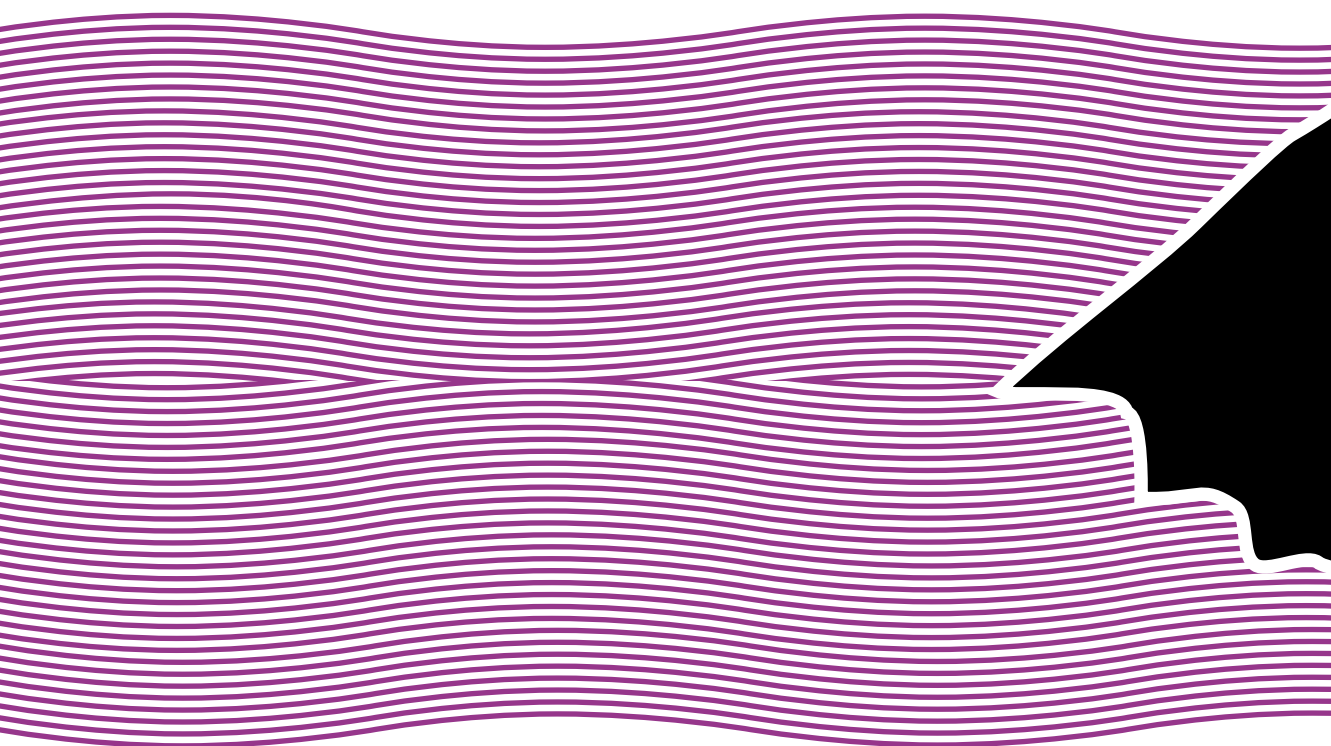
The changes take place in our daily life, in our society, in our work, and as a consequence, it should take place in our education system. The schools and curricula

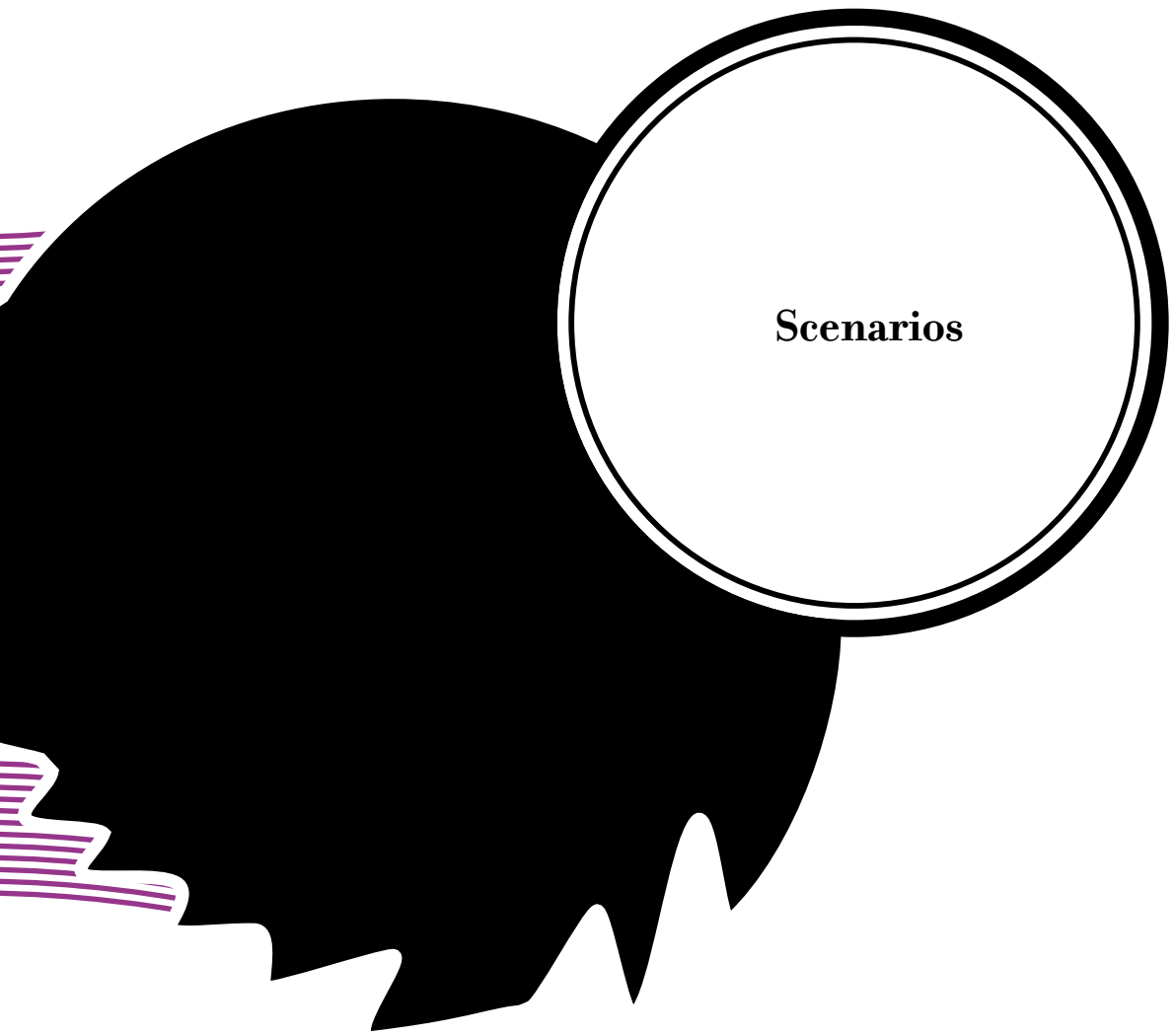
of lessons must reflect the changing needs for skilled workers in the future. The changes in work that are visible now and that are to be expected in the future make the present education system, with its focus on memory and reproduction, outdated. In Bloomberg's model, we illustrated the classic system and we outlined the shifting gravitas of the educational approach. The workers of the future are the students of today, and the skills of the future must be taught today, but with the ever-changing demands for skills, that is a difficult task.

References

1. Cognition, <http://en.wikipedia.org/wiki/Cognition>
2. Piaget, J., & Inhelder, B. (1973). *Memory and intelligence*. London: Routledge and Kegan Paul.
3. Rowley, J., The wisdom hierarchy: representations of the DIKW hierarchy. *Journal of Information Science*, 33 (2), 2007, 163-180.
4. Houle, C. O., *Patterns of Learning. New Perspectives on Life-Span Education*. Jossey-Bass Inc., Publishers, San Francisco, CA.
5. Christakis, D.A., Zimmerman, F.J., DiGiuseppe, D.L., & McCarty, C.A. (2004). Early television exposure and subsequent attentional problems in children. *Pediatrics*, 113, 708-713.
6. Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review* 63 (2): 81-97.
7. Cowan, N. (2001). The magical number 4 in short-term memory: A reconsideration of mental storage capacity. *Behavioral and Brain Sciences* 24 (1): 87-114.
8. Sparrow, B., Liu, J., and Wegner, D., M., Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips. *Science* 5 August 2011: 333 (6043), 776-778.
9. Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, 42 (4), 73-93.
10. Hemp, P. (2009, September). Death by information overload. *Harvard Business Review*, 87(9), 83-89. Retrieved from <http://hbr.org/>
11. Gorla, N., and Lam, Y., W. 2004. Who should work with whom?: building effective software project teams. *Commun. ACM* 47, 6 (June 2004), 79-82.
12. I/O Solutions. Fleishman's Taxonomy of Human Abilities. Industrial/Organizational Solutions. White Paper 015, 2010. http://www.iosolutions.org/uploadedFiles/IOS/IO_Solutions/Research_and_Resources/Agency_Resources/White_Papers/Fleishman-white%20paper.pdf. (Accessed 7.4.2012)
13. Web 2.0 at Work. http://www.thecontenteconomy.com/2008/09/presentation-from-our-web-20-at-work_23.html.
14. Carr N. *The Shallows: What the Internet is doing to our brains*. W.W. Norton & Company Inc. 2010.
15. Lanier, J. (2010). *You are Not a Gadget: A Manifesto*. London: Allen Lane.
16. hashtags on Twitter. <http://twitter.com/#!/hashtags>.
17. Grudin, J. (1994). "Computer-Supported Cooperative Work: History and Focus". *Computer* 27 (5): 19-26.
18. Fingar, P. *Competition: Innovation And the Great 21st Century Business Reformation*. Meghan-Kiffer Press, Jan 31, 2006, 222 pages.
19. Fingar, P. *The Coming IT Flip Flop*. bptrends November 2005. *The Coming IT Flip Flop*: www.bptrends.com/publicationfiles/12-05ART-ComingITFlipFlop-Fingar.pdf
20. Pink, D. *A Whole New Mind: Why Right-Brainers Will Rule the Future*. Riverhead Books, 7.3.2006, 275 pages.
21. William M. Dugger. *Economic Abundance: An Introduction*. M.E.Sharpe, 2009. See also: <http://www.abundanceeconomics.org/> Accessed 7.4.2012.
22. Thrift, N. Re-inventing invention: new tendencies in capitalist commodification. *Economy and Society*, Volume 35 Number 2 May 2006: 279-306.
23. Schneider, F., Kallis, G. and Joan Martinez-Alier, 2010., Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue. *Journal of cleaner production* 18(6): 511-518.

24. Nonaka, I., Konno, N., The concept of “Ba”: Building foundation for Knowledge Creation. California Management Review Vol 40, No.3 Spring 1998
25. Snow C.P. The Two Cultures. Cambridge University Press, Jul 30, 1993, 107 pages.
26. Jones S. Making Innovation work. Media Lab Europe. <http://www.simon-jones.com/MAKING%20INNOVATION%20WORK%20v1.1.pdf> (Accessed 7.4.2012).
27. Education, <http://www.merriam-webster.com/dictionary/education> (accessed 20.6.2012).
28. Education, <http://en.wikipedia.org/wiki/Education> (accessed 20.6.2012).
29. Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). Taxonomy of educational objectives: the classification of educational goals; Handbook I: Cognitive Domain New York, Longmans, Green, 1956.
30. Anderson, L. & Krathwohl, D. A. (2001) Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom’s Taxonomy of Educational Objectives New York: Longman.
31. Khan Academy, www.khanacademy.org (Accessed 20.06.2012)
32. Udacity, www.udacity.com (Accessed 20.06.2012)
33. BloomsApps, <https://sites.google.com/site/bloomsapps/> (Accessed 20.06.2012)
34. VisualBloom’s, A Visual Representation of Bloom’s Taxonomic Hierarchy with a 21st Century Skills Frame. <http://visualblooms.wikispaces.com/> (accessed 20.06.2012)
35. Gapminder, www.gapminder.org (Accessed 20.06.2012)





Introduction to the Scenarios

To complement the themes discussed in the reports, we asked the groups to produce short scenarios of the future in the 2020s. The groups started their work in a workshop, where the basic rules of scenario building and the initial assumptions of a scenario were settled. As a basis of the scenario, each team chose two variables that were to form the essential premise of the described future. These variables were put in the form of a quadrant and are introduced at the beginning of each scenario.

To flesh out the narratives, the students were asked to describe the technological, environmental, political, societal, economical, and/or legal developments that led to the scenarios. They also reflected upon the possible forces that are for and against to the described future situation.

Finally, the teams produced short narratives – *Internet, Find Me a Cure; High Tech Nationalism; Internet Kindergarten; and Trader's Network* – of a life in the 2020s.

We want to thank Petri Aaltonen from Perfecto Ltd for his consultancy in teamwork and scenario building, our tutors for providing valuable information and ideas during the process, and Senior Teacher Vesa Kantola and Senior Researcher Scientist Olli Pitkänen for providing the possibility to build scenarios under their guidance¹.

Yrjö & Elina

¹ Their playful method for scenario creation is used in the first scenario, *Internet Find Me a Cure*.

