Configuring peer-to-peer software: an empirical study of how users react to the regulatory features of software

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Abstract

The emergence of new digital media has led to new sources and locations of power, and as a result, a heated debate on the regulability of cyberspace. The myth that cyberspace is by its nature free and uncontrollable has been challenged by Lessig's New Chicago School of Regulation that argues that code, or the architecture of information technologies, will be an important regulatory modality. This paper examines the relationship between regulation, information technologies and human behaviour, by examining what happens whenever individual human beings configure technology for use, in this case, file-sharing peer-to-peer applications. The evidence from the research suggests that Lessig's view does not capture all the nuances of practice involved in the use of peer-to-peer applications. The paper ends with proposals for future study of the actual practices of the users of this technology that will improve our understanding of the relationship between technology and regulation.
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Introduction

> The rise of an electronic medium that disregards geographical boundaries throws the law into disarray by creating entirely new phenomena that need to become the subject of clear legal rules but cannot be governed, satisfactorily, by any current territorially based sovereign.
>
> (Johnson and Post, 1996)

The above quotation is an excellent summary of the myth that has pervaded public consciousness since the very birth of the internet – the myth that cyberspace, the on-line world that includes commercial and private networks and on-line services, is, by its very nature, unregulable and free. However, this myth has come under attack in the recent years (Tsiavos *et al.*, 2003). The emergence of new digital media has led to the creation of new sources and locations of power (Murray & Scott, 2002), and resulted in a heated debate as to how cyberspace and these various sources of power can be controlled. Perhaps no other dispute exemplifies the nature and the extent of the current regulation debate better than the peer-to-peer file sharing controversy (Biegel, 2001).

It all began when Shawn Fanning, a freshman at Northeastern University, founded Napster, an on-line music service that allowed users to share MP3 files stored on their individual computers, using a centralized indexing service to locate the files (Alderman, 2001). Napster became

hugely popular. In January 2001, for example, an estimated 50–60 million users downloaded 2.7 billion songs through Napster (Biegel, 2001). Naturally, the music industry did not like the fact that people could share copyrighted music for free, and so in December 1999 multiple record labels filed a lawsuit against Napster, which ultimately resulted in its closure and absorption into Bertelsmann, a year later.

This was not the end of peer-to-peer applications, however, as there has been an immense proliferation of new applications that are considered 'true' peer-to-peer: applications whose nodes bypass DNS, do not have fixed IP addresses, and have significant autonomy from central servers (Oram, 2001; Pavlov & Saeed, 2003). Some of the more centralized applications such as AudioGalaxy have been shut down, and some of the others, such as KaZaA, Morpheus and Grokster are facing lawsuits (King, 2002). These peer-to-peer applications have become hailed as anti-regulatory, anti-authority devices, thus perpetuating the myth of unregulable cyberspace. Moreover, peer-to-peer applications have disrupted the *status quo*: not only have they shifted power relations between internet users and media producers, they have also challenged the very client–server structure of internet interactions with its end-to-end architecture (Oram, 2001).

Perhaps the most prominent critic of the myth that internet is by its nature free is Lawrence Lessig, a legal scholar, whose work *Code and Other Laws of Cyberspace* (Lessig, 1999) is regarded as the most thorough analytical study of the many forms that regulation of new media does or may take. In his work, Lessig posits that there are four main modalities of regulation: law, markets, norms and architecture, and 'the net regulation of any particular policy is the sum of the regulatory effects of the four modalities together' (Lessig, 1998). These four modalities enable regulation in the real physical world as well as in cyberspace. However, Lessig argues that in cyberspace, architecture will play the most important part – mainly because architecture, or the *code*, is self-executive when it comes to constraining human behaviour. Since architecture is a function of human design, and thus embeds the values of the designer, the architecture may enable or constrain various kinds of human activity (Orlikowski, 2000); code is thus a double-edged sword: it can either make cyberspace 'free' as in the early internet, or almost perfectly controlled.