Internet, Find Me a Cure

Evgenia Litvinova¹, Vilen Looga², Håkan Mitts², Gautam Raj Moktan³,
Olli Mäkinen², Suleiman Ali Khan⁴, and tutor Meri Kuikka⁵

¹ Aalto University School of Science, Department of Media Technology
PO Box 15400, FI-00076 Aalto

² Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

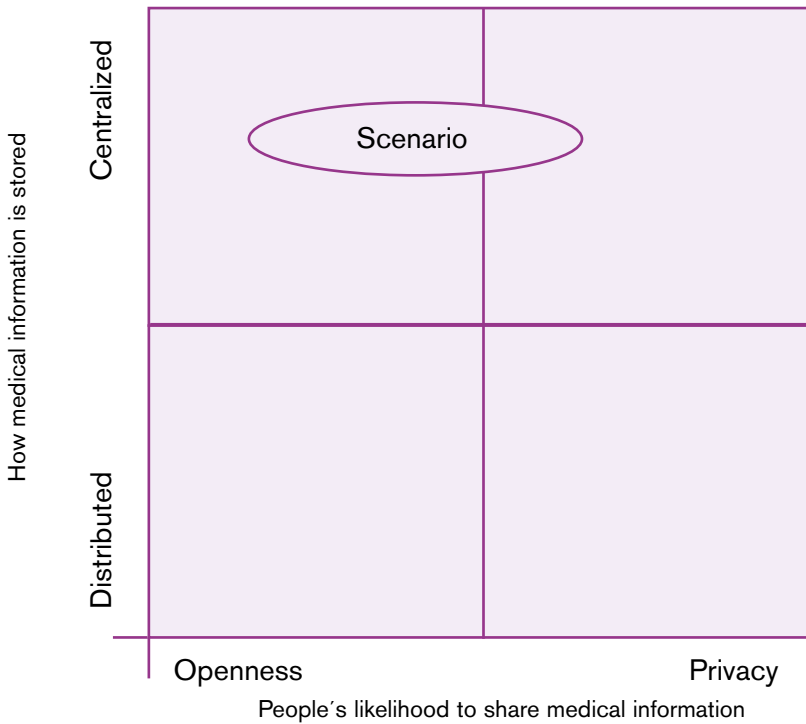
³ Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

⁴ Aalto University School of Science, Department of Information and Computer Science
PO Box 15400 FI-00076 Aalto

⁵ Aalto University School of Economics, Department of Information and Service Economy
PO Box 21220, FI-00076 Aalto

1 *Quadrant*

This scenario is based on two variables: open vs. private and distributed vs. centralized medical information. This quadrant is spaced in the centrally stored and quite open sharing of medical information. In the scenario, medical information is stored on government-controlled servers to be able to track down epidemics, but also shared eagerly with insurance companies and Web-based health diagnosis services.



2 Factors Driving towards This Scenario

Individuals that would be driven towards this scenario would be the early adopters of monitoring systems, who are very conscious about their health. Additionally, people with rare diseases or those who have to be monitored constantly would greatly benefit from such a service. The state's incentives for this kind of scenario would be large-scale savings on national healthcare costs. Preventative medicine personnel would not have to be employed as much as in today's world. Insurance companies would benefit from an accurately targeted insurance cost system, and other companies could provide direct offers based on medical conditions, such as salad discounts for people with high cholesterol. The technological factors driving towards this scenario are most importantly evolving sensor and transmission technology. Personal DNA sequencing allows for more targeted medication, and data mining on the national level is used for tracking down epidemics.

3 Factors Discouraging this Scenario

For individuals, factors that would discourage this scenario are privacy consciousness, not caring about technological systems, and not wanting to know about the current health situation or not wanting to change unhealthy habits. Legislation against exchanging private information for financial gain in insurance policies would also discourage sharing data with insurance companies. The government can also be inept – they have the data but cannot act on it. Also, the data collected by insurance companies are an asset for them, and sharing their data with other organizations is not desirable.

4 Narrative

Around 2020, health care saw a few major technological developments. The first major development was the establishment of a global health information system that could store health-related information about everyone in the world. The system was mainly used to track the ever more common global epidemics and was intended to provide an early warning system for such epidemics. The system however did not get global coverage. Most countries did deploy the system, but national privacy policies resulted in a situation where people could still choose not to input their vital health information into the system if they felt that the information could harm their privacy.

The other major trend in health care was home analysis units that quickly became as widely used in most developing countries as microwave ovens. These systems used cheap genome-based technologies to analyze a person's health using daily small urine samples. The systems proved very popular because most common illnesses, such as common virus- and bacteria-based diseases, could be easily analyzed. The main drawback of the systems tended to be that they sometimes incorrectly identified some rare or new diseases as other, more common diseases.

The third major change was the new medical business ecosystem built around the insurance companies. As government health spending could no longer be increased but the cost of health care continued to grow, more and more people started to take out personal insurance policies.

The governments were pleased with this development, but they imposed rather strict global regulations on these insurance policies. As a result, the promising health insurances became less profitable also for the insurance companies. This led to the insurance companies acquiring major companies that made drugs and health equipment. Thus the insurance companies took on a leading role in medical research and development.

As a result, a few global insurance companies started to exert a major influence on most aspects of the medical services. For instance the insurance companies normally

owned the home analysis units, and a daily routine check was one of the requirements to be able to make any health-related insurance claims. The analysis units were also automatically connected to the information systems of the insurance companies in order to fulfil the requirements of typical insurance policies.

4.1 Imatra, April 2021

It is the spring of 2021 and the eyes of the world are turned on the little city of Imatra in Finland for the annual World Cup of Mämmi-eating (MEWC).

Kukka, who runs a bakery in Imatra, won the award for the best mämmi of the year 2021 and will be supplying the mämmi that will be used in the World Cup main event.

Kukka is very happy that she won, but she is stressed out. Kukka's children have been sick several times with the flu in the weeks before the MEWC.

In 2021, the international online purchase of drugs and medicines is allowed. In order to make sure that the kids will not be sick during the critical days of the mämmi production just before the main event, Kukka ordered some special antibiotics from China for her children. She found information about the antibiotics from a Chinese discussion board that Kukka checked out with the help of a Finnish-Chinese online translation service. Kukka gave the antibiotics to her children as a safety precaution just before the games.

Kukka's best friend Minttu, as well as many other people from Imatra, will be participating in MEWC. Minttu just loves good food – this is obvious to everyone from her rather well-rounded figure – and she loves Kukka's mämmi more than anything else. Minttu does quite well in the competition, but still does not make it to the finals.

A few days after the competition, Minttu is starting to feel a bit sick. Minttu's medical home analysis system also raises an alarm and prompts Minttu to do a more thorough check.

Minttu checks her symptoms from the WebMD service that provides a wide range of medical services for people handling most of their healthcare themselves. The symptoms seem to point to a specific sexually transmitted disease. Minttu feels very embarrassed and decides not to consult a doctor. Instead she decides to use her own medical home analysis system to analyze her problem.

Minttu orders a special self-diagnosis package for her home analysis system and does the in-depth analysis herself. The home analysis indeed seems to confirm that Minttu has contracted an STD.

Because of the embarrassing nature of the disease, Minttu informs her system not to upload the analysis information to the government medical analysis system. Instead she uses the WebMD system to order antibiotics for the disease she thought she had. The WebMD site asks for permission to contact her home analysis system, verifies the diagnosis, and places an order for the medicine at a Chinese online pharmacy.

The next day, Minttu gets the medicine and starts the treatment. The disease however does not seem to be cured by the treatment. In fact, it seems to get worse by the day.

Luckily for Minttu, she has a medical insurance. When Minttu bought the medicine for her assumed disease, the WebMD service sent information about the purchase to her insurance company so that she will get reimbursed.

The insurance company constantly monitors all its claims. An automatic analysis system detects that there is a sudden outburst of a specific STD in Imatra. Such a big concentration is well beyond the normal, and the system sets an alarm, which is sent to the EU health governing board.

The EU health governing board quickly analyses the information on visits to the doctor in Imatra around the time of the MEWC. When doing the analysis, the EU health governing board detects one case of a resistant strain of bacteria that has been detected at the main hospital in Imatra. The bacteria were initially incorrectly diagnosed as an STD. Is there a connection here?

As most people seem to have analyzed the disease with their home equipment and kept their home equipment from sharing the information with the Finnish health organization, there is no additional information about the situation in Imatra to be had from the Finnish health records.

Instead, the EU health governing board uses a special EU directive to force the insurance companies to reveal the identities of the people in Imatra who have placed claims for antibiotics that can be used for STDs. There are a number of such cases, one of which is Minttu. Her information is passed to the EU health governing board, which immediately calls Minttu and some other people to come to the Imatra hospital for a detailed health examination.

Minttu is a bit surprised when she gets the invitation, but after the examination she is both relieved and scared. She is relieved to hear that she does not have an STD, but she is very worried when she hears that she has a resistant strain of bacteria for which there is no known cure at this time.

The EU health governing board immediately puts out an alarm: this is a potentially serious epidemic. An investigation into the bacteria starts immediately. The findings are both good and bad. The good news is that a very expensive broad-spectrum antibiotic can kill the bacteria. The bad news is that the bacteria is very aggressive and spreads rapidly, but only among certain people.

As Finland collects very extensive medical information about its citizens, the Finnish health officials immediately start to data mine the open medical records. Based on an intensive data mining session, it seems likely that the bacteria only affects people who have taken an overdose of some specific Chinese-manufactured antibiotics and at the same time are very overweight thus having an increased risk of type 2 diabetes.

Now the health officials have the necessary information to start tracking down people who might be spreading the disease. By comparing the list of people that had

visited Imatra, it was possible to identify some potential carriers of the disease. Unfortunately, not all countries had the possibility to track down the potential carriers. Some countries lacked the health information needed to identify possible carriers, while other countries had privacy policies that enabled the citizens to hide some of their health information. Thus the success of preventing wide epidemics varied greatly between countries.

As information about the disease spread, people also learned that the broad-spectrum antibiotics were currently the only medicine that could cure the illness.

The EU has very strict regulations that broad-spectrum antibiotics can only be used to treat resistant strains of bacteria diagnosed by a hospital endorsed by the governments. However, Chinese medical companies are not regulated in the same way and they sell antibiotics that are illegal in the EU to people who have only done a home analysis.

People from Europe who suspect that they have the disease order illegal online versions of these antibiotics. Many of them actually do not need the broad-spectrum antibiotics. As a result, new strains of resistant bacteria are born and two years later a new epidemic starts again, but this time not from Imatra.

High Tech Nationalism

Abu Shohel Ahmed¹, Andy Best-Dunkley², Raisa Halonen³, Mokter Hossain⁴,
Pyyry Kivisaari⁵, Nam Vu Hoang⁶, and tutor Andrea Buda⁷

¹ Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

² Aalto University School of Arts, Design and Architecture, Department of Media
PO Box 31000, FI-00076 Aalto

³ Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

⁴ Aalto University School of Science, Department of Industrial Engineering and Management
PO Box 15500, FI-00076, Aalto

⁵ Aalto University School of Science, Department of Biomedical Engineering and
Computational Science
PO Box 12200, FI-00076 Aalto

⁶ Aalto University School of Science, Department of Information and Computer Science
PO Box 15400, FI-00076, Aalto

⁷ Aalto University School of Engineering, Department of Engineering Design and Production
PO Box 14100, FI-00076 Aalto

{abu.ahmed, andy.best, raisa.halonen, mokter.hossain, pyry.kivisaari, nam.vuhoang, andrea.buda}
@aalto.fi

Keywords: Globalisation, nationalism, human experience, machine intelligence, gamification

1 Introduction

The future, as we have analyzed in our scenario analysis, is based on two major variables as depicted in figure 1. The vertical axis defines the rules governing society (i.e., local or global), and the horizontal axis defines societal dependency on machine

intelligence (i.e., machine intelligence dependent society or human experience dependent society). These two variables have led to four possible scenarios. The upper right corner is “Global Village Utopia”, which leads to truly global citizens with individual control over life. The lower right corner is “Craft Revolution”, in which local customs flourish with human control over life. The lower left corner is “High Tech Nationalism”, in which society mainly depends on machine intelligence with increasing control of local rules and regulations. Finally, the upper left corner is “Corporate Fascism”, in which big Mughals control human life using machine intelligence. For the purpose of this scenario analysis, we describe the drivers and inhibitors for the scenario “High Tech Nationalism” with an added gamification dimension and present a snapshot of life in 2025 based on this scenario.

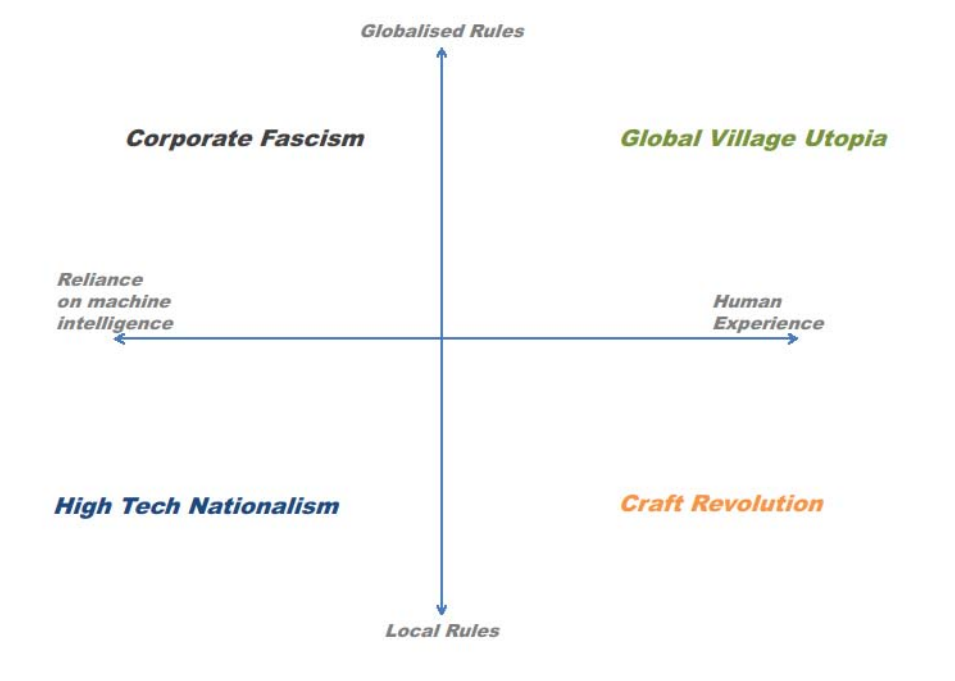


Fig. 1. Variables and scenarios.

2 Driving Forces

Table 1 presents the driving forces towards and away from our scenario. It can be seen that there are strong driving forces both towards local rules and towards global rules. The same holds for the dimension of reliance on human experience vs. reliance on machine intelligence.

Table 1. Variables, driving forces towards and driving forces away from the scenario “High Tech Nationalism”.

Variables	Driving forces towards	Driving forces away	Narrative
National/Local rules/ customs	Local rules security/safety control of population economic crisis religion fear/idea that all our problems are caused by other people	Globalisation companies trying to get global market leveraging on the Internet fading of national economic boundaries due to global marketplace rise of homogenised global culture	
Global rules	 growing protectionism extreme right and left parties increasing political influence		
Reliance on machine intelligence	Machine intelligence drive to connect all machines to the Internet miniaturisation of technology enhancing reality with technology (AR) trust machine intelligence rather than own instincts	Human experience desire for individual freedom individual education levels rising downshifting collective tiredness of relying on technology massive personal information leaks causing a global reluctance to give away one’s personal information anywhere	
Reliance on human experience, intuition, emotion			
Gamification	Gamification aspects gaining status at work and in society attending religious service shopping loyalty cards application of game-like strategies in education gaming reputation counts at workplace human’s entire reputation increasingly based on one’s “Google score”		More extreme version of today’s society. Individual decisions controlled by apps. Embedded technologies everywhere.

3 Narrative for “High Tech Nationalism” in 2025

The global financial crisis has continued and affected many regions around the globe, particularly in the developed world. This has led to increased political tensions and a rise of extreme nationalistic policies. Intolerance and religious ideas are also more prominent in society, leading to various social restrictions and norms being enforced depending on the local culture. At the same time, the Internet has continued to be developed, and many companies are trying to gain market share around the world with their products. The governance model of the Internet has also changed from global to local. Companies, irrespective of their local and global origin, need to develop solutions customized for local markets and follow local governance policies. The “Internet of things” has become a reality, so that most everyday objects are connected to the Internet and to local cloud servers, resulting in that nearly all behaviour can be tracked and traced back to individuals by the state. Social networks are now used for enforcing behaviour as your status reflects your real world values and activities. Social networks and everyday activities have included gamification to the extreme – pointsification – resulting in a life choice in which people value their badges and points more than anything else.

A sunny afternoon in 2025. A university-educated doctor, originally from a remote village in Bangladesh, is on a holiday trip with his wife, an engineer, in Europe. They live in Dhaka, the capital of Bangladesh, but their old parents still live in their home village. As in many other regions of the world, Bangladesh has faced economic, political, and environmental crises over the last few years. So in 2025, the village still lacks proper infrastructure such as road connections and electricity. However, these crises have led to new business opportunities for entrepreneurs. Mango+, a global technology company, has introduced a new communications technology using mPaper+, a super energy-efficient device that works with solar power. It is connected to 6G networks and provides instant communication. Mango+ has a special feature – you can sign up to get free service if you let the company sell all the information they can mine from your account. This allows everyone, even the most disadvantaged, to receive service from Mango+ in return for his or her personal information. The parents of our couple are waiting for a call from their children.

In Europe, the middle-aged couple, well respected back home in Dhaka, find that the societal norms are in sharp contrast to those of their home country. Arriving at the airport in Frankfurt, they find that their Mango+ device has automatically installed the “European Good Citizen (EGC)” app. This tracks their every move – where they go, what they buy, what they eat – using a variety of networked embedded technologies in the “Internet of Things”. As their own Mango+ devices are registered to their personal databody, it is easy for the EGC to compile a profile of each individual and provide assistance in everyday life, making suggestions for travel plans, restaurants, news sites – in fact, all information is provided by the Mango+ service.

The EGC instructs the couple on local customs and cultures. For example, the woman was instructed to wear a short dress when she planned to visit an upscale shopping district. Due to the strong emphasis on local controls and customs, everyone is forced to comply with local customs wherever they are travelling. The couple decides to go out shopping. Mango+ directs them to the shopping areas full of boutiques and jewellery stores due to their cultural profiling. While they are shopping, Mango+ records any purchases they make and shops they enter. This data is used in real-time to provide hints for other suitable shopping experiences nearby. The collected data is also sold to other marketing campaigns, so that targeted ads start to flash on Mango+, and street billboards subtly change to reflect their interests as they walk past.

During the day, they wish to find a local mosque. It turns out that all the mosques and religious institutions are strictly controlled for locals and foreigners. The increasing worldwide threats toward religious terrorism have prompted the local governments to force this decision. As the couple rides in a taxi towards the mosque, the local police, via a Mango+ device, track their movement. As foreign nationals, they are also automatically tracked by the local national security apparatus, which raises their perceived threat level depending on their location in the city. Any unusual activity is flagged for follow-up, and in the case of high priority cases, CCTV images are checked immediately by software agents.

In Europe, the couple is amazed by the modern technologies in use. While most people rely on regular augmented reality glasses that provide real-time data based on location, activity, and weather conditions, they have seen wealthy Europeans relying on their Terminator-style electronic contact lenses which are slowly emerging on the market but which they haven't been able to afford yet. The technology has had several challenges and a violent IPR war has started between two competing companies over ownership of the technology.

Sitting at an outdoor café in the city's main square, the doctor makes the evening call to their parents using their newly purchased AR glasses. He and his wife are able to see their parents superimposed over the cityscape in the background. The parents are amazed at the size of the city but are shocked to see the revealing clothes that are being worn – particularly by their daughter. It takes awhile for the doctor and his wife to explain that this is normal in Europe, and that they are forced to comply with the local regulations. Sharing their day's activities via Mango+, the parents are of course happy to see that the couple have improved their social status score on their national ranking tables due to the high-class shopping purchases and visit to the mosque that they made earlier.

Internet Kindergarten

Kari Visala¹, Wael Soliman², Henna Warma³, Mário Costa⁴, Lionel Reya⁵,
Tuomas Ritola⁶, and tutor Kristi Grisakov⁷

¹ Aalto University School of Science / Helsinki Institute for Information Technology HIIT
PO Box 15400, FI-00076 Aalto

² Aalto University School of Economics, Center for Knowledge and Innovation Research
PO Box 21255, FI-00076 Aalto

³ Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

⁴ Aalto University School of Electrical Engineering, Department of Signal Processing and Acoustics
PO Box 13000, FI-00076 Aalto

⁵ Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

⁶ Aalto University School of Engineering, Department of Engineering Design and Production
PO Box 14100, FI-00076 Aalto

⁷ Aalto University School of Engineering, Center for Urban and Regional Studies,
PO Box 12200, FI-00076 Aalto

{Kari.Visala, Wael.Soliman, Henna.Warma, Mario.Costa,
Lionel.Reya, Tuomas.Ritola, Kristi.Grisakov}@aalto.fi

1 Variables

For the purpose of building the scenario, we have chosen two variables (as seen in figure 1):

- 1) The level at which people adopt – and rely upon – technology in their everyday lives. We have called this “Technology Acceptance”, and it varies between high and low acceptance rate.

- 2) The level of control concentration (i.e. centralization) of Internet services. We have called this “Internet control mechanism”, and it varies between highly centralized to highly decentralized.

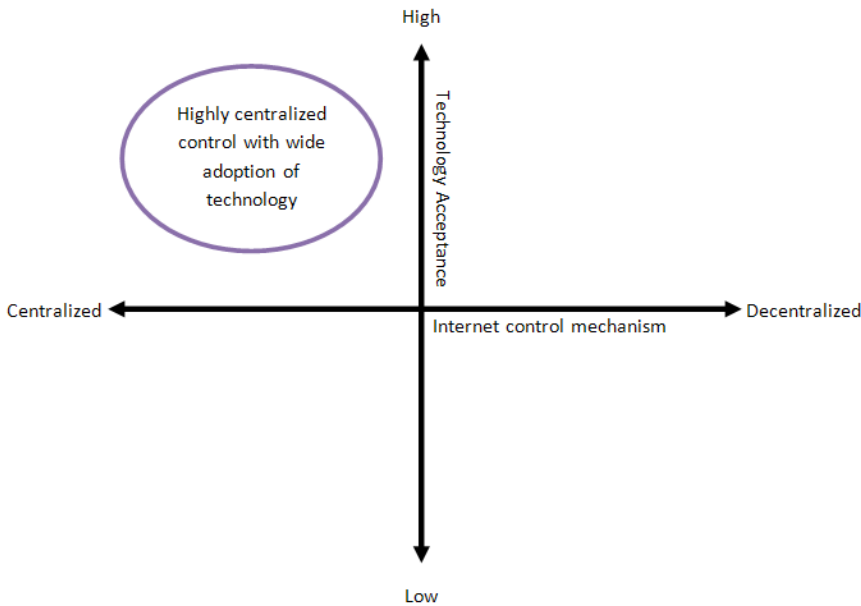


Fig. 1. Variables used in scenario-building

The scenario you are about to read takes place in 2022. It is assumed that the Internet control mechanism is highly centralized (i.e., in the hand of few players), and that people willingly experience a high level of dependence on technology.

2 Situation in 2012

In 2012 the era of personal computers dominated by Microsoft had already been largely replaced by services moved to the cloud as well as mobile terminals ranging from smartphones to tablets and ultraportable laptops. Google search was the main way of finding new content, and end users spent 15% of their time online on Facebook. New scalable Web services were easy to deploy on cloud platforms provided by companies like Google and Amazon. On the mobile side, the market was divided by two application ecosystems of Apple and Android. More and more applications were migrating to the cloud, as it provided better scalability and robustness, synchronization, federated identity management, and automatic backup while not tying the user to a single end device.

The introduction of the Internet as a medium was historically fast and followed the exponential technology curve. New services that significantly changed our way of using the Internet were rolled out on an almost yearly basis, such as blogging platforms, Facebook, and Google Reader. Everything was new and people were interested in trying the novel features without much critical thought, since simply following the technologies of the time was time consuming. For example, most Internet users were willing to divulge their private and work emails, chat messages, and documents to companies such as Google. Feature-laden smartphones became status items for adults, and teenagers competed in games and the fluency of using new communication tools. Threats of technology were generally not visible to common end users, as the companies tried to hide problems to protect their brands. People generally accepted the Google's motto "Don't be evil", and the technology projects such as investments in solar energy, augmented reality glasses, and the driverless car were enough to maintain the positive view on Google. Google also decided to stop censorship in China and kept the interfaces of its services ostensibly open, which increased trust in it.

3 Developments and Forces Pulling towards the Scenario

In early 2015, the world was struck by an extensive financial crisis. The crisis was a continuation of the unstable conditions in the financial world that were seen throughout the last seven or eight years. Many of the banks went bankrupt, and due to this, the financial situation of many (some even huge) companies got extremely difficult. Many large international companies crashed in the crisis, including many Internet companies. The two largest Internet service companies, Google and newly-formed Microapple, survived the financial crisis well compared to the other big players in the Internet domain due to their already huge market shares, solid financial situations and substantially grown worldwide sales.

Apart from the two biggest players, the Internet companies in general were among the ones that were most affected by the crisis. Many extremely potential and valuable Internet service companies went bankrupt as a consequence of the financial crisis. This gave two of the greatest influential players, Google and Microapple, a great opportunity to acquire a huge amount of new talent and many smaller companies that complemented their offerings to an great degree.

Largely due to the crisis, by the end of the year 2016, Google and Microapple were by far the largest companies in the Internet service domain. They had acquired nearly all of their competitors and had grown into Internet conglomerates with massive competitive advantage compared to the rest of the remaining Internet service companies. The two companies also collaborated with each other, and the competition between them did not look that fierce. The services they offered were largely

complementing each other instead of competing. The only smaller survivor in the crisis was a company called SenseNET, which was still a start-up in 2012 but is very successful developer of sensor technology and its integration into the Internet. Despite the financial crisis, SenseNET was able to create a service offering which really responded to people's needs and experienced a Google-like growth in just a decade. It really seems that the company is becoming the third giant in the market and the third teacher in the kindergarten.