The purpose of this research is to explore the complex relationship between regulation, information technologies and human behaviour, by examining what happens whenever individual human beings *configure* technology for use, in this case, file-sharing peer-to-peer applications. The purpose is not to contest the idea that technology has some regulatory capabilities – that architecture can enable and/or constrain human behaviour – or to produce judgments as to how cyberspace should be regulated. Rather, it is to identify the locus and content of regulation in peer-to-peer systems, and to explore how individuals actually use and configure the technology *in situ*, in order to develop a grounded understanding of what the dynamic of regulation entails.

Although peer-to-peer systems 'defy sources of external control,' they are about sharing, interconnectivity and collaboration and face issues of free riding and network capacity (Samant, 2003, Snir, 2003). Any of these goals, though, requires a set of *rules* governing the human and artefact relationships between the nodes in the peer-to-peer network. As such, peer-to-peer networks can be considered to be self-regulating (Tsiavos *et al.*, 2003). This gives rise to a series of research questions:

- Where is the locus and content of regulation in peer-to-peer systems: which features of the software are purely technical, and which attempt to regulate human behaviour by inscribing certain values into the software?
- Are there any regulatory features of the application that are perceived as negative? Where exactly is the disagreement, the conflict in regulation of behaviour.
- How do users respond to the regulatory measures inscribed in the technology? Do they attempt to shape the technology and if so, how?
- Are people consciously aware of these rules and regulations embodied in the software?

The next section discusses the particular methodological choices that were made when designing the data collection aspect of the research. This is followed by a description of the respondents and an analysis of their experiences in configuring and using peer-to-peer software, before presenting the conclusions and contributions of the research and outlining areas for future research.

Methodology

This section describes the research methodology used in the study. It begins with a formal statement of the aims and objectives of the research and considers them in terms of broader research approaches. The section then highlights the underlying goals of the research and the particular techniques used in the research to achieve those goals.

The aim of the research is to develop our understanding of how regulation takes place in information technologies. To address this aim, the particular objective of the research is to explore the relationship between users and the regulative elements of peer-to-peer software.

This objective is met by focusing on the actual processes of interaction that arise when individuals use the technology to download and share music, that is by studying how people view or do not view, respond to or do not respond to, the regulation embedded in the software. Thus, the empirical study of the use of peer-to-peer software will provide a very different perspective on the role of code as law to that provided by the more idealised, abstract view presented by Lessig (Hosein *et al.*, 2003).

To meet this objective, the research needs data collection techniques that will reveal the role that the technological artefacts play in the daily lives of the users *as well as* highlighting their attitudes to the regulatory mechanisms embedded in the software. In other words, both in how people *do* and *see* things (Silverman, 1998).

This research takes a qualitative approach to *explore* the processes of regulation in these artefacts. Qualitative research involves the use of data such as interviews, documents and participant observation to explain and understand phenomena. The main advantage of qualitative research is that it opens up areas for the researcher to explore: interviewees may talk at length and think about things in their own terms. Similarly, qualitative approaches are more likely to allow issues to emerge spontaneously.

As well as being qualitative, the approach taken in this research is also interpretivist and pragmatist. It therefore acknowledges that the researcher is intimately involved in the research and explicitly draws upon the benefits that arise from the researcher's subjective experiences in conducting the research. In a similar manner, although the interpretivist paradigm is now becoming accepted in information systems, there is still a tendency to emulate the positivist norm of presenting the research process as rational, abstract and objective. Although most researchers have an *a priori* theory that they apply to collected data, positivist accounts do not allow us to understand exactly how the researcher's analysis develops over time, especially when the *a priori* theory fails to match the nuances of the rich empirical data that has been collected. In contrast to the positivist norm, this paper provides an *impressionist* account. Although the methodology will be presented linearly, the paper will give a personal account of the process that helps present a grounded feel for the actual analysis undertaken (Flick, 1998).