In general, the following variables were identified as the major issues why the world became as it is described in this scenario:

- **Network effects** around Internet services have created a situation where a single or a few huge players dominate each market such as Internet search, social networking, and operating system.
- **Economies of scale** have given an advantage to larger services, as they can collect more information from users and optimize their service based on their feedback. The infrastructure of the big players are comprised of around a million servers distributed globally in data centres, which reduces latencies to their services in a way only possible by using a 3rd party cloud platform or a *content delivery network* (CDN).
- **Economies of scope** has led to the amalgamation of different service markets into horizontal ecosystems, where the identity of the users is managed in the cloud, and the seamless integration of services and end devices has led to a large number of dependencies and synergies between the functions inside the ecosystem.
- **A common vision of the future** started to inspire people living in a constantly changing and fragmented reality again. One of the big players started to develop AI for predicting the future based on the massive data mining of contents in the cloud. Users started to see the benefits and AI became the “rocket to the moon” race of the current generation between western countries and China.

4 Situation in 2022

It's been five years since the October 2nd (2017) disaster; people commemorate that sad day by meeting and exchanging supporting messages and grieving over their loved ones who were lost in the massive earthquake that struck several parts of the planet. Walking on a London street, I see Steve Smith (Google's CEO) on a public projector talking about how Google, in collaboration with SenseNet (the major location transmitter device manufacturer), have made our lives much safer and more enjoyable after pushing the Technology Acceptance Bill (TAB) forward. TAB has paved the way for developing the British version of the Australian NEWS (National

Emergency Warning System)¹. Now with TAB and NEWS in place, Google, in collaboration with its partner SenseNet, has been able to produce the first perpetual human-integrated locator. Just like in every commemoration in the past four years, Mr. Smith has to remind us that had this technology been in place during this crisis, many lives would have been saved by locating their positions and sending the help they needed. Anyway, technology has become an integral part of our lives.

Apart from the NEWS systems, people are widely using the well-integrated services offered by the three big players (Google, Microapple and SenseNET) partly as a result of social influences, but most likely due to a psychological attachment to the new service offering because they find it compatible with their values. Users in this category, which is now the mainstream, could be described as committed and enthusiastic towards the use of these new services. People appreciate companies offering the services just as children appreciate their kindergarten teachers. However, there exists another but minor category of users who might be coerced into accepting these new services in order to get a reward or avoid punishment. For example, a government can require its citizens to adopt a new service that they consider beneficial to society or after a crisis or disaster.

Google Augmented Reality (AR) Contact Lenses is a product that enables functionalities that were commonly done by smartphones. These eye-wearable devices are embedded systems connected to the Internet by a nano-radio and are composed of a machine-brain-interface (MBI). AR is now a well-developed technology that allows these contact lenses to project information in the form of 3D virtual objects alongside the physical world around us. Tasks such as localization and search are now accomplished without having to resort to pre-defined steps common in traditional smartphone-based interfaces. There are a group of people that refuse to wear these contact lenses because the effect of so much information on the human brain is not unanimously seen as beneficial.

Google has also launched a GoogleOS, a cloud-based operating system, which has become widely adopted by users. It works seamlessly with the extensive list of existing Google services and is independent of the hardware used. The user can log into his or her own operating system profile from any laptop, tablet or handheld device connected to the Internet. After the successful launch of GoogleOS, its main competitor, Microapple, strategically chose to align its services with GoogleOS after first losing a significant share of the market from its own iWindOS to GoogleOS.

Already in 2012, some governments were collaborating with the network giants at the time. For example, Google was initially providing search results in China af-

1 For more on the NEWS system, check <http://www.emergencyalert.gov.au/> and also, Aloudat, A. & Michael, K. (2011): Toward the regulation of ubiquitous mobile government: a case study on location-based emergency services in Australia. *Electronic Commerce Research*, 11(1), pp.31-74. Available at: <http://www.springerlink.com/index/10.1007/s10660-010-9070-0> [Accessed April 5, 2012].

affected by the government, but also some countries in the western world had made agreements that, in certain situations, some information could be requested from the data-collecting companies. This collaboration with nation states and cities has only strengthened in the past ten years. The big companies are helping the governments develop new public e-services for the benefit of the citizens, but they also give access to databases of information about their citizens. This data acquisition is not known to be used wrongly by the governments, but the concern always remains whether this may change in the future.

5 Forces Pulling away from This Scenario

There is always the other side of the coin. Therefore, many forces can be identified that may pull the ecosystem away from the nice, smoothly working Internet Kindergarten. These are discussed next.

- **Democratic and demographic forces, anarchists.** The public's ability to use these services and still maintain a "normal" lifestyle is increasingly becoming difficult. People lost their jobs because of the new services provided by Google and Microapple, which led to instability in some western states. Furthermore, some parts of society as a whole are not knowledgeable in the use of these services, making them less desirable, leading to calls during elections or other democratic means to put an end to these monopolies. Anarchists within society began a campaign of attacking these monopolies without proposing any other solutions.
- **Variation of people's needs.** The stability of the Kindergarten is based on the premise that the big players (i.e., Google, Microapple, and SenseNet) can provide or even decide on people's needs in terms of technology and welfare. However, monopolies lose the ability to innovate and people's real needs are not satisfied. Technologies and solutions are not adopted as a result of competition anymore. They are simply imposed by the big players. The Internet, even as a monopoly, cannot be fully predictive in a way that people's needs can be anticipated. Hence, a revolution in the Kindergarten is to be expected.
- **Regulation against monopolies.** The huge costs of delivering these services are passed on to consumers. Having reluctantly allowed these monopolies to thrive, there is constant pressure on governments to do more in exercising some form of control by either breaking up these large firms or at least regulating the price paid by users. By nature, markets also regulate these monopolies as well as generate enough wealth and new technologies that increase the competitive pressures on the few major players by causing a reduction in the cost of new start-ups.
- **Ossification and internal corruption.** "Nothing can grow forever". That's an old saying but verifiably true. When one grows big enough, there is a real threat

for companies to ossify and become inefficient, which leads to a decrease in the capability to respond to people's needs. Some smaller companies with agile processes can start to grab market share from the three big players. The larger the company grows, the greater the threat becomes for using such a position in the wrong way. After all, running a company is always a human process and people make mistakes. The big companies have become prone to making decisions that benefit the company or the government but not the crowd out there.

Trader's Network

Hendrik Hielkema¹, Somaya Arianfar², Petri Saarikko³,
Mohammad Hoque⁴, Yang Deng⁴, Jan Kallenbach³, and tutor Timo Kiravuo²

¹ Aalto University School of Economics, Center for Knowledge and Innovation Research
PO Box 21255, FI-00076 Aalto

² Aalto University School of Electrical Engineering, Department of Communications and Networking
PO Box 13000, FI-00076 Aalto

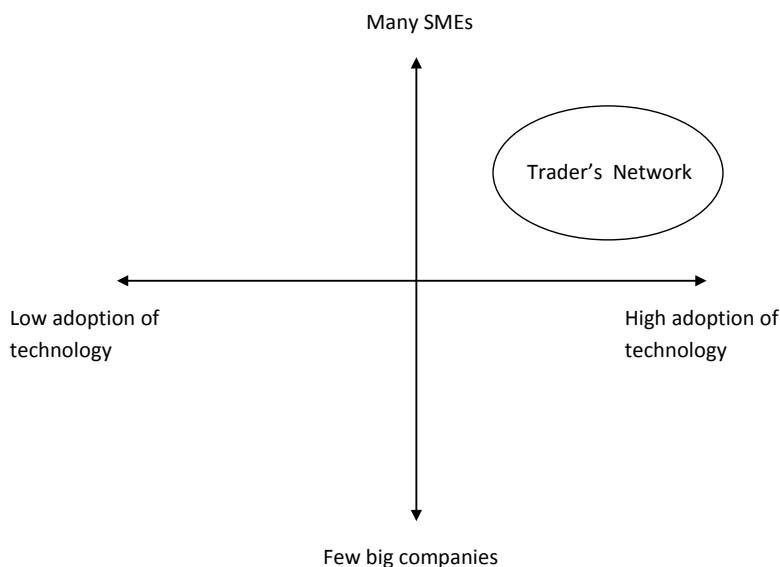
³ Aalto University School of Science, Department of Media Technology
PO Box 15500, FI-00076 Aalto

⁴ Aalto University School of Science, Department of Computer Science and Engineering
PO Box 15400, FI-00076 Aalto

{Hendrik.Hielkema, Somaya.Arianfar, Petri.Saarikko, Jan.Kallenbach,
Yang.Deng, Mahmmd.Hoque, Timo.Kiravuo}@aalto.fi

1 *Quadrant*

This quadrant is about positive opportunities that the Internet could bring to the market, both in terms of “selling your own product” and “buying the best product that fits your needs”. There are no barriers to enter the market for those who want to. However, there is high competition in the market to find the right customers. Emergence of new forms of currencies in the future market is also considered important here. In this quadrant, people’s mental acceptance and their openness to accept new ideas and using new products is one of the keys to the future.



2 Factors Driving Towards this Scenario

The explosion of the online market and usage of augmented reality- and artificial intelligence-enabled devices are the driving forces that lead to this quadrant. Trading online information as a means to increase competitiveness in the market is also an important driving force behind this quadrant.

3 Factors Driving away from This Scenario

Factors driving away from this scenario are the need towards keeping the market close to its traditional form with less emphasis on the online market, trading online information, and new forms of currencies. There is also another factor that could drive us away from this foreseen future, and that is when general public is not ready to accept using artificially intelligent products in the course of everyday life. It might happen that even in the future, the general public will find augmented reality- and artificial intelligence-enabled devices too freaky to use.

4 Narrative

Person: Female, 25 years old, 3D designer, operates online.

Person: Male, 27 years old, insurance risk analyst, available online.

Person: Male, 22 years old, journalist, available globally.

Android: Female, 3rd generation, beta model companion, leased.

It is 11 o'clock in the morning and Jill has her second espresso and discusses her new design with a friend. She has made a handy tool that allows for companies to give away a nice present while still leaving enough surface area for company logos, etc. She hopes that this time there will be companies who use her designs in their Christmas gift package. Her 3D printer has made various examples in different colours, sizes, and styles, and she hopes that using them in real life will teach her which ones are the most practical. She has been at this point before: every time she holds the first hard copy of a new design she wonders where it will bring her, dreaming of a world-wide success and maybe a prize in the online design community competitions.

Jill's work as a freelance design specialist, combined with her evening job in a fast-food restaurant, gives her the possibility to keep on dreaming about the big success that might bring her the fame and fortune that everybody in her generation is looking for. She was pretty good in school, enjoying the work done with people from other countries in small groups, often winning in her class, sometimes even winning district competitions and once making it to a presentation at the national level when she was 12. Useful object design has always been what she did best. A friend, however, usually does the colours. Her friend cannot help her anymore because he has started to work for a large Indian manufacturer on an exclusive basis. She hopes that the potential customers will appreciate the "roll-your-own" colour and function kit she has added with the design. When she made a "roll-your-own" toolkit for free download last year, she got a lot of good comments and hopes that with what she learned from the comments she can now make money.

When she sells her work she gets paid in a cooperative currency.

Jill's boyfriend !mbala is a self-employed actuator, evangelist, analyst and risk assessor working for insurance companies. Insurance companies come to him with assignment offers that he rejects or accepts from an online job market. When he does not get an offer that suits him, he searches open offers also available on the job market. His reputation score given to him by previous customers and employers helps him to qualify for complex and demanding but high paying short-term tasks that pay reasonably well.

Both Jill and !mbala enjoy the freedom that this Internet-based job market offers to them. They are young and like to pick up challenging tasks but do not want to link themselves to a specific employer. With this job market, they are able to get maximum benefit from their skills and qualifications.

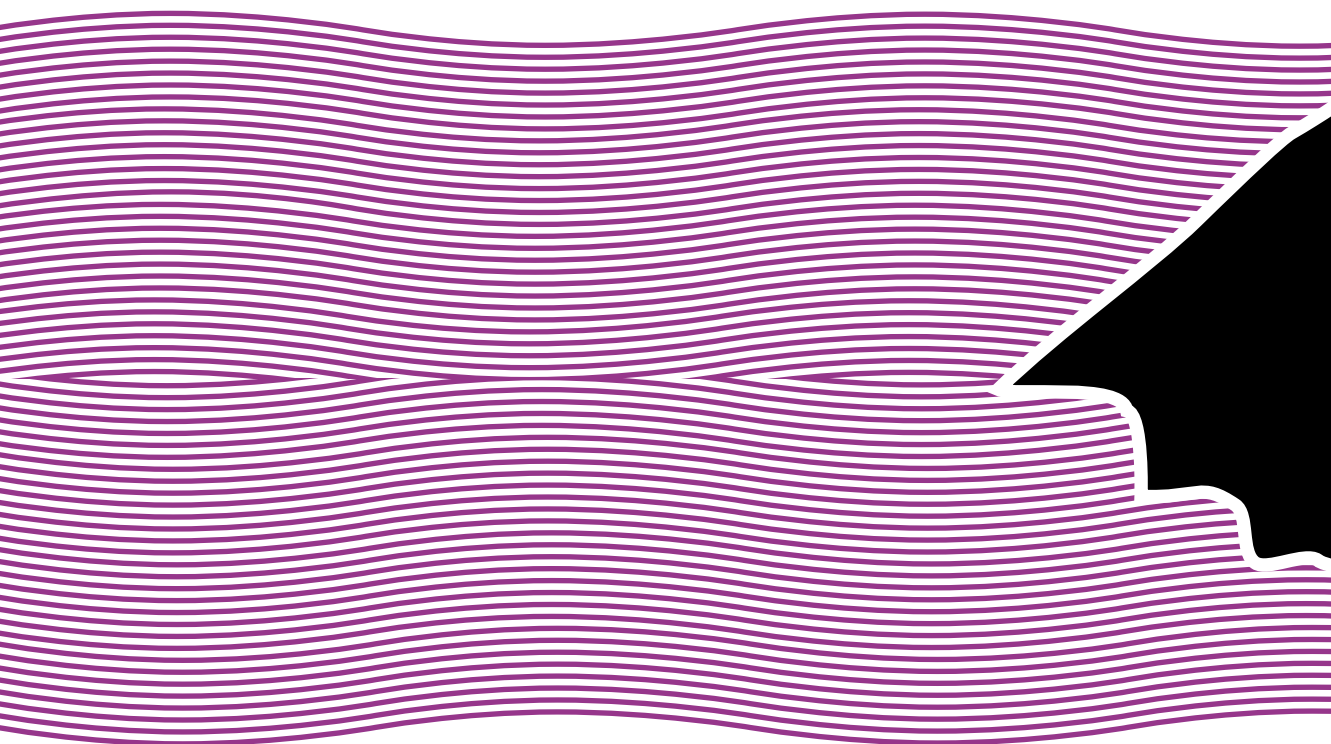
!mbala used to be her cloud-mate, the post-social media network that is generated by the government-controlled public cloud, and he became her real boyfriend. Practically all people have an avatar in the public cloud and many also manifest in various commercial social clouds where more services are available at a cost.

A large part of life in 2025 takes place in these clouds. People meet, greet, enjoy, and self-actualize online. The clouds provide automatic suggestions for interests, activities, friends, and relationships based on their profile and activity history. Most people have already paid cloud providers.

To sell their products, they go to parties and meet-ups. With their latest edition of Google AR lenses, they do not need to talk to all people to find potential customers. Instead, while looking at people through their glasses, they can see their cloud profile and get informed about their interests. Jill and !mbala have bought access to the cloud through providing some of their information.

Using Google as a broker for personal and professional information has become commonplace, and sometimes the blog articles of !mbala have gained some attention, but not as much as the videos made by his brother Pekka. Pekka is able to finance his trip around the world by making short reports about the places that he visits. For every product placement that he does, he is rewarded with free goods and sometimes even money. Pekka takes advantage of the recent trend of having semi-robotic pets. Programming them he is able to use his personal owl to utilize it as a flying camera capturing photos and videos of the places he visits. When he is not at home, his pets are monitoring his house.

When Pekka is at home, !mbala uses his owl to monitor the behaviour of his latest project: a semi-autonomous Taiwanese android, the latest companion package leased from HTC. !mbala is very lucky to be one of the first people to partake in the user tests of these types of machines. The Anastasia companion is a recent development linking robotics technology with the clouds. Via the clouds, the androids are able to operate semi-independently and can perform simple tasks in the house, like vacuuming and the garden. With the Google driver function, Anastasia is even able to go to the local store and shop for daily groceries.





Appendices

1 The Bit Bang People

Management



Neuvo, Yrjö – Bit Bang and MIDE Leader Professor and Research Director. Ph.D. in Electrical Engineering from Cornell University. He is former CTO of Nokia Corporation. He has been National Research professor at Academy of Finland and visiting professor at University of California, Santa Barbara.



Ylönen, Sami – MIDE Project Manager Dr.Tech., in Automation Technology from Helsinki University of Technology.



Karvonen, Elina – MIDE Project Coordinator MSocSci from University of Jyväskylä. Major in Political Science. Also studied in University of Latvia and in Aleksanteri Institute's Master's School in Russian and Eastern European Studies. Has worked abroad with e.g. export promotion.

Tutors



Buda, Andrea – Researcher and doctoral candidate in the department of Engineering Design and Production. Project Manager for the CAD/CAM/CAE Group. Currently working on Simulation Driven Product Development and Simulation Lifecycle. Has M.Sc. in Computer Science from University of Milan.



Grišakov, Kristi – A PhD researcher in the Aalto University School of Engineering, Department of Architecture. Works in the Centre for Urban and Regional Planning. B.A. in Art History and M.A in European Urban Cultures. Current research topic is looking into the use of digital tools in the process of planning border-crossing regions of Europe, in particular Helsinki and Tallinn. Scientific interests also include Future Studies, specifically scenario planning for urban areas. Additionally to running courses in Aalto University, is also coordinating a master course in Estonian Academy of Arts, Department of Architecture.



Kiravuo, Timo – Researcher in Aalto ELEC/ComNet, working on the security of large Ethernet based networks. Has M.Sc. in Computer Science from TKK and has previously worked as a teacher of data communications and security technologies at TKK, and as a security consultant, Internet specialist, systems administrator etc. at Nixu Ltd.



Kuikka, Meri – Social media researcher, doctoral candidate in Information Systems Science. MSc (Information Service Management) and BSc (Business Technology) from Aalto School of Economics. Current research themes include social media strategy for organizational use and challenges related to technology adoption in organizations.

Participants



Ahmed, Abu Shohel – Bangladeshi, MSc in Computer Science and Engineering from Aalto University. PhD thesis topic: Security issues in Telecommunication Clouds, focusing on bringing new value in telecommunication clouds and related security challenges. Interests: Technology review, ideation, running, cycling, and travel.



Arianfar, Somaya – Iranian, PhD candidate in Aalto university, department of communication and networking. Working in the area of future Internet, more specifically on data-centric networks. Master's degree in "Telematics & Information security" from NTNU, Norway. Hobbies include swimming, long nature walks and reading.



Best-Dunkley, Andrew – British/Finnish, MFA. Research topic: Social Empowerment through interaction with media art works. Other interests: Sailing, Building things, Family, Snowboarding, Playing guitar & electronic music, Politics.



Costa, Mário Jorge – Portuguese, M.Sc. in Communications Engineering, PhD student at the Department of Signal Processing and Acoustics. Thesis topic: Signal processing for arbitrary array configurations and wavefield modeling. Interests/Hobbies: Reading, playing guitar, sports, photography.



Deng, Yang – Chinese, M.Sc. in Computer Science, PhD candidate in the department of Computer Science and Engineering. Thesis topic: Building Internet of Things by CoAP. Interests: reading, classical music, football.



Grönvall, John – Finnish, M.Sc., B.Sc. In progress: Cum Laude in Pedagogy. Field of research: Media and Communications, e-democracy. Other interests: Jazz playing, sports.



Halonen, Raisa – Finnish, MSc in Graphic Arts Technology. Doctoral Candidate at Visual Media Research Group, Dept. of Media Technology. Research focus: Subjective high-level image quality. Hobbies: floorball goalie.



Hielkema, Hendrik – Dutch, MSc Business Technology. Research topic: Information Systems Science and User Driven Innovation. Other interests: Future Internet Research and Experimentation utilizing the User as both the beneficiary and the driver of Innovation.



Hoque, Mohammad Ashraful – Bangladeshi, Master of Science. Research Topic: Energy Efficiency in End-to-End mobile communication. Other Interests: Travelling, Reading.



Hossain, Mokter – Bangladeshi, MBA and Master's Int. Business. PhD student at the Department of Industrial Engineering and Management. Thesis topic: Open Source Idea Generation for Innovation - Users' Motivation to Contribute in Online Platforms. Interests: Travelling and Reading.



Kallenbach, Jan – German, M.Sc. in Media Technology, Postgraduate in the Department of Media Technology. Thesis topic: User experience of interactive media psychophysiological methods. Interests: Programming, wine, foreign cultures, travelling.



Khan, Suleiman Ali – Pakistani, EuMI - European Masters in Life Sciences Informatics from Universities of Edinburgh/Trento. Research topic: Statistical Machine Learning and Bioinformatics. Other interests: Travelling, Swimming.



Kivisaari, Pyry – Finnish, MSc. in Electrical Engineering at Aalto in 2010 (Major: Electrophysics, Minor: Computational Science). Research topic: Computational Modeling of Highly Efficient Optoelectronic Devices. Other interests: Music (especially singing in choirs, vocal groups and solo), reading, fishing.



Litvinova, Evgenia – Russian, PhD candidate at School of Science, Department of Media Technology. Received MSc from University of Eastern Finland in 2011. Field of research: engaging end users in creating rules for smart spaces. Research interests are user interfaces, end user development, usability and user experience.



Looga, Vilen – Estonian, MSc., Tech. Doctoral studies topic: Cloud computing on mobile ad hoc networks.



Mitts, Håkan – Finnish, Lic. Tech (CSE). Research topic: Using consumer-generated images to enhance B-2-C services, especially of small, labour intensive companies. Free-lance marine journalist/photographer, spending time in the Finnish archipelago with or without a boat.



Muktan, Gautam Raj – Nepalese, M.Sc.(Tech) Communications Engineering. Field of study: Networking Technology with minor in Network Economics. Research topic: Resource Sharing principles in Internet transport, trying to optimize transport protocols for improved user experience and more energy savings. Other interests include technology related stuffs, music & capoeira.



Mäkinen, Olli – Finnish, M.Sc. in Computer Science (Telecommunications Management). Researching mobile social media services and their business models, as well as their impact on the consumption of traditional mobile services. Other interests: Interests include running, swimming and photography.



Reya, Lionel – Cameroonian, B.Eng., EVTEK. M.Sc. (Tech) Aalto, 2010. Thesis topic: 4G Technology Features & Evolution towards IMT-Advanced. Research Scientist and Doctoral studies at COMNET, Aalto. Research: Future Mobile Communication Solutions for Emerging markets. Interests: Soccer, technology, music, walking.



Ritola, Tuomas – Finnish, M.Sc. in Mechanical Engineering, post-grad in Department of Engineering Design and Production. Thesis topic: Facilitating Business Model Design in Product Development Process. Interests: Playing drums and trying to play various other instruments; collecting instruments; jogging and swimming; good music and interesting people.



Saarikko, Petri – Finnish, MA in New Media. PhD topic deals with the combination of physical location, mobile information and social practices, establishing a framework for research question: How-to design rich and meaningful context? Other interests: Basil, visual arts, meditation.



Soliman, Wael – Egyptian, M.Sc.(Econ). From Hanken School of Economics, PhD Student in Aalto School of Economics (Information Systems Science), Project Manager at CKIR (Centre for Knowledge and Innovation Research). Research interest: E-Government and Open Innovation. Other interests include scuba diving, squash and biking among other things.



Visala, Kari – Finnish, M.Sc. in Computer Science from Tampere University of Technology. Currently a PhD student at Aalto University. Research topic: Inter-domain issues in Data-centric Networking. A European 4 dan go player, ran the Helsinki City Marathon in 2011.



Vu Hoang, Nam – Vietnamese, M.Sc. Information Systems, Moscow Engineering Physics Institute (State University). PhD student in Computer Science. Thesis topic: Linked Data in building information management. Other interests: Photography, music, sport, books, business.



Warma, Henna – Finnish, M.Sc. (Tech.). Field of Study: Network Economics, Supplementary field: Systems Analysis. Research topic: Socio-economic Analysis of Multipath Protocols in the Internet. Other interests: Sailing, scouting, scuba diving and all kinds of sporty activities.

2 Bit Bang Guest Lecturers

Autumn 2011–Spring 2012

Aaltonen Petri, Partner, Perfecto Ltd

“Team Cooperation and Scenario Building”

Bilardello Giuseppe, Senior Vice President, Research & Development, KONE Plc

Chunarkar Sumedh, Head of Human Resources; **Parthsarathy Hariprasad**,
Business Relationship Manager, TATA Consultancy Services Ltd
“NextGen Internet”

Eskelinen Jarmo, CEO, Forum Virium
“Smart Cities”

Hurri Pasi, CEO, BaseN Ltd
“Redefining Hardware, Software - and the Cloud”

Kiravuo Timo, Researcher, Department of Communications and Networking,
Aalto University
“What is Internet?”

Kähkönen Matti, President and CEO, Metso Plc

Lipiäinen Juho, COO, DigiEcoCity Ltd

Lundström Petra, Vice President, Solar Business Development, Fortum Plc
“Solar Energy and the Future Energy System”

Lämsipuro Yrjö, Vice President, ISOC Finland
“Internet Governance”

Mehtälä Markku, CEO, Meontrust Inc
“Passwords, Privacy & Better Business”

Ormala Erkki, Vice President, Nokia Plc
“Can Europe’s ICT Industry Survive in the Context of the Internet Revolution?”

Paajanen Reijo, CEO, Tivit Ltd

Pöllänen Ossi, Senior Consultant, Nokia Siemens Networks Ltd
“Managing the Wireless Traffic Explosion”

Sulonen Reijo, Professor, Aalto University / Ajelo Ltd
“Bit Powered Transport Revolution”

Öistämö Kai, Executive Vice President, Chief Development Officer, Nokia Plc

3 Course Literature

Bit Bang I. Rays to the Future. Yrjö Neuvo & Sami Ylönen (eds.) 2009.

Bit Bang II. Energising Innovation, Innovating Energy. Yrjö Neuvo & Sami Ylönen (eds.) 2010.

Bit Bang III. Entrepreneurship and Services. Yrjö Neuvo & Sami Ylönen (eds.) 2011.

Karlson, Bo et al. (2003) Wireless Foresight. Scenarios of the mobile world in 2015. Chichester, West Sussex: John Wiley & Sons.

Jurvansuu, Marko (2011) Roadmap to a Ubiquitous World. Where the difference between real and virtual is blurred. VTT Research Notes 2574. VTT Technical Research Centre of Finland.

Palfrey, John; Gasser, Urs (2008) Born Digital. Understanding the first generation of digital natives. New York: Basic Books.