An important element of the research design was the decision that the subjects should remain ignorant of the research goal to prevent them from giving answers in terms of what they thought the researchers wanted to hear. Often more experimental studies of technology use lack validity because the very knowledge that they are participating in an 'experiment' predisposes the research subjects to unnatural behaviour (Introna & Whitley, 2000; Latour, 2000). Observing subjects in a natural environment is thus a way to *objectify* the research.

Another benefit of studying technology-in-use is it gives the researcher information about what actually happens when the person *uses* the technology in their day to day life – for example, how subjects configure their software. Interviews can only yield information about what the research subject *thinks* is or was happening. Interviews thus do not give us much information about the reality out there. As Silverman argues, neither purely quantitative studies of objective structures nor purely qualitative studies of people's subjective experiences can give us a full picture of the precise mechanics of interaction with technologies. He therefore also calls for studies that occur in their natural context (Silverman, 1998, p 16).

As a result, the research was undertaken *in situ*, so that the person's use of the software could be directly observed. Thus the approach was similar to a mini-ethnography (Myers, 1999). However, the research cannot be really classified as purely ethnographic, as only about an hour and half was spent observing each person. Moreover, the interaction was more artificial, as the users were asked about all the different aspects of the software, and about how they configured and used it.

In conjunction with the *in situ* observation of technology-in-use, the study also used in-depth episodic, narrative interviews. The episodic interview approach is based on the assumption that people often remember events both in terms of particular content as well as in the form of narrative stories. Episodic interview thus tries to elicit narratives and content by means of various devices. The research subjects can relate various stories based on their subjective judgement of what is relevant but the interviewer can also ensure that the narrative does not deviate into irrelevant discussions (Flick, 1998).

The narrative approach to interviews allows the subjects to choose what they think is important – without being influenced by the content or type of the questions the interviewer can pose. Even when the subject does not mention something, that omission has informative value for the researcher (Wagner, 2003).

Throughout the study a 'naïve' researcher role was used in order to prevent the subjects from giving the answers they thought the observer would want. For example, the researchers pretended not to understand how the different peer-to-peer applications functioned, and asked the research subjects to explain all the different things they did with the technology. Thus, many specific questions about what the software itself does could be asked by letting them explain or narrate what they thought was interesting in the application use.

As the purpose of the research was to find *important patterns* in the process of regulation, rather than to generate an empirically justified theory or to make statistical claims, and given the avowedly interpretivist approach of the work, case selection proceeded according to the relevance of the cases, not their representativeness. According to Flick, what is decisive for choosing a sampling strategy and the sample as a whole, is whether it is *rich in relevant information* (Flick, 1998). Similarly, no attempt was made to triangulate the results, or come to any statistically generalisable result (Lee & Baskerville, 2003).

Respondents

The choice of interviewees was primarily based on access and variation. Given the time constraints, and the relatively long interviews needed in order to allow time for exploring all the different aspects of the human–software interaction, the case pool was limited largely to

students and academics: this group of people have relatively more time to spend on downloading files (and on in-depth interviews). Studying students and academics also allowed the interview to be kept informal, and thus more natural. This also made discussion about file-sharing, technically an illegal activity, easier (Flick, 1998). This choice could be criticized on the grounds that the student/academic population is hardly representative of the population's interaction with peer-to-peer software; however, it should be recalled that the purpose was to look for patterns, not objective structures.

An additional criterion for the selection of respondents was based upon the experience and applications they used. It was necessary to study more than one type of application. However, variation in applications also had to be limited: studying only one user per application could have been problematic. Only experienced users were studied. The classification of an 'experienced' user is rather difficult, but broadly they were taken to be those who felt comfortable using the software, and who had downloaded many songs over the past year or more.

The number of interviewees was initially limited to 10 or 15. There is always a trade-off between the number of interviewees and the amount of interesting information gained. The researcher should not be overwhelmed with data and needs to be able to re-live and remember the interviews. Too many interviews can also lead to repetition. In total, 10–15 interviews thus seemed enough to gain an understanding of the variations in the downloading process and not too many to become unmanageable.