4 Study Programme in Tokyo

January 28th – February 4th 2012

Saturday, January 28th

15:20 Meeting at the Helsinki-Vantaa Airport

17:20 Finnair flight AY073 Helsinki – Tokyo

Sunday, January 29th

10:00 Arrival in Tokyo Narita Airport

12:00 Arrival at Hotel Shinagawa Prince

10-30 Takanawa 4-chome, Minato-ku, Tokyo

16:00 Late lunch and get-together at Hokkaido Shinagawa Intercity

Shinagawa Intercity Shop & Restaurant 5F, 2-15-2 Kounan, Minato-Ku, Tokyo 108-0075,

www.hokkaido-aji.com/shop/shop251

Monday, January 30th

7:20 Departure from the hotel

9:30 Meeting with Mr. Hiroaki Nishino, General Manager, Robot Technology Department at Kokoro Ltd.

4-9-1 Shinmeidai Hamura-shi, Tokyo 205-8556

www.kokoro-dreams.co.jp/english

14:00 Tour at the Metropolitan Area Outer Underground Discharge Channel

720 Kamikanasaki, Kasukabe city, Saitama 344-0111

www.ktr.mlit.go.jp/edogawa/project/gaikaku

17:00 Finpro presentation by Mr. Masahiro Kimura, Senior Consultant at Finpro Japan

TKP Shinagawa Conference Center, 3-13-1 Takanawawa, Minato-ku

Tuesday, January 31st

08:20 Departure from the hotel

10:30 Meeting with Mr. Yutaka Kobayashi, Acting Manager in the Planning Section, Taisei Construction Ltd

344-1 Nase-cho Totsuka-ku, Yokohama, Kanagawa 245-0051

http://www.aisei.co.jp/english

14:30 Meeting with Mr. Kenichi Noda, Deputy General Manager at Toshiba Science Museum

1 Komukai Toshiba-Cho, Saiwai-Ku, Kawasaki 212-8582

<http://museum.toshiba.co.jp>

17:00 Arrival at the hotel

Wednesday, February 1st

7:20 Departure from the hotel

9:30 Meeting with Mr. Seizo Onoe, Senior Vice President and Managing Director of R&D Strategy Department and Mr. Takehiro Nakamura, Director of Radio Access Network Development Department at NTT DoCoMo R&D

Yokosuka Research Park, 3-5 Hikarinooka Yokosuka-shi, Kanagawa

www.nttdocomo.co.jp/english/corporate

www.yrp.co.jp/en/yrp_story_en.html

12:00 Lunch at Yokosuka Research Park

www.yrp.co.jp/en/yrp/shop/restaurant.html

13:00 Departure to Fujitsu

15:00 Meeting with Mr. Osamu Tanaka, Vice President, Global Business Group and Mr. Shin Nakajima, Global Business Group at Fujitsu

1-3-1 Miyuki Building 1st floor, Uchisaiwaichou Chiyoda-ku Tokyo

jp.fujitsu.com/showrooms/netcommunity/en

17:30 Arrival at the hotel

Thursday, February 2nd

8:35 Departure from the hotel

9:30 Meeting with professor Junichi Iijima, Department of Industrial Engineering and Management at the Tokyo Institute of Technology

Ookayama campus, 2-12-1, Ookayama, Meguro-ku, Tokyo

www.titech.ac.jp/english

12:30 Lunch with Japanese students

14:30 Tour at Advanced Technology Exhibition Hall TEPIA

2-8-44 Kita Aoyama, Minato-ku, Tokyo 107-0061

www.tepia.jp

16:30 Tour at Honda showroom
2-1-1 Minamiaoyama Minatoku Tokyo 107-8556
www.honda.co.jp/welcome-plaza/guide/asimo

18:00 Arrival at the hotel

Friday, February 3rd

8:35 Departure from the hotel

9:20 Meeting with Mr. Kiyohito Nagata, Senior Vice President and Managing Director
at the Strategic Marketing Department at NTT DoCoMo
Sannou Park Tower 27th floor, 2-11-1 Nagata-chou Chiyoda-ku Tokyo 100-6150

12:00 Lunch at Ginza Lion Sannou Parktower
Sannou Park Tower B1

14:00 Tour at Sony Exhibition room
5-3-1 Ginza Chuo-ku Tokyo 104-0061
www.sony.net/SonyInfo/CorporateInfo
www.sonybuilding.jp/e

16:30 Tour at an exhibition Internet Art Future – Reality in Post Internet Era at NTT
Internet Communication Center
Tokyo Opera City Tower 4F, 3-20-2 Nishishinjuku, Shinjuku-ku, Tokyo 163-1404
www.tokyoartbeat.com/event/2012/6357

18:30 Closing dinner
Restaurant Songoku at Hotel Shinagawa Prince

Saturday, February 4th

7:50 Departure to the Tokyo Narita Airport

12:00 Finnair flight AY074 Tokyo – Helsinki

15:20 Arrival at Helsinki-Vantaa Airport

Contacts Finpro Japan

Mr. Masahiro Kimura, Senior Consultant

Ms. Maki Shoji, Market Analyst

Ms. Aiko Furusawa, Commercial Assistant

5 Tokyo Study Tour Reports

Summary of the visits in January 30th – February 3rd, 2012

Monday, January 30th

Kokoro Ltd

The main business focus of Kokoro animatronics and robot company is on custom designed exhibition robots exhibited widely in museums and theme parks. The company delivers commercial products but also provides a selection of robots for rental purposes. Another branch of Kokoro's activities focus on human like humanoid robots such as actroids which design principles are inspired by the skin and surface qualities rather than mechanical skeletons. Kokoro's approach is unique as it attempts to approach anthropomorphic man machine design from aesthetic point of view. Humanoid robot designs convey human like qualities without acknowledging their uncanny human similarities. Even Kokoro humanoids appear inhumane the company acknowledge their essence as research instruments but as well opinion makers and popular culture items. Besides, they have plan to improve the performance of the humanoid by adding more facing expressions in near future. There are only few other companies in the world that are able to deliver Kokoro's level of craftsmanship. The courage to go beyond conventional western style industrial robot design is unique for Japanese robotics.

During our visit company Kokoro's chief marketing manager presented the company's extensive product portfolio covering animatronic and robotic products ranging from commercial assignments such as one ton T-Rex Jurassic Park dinosaurs to humanoid robot research and development projects. We witnessed a live demonstration of 1:1 size remotely operated T-Rex dinosaur which pneumatically operated skeleton and multimedia devices had been engineered and seamlessly encapsulated into life like skin by the Kokoro's art department.

Kokoro's humanoid robotics is deeply R&D oriented due to complex modeling of the human form. Kokoro has been collaborating with the National History Museum in London. Company's image seemed a bit outdated and the premises visited slightly dusty. It's business regarding the current economic downturn may have influenced its business and R&D activities. Company employs currently some 50 people producing large scale animatronic robots Dinosaurs, weighting up to one ton. Kokoro ltd is owned by the Sanrio Group which owns brands such as Hello Kitty.

Metropolitan Area Underground Water Discharge Channel in Kasukabe

On the afternoon of Monday 30th January we have visited the Kasukabe's Metropolitan Area Underground Water Discharge Channel. As it comes from the name, there was not much to see on the ground, only a small reception/administration building and a football field. The magical infrastructure itself is laid under the football field and its surrounding areas.

We took 116 stairs under the ground to reach the water regulation area (water tank) with 177m length, 25.4m width, and 70m height. Once downstairs the infrastructure seemed huge and impressive. 59 big cement columns each weighting 500 tones hold up the roof inside the water tank. The cost of building this project has been around 2.3 billion Euros.

A few number of rivers are connected to this water regulation tank to prevent the flood. The water from each river can get to the water tank trough a big silo of size 65m*32m and a wide tunnel beneath the silo that connects the silo to the water tank. Usually the water from a river only gets to the water tank if the silo gets filled. In this case the pressure pushes the extra water towards the tank. Once the amount of the water in the water tank reaches a threshold level, big water pumps start to evacuate the water from the tank and regulate the water to other rivers by directing the water towards silos connected to other rivers. Two pumps of 10 MW can evacuate up to 200 tons of water per second from the water tank. This amount of water equals the water inside a normal size swimming pool. These main pus are actually modified aircraft engines.

After the water level in the water tank reduces, smaller water pumps are used to evacuate the tank and the silos completely. These smaller pumps can easily regulate up to 50 tones of water in one second.

The water has gone through the water tank over 9 times last year (2011). However, only 4 times the level of the water has reached the point that main pumps have started to work.

Tuesday, January 31st

Taisei Corporation Ltd, Technology Center

On Tuesday Morning we visited Taisei Construction Company. Taisei is a major construction company, at present they are the fourth largest Japanese construction company and in the top25 worldwide. They build things from roads to shopping malls to high rise buildings.

Annual turnover of the company is 1.2 trillion Yen (2011, company report), Total Assets at 31/3/2011 are 1,3 trillion Yen. Annual turnover is declining with 15 % from the previous year and has been declining for the past 4 years.

The visit was to the technology center, where we were shown various technologies:

- Technologies that are used in testing building materials, such as pressure and stretch resistance, resistance under heat, and durability.
- Environmental conditioning technologies to save energy and reduce CO2 emission, such as personalized (remote controlled) airconditioning, sunlight filtering sheets between window panes, air cooling through the floor and carpets, and isolating windows.
- Seismic Tremor Absorbing rubbers and springs under the building to reduce the effects and damages of earthquakes the building was lifted and placed on shock absorbing layers.

Toshiba Science Museum

Toshiba Science Museum¹ introduces the corporate history of technical innovation and offers hands-on experience with the latest technologies in the environment and energy fields, social infrastructure, and digital products. Toshiba Science Museum opened in 1961. As shown in the illustrating graph, the museum's main concept is to allow people to know Toshiba's corporate culture via two-way communication. The Museum offers hands-on experience with the latest technologies in the environment and energy fields, information and communication, social infrastructure, and digital products. The Science Museum is intended to be a hub of cultural exchange with local communities, a communication center for "touching" scientific technology, and a space where hopes for harmonious coexistence on the earth and dreams of the future are shared.

The Museum is divided into three floors: The first floor is dedicated to environment and energy exhibits. On this floor, visitors can experience very interesting inventions. For instance, Wheelie is a Self-Balancing two wheel robot that can detect objects and avoid stumbling into them. Wheelie runs on Toshiba's latest SCiB² (Super Charge Ion Battery) technology, which allows the robot to run for two hours and recharges in five minutes only.

1 For more information visit: <http://museum.toshiba.co.jp/index.html>

2 For more information visit: <http://www.scib.jp/en/>



Fig. 1. Wheelie runs on Toshiba's latest SCiB technology

The second floor is dedicated to the newest digital technologies. On this floor visitors see the latest Toshiba cutting edge technologies. For instance, different types of 3D displays, virtual gaming environments, a variety of solid state drives (SSD), and of course the latest computing devices (e.g. laptops, tablets, etc.).



Fig. 2. A 3D display at Toshiba Science Museum

The third floor presents Toshiba's history, including the most genius inventions. One of the items that had the most impact on us is the Perpetual Clock³. It is one of the most innovative pieces that combines art and design with skillful engineering. It is worth noting that this piece was completed in 1851. While the one that's shown in this floor is a replica, the original piece is exhibited national science museum.



Fig. 3. Perpetual Clock at Toshiba Science Museum

Wednesday, February 1st

NTT DoCoMo R&D Center, Yokosuka Research Park

On Wednesday, 1.2.2012, our group had an early wakeup for the visit to NTT Docomo R&D center at Yokosuka Research Park, about 15 km from Tokyo. The center hosts around 60 organizations from industry, academia, and government concentrating on radio/mobile telecommunication technologies with approximately 6000 employees in total. Facilities include, for example, labs for measurement, analysis, and evaluation of these technologies.

The day started at 9:30 in the presentation room with an introductory presentation by Seizo Onoe, Senior Vice President, Managing director of R&D Strategy Department. Subscriber migration from 2G (PDC) to 3G (W-CDMA) in Docomo started in 2001 and currently almost all of 60 million subscribers (47.5% market share of Japan) are using the 3G. LTE has also been recently launched and Docomo's strategy is to provide a better network than the main competitors SoftBank Mobile (22%) and KDDI (27.3%). The goal of Docomo's current strategy is the Harmonize, Evolve, Advance, Relate, Trust (HEART) 2020 vision with the idea of becoming an "integrated service company" as opposed to a "dumb pipe".

³ For more information visit: http://museum.toshiba.co.jp/toshiba_history/hisashige_tanaka/p01_3.html

After 10 o'clock we split into two groups for 4G demonstration and exhibition hall "WHARF". In the exhibition we were shown an augmented reality based experimental interface that was used by wearing stereo glasses, which showed 3D graphics on top of video camera input from the front of the glasses with an additional audio instructions. For example, a magazine cover was recognized from the image and overlaid with a 3d map in the same orientation with an avatar. The 2nd demo was a game played on large touch-screen tables, where the player played the role of the mayor of a city. The idea was to utilize population data collected from mobile network in the urban planning and, for example, in managing disasters. For example, an age distribution, gender, and movement of people can be collected in different areas of city without compromising the individual identities of subscribers. Third demo was about prior planned mobile products such as a bracelet that recognized rhythms to activate different home functions and a ring accessory as a mobile phone with Bluetooth audio and voice recognition interface. The audio of the device could be also heard by putting the finger in the ear and using the bone as the conductor of audio. Exhibition room had also an Emmy award for contribution to H.264/MPEG-4 AVC standardization adopted, for example, for blueray technology. Also a real-time multimedia broadcasting equipment supporting 3 Mbit/s high quality encoding was shown with a video feed from a camera outside. Fifth demo demonstrated intra-body communication via body network between headphones and a phone.