The entire research, as well as the interview process, was circular and reflexive. Although a linear process is more common, a circular approach is more reflective of the character of discovery that goes on in real life and of the nature of qualitative research. The strength of the circular approach is that it forces the researcher to reflect continuously on the research process and on particular steps in the light of the other steps in the research. This means that instead of just testing a fully pre-conceived theory or an abstract model of the world, the researchers are able to reformulate their preconceptions in light of the emerging empirical evidence. For example, in this research, the research question and questions in the topic guide were reformulated after every interview, as problems or new ideas appeared.

In total, 13 interviews, of four women and nine men, were transcribed and used in the analysis. The interviews took place between 30 June and 16 July, 2002. Originally, fifteen 1–$1\frac{1}{2}$ h long interviews were conducted, but two of these were not included because it was not possible to observe them using their computer. All of the interviews were conducted where they normally downloaded music: four were conducted in the person's home, and the rest were done in university labs. In total, seven different types of file sharing peer-to-peer applications were observed: BearShare, AudioGalaxy, KaZaA, I-Mesh, Morpheus, WinMX, and LimeWire. As certain interviewees used more than one application, 16 observations of applications were conducted.

Among these AudioGalaxy was a special case, because it was actually shut down in late June 2002 for copyright reasons. However, the web interface was still working during the first few interviews, and some people still had the Satellite software on their computer. It was thus possible to pose questions about AudioGalaxy's use, and questions about how people responded to its shut-down; a form of external, legal regulation.

Analysis

- Where is the locus and content of regulation in peer-to-peer systems: which features of the software are purely technical, and which attempt to regulate human behaviour by inscribing certain values into the software?

Although it is difficult to separate the features of the technology that are purely technical (i. e. some default rules must be set in order for the system to function at all) from the features that are supposed to regulate human behaviour, the empirical data show that such categorization is, at least in part, possible. These technical features include the search engine interface, the search results interface and in the case of options, the number of search results shown. All of these features are still regulatory, in the sense that they constrain or enable certain actions. However, these features do not have a particular interest or goal *inscribed* into them; they are simply there because there must be certain structure to the search engine in order for it to exist.

Other features in the observed applications had interests inscribed, presumably by the software programmers; for example, both KaZaA and AudioGalaxy forced the user to upgrade to a new version that included extra spyware. Almost all of the applications observed had a default setting for running the application on start-up. According to one respondent, this was presumably 'to get you to use the services more often'.

All of the applications included a default setting for the number of simultaneous downloads and uploads in their options or settings tab. These defaults were set in order to promote file-sharing behaviour among the network users. LimeWire and KaZaA also had a feature for setting upload bandwidth. Although the users were able to change these settings, the defaults were always set to maximize the number of files that a user could upload from elsewhere and minimize the number of downloads. For example, in LimeWire, the upload bandwidth default was 100%, and in KaZaA it was 1024. Most of the applications, in particular LimeWire, KaZaA and BearShare, also had a specific default setting for sharing files, although the user could disable the file-sharing feature, meaning that uploads from the machine would be prohibited. Moreover, LimeWire has a special feature in its options, which allowed the user to set a minimum number of files that the other users had to share, in order for them to be able

to upload files. The default was on 1, again a feature promoting file-sharing and 'coded' to counter free-riding (Samant, 2003). Another default feature set to promote sharing was the 'super-node' or 'super-peer,' usually located in the options or settings tab: the super node would help other users download faster, but the node's own speed connection would suffer.

All of the applications also had a default setting for the folder in which downloaded files were placed. This feature was regulatory in the sense that if users did not want to share files, they had to move the files into another directory. However, it is difficult to say whether this was the intention behind the feature: some kind of a default directory was necessary, and in all the applications the user could remove all the files into another folder if wanted.

Some of the other most often mentioned controlling features were spy-ware and pop-up advertisements. These elements of software were usually difficult to get rid of: when downloading LimeWire, the BonzeBuddy software was attached, and it was impossible to delete it without jeopardizing the function of LimeWire itself. Advertising was also sometimes a part of the interface itself: 'with Morpheus it would connect to the music CD page and then you would need to go to search…'. This was also a feature of KaZaA.

- Are there any regulatory features of the application that are perceived as negative? Where exactly is the disagreement, the conflict in regulation of behaviour.

Advertising and spy-ware were both mentioned as problems. Although advertising was considered annoying, most people would simply close the pop-up windows, or ignore the advertisement banners in the lower corner of the screen. In fact, most observed users would just close the windows automatically, without saying anything, and only complained if directly asked about it. Spy-ware, on the other hand was often clearly mentioned as one of the things to change.

Another problem with most of the applications was speed: several users mentioned that the down-loading process is extremely slow and time-consuming, mainly because all the other users were also trying to optimize their download speed, so that they could download as many files as possible. As the software allowed users to change the number of simultaneous uploads and downloads, and sometimes even the number of files that a user could download at one time, most of the users set the number of downloads at a relatively high number, and limited the number of uploads to one. In certain applications, like WinMX, this resulted in long queues for the file. Sharing files was thus a prisoner's dilemma. Although the defaults in all the applications were set to promote sharing, in all the cases everyone wanted to download the most, and to share the least, and their configuration of software reflected that.

- How do users respond to the regulatory measures inscribed in the technology? Do they attempt to shape the technology and if so, how?

All of the users attempted to shape the technology in one way or another to suit their own purposes. Certain problems, particularly the problems of connection speed, and hence the problem of file sharing, were solved by clearly deliberative action. Most users consciously mini-mized the number of uploads and upload bandwidth and maximized the number of downloads. However, people came up with other tricks to speed up connection. Most of the KaZaA and WinMX users would only download files that had more than one peer: this way, the file would be downloaded from many different peers simulta-neously, speeding up the connection. A user of KaZaA had another trick: 'If you know a connection with a particular user is quick, you will want to take advantage of this connection, see what he shares and if you find something else that you like download it from him'. A LimeWire user had another way of speeding up his connection – he cleverly limited the amount of uploads by placing only small, uninteresting files in his shared folder. Moreover, he tried to fool people into thinking he had a slow connection by choosing the modem setting in options, although he was on a much higher connection: 'everything is classified from 0 to 4 stars, so they could see I'm lying about the modem, but most people just look at the speed, and you know, they prefer to download from somebody that said you know, T3 or higher, T1'.

The problem of spy-ware was also treated in a rather deliberate way by some of the users. For example, some users used firewalls to actively eliminate spy-ware. Other people also used software such as AdAware to remove all unwanted software from the computer.

People also developed techniques for choosing the files they wanted from the copious search results. For example, most of the people interviewed ranked the search results by speed, file size and file type, in order to avoid downloading the wrong file. People also looked at the description of the file to see if it contained porno-graphic material. In the case of AudioGalaxy, one user also had a trick for getting the file he wanted. Since most of the popular songs were copyrighted, and hence could not be downloaded legally, people would upload those songs under 'sloppily misspelled' names. He would then run searches with deliberately misspelled names, or he would click on files whose names did not exactly correspond to the right one.

However, not everyone took such direct action in solving downloading problems. Some people did not customize their software in the beginning and only changed things if problems appeared. One user, for example, remained ignorant of the fact that you can customize the software, until the University information services specifically blocked her access from the hall of residence, as she was a heavy user. Although she was not happy with the slowness of the downloads before, she did

not do anything about it until the information services staff explained to her how to manage her bandwidth.

- Are people consciously aware of these rules and regulations embodied in the software?

There seems to be a correlation between the awareness of control and the technical expertise of the application user. Some users, who could be classified as 'techies', tended to configure the software before they would actually start using it. They consciously customized it in order to control specific regulatory elements embodied in the software, ones they deemed undesirable. As one stated: 'I customize things right away. Yeah, because I like to be in control. It's not like all of a sudden I go 'Oh my goodness' I realize now they have spy-ware on this program! I'd better go get a firewall! I know in advance that this program will try to generally send my information to other sites, so I customize it before, I don't just react to small issues as they come along…'. Others, however, directly stated that they did not have enough technical knowledge to handle certain aspects of the software, and so they were just happy to have it work, and to fiddle with it once in a while.