In the lab we were shown a live demonstration of LTE-advanced, 4G technology supporting 1 Gbps peak throughput with 100MHz bandwidth and downward compatible with the current LTE both in terminals and mobile stations. In the demonstration two mobile stations in racks were connected to a base station and all the antennas were installed in the same room. Multiple HD video streams from 6 stereo cameras forming a full panoramic view were relayed in the demonstration and the screen showed the actual throughput in real-time. The technology also supports carrier aggregation. A question was raised about the applications for such bandwidth, to which the response was that the speed must come first and the applications will follow. HD video is also expected to become more and more popular in the future posing significant challenges for networks. This forth generation technology will be deployed around 2015.

The last demonstration was a cloud-based service that automatically translated calls from one terminal to another between two languages. The speech was first transformed into text, then the translation performed, and voice synthesis used to produce the audio sent to the receiving terminal. The demo had some glitches and it seems that the speech recognition and translation remain as difficult problems in practice. After the tour we convened back in the meeting room for a presentation. Docomo has research facilities in Japan, China, Europe, and US and the main activities are structured under service, network infrastructure, and device areas. We were explained the history of 3G standardization wars and explained that W-CDMA → HSPA and

CDMA2000 → EV-DO will converge to LTE. LTE deployment will cover major cities this year, march 2013 70% or more of the country and 2015 almost everywhere. In the end, the field experiments to test the LTE-advanced with a car and mobile stations positioned in the city were explained. A question was raised about the 4g deployment in developing countries, and the answer was that some countries could skip 3G and move directly to 4G. Another question was related to open innovation in NTT Docomo and the answer was that good technologies are constantly searched from outside the house. After the brief Q&A session the parties exchanged some gifts and we left for a lunch at Rose café.

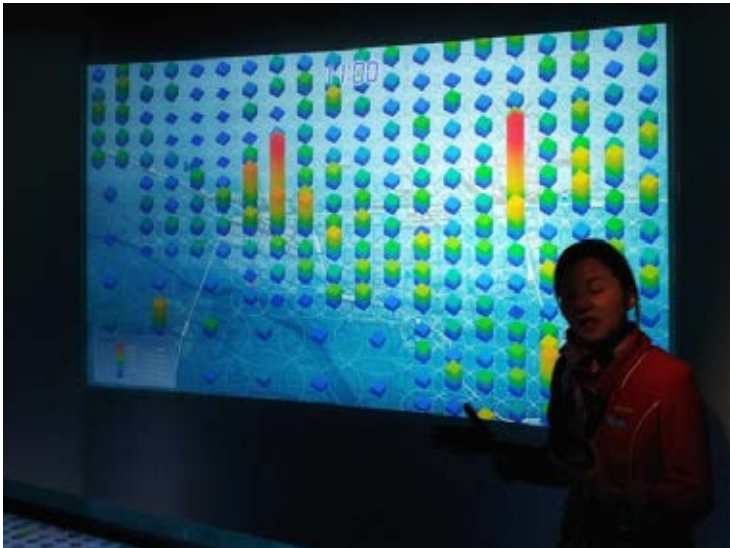


Fig. 4. Urban planning demonstration with anonymized mobile subscriber data



Fig. 5. Docomo formula used for 300km/h experiments for bullet trains in the lobby

Fujitsu

We arrived the Fujitsu building 15 minutes before the official program was supposed to start. Just as in some of the companies we had visited earlier in the week, our hosts were well prepared to welcome us. There was a Japanese and Finish flag on display next to each other at the reception area.

After the initial greetings and few minutes to get settled and relaxed, Mr. Nakajima officially welcomed us to their establishment and asked how we were enjoying our stay in Japan so far. He then continued by presenting the day's programme. We were then split into three pre-assigned groups for a 3 x 20 minutes tour of the facility so as to ensure each one gets a better chance of appreciating and even trying some of the fantastic products on display. However, before the groups began touring the facility, Mr. Nakajima introduced his boss who briefly presented the company and its core business. He said the company was established in 1935 with headquarters in Tokyo and is a technology-based ICT company. He continued by elaborating on some of the key areas of the company which included technology solutions as well as device solutions with the goal of pursuing a human-centric intelligent society as the demos will later show.

Next, to our great astonishment, we were privileged to watch the latest commercial video of the company and guess where the video had been filmed? FINLAND! This drew a round of applause at the end from the audience. Following this was another short video of the company's President Mr. Masami Yamamoto who discussed briefly the company's vision emphasizing once more on the human-centric ICT to support the move towards an Intelligent Society. The key phrase here was: "Shaping Tomorrow with You". The groups finally separated to begin touring the different exhibitions that had been set up. I was in group 3, led by Elina, the Bit Bang 4 course coordinator.

The first exhibition we saw was about "A Healthy Lifestyle" whereby a person's health habit can be remotely monitored and data stored for future reference. With the collected data, health information and advice can be sent to the person. Also, by wearing a device on his/her wrist, the person's vital signs like blood pressure and heart beat can be constantly monitored and an emergency call can be activated if the person suddenly has a heart attack or similar effects.

Next was the Media Cloud space where we were introduced to a system which uses face pixilation to identify persons. It can also be used to count how many people have come IN or OUT of a building. In addition, it could be used to generate an alert if an item is left unattended for a certain amount of time. After about 10 seconds, a snapshot of the item is captured and a picture of whoever left the item or comes to collect it is also captured, in case further investigation is required.

We then saw the IP-9500 real-time HD video transmitter and a short demonstration carried out and a clear view of the seats in a stadium located a few kilometers away showed the capabilities of the system. Next was the Plasma tube array which was a curved video screen comprising of 1m square sections and it could be place around objects or furniture at home. The cost of each 1 m square section was estimated at about 30,000€ Our group then saw a demonstration of a paper-based

encryption technology which could be used for secure bank transactions and sending other sensitive information securely.

All three groups met again in the conference room for one final presentation of Fujitsu's Supercomputer development, which is one of their flagship products for the future. This was closely followed by a lively Q & A session. The visit ended shortly after that and each of us was handed a nice bag with the company logo containing brochures of some of the products on exhibit as well as some small items like a notebook and pen.

Thursday, February 2nd

Tokyo Institute of Technology

On Thursday morning we went to visit the Tokyo Institute of Technology, Graduate School of Decision Science and Technology. We were hosted with a warm hospitality by Prof. Junichi Iijima [1]. In the beginning of the visit we were invited to see the new university library [2] opened in June 2011. The old library was currently being torn down due to damages caused by the earthquake in March 2011.

The new university library design was simple and heavily basing on concrete but it was still very impressive and functional. It was designed by the university's own professor of architecture and it had functioning study facilities, group work rooms, and reading rooms with a good choice of journals. A reading room with the most important popular scientific journals (e.g. Nature, Science, New Scientist) would be very good and inspiring for the students of Otaniemi as well, maybe in connection to a cafeteria. We feel that currently something like that is missing.

The journal collection in the underground level was very impressive with all the printed journals in a good order in electronically controllable shelves. We wondered how so much effort was put to the paper-form journal collection now at the time of electronic archiving but inferred that maybe scientific knowledge is one of the things worth archiving in paper form as well worldwide. In addition, the library was equipped with 30 kW solar panels. The cherry trees on the university yard surely look fantastic during the cherry blossom time.



1.



2.



3.



4.



5.



6.

Apparently the university library was only for members of the university. In this aspect the Finnish university library system definitely makes its mark, because here everyone is allowed to use the university library services. This increases the educational and societal impact of the universities on the whole, which is a very important task of universities in the long run.

After seeing the university library we made a research exchange with students of the graduate school in the form of a seminar. Fall semester groups of the Bit Bang course presented their works from the fall as 10-minute talks, which gained a lot of interest from participating students and professors [3].

Three graduate students of the Tokyo institute of technology also gave talks. The first talk was by Yuri Yoshida and it was entitled “Scale in post-war art history”. The talk was about his work on

the use of scales in modern, mainly abstract visual art, concentrating especially on works by Barnett Newman. The second talk was given by Tang Jing and surprisingly, it was entitled “Operational models redesign in Finnish Healthcare systems” [4]. It was about challenges that the Finnish so far effective healthcare system is facing in the future. The last talk was by Jader Zelaya with the title “In search of a grand theory of knowledge management”. The goal was to provide a comprehensive framework on knowledge management and its effects in all kinds of businesses.

Our warm-hearted visit to the Tokyo Institute of Technology Graduate school of decision science and technology ended with lunch from traditional “Bento” lunch boxes [5], a quiz about Japanese culture, and exchanging contact information for possible future collaborations [6]. As discussing with the university staff, we also heard about one interesting thing in the Japanese mobile phone market that was also discussed in a great detail in Friday’s presentation at NTT Docomo, namely the competition between the American Apple and the Japanese NTT Docomo. It turned out that in Japan people mainly choose between using Apple’s phones and not using Docomo’s services or using Android phones and Docomo’s services. It will be interesting to see how operators like Docomo keep their place in the mobile service market in the future.

TEPIA

In its own words, TEPIA describes itself with the following words: “Advanced Technology Exhibition Hall @ TEPIA’ is an exhibition facility that clearly introduces advanced technology and progress of human lifestyle and society. ... Based on the common theme ‘For a Brighter Tomorrow. Japanese Advanced Technology Leading the World’, the exhibition focuses on advanced technology and products that highlight Japan’s efforts, mainly in the areas of information communications, health and medicine, and environment and energy, as they gain worldwide attention.” Based on this, one could compare TEPIA with the Finnish Heureka science centre as its technology-cantered counterpoint in Tokyo, although TEPIA was more like a trade show than a museum - each exhibit was for a particular company’s product.

Japan has many technology museums and exhibition centres for public, and it is interesting to compare these with each other. We can e.g. Compare TEPIA to TOSHIBA museum which we visited on Tuesday. One important factor about TOSHIBA museum was that it binds the history of TOSHIBA products with their future, while TEPIA is more on showcasing current products on several themes. In both cases, there was a lack of written description or hand-out for the visitors.

TEPIA felt like an important place for increasing everybody’s awareness of current trends in technology, despite the fact that the Japanese writing in the exhibition hall made it difficult to understand in which viewpoint and depth different technologies were presented. However, it felt like technology could have been presented to



1. Robot “Wakamaru”



2. Age estimation technology



3. Seismic isolation air



4. Paper recycling solution

the public in somewhat more depth both in terms of the technology and societal and behavioural impact. Whatever the reason for this, we would like the possible technology information centre of any European country to be more descriptive, open, and discussion-evoking.

The main exhibition hall of TEPIA consisted of five different sectors:

- Communications in Our Lives [1] [2]
- Health and Medical Care
- Cities and Mobility [3]
- Environment and Energy/Resources [4]
- A Small World and High Performance Materials



5. Video library

For example, sector 1 was showing a Toshiba 3D TV without the need of using 3D glasses, section 2 was showing a potential system for restoring brain-nerve connection system after an injury, and section 4 was showing solar cells and a machine for making toilet paper from shredded office paper. And of course, as in almost all the other places we visited, there was a cute moving “Wakamaru” robot in the lobby of TEPIA greeting visitors [1]. Exam-

ples of products for disabled people were particularly nice, for example the wheelchair user’s motortrike.

In the second floor there was the video centre of TEPIA with the possibility of watching different videos about technology issues and development [5]. Many of the videos seemed to be very well-made and interesting, and most importantly, they can be found online for anyone interested in <http://www.stream.tepia.jp/foreign.html>.

An interesting video about industry robot development called “The 4th Robot Award” was shown to all of us, and it can also be found in the website.

At the end of the visit, 5 BitBang participants were interviewed about using high technologies in Finland. A summary of the interview can presumably be found at <http://www.tepia.jp/exhibition/interview/index.html>.

In total, the idea of TEPIA was extremely good, but we feel that a more detailed description of technological issues and factors would be of high importance.

Honda Showroom

Our last visit on Thursday afternoon was to showroom of Honda Motor Company Ltd., a Japanese public multinational corporation primarily known as a manufacturer of automobiles and motorcycles. This was unarguably one of the most awaited visits among our group because Honda has been the world’s largest motorcycle manu-

facturer since 1959. The family of one of our group members uses three motorcycles and all of them are produced by Honda in the same time. Another important reason is the ASIMO humanoid robot developed by Honda [1].

Before seeing the ASIMO robot we took a look of some of Honda's most well-known market products, namely cars and motorcycles [2]. And we have realized that Honda develops very various product lines for different markets: Japan, North America, Europe and Asia. For instance, some cars presented in the showroom are right-hand drive and much smaller than those models that we usually can see in Europe because average European people are higher than the local ones [3]. On other hand, all the presented motorcycles are referred to sport models and cruisers which are difficult to use in such countries like Malaysia, Vietnam or India [4].

We also could find out many Honda's state-of-the-art technologies, including innovative ideas for the ultimate in eco-friendly products, for example, household solar power generation systems and hydrogen-based fuel cell vehicles that emit no CO₂ [5].

The ASIMO presentation fulfilled our expectations and was one of the most fascinating experiences during our visit to Japan [6]. The name ASIMO stands for Advanced Steps in Innovative MObility. The ASIMO robot was walking, running, dancing, and making several kinds of movements with its hands. As we know, this robot is already able to climb stairs, making it able to move also in complex environments.