The correlation between technical experience, and awareness of regulation or control is not completely clear. It seems that although people who are technically aware are better able to customize the software to their needs, and are perhaps more aware of how technology can regulate interactions, what really matters for action is how strongly users feel about a problem in the environment. Although users might not be aware of controls in the software and the regulatory aims of the system designers, they will still attempt to shape their environment if the problem is compelling enough.

Moreover, both the techies and non-techies expressed the view that some rules are necessary in any system and that peer-to-peer systems thus represent a trade-off: some restrictions are worth the free music.

Concluding discussion

The evidence suggests that during the process of interaction with peer-to-peer technologies, most people act in a deliberate manner only if they feel that a particular problem affects their goals or interests. In that case, whether users are consciously aware of regulations inscribed into the software or not does not play a role in whether they act deliberately. If users are aware that they can make certain changes to the software or the environment, then they will configure the software. For example, as speed was considered a problem for most users, almost all of them, whether technically experienced or not, customized the software and came up with different tricks to speed up the downloading process. However, it is clear that people with more technical experience tend to be more aware of the control mechanisms inscribed into software, and tend to be in a better position to alter their environment, as they have more knowledge about the locus and content of the regulations and the way to configure the software. In the case of spy-ware, more technically informed individuals reacted actively and deliberately to eliminate it: for example, by means of other software, such as firewalls, AdAware, and the uninstall functions of the computer itself. Non-techies also attempted to deal with the software, but usually in a more situated or reactive way: some simply stopped using the application, some attempted to delete the files and icons, and some just gave up. Spy-ware can thus be classified as an example of a 'black-box' technology: for the non-techies, the spy-ware presented a problem that had to be *reacted to*, *not controlled*, while for the techies, the black box was not a problem at all, it could simply be redesigned at will.

The research presented in this paper therefore contributes to the study of information systems (and the study of regulation) in three ways: in terms of research design; methodology and specific results. By providing one of the first, empirical studies of peer-to-peer usage, it presents a useful complement to those studies of peer-to-peer software that are grounded in abstract models of individual and network behaviour.

The research also shows how narrative research approaches can be used in data collection about how users configure their technologies. It is particularly useful in allowing the users to highlight the particular configuration choices that they find the most important.

Finally, the results of this research suggest that Lessig's view of regulation does not explain all the nuances of practice. Peer-to-peer users shape technology by means of deliberate, as well as situated, actions. The more technically experienced users tended to view and *use* the technology as a simple *tool* to be altered and *controlled* for the purpose at hand. Less technically experienced users also tried to configure the technology, but in a more gradual, round-about way. Either way, all the users were attempting to impose counter-controls on the technology, to change it to suit their own purposes and interests. A key contribution of this paper, therefore, is empirical evidence that show that the process of regulation in peer-to-peer technologies is not simply the case of passive reactions to the technology. All the users constantly tried to control and configure the structure of the technology to make it suit their current and changing needs. Regulation is thus a dynamic process that involves not only the users, but also the technology itself.

This study suggests a number of further areas for research. First, it is readily acknowledged that this is an area where both the technology and the regulatory features coded into it are frequently changing. It is therefore necessary to provide further studies of both new regulatory features of software *and* new ways in which users react to them. A second important avenue of research exists in trying to understand the processes by which these regulatory characteristics are written into the code (Tsiavos *et al.*, 2002) and evaluating alternative governance models for this process (Hosein and Tsiavos, 2003).

More generally, Lessig's notion of code as law relates to important debates within information systems about the relationship between structure and agency – technology and users (Orlikowski, 2000) and provides an alternative perspective for exploring this question. Finally, empirical studies of regulation and technology allow information systems scholars to contribute directly to debates in other disciplines (Baskerville & Myers, 2002; Hosein & Tsiavos, 2003), particularly law and regulation.

Editorial comment

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