Connecting this robot's mechanical abilities to development of artificial intelligence (AI) raises a number of interesting questions. Current algorithms for machine learning already enable a very sophisticated way for machines to evolve based on their observations, offering a significant potential for the future of intelligent



1.



2.



3.



4.



5.

compared to ours in the Western countries. In Japan many companies make human-like robots, and people are very excited about robots. In Western cultures, on the other hand, we usually do not feel comfortable making human-like creatures and presenting them to people in exhibitions.

robotics. However, artificial self-awareness is still relatively far away, which still keeps ASIMO quite distant from human-like robots predicted in the science fiction literature. ASIMO is still something totally different than these sci-fi creatures but already raises thoughts about our relationship to human-like robots.

It was very interesting overall to see the Japanese people's different relation to robots



6.

Friday, February 3rd

The last day of the study tour was dedicated to marketing strategies of big corporations and Internet art, ending with a lively group dinner. The day comprised of visits to the NTT DoCoMo headquarters, the Sony showroom and the Internet Art Future Museum.

NTT DoCoMo Headquarters Guide: Tatami Askawa

A forty person fast lift took us to the 27th floor of the DoCoMo tower in approximately 12 seconds, where Senior Vice President of Strategic Marketing, Mr. Kiyohito Nagata received us. It was a pleasure to learn that Prof Yrjö who was in Nokia and Mr Nagata from DoCoMo played a key role in the success of the 3G infrastructure around the world. The visit included demonstrations of next (upcoming) and future technologies as well as a presentation of the marketing strategy of DoCoMo.

Demo of the Future Station: As an upcoming technology, DoCoMo is developing technologies to allow sensors to be easily added to mobile devices using phone jackets. DoCoMo demonstrated the use of hunger level and fat burning, blood alcohol content as well as radiation level jackets for existing smart phones using NFC. This technology could revolutionize the world of devices as it could potentially not only provide the required services but will also update the data directly to the cloud.

For future technologies, DoCoMo looks forward to a 3D virtual reality communication system. A prototype demonstration was provided with one active human participant. Seen together with DoCoMo's LTE-Advanced (under trial, see report of Wednesday) technology which could provide a throughput of up to 1Gbps and the existing 3D virtual reality prototype (though a bit bulky) the goal seems realizable.

Presentation and Discussion: DoCoMo's vision 2020 is to evolve by advancing, building relations and creating trust to achieve a harmonious telecom society. The marketing strategy of DoCoMo is twofold, one for competitors in Japan and other for contribution to global technological development. Inside Japan DoCoMo was and stands to be the largest telecom service provider with approximately 50% of the total user base. DoCoMo's competitors Softbank and KDDI have captured the iPhone market in Japan. DoCoMo has selected to use Android-based devices which allow it to provide smartphone users the same i-Mode services as DoCoMo currently provides for feature phones. Wallet facilities are provided using Sony's FeliCa RFID smart card technology. Given the iPhone's inability to incorporate the smart id at the moment, DoCoMo plans to avoid them in its marketing strategy. Q: Did the Android devices include Wallet? Most discussion was on iMode?

The Wallet facilities of DoCoMo set it apart from its competitors and are currently used by over 60% Japan's customer base at least once a week. The service allows users to use their mobile phone like a smart card for making payments in stores, train/metro ticketing, food order placement and payment (implemented in McDonalds across Japan) and for identification purposes.

With respect to feature phones, DoCoMo understands that the key desirable of Japanese market are waterproofing, television service and Wallet phone, in order of priority. In data services DoCoMo have a proved success record of achieving 100% coverage of WCDMA in five years and HSDPA 2.5 years, which allows is to target and build a marketing strategy for 75% LTE coverage till 2015.

The Japanese mobile subscription market is saturated and therefore DoCoMo needs to look for new businesses. One such attempt is the launch of new data-enabled PSP Vita by Sony with a DoCoMo pre-paid SIM-card. This trial resulted in DoCoMo creating 200,000 new customers in Japan in December 2011 alone.

DoCoMo's key focus from now onwards is to become an *integrated services* company. It was clearly evident that DoCoMo strives and plans to continue to be the best service provider in Japan.

On a global front DoCoMo's FeliCa technology is competed by the later developed NFC. DoCoMo plans to focus on FeliCa in Japan at the moment and cooperate on NFC deployment in the world with a smooth transition of Japanese customers to NFC as well. Adaptation of a common technology will make Wallet phone and related services available while on roaming. A key question is that who will lead the world to adaptation of NFC? DoCoMo has achieved the parallel in Japan already, while EU seems to lack the initiative and infrastructure.

DoCoMo had a very interesting approach to battle the 3rd party free VoIP service providers - a fixed Voice over LTE (VoLTE) package with unlimited calling within the DoCoMo network for around 7 dollars per month. As the LTE network loses the traditional circuit-switched voice calling features, moving into packet-based voice calling also saves resources on the operator side. Naturally, this is only feasible when the network is as huge as DoCoMo's (50% customer base), in a more operator-fragmented country it would not be as useful at all.

Key observations: Demonstration of 3D virtual reality, DoCoMo's role in internet and telecom advancement of the world. The fact that DoCoMo's network was overwhelmed and shut down for seven hours in parts of Japan due to overload demonstrates the sheer usage of data services by the Japanese masses.

Sony

Visit to Sony was unique in several ways, firstly it was a visit to a Sony showroom and store and no formal discussions took place. Secondly, Sony is a unique company that it develops both technology and content, therefore both were on display. Key highlights of the technology were Internet TV with a browser, Sony's ergonomically designed Android tablets and 3D technology. The Internet TV experience is slightly inferior to that provided by Samsung's Smart TV as it operates with a remote control instead of a mini QWERTY keyboard like Samsung. The experience from Samsung's RMC-QTD1 mini remote is still not optimal, and there exist room for a full sized wireless keyboard. The question is who does it first?

On the other hand Sony's new Android-based tablet S stands out as being ergonomically designed which is easier to hold in hand for longer periods of time and improved visual while resting on table. In contrast to iPad the tablet allows memory expansion using SD cards and USB devices. A smaller pocket tablet P which opens

up like a makeup box has also been launched. Like most other technology companies Sony also demonstrated their 3D technologies heavily, including 3D binoculars (capable of recording movies), 3D sky diving virtual experience and bicycle driving. Though the technologies are still away from being perfect and require 3D glasses but stand to be useable and appreciable. In contrast the glasses free technology by Toshiba seemed more plausible.

Sony's marketing strategy in the tower was interesting. Several games were laid out which required visiting specific technology showcases or using the technology physically to participate. Unfortunately the international sales office had only a few items, specifically lacking the new Sony Tablets. Also, the new Sony PSP Vita was not to be seen anywhere, although it was already launched last year in Japan.

Sony is in a rather difficult financial situation, making a big loss in the last quarter of 2011. The main culprit is the TV-business as well as an one-time write-off for an acquisition. The lack of a very compelling wow-effect in the Sony showroom does not bode too well for a quick turn-around in Sony's profitability.

Internet Art Future Museum

The last visit of the tour was to the Internet art museum in Shinjuku. The visit started with an armless clock, whose arms appeared only when standing at a specific spot, and were in the form of pictures of the standing person. The art works could be divided into two categories, ones where a specific art was created using Internet and/or technology while other being use of technological advancements to guide abstract art creation. The former included works like tele-present water, Sonar/Phototropic drawing devices by David Bowen, crowd sourced large sized drawing of a \$100 bill, a digital clock looking like a paper printed replica of a real clock nearby and others. The tele-present floating water replicated the exact movement of water waves of a buoy located 380km southwest of Honolulu based on recorded data. It would be interesting to see if a real time replica of water waves could be made in future.

The technology guided abstract art creation included base coupling of two optical mice which created random pattern of mouse movements, automatic keyboard typing with letter sizes reflecting the thinking process of the writer and projected story playing in the dark room. The visit concluded with a lifetime experience of Maria Anechoic room version 2010. The dramatic sound and bright light patterns started as a thrilling experience giving impression of high intensity explosions and laser fires on board a space mission. We must acknowledge that despite the high frequency waves the room was entirely echo free.

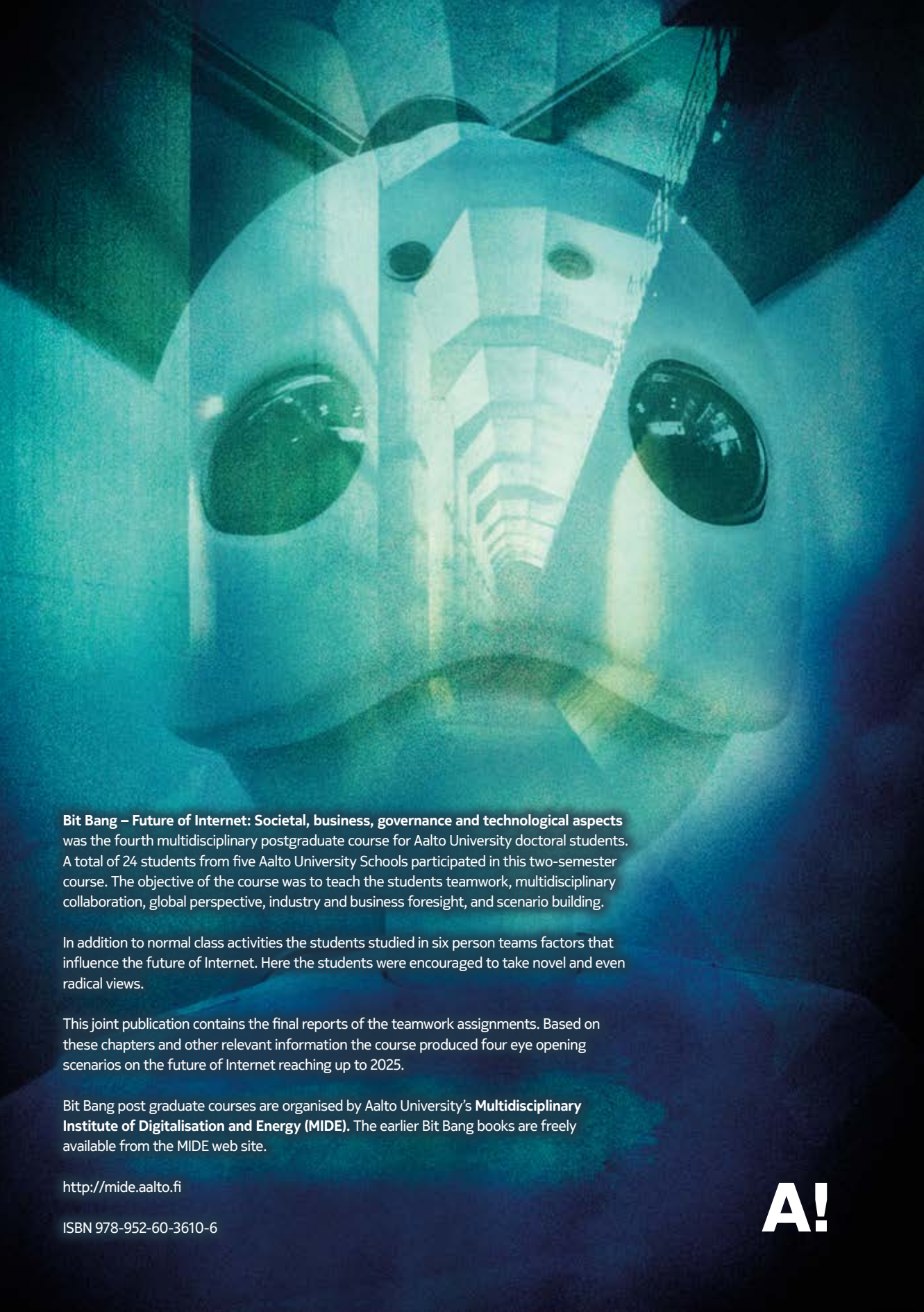
The visit was interesting and revealing on how the art is evolving and involving masses with the development of Internet.

Group Dinner

The tour ending dinner took place at Songoku Chinese restaurant at our residence Prince Hotel Shinagawa. The peaks were each group's artistic and hilarious presen-

tations on things learned in the tour. Group 1 performed a pantomime of salient Japanese customs, ASIMO performance and reindeer gifting covering a wide range of activities. Group 2 performed ASIMO dancing and singing with high quality acting and singing performance. Group 3 used crowdsourcing idea similar to drawing of \$100 bill at the internet art studio to replicate a large sized image of ASIMO using artistic capabilities of all Bit Bang participants, while group 4 performed a detailed pantomime of gifts from Finland especially the artificially created reindeer cum cockroach. The committee voted for Group 2 to be the winner, and Group 1 second.





Bit Bang – Future of Internet: Societal, business, governance and technological aspects was the fourth multidisciplinary postgraduate course for Aalto University doctoral students. A total of 24 students from five Aalto University Schools participated in this two-semester course. The objective of the course was to teach the students teamwork, multidisciplinary collaboration, global perspective, industry and business foresight, and scenario building.

In addition to normal class activities the students studied in six person teams factors that influence the future of Internet. Here the students were encouraged to take novel and even radical views.

This joint publication contains the final reports of the teamwork assignments. Based on these chapters and other relevant information the course produced four eye opening scenarios on the future of Internet reaching up to 2025.

Bit Bang post graduate courses are organised by Aalto University's **Multidisciplinary Institute of Digitalisation and Energy (MIDE)**. The earlier Bit Bang books are freely available from the MIDE web site.

<http://mide.aalto.fi>

ISBN 978-952-60-3610-6

A